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Negative Externalities, Network Effects, and Compatibility

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Abstract

Positive network effects arise where incremental product use increases the utility of users of compatible products (user-positive effects), but also in situations where product use imposes negative externalities that selectively affect the adopters of incompatible alternatives (nonuser-negative effects). This paper compares the social optimality of firms' incentives for compatibility under these two regimes. Using a "location" model of differentiated products, I find that, under both regimes, incentives for unilateral action to increase compatibility tend to be suboptimal when firms' networks are close in size, but they may be excessive for small firms when networks differ greatly in size. The result is consistent with prior analysis of the user-positive context (e.g., Katz & Shapiro, 1985), but challenges the intuition that activities involving negative externalities are always oversupplied in an unregulated market. Public policy implications are discussed.

Keywords: networks, imperfect markets, compatibility, externalities

1. Introduction

There are many situations in which the value to a consumer from using a product increases, relative to alternatives, with the number of other users of the same product or compatible products. Such products are said to exhibit network effects. Almost exclusively, the network effects phenomena described in the literature involve positive consumption effects, or more precisely "user-positive effects," whereby each consumer that uses the product increases the utility of other users of the product or compatible products (Note 1). Sometimes these effects are direct, such as on a telecommunications network, where utility derives directly from the number of people one may contact using the network. Other times, the effects are indirect. For instance, electronic game platforms provide greater benefit to users when more gaming software is available for use on them, and this tends to occur if they have more users.

But network effects are not limited to users increasing each other's utility. They also occur for products, or on platforms, characterized by users imposing costs on other people while simultaneously enjoying some degree of insulation against those costs. Such "nonuser-negative effects" occur as a result of what one may call "selective" negative externalities. For example, sport utility vehicles (SUVs) impose greater risks of injury and death on other motorists than do cars, while at the same time providing their occupants with increased protection against these same risks relative to cars (Note 2). Other examples include noisome products, ranging from cigarettes to noisy leaf blowers, for which adoption reduces the displeasure from others' use; and situations in which non-adopters of a product or platform, such as ISO certification or expensive interview suits, incur a stigma that increases with the number of adopters (Note 3). In all these examples, incremental adopters increase other agents' preferences for adopting the product or platform relative to its alternatives because they impose external costs *selectively* (i.e., exclusively or to a greater extent) on non-adopters. The result is what one might call an "if-you-can't-beat-'em-join-'em" (IYCBEJE) network effect, whereby consumers join a bandwagon created by the increased undesirability of the alternative choice (Nagler, 2011).

A key feature of the performance of markets with user-positive network effects is the scope of the relevant "network," that is, the scope of the product set through which the benefits of compatibility flow. Can, for example, the products of different firms be used together? (Katz & Shapiro, 1985). It also matters *how* compatible other products–are they fully interoperable, or with some degree of limitation or impedence? (Cremer, Rey, & Tirole, 2000). These dimensions of compatibility affect not just the benefits derived by the individual user of the product, but also the competitive outcomes (e.g., prices and outputs), profits, and social welfare

derived. A number of theoretical papers have found that profit-maximization-based decisions on who to extend compatibility to, and how fully, do not generally lead to socially optimal outcomes (Katz & Shapiro, 1985, 1986; Economides & Flyer, 1998; Church & Gandal, 2000; Malueg & Schwartz, 2006; Casadesus-Masanell & Ruiz-Aliseda, 2009).

In markets involving nonuser-negative effects, compatibility comes into play just as it does with user-positive effects. When a consumer considers whether to use a selective-externality-imposing product or some alternative, she typically considers how well or badly the alternative will fare in terms of its relationship to the imposing product and how many units of the imposing product there are in use. For example, the prospective buyer of a car might wonder how well she will make out if she collides with an SUV, and how many SUVs she is likely to encounter on the road. The first question has to do with compatibility, and the second with the size of the relevant installed base (Note 4).

A key strategic question facing the manufacturer in this context is how large to make the selective negative externality. That is, how *incompatible* should the product be with competing products (Note 5)? For example, the manufacturers of SUVs must consider how dangerous to make their vehicles to the occupants of cars. The question of the social optimality of firms' incentives for compatibility in this case seems to have a trivially obvious answer. Because incompatibility directly increases relative preference through the IYCBEJE bandwagon, intuition suggests that private incentives for incompatibility would always be excessive. Public policy, one expects, could unambiguously improve welfare by reducing incompatibility at the margin.

This paper compares incentives for compatibility under user-positive and nonuser-negative network effects regimes and looks at both relative to the social optimum. I analyze a "location" model of differentiated products. In this sense, the approach is similar to the analyses of network externalities offered by Farrell and Saloner (1992) and Matutes and Regibeau (1988, 1992), and different from the homogenous products model of Katz and Shapiro (1985). I focus on incentives for unilateral action on compatibility (e.g., in the case of user-positive effects, developing an adapter), rather than joint action (e.g., developing a standard). I also restrict attention to a static environment (i.e., a single-period model). My findings for user-positive effects essentially replicate the results of Katz and Shapiro (1985) concerning the relationship of firm size to compatibility incentives. But my findings for nonuser-negative effects do not bear out the intuition about excessive incentives. Instead, I find incentives for incompatibility that follow closely, though not exactly, Katz and Shapiro's results relating optimality of firms' incentives to network size: whereas firms that are close in size tend to have socially excessive incentives for incompatibility, an imposing firm has insufficient incentives for incompatibility if its "network" (customer base) is relatively very small or very large.

The next section lays out the general model. Section 3 derives welfare results for the user-positive case. Section 4 derives welfare results for the nonuser-negative case. Section 5 offers a public policy discussion and concludes.

2. A Model of Differentiated Product Duopoly with Network Effects

Consider a market for two products, A and B, sold at prices p_A and p_B, respectively. Consumers are distributed uniformly on a unit segment based on their preferences for A versus B, with the total number of consumers normalized to 1. There are no outside goods: consumers choose whether to purchase A or B, and each consumer will choose at most one unit of one of the two products. I posit a general framework of network effects as given by the following utility functions, representing the utility that the consumer located at a point j ($1 \geq j \geq 0$) obtains from purchasing a unit of product A or B, respectively:

$$U_A(j) = v + \theta - t(1-j) + \sigma_A \lambda Q_A + \sigma_{BX} \lambda Q_B - p_A \quad (1)$$

$$U_B(j) = v - \theta - tj + \sigma_B \lambda Q_B + \sigma_{AX} \lambda Q_A - p_B \quad (2)$$

Here, v represents the demand for all products; θ, which may be positive or negative, parameterizes the demand for A relative to B; t represents the intensity of consumers' relative preferences for A or B ($t > 0$); Q_i is the number of consumers who purchase product i ($i = A, B$); λ parameterizes the overall size of the network effect ($\lambda \geq 0$); and σ_i sizes and signs an *own* component of the network effect ($\sigma_i \in [-1,1]$), while σ_{iX} similarly sizes and signs a *cross* component of the network effect ($\sigma_{iX} \in [-1,1]$). A consumer who chooses neither A nor B receives utility of zero. Each consumer makes the choice that maximizes her utility.

Now, consider two cases: (I) $\sigma_A = \sigma_B = 1$, $\lambda > 0$ are given, and firm A sets $\sigma_X \equiv \sigma_{AX} = \sigma_{BX} \in [0,1]$; and (II) $\sigma_{AX} = -1, \sigma_A = \sigma_B = \sigma_{BX} = 0$ are given, and firm A sets λ. The first case is the classic case of a user-positive network effect: incremental users of A and B provide a benefit, λ, to other users of the same product.

The decision that firm A faces is whether, and to what extent, to include firm B's consumers in the network. Does firm A makes B's consumers fully compatible with its own consumers, or partially compatible, or not at all? Here I assume, in Katz and Shapiro's (1985) parlance, that the compatibility technology is an "adapter," hence A and B are compatible if A unilaterally decides to undertake the expense to make them compatible. Note that the decision to make firm B's consumers compatible also means that firm A's consumers are compatible with firm B's, so that B's consumers receive increased network benefits as well; that is, the benefits are mutual. Since my purpose is to examine whether the level of compatibility chosen by a firm of a given network size is too high or too low, I assume without loss of generality that only A makes the decision of whether to make the products compatible.

The second case involves a nonuser-negative effect: firm A considers the possibility of imposing a negative externality that only affects the users of product B. I will show that the effect of doing this is also to create a network externality: when $\lambda > 0$, the reservation price of users of A increases with the number of users of A, all else equal (Note 6). Obviously, A's decision to make B's users more *incompatible* with product A does not have a mutual effect: A's users are not reciprocally harmed by users of B. That is, B is made more incompatible with A, but A is not made more incompatible with B.

The relative private and social incentives for compatibility in this case might seem obvious. As discussed in the introduction, since the incompatibility decision involves a unilaterally imposed negative externality, the incompatibility incentives of firm A would seem always to be excessive, unlike in the case of user-positive effects. The model considers whether that expectation is correct.

3. Equilibrium with User-Positive Effects

Setting parameters to the values proposed for case (I) above, (1) and (2) become:

$$U_A(j) = v + \theta - t(1-j) + \lambda Q_A + \sigma_X \lambda Q_B - p_A \tag{3}$$

$$U_B(j) = v - \theta - tj + \lambda Q_B + \sigma_X \lambda Q_A - p_B \tag{4}$$

Assume v is large enough that all consumers choose A or B at equilibrium prices, implying $Q_A = 1 - Q_B$ (Note 7). Combining (3) and (4) reveals that the consumer at j prefers A over B if $2\theta - t(1-2j) + (1-\sigma_X)\lambda(Q_A - Q_B) + p_B > p_A$. Therefore

$$\Psi_j = 2\theta - t(1-2j) + (1-\sigma_X)\lambda(Q_A - Q_B) + p_B \tag{5}$$

may be viewed as the consumer's reservation price for A relative to B. It is interesting also to note that the relative quantity of A versus B matters more to the relative willingness-to-pay the less compatible the two products are.

Following Katz and Shapiro (1985), we assume that firm A incurs a fixed cost of compatibility, $C(\sigma_X \lambda)$. This is assumed to depend upon the size of the compatibility benefit received by its users from each incremental user of B, and which B's users receive in turn from the incremental user of A. For simplicity, assume $C(\sigma_X \lambda) = k\sigma_X \lambda$ for $k > 0$. Firm A sets p_A and σ_X to maximize

$$\Pi_A = p_A Q_A - k\sigma_X \lambda \tag{6}$$

while firm B sets p_B to maximize

$$\Pi_B = p_B Q_B \tag{7}$$

I restrict attention to $\lambda < t$, which is required for a stable interior solution; otherwise a small exogenous shift of consumers between products results, through the network effect, in all consumers shifting.

For an interior solution, $\Psi_{j^*} = p_A$, where j^* represents the threshold consumer (i.e., $Q_A = 1 - j^*$). Assuming such a solution, using (5), and making appropriate substitutions,

$$Q_A = \frac{t - p_A + p_B - (1-\sigma_X)\lambda + 2\theta}{2[t - (1-\sigma_X)\lambda]} \tag{8}$$

and

$$Q_B = 1 - Q_A = \frac{t - (1 - \sigma_X)\lambda + p_A - p_B - 2\theta}{2\left[t - (1 - \sigma_X)\lambda\right]} \tag{9}$$

The first-order conditions for firm A's profit maximization with respect to p_A and σ_X, respectively, are given by

$$\frac{t - (1 - \sigma_X^*)\lambda - 2p_A^* + p_B^* + 2\theta}{2\left[t - (1 - \sigma_X^*)\lambda\right]} = 0 \tag{10}$$

$$\frac{p_A^*\left(\frac{1}{2} - Q_A\right)}{\left[t - (1 - \sigma_X^*)\lambda\right]} = k \tag{11}$$

while the first-order condition for firm B's problem is

$$\frac{t - (1 - \sigma_X^*)\lambda + p_A^* - 2p_B^* - 2\theta}{2\left[t - (1 - \sigma_X^*)\lambda\right]} = 0 \tag{12}$$

It is immediately clear from (11) that a corner solution is the only equilibrium when $Q_A \geq \frac{1}{2}$: firm A would like to set $\sigma_X < 0$ because the marginal benefit of compatibility at any positive level of compatibility is negative when firm A has more than half the market. Meanwhile, for $Q_A < \frac{1}{2}$, the smaller Q_A, the greater firm A wishes to set σ_X. Thus, the smaller the market share of a firm on this range, the greater its incentives for compatibility.

Solving (10) and (12) together yields

$$p_A^* = t - (1 - \sigma_X^*)\lambda + \tfrac{2}{3}\theta \tag{13}$$

and

$$p_B^* = t - (1 - \sigma_X^*)\lambda - \tfrac{2}{3}\theta \tag{14}$$

Hence, consistent with Farrell and Saloner (1992), compatibility implies higher prices. Incentives to cut price to achieve greater sales through enlargement of the own-product-specific network effect are diminished the more compatible the products are. Substituting (13) and (14) into (8) provides a useful partial-reduced-form for Q_A,

$$Q_A = \frac{t + \frac{2}{3}\theta - (1 - \sigma_X^*)\lambda}{2\left[t - (1 - \sigma_X^*)\lambda\right]} \tag{15}$$

Solving (11) explicitly for $(1 - \sigma_X^*)\lambda$ yields two roots:

$$(1 - \sigma_X^*)\lambda = t + \tfrac{1}{6k}\theta\left[1 \pm \sqrt{1 - 8k}\right] \tag{16}$$

As we demonstrate in the appendix, the values of σ_X^* that correspond to both roots are maxima. It is not necessary to our welfare results to determine which value of σ_X^* is preferred by firm A; we are able to proceed with (16). Substituting (16) into (13) and (14) yields the following corresponding equilibrium prices and quantities:

$$(p_A^*, p_B^*) = \left(\tfrac{2}{3}\theta - \tfrac{1}{6k}\theta\left[1 \pm \sqrt{1 - 8k}\right], -\tfrac{2}{3}\theta - \tfrac{1}{6k}\theta\left[1 \pm \sqrt{1 - 8k}\right]\right) \tag{17}$$

$$\left(Q_A^*, Q_B^*\right)=\left(\tfrac{1}{2}-\frac{2k}{1\pm\sqrt{1-8k}}, \tfrac{1}{2}+\frac{2k}{1\pm\sqrt{1-8k}}\right) \tag{18}$$

Thus, in my simple model, firm A uses compatibility over the range of an interior solution as a "buffer" to keep Q_A at an optimizing level that is independent of θ. A lower level of demand will cause A to set σ_X and p_A higher (hence, p_B will be higher as well – recall that prices rise with compatibility), keeping Q_A steady at the level given in (18). Meanwhile, when demand is high enough or low enough to correspond to a corner solution with respect to compatibility, firm A does not buffer its output. Equation (16) shows that $\sigma_X > 0$ requires $\theta < \frac{6k(\lambda - t)}{1\pm\sqrt{1-8k}} < 0$. At higher levels of demand, as inspection of (15) indicates, firm A sets $\sigma_X = 0$ and allows Q_A to vary positively with p_A. Meanwhile, $\sigma_X < 1$ requires $\theta > \frac{-6kt}{1\pm\sqrt{1-8k}}$ (Note 8). When demand is below this lower threshold, firm A favors full compatibility, sets $\sigma_X = 1$, and again allows Q_A to vary positively with p_A.

We now turn to the question of how the level of compatibility chosen by firm A relates to the social optimum. Define welfare as

$$W \equiv \Pi_A + \Pi_B + \int_{j^*}^{1} U_A(j)dj + \int_{0}^{j^*} U_B(j)dj \tag{19}$$

Making substitutions from the model and differentiating with respect to σ_X, I obtain the following result:

PROPOSITION 1: Unless the costs of compatibility are very large, when the firms are the same or close to the same size, the unilateral private incentives for each firm with respect to compatibility are too low. When the firms are not close in size, the smaller firm has socially excessive incentives to seek compatibility unilaterally.

The proposition is essentially consistent with the findings of Katz and Shapiro (1985) that firms with large networks or good reputations are biased against compatibility, whereas those with small networks or weak reputations are biased in favor of it.

4. Equilibrium with Nonuser-Negative Effects

Now let us set parameters to the values proposed for case (II). (1) and (2) become:

$$U_A(j) = v + \theta - t(1-j) - p_A \tag{20}$$

$$U_B(j) = v - \theta - tj - \lambda Q_A - p_B \tag{21}$$

Again assume *v* large enough that all consumers choose A or B at equilibrium prices (Note 9). Combining (20) and (21) yields

$$\Psi_j = 2\theta + \lambda Q_A - t(1-2j) + p_B \tag{22}$$

as the consumer's reservation price for A relative to B. Note that if $\lambda > 0$ the consumer's relative reservation price for A increases with Q_A; this reveals that a negative externality that selectively affects nonusers fosters a network externality.

Assume firm A incurs a fixed cost of *incompatibility*, $C(\lambda)$, which depends upon the size of the incompatibility cost imposed on product B's users by each incremental user of A. For simplicity, let us posit $C(\lambda) = k\lambda$ for $k, \lambda > 0$ (Note 10). Firm A therefore sets p_A and λ to maximize.

$$\Pi_A = p_A Q_A - k\lambda \tag{23}$$

while, as in the previous case, firm B sets p_B to maximize (7).

Assuming an interior solution, using (22), and making appropriate substitutions,

$$Q_A = \frac{t - p_A + p_B + 2\theta}{2t - \lambda} \tag{24}$$

and

$$Q_B = 1 - Q_A = \frac{t - \lambda + p_A - p_B - 2\theta}{2t - \lambda} \tag{25}$$

The first-order conditions for A's and B's profit maximization, respectively, are given by

$$\frac{t - 2p_A^* + p_B^* + 2\theta}{2t - \lambda^*} = 0 \tag{26}$$

$$\frac{p_A^* Q_A}{2t - \lambda^*} = k \tag{27}$$

and

$$\frac{t - \lambda^* + p_A^* - 2p_B^* - 2\theta}{2t - \lambda^*} = 0 \tag{28}$$

Solving (26) and (28) together yields

$$p_A^* = t + \tfrac{2}{3}\theta - \tfrac{1}{3}\lambda^* \tag{29}$$

$$p_B^* = t - \tfrac{2}{3}\theta - \tfrac{2}{3}\lambda^* \tag{30}$$

Comparing (29) and (30) to (13) and (14), one is struck by the similarity of the equations. With σ_X set to zero, the equations are identical, but for the coefficients on λ^*. Thus, in the current case, we obtain a pricing result that is the precise flipside to the result in the previous case: *in*compatibility implies *lower* prices. In both the user-positive and nonuser-negative cases, the price effect is proportional to the size of the network effect.

However, if one compares the price differential in the current case with the differential in the previous case, an important difference emerges. With user-positive effects, the price differential between the products is independent of the network effect. This follows naturally from the mutuality of the effect. But with nonuser-negative effects, the price premium for product A *increases* with the network effect. Because this case involves a negative externality imposed unidirectionally, the "victimized" product, B, is in effect degraded relative to imposing product A.

Turning to the determination of equilibrium outcomes, substitution of (29) and (30) into (24) obtains

$$Q_A = \frac{t + \frac{2}{3}\theta - \frac{1}{3}\lambda^*}{2t - \lambda^*} \tag{31}$$

and substituting this into (27) yields

$$\lambda^* = 2t - \frac{\frac{1}{3}(t + 2\theta)}{\sqrt{k} - \frac{1}{3}} \tag{32}$$

Note that an interior solution in quantities requires $\lambda < 2t$, hence $k < \frac{1}{9}$ for $\theta < -\frac{t}{2}$, and $k > \frac{1}{9}$ for $\theta > -\frac{t}{2}$. Moreover, $\lambda > 0$ requires $\frac{t + 2\theta}{\sqrt{k} - \frac{1}{3}} < 6t$. Thus, observing what happens as *k* approaches $\frac{1}{9}$ in (31), it becomes evident that $k > \frac{1}{9}$ implies a corner solution of $\lambda = 0$ for all $\theta < -\frac{t}{2}$, and $k < \frac{1}{9}$ implies $\lambda = 0$ for all $\theta > -\frac{t}{2}$.

Does λ^* given in (32) represent a maximum? Using (29) and (31), we may re-write the first derivative of A's profit function with respect to λ as

$$\frac{\partial \Pi_A}{\partial \lambda} = Q_A{}^2 - k \tag{33}$$

The second derivative is therefore

$$\frac{\partial^2 \Pi_A}{\partial \lambda^2} = 2Q_A \frac{\partial Q_A}{\partial \lambda} \tag{34}$$

where, using (31),

$$\frac{\partial Q_A}{\partial \lambda} = \frac{\frac{1}{3}(t+2\theta)}{(2t-\lambda^*)^2} \tag{35}$$

Successive substitution of (32) into (35) and then into (34) shows that the second derivative is positive when $\theta > -\frac{t}{2}$, and negative otherwise. When demand for product A is relatively large, the marginal revenue product of λ increases in λ, while marginal cost of λ is constant. A corner solution equilibrium is the result: Firm A's profits are maximized by setting λ large enough to achieve $Q_A = 1$ (if the cost of increasing λ to this value is small enough relative to the benefit of taking the entire market) or else setting $\lambda = 0$ (if raising λ is prohibitively costly). However, when demand for product A is relatively small, the marginal revenue product of λ decreases in λ, while marginal cost is constant. Consequently, the first-order condition for profit maximization yields a maximum.

For $\theta < -\frac{t}{2}$, the profit-maximum represented by (31) corresponds to the following prices and quantities:

$$(p_A{}^*, p_B{}^*) = \left(\frac{\frac{\sqrt{k}}{3}(t+2\theta)}{\sqrt{k}-\frac{1}{3}}, \frac{\frac{1}{3}(t+2\theta)\left[1-\sqrt{k}\right]}{\sqrt{k}-\frac{1}{3}} \right) \tag{36}$$

$$(Q_A{}^*, Q_B{}^*) = \left(\sqrt{k}, 1-\sqrt{k}\right) \tag{37}$$

As in the case of user-positive effects, I obtain a "buffering" result, that is, Firm A sets λ as a buffer to keep Q_A at an optimizing level that is independent of θ. A lower level of θ causes A to set λ lower and p_A higher. Firm B raises p_B as well – recall that prices *fall* with *in*compatibility – and the price differential $p_B - p_A$, which is positive in this region of low relative demand for A, increases as λ falls. Thus, Q_A remains steady at the level given in (37).

When demand is low enough to correspond to $\lambda = 0$ in (31), to wit, when $\theta < 3t\sqrt{k} - \frac{3}{2}t$, equilibrium prices and quantities are given, respectively, by

$$(p_A{}^*, p_B{}^*) = \left(t + \tfrac{2}{3}\theta; t - \tfrac{2}{3}\theta\right) \tag{38}$$

$$(Q_A, Q_B) = \left(\tfrac{1}{2} + \tfrac{\theta}{3t}; \tfrac{1}{2} - \tfrac{\theta}{3t}\right) \tag{39}$$

In this region, firm A favors full compatibility and allows Q_A to vary positively with p_A.

I now turn to the question of how the level of incompatibility chosen by firm A relates to the social optimum. Define welfare as above in (19). Substituting and integrating, I obtain

$$W = \Pi_A + [\lambda - t]Q_A{}^2 + [2\theta - p_A + t - \lambda]Q_A - \tfrac{t}{2} + v - \theta \tag{40}$$

Differentiating with respect to λ, we obtain the following result:

PROPOSITION 2: When the imposing firm is small relative to its competitor, or when it is relatively large and the costs of incompatibility are large but not prohibitive, its incentives for incompatibility may be too low. When the imposing firm and its competitor are close in size, its incentives for incompatibility are too high, except when the costs of incompatibility are relatively large, in which case social and private incentives conform for zero incompatibility (i.e., perfect compatibility).

Table 1 summarizes more specifically the social optimality outcomes with respect to firm A's incompatibility decision in terms of the incompatibility cost parameter, *k*, and relative demand parameter.

Table 1. Summary of social optimality outcomes for firm A's incompatibility decision (nonuser-negative case)

	$\theta < -\frac{3t}{2}$	$\theta \in \left(-\frac{3t}{2}, -\frac{t}{2}\right)$	$\theta \in \left(-\frac{t}{2}, \frac{3t}{2}\right)$	$\theta > \frac{3t}{2}$
$k \in \left(0, \frac{1+2\sqrt{7}}{27}\right)$	Private and social incentives conform for $\lambda = 0$.	There exists $\underline{\theta}(k) \in \left(-\frac{3t}{2}, -\frac{t}{2}\right)$ such that for $\theta < \underline{\theta}$ firm A sets λ **too low**.	$\theta \in \left(-\frac{t}{2}, \frac{9tk}{2}\right)$: private and social incentives conform for $\lambda = 0$. $\theta \in \left(\frac{9tk}{2}, t\left[\frac{-1+2\sqrt{7+27k}}{6}\right]\right)$: firm A sets λ **too high**. $\theta \in \left(t\left[\frac{-1+2\sqrt{7+27k}}{6}\right], \frac{3t}{2}\right)$: private and social incentives conform for $Q_A = 1$.	Private and social incentives conform for $\lambda = 0$. ($Q_A = 1$ regardless.)
$k \in \left(\frac{1+2\sqrt{7}}{27}, \frac{1}{3}\right)$			$\theta \in \left(-\frac{t}{2}, t\left[\frac{-1+2\sqrt{7+27k}}{6}\right]\right)$: private and social incentives conform for $\lambda = 0$. $\theta \in \left(t\left[\frac{-1+2\sqrt{7+27k}}{6}\right], \frac{9tk}{2}\right)$: firm A sets λ **too low**. $\theta \in \left(\frac{9tk}{2}, \frac{3t}{2}\right)$: private and social incentives conform for $Q_A = 1$.	
$k \in \left(\frac{1}{3}, \frac{2}{3}\right)$		Private and social incentives conform for $\lambda = 0$.	$\theta \in \left(-\frac{t}{2}, t\left[\frac{-1+2\sqrt{7+27k}}{6}\right]\right)$: private and social incentives conform for $\lambda = 0$. $\theta \in \left(t\left[\frac{-1+2\sqrt{7+27k}}{6}\right], \frac{3t}{2}\right)$: firm A sets λ **too low**.	
$k > \frac{2}{3}$			Private and social incentives conform for $\lambda = 0$.	

θ. Parametric regions corresponding to incentives for incompatibility being too low are displayed in blue; regions in which incompatibility is too high are displayed in red. As with Proposition 2, the results are derived in the appendix.

The intuition of the results for nonuser-negative effects can be seen from the car and sport-utility vehicle case example. When demands for cars and SUVs are relatively close in size, the SUV manufacturer's incentives for incompatibility may be excessive. Making SUVs more hazardous to car drivers provides maximum benefit to the SUV manufacturer when the network sizes for the two vehicle types are near equal because the effect on SUV sales at the margin is greatest. However, the social cost of vehicle incompatibility is also highest in this situation, since the probability of deadly car versus SUV accidents is greatest when cars and SUVs coexist on the road in near equal numbers (White, 2004).

Meanwhile, when SUVs significantly outnumber cars, the manufacturer's incentives for incompatibility may be too low. This is because manufacturers fail to account for the social benefit that SUV-imposed external costs have of increasing homogeneity of the product mix, so that the incidence of car versus SUV accidents is reduced. Similarly, SUV firms' incentives for incompatibility are too low when cars significantly outnumber SUVs. In this situation, the increase in the price differential between SUVs and cars has a negative effect on SUV sales that outstrips the positive network effect. So, though SUVs are made more dangerous, the number of SUVs declines sufficiently to increase welfare overall. In both cases of lopsided network size, the manufacturer considers mainly the marginal effect of incompatibility on his sales, and this is smaller the more lopsided the network sizes are.

Though not exact, there is a strong correspondence between the results we obtained with respect to user-positive effects and those that arise under nonuser-negative effects. The clearest correspondence exists for firms with relatively low demand (i.e., small networks). I observe under nonuser-negative effects that such firms have suboptimal incentives for incompatibility from a social welfare perspective, just as firms with small networks had excessive incentives for compatibility under user-positive effects. When the two firms are close in size, the results also conform in most cases. When $k < \frac{2\sqrt{7}+1}{27}$ and $\theta \in \left(\frac{9tk}{2}, t\left[\frac{-1+2\sqrt{7+27k}}{6}\right]\right)$, firm A sets λ too high.

Thus, under nonuser-negative effects, a firm's incentives for incompatibility may be excessive for moderate levels of relative demand, so long as the costs of incompatibility are not too large. This corresponds to the case of moderate demand under user-positive effects, in which private incentives for compatibility are too low.

Interestingly, with respect to firms with large networks, my results for the nonuser-negative case differ from Katz and Shapiro's (1985) findings for the user-positive case. While Katz and Shapiro find that firms with large networks or good reputations tend to be biased against compatibility, I find that they might be biased against *in*compatibility. Specifically, for $k \in \left(\frac{2\sqrt{7}+1}{27}, \frac{1}{3}\right)$, when $\theta \in \left(t\left[\frac{-1+2\sqrt{7+27k}}{6}\right], \frac{9tk}{2}\right)$, firm A sets λ too low. The same thing happens for $k \in \left(\frac{1}{3}, \frac{2}{3}\right)$ when $\theta \in \left(t\left[\frac{-1+2\sqrt{7+27k}}{6}\right], \frac{3t}{2}\right)$.

5. Conclusion

Previous analyses of incentives for compatibility in the context of network effects have focused on the case of user-positive effects. By and large, the results of these studies have suggested that firms focus primarily on compatibility as a tool to win over marginal customers, and they tend correspondingly to undervalue the utility that inframarginal customers gain from having a product that is compatible with products used by others. Thus, firms with large or moderate market shares, who have therefore a greater ratio of inframarginal to marginal consumers, tend to undervalue compatibility. Meanwhile, firms with small market shares place too much emphasis on it.

This paper has shown that a similar pattern of compatibility preferences relative to the social optimum exists for small and mid-sized firms under nonuser-negative effects. As in the user-positive case, the result relates to firms' incentives to win consumers at the margin; however, because the mechanism of the network effect is different in the nonuser-negative case, so is the logic of the result. Nonuser-negative effects result from negative externalities that users impose on nonusers, thus both their value to the imposing firm and their adverse social effects are stronger the more "contact points" there are between users and nonusers. For this reason, firms' incentives for incompatibility tend to be excessive when market shares are near-equal. Correspondingly, when a firm has a small market share, the number of contact points with nonusers is diminished because the firm has a smaller installed base. This decreases its incentives for incompatibility. Meanwhile, the adverse social effects of incompatibility are also decreased, while the social benefit that increased incompatibility has through its ability

to shift consumers and increase homogeneity in the product mix becomes relatively prominent. The result is that a firm's incentives for incompatibility may be too low when its market share is small.

The paper has further indicated that, with respect to firms with large market shares, the social optimality of firms' compatibility incentives may differ in the nonuser-negative case relative to the user-positive case. Indeed, the same mechanism is at work for large and small firms under nonuser-negative effects: private benefits to incompatibility are diminished when firm sizes are lopsided, but social benefits are increased. This represents a difference relative to the conventional, user-positive case.

The general implication is that public policy has a role in encouraging compatibility when competing products have near-equal network sizes. This is true not only in the case of user-positive effects, but also when external costs are imposed selectively by users on non-users. Conversely, policy makers may need to dampen unilateral private incentives for compatibility at the margin when network sizes are lopsided. The surprising thing is that this may actually mean encouraging firms to impose larger external costs that selectively affect rivals' products. For example, if SUVs represented a small enough share of the motor vehicle market, it might actually improve welfare to make them more hazardous to car drivers, because the price effects of doing would further curtail sales of SUVs. If instead the overwhelming majority of vehicles were SUVs, making them more hazardous would again improve welfare–in this case, by reducing further the number of car drivers that incur incompatibility losses due to SUVs. In both situations, increased incompatibility at a per-unit level improves welfare by increasing standardization and thereby reducing the adverse effects of incompatibility at an aggregate level.

Beyond pure compatibility considerations, the broader implications of my results for public policy are perhaps equally surprising. The wisdom that external costs are provided excessively in the market and should be reduced is called into question when one considers that, in many cases, such costs have implications for the competitive equilibrium in markets (Note 11). Situations involving user-imposed externalities should be scrutinized to consider whether the externalities selectively, or asymmetrically, affect non-users (i.e., are nonuser-negative). The desirability of certain policy prescriptions, such as the use of Pigouvian taxes, might be affected by such asymmetries.

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Notes

Note 1. Such phenomena have been referred to as "positive consumption externalities" (e.g., Katz & Shapiro, 1985, 1986; Economides, 1996), but recent analysis calls into question whether the positive consumption effects that give rise to network effects are always truly externalities. See, e.g., Liebowitz and Margolis (1994) and Farrell and Klemperer (2007, p. 2020).

Note 2. Nagler (2014) measures the nonuser-negative effect of light trucks in the market for motor vehicles.

Note 3. For a more extensive list of examples and discussion, see Nagler (2011).

Note 4. In the field of highway safety analysis, the first question is recognized as a compatibility issue, with studies referring to the "crash test compatibility" of different vehicles. See Bradsher (2002).

Note 5. External costs can often be manipulated through product design. SUVs generally have high, stiff front ends, and this increases the damage done to vehicles with which they collide; these effects could be undone through various design changes (Bradsher, 2002; Latin & Kasolas, 2002). Cigarettes could be manufactured to give off more or less smoke from the lit end, and the amount of smoke and noise emitted by gasoline-powered outdoor equipment could similarly be altered by design. Meanwhile, the size of the external costs that consumers perceive might be manipulated using marketing messages. For instance, calling greater attention to how imposing a particular SUV is might convince consumers that it is more dangerous to other motorists. (See Bradsher (2002) for examples of intimidating SUV advertisements.) By advertising, "Don't be the last programmer in the market to get one," a purveyor of computer programming certifications might enlarge perceptions of the stigma imposed on non-adopters by incremental adoptions.

Note 6. Nagler (2011) examines a more general framework allowing $\sigma_A \in [-1, 0]$, so that the degree of "selectivity" of the negative externality is a parameter in the analysis,. The extreme case $\sigma_A = -1$ represents a pure negative externality due to the use of product A, with no consequent network externality; while varying values of $\sigma_A \in (-1, 0]$ varies both the degree of selectivity and size of the network externality.

Note 7. Consider $\overline{v} \equiv \theta + t + \varepsilon$ for arbitrary $\varepsilon > 0$. Then, for all $\lambda, \sigma_X > 0$, there exists $p_B > 0$ such that $U_B > 0$. Thus $\overline{v}$ satisfies the requirement.

Note 8. Note that $\frac{6k(\lambda - t)}{1 \pm \sqrt{1-8k}} > \frac{-6kt}{1 \pm \sqrt{1-8k}}$.

Note 9. As shall be shown, $Q_A + Q_B = 1$ implies *v* does not appear in the first-order conditions for A's profit maximization. This means $\lambda^*\big|_{Q_A+Q_B=1}$, A's profit-maximizing choice of λ subject to all consumers choosing to purchase A or B, is a function of exogenous parameters other than *v*. Accordingly, $\overline{v} \equiv \theta + t + \lambda^*\big|_{Q_A+Q_B=1} + \varepsilon$ satisfies the requirement for arbitrarily small $\varepsilon > 0$.

Note 10. Nagler (2011) assumes a convex cost of incompatibility, with a linear, increasing marginal cost to enlarging the negative externality. The structure used here simplifies the equilibrium solution, but does not have a significant impact on the main results.

Note 11. This issue is explored directly by Nagler (2011).

Appendix A

Second Order Conditions–Positive Consumption Externalities Case

The Hessian in this case is given by

$$|H| = \begin{vmatrix} \frac{\partial^2 \Pi_A}{\partial p_A^{\,2}} & \frac{\partial^2 \Pi_A}{\partial p_A \partial \sigma_X} \\ \frac{\partial^2 \Pi_A}{\partial p_A \partial \sigma_X} & \frac{\partial^2 \Pi_A}{\partial \sigma_X^{\,2}} \end{vmatrix} \tag{41}$$

where, using (8), (13), (14), and the first-order condition $Q_A + p_A \frac{\partial Q_A}{\partial p_A} = 0$, the components are given by

$$\begin{aligned} \frac{\partial^2 \Pi_A}{\partial \sigma_X^{\,2}} &= p_A \frac{\partial^2 Q_A}{\partial \sigma_X^{\,2}} = p_A \frac{\partial}{\partial \sigma_X} \frac{2\left[t-\left(1-\sigma_X\right)\lambda\right]\lambda - 2\lambda\left[t-p_A+p_B-\left(1-\sigma_X\right)\lambda+2\theta\right]}{4\left[t-\left(1-\sigma_X\right)\lambda\right]^2} \\ &= p_A \frac{2\lambda^2\left\{\frac{2}{3}\theta\right\}}{2\left[t-\left(1-\sigma_X\right)\lambda\right]^3} \end{aligned} \tag{42}$$

$$\frac{\partial^2 \Pi_A}{\partial p_A^{\,2}} = 2\frac{\partial Q_A}{\partial p_A} + p\frac{\partial^2 Q_A}{\partial p_A^{\,2}} = 2\left[\frac{-1}{2\left[t-\left(1-\sigma_X\right)\lambda\right]}\right] + p[0] = \frac{-1}{\left[t-\left(1-\sigma_X\right)\lambda\right]} \tag{43}$$

$$\frac{\partial^2 \Pi_A}{\partial p_A \partial \sigma_X} = \frac{\partial Q_A}{\partial \sigma_X} + p_A \frac{\partial^2 Q_A}{\partial p_A \partial \sigma_X} = \frac{\lambda\left(\frac{1}{2}-Q_A\right)}{\left[t-\left(1-\sigma_X^{\,*}\right)\lambda\right]} + p_A \frac{-\lambda\frac{\partial Q_A}{\partial p_A}}{\left[t-\left(1-\sigma_X^{\,*}\right)\lambda\right]} = \frac{\lambda}{2\left[t-\left(1-\sigma_X^{\,*}\right)\lambda\right]} \tag{44}$$

Substitution into (41) yields

$$\begin{aligned} |H| &= \begin{vmatrix} \frac{-1}{\left[t-\left(1-\sigma_X\right)\lambda\right]} & \frac{\lambda}{2\left[t-\left(1-\sigma_X^{\,*}\right)\lambda\right]} \\ \frac{\lambda}{2\left[t-\left(1-\sigma_X^{\,*}\right)\lambda\right]} & p_A \frac{2\lambda^2\left\{\frac{2}{3}\theta\right\}}{2\left[t-\left(1-\sigma_X\right)\lambda\right]^3} \end{vmatrix} \\ &= \frac{-\lambda^2\left\{\frac{4}{3}\theta + t - \left(1-\sigma_X^{\,*}\right)\lambda\right\}^2}{4\left[t-\left(1-\sigma_X\right)\lambda\right]^4} < 0 \end{aligned} \tag{45}$$

So all solutions to the first-order conditions are maxima.

Appendix B

Proof of Proposition 1

Making substitutions from the model in (19) and integrating, we obtain

$$W = \Pi_A + \left[2\left(1-\sigma_X\right)\lambda - t\right]Q_A^{\,2} + \left(2\theta + t + 2\sigma_X\lambda - p_A - 2\lambda\right)Q_A + v - \theta + \lambda - \tfrac{t}{2} \tag{46}$$

Differentiate (46) with respect to σ_X, use (13) and (15), and assume an interior solution:

$$\begin{aligned}
\frac{\partial W}{\partial \sigma_X} &= \frac{\partial \Pi_A}{\partial \sigma_X} + \frac{\partial}{\partial\left[\left(1-\sigma_X\right)\lambda\right]}\left\{\begin{matrix}\left[2\left(1-\sigma_X\right)\lambda - t\right]Q_A^2 \\ +\left(2\theta - p_A - \left[2\left(1-\sigma_X\right)\lambda - t\right]\right)Q_A\end{matrix}\right\}\cdot\frac{\partial\left[\left(1-\sigma_X\right)\lambda\right]}{\partial\sigma_X} \\
&= 0 + \left\{\begin{matrix}2Q_A^2 + 2\left[2\left(1-\sigma_X\right)\lambda - t\right]Q_A\frac{\partial Q_A}{\partial\left[\left(1-\sigma_X\right)\lambda\right]} \\ -\left[2 + \frac{\partial p_A}{\partial\left[\left(1-\sigma_X\right)\lambda\right]}\right]Q_A + \left(2\theta - p_A - \left[2\left(1-\sigma_X\right)\lambda - t\right]\right)\frac{\partial Q_A}{\partial\left[\left(1-\sigma_X\right)\lambda\right]}\end{matrix}\right\}\cdot -\lambda \\
&= \left\{\begin{matrix}2Q_A^2 + 2\left[2\left(1-\sigma_X\right)\lambda - t\right]Q_A\left[\frac{-2\left[t-\left(1-\sigma_X\right)\lambda\right]+2p_A}{4\left[t-\left(1-\sigma_X\right)\lambda\right]^2}\right] \\ -\left[2+-1\right]Q_A + \left(2\theta - p_A - \left[2\left(1-\sigma_X\right)\lambda - t\right]\right)\left[\frac{-2\left[t-\left(1-\sigma_X\right)\lambda\right]+2p_A}{4\left[t-\left(1-\sigma_X\right)\lambda\right]^2}\right]\end{matrix}\right\}\cdot -\lambda \\
&= \left\{2Q_A^2 - Q_A + \left\{\left(2Q_A - 1\right)\left[2\left(1-\sigma_X\right)\lambda - t\right] + 2\theta - p_A\right\}\left[\frac{-1}{2\left[t-\left(1-\sigma_X\right)\lambda\right]} + \frac{p_A}{2\left[t-\left(1-\sigma_X\right)\lambda\right]^2}\right]\right\}\cdot -\lambda \\
&= \left\{2Q_A\left(Q_A - \tfrac{1}{2}\right) + \frac{\left\{\left(2Q_A - 1\right)\left[2\left(1-\sigma_X\right)\lambda - t\right] + 2\theta - p_A\right\}\left(Q_A - \frac{1}{2}\right)}{\left[t - \left(1-\sigma_X\right)\lambda\right]}\right\}\cdot -\lambda \\
&= -\lambda\left(Q_A - \tfrac{1}{2}\right)\left\{2Q_A + \frac{2Q_A\left[2\left(1-\sigma_X\right)\lambda - t\right]}{t-\left(1-\sigma_X\right)\lambda} + \frac{2\theta - p_A - 2\left(1-\sigma_X\right)\lambda + t}{t-\left(1-\sigma_X\right)\lambda}\right\} \\
&= -\lambda\left(Q_A - \tfrac{1}{2}\right)\left\{\frac{2Q_A\left(1-\sigma_X\right)\lambda}{t-\left(1-\sigma_X\right)\lambda} + \frac{2\theta - p_A - 2\left(1-\sigma_X\right)\lambda + t}{t-\left(1-\sigma_X\right)\lambda}\right\} \\
&= -\lambda\left(Q_A - \tfrac{1}{2}\right)\left\{\frac{2\left\{\frac{t+\frac{2}{3}\theta-\left(1-\sigma_X^*\right)\lambda}{2\left[t-\left(1-\sigma_X^*\right)\lambda\right]}\right\}\left(1-\sigma_X^*\right)\lambda}{t-\left(1-\sigma_X^*\right)\lambda} + \frac{2\theta - \left[t+\frac{2}{3}\theta-\left(1-\sigma_X^*\right)\lambda\right] - 2\left(1-\sigma_X^*\right)\lambda + t}{t-\left(1-\sigma_X^*\right)\lambda}\right\} \\
&= -\lambda\left(Q_A - \tfrac{1}{2}\right)\left\{\frac{2\left(1-\sigma_X^*\right)\lambda\left\{t+\frac{2}{3}\theta-\left(1-\sigma_X^*\right)\lambda\right\}}{2\left[t-\left(1-\sigma_X^*\right)\lambda\right]^2} + \frac{\frac{4}{3}\theta-\left(1-\sigma_X^*\right)\lambda}{t-\left(1-\sigma_X^*\right)\lambda}\right\} \\
&= -\lambda\left(Q_A - \tfrac{1}{2}\right)\left\{\frac{\frac{4}{3}\theta\left(1-\sigma_X^*\right)\lambda}{2\left[t-\left(1-\sigma_X^*\right)\lambda\right]^2} + \frac{\frac{4}{3}\theta}{\left[t-\left(1-\sigma_X^*\right)\lambda\right]}\right\} \\
&= -\frac{\frac{4}{3}\theta\lambda\left(Q_A - \frac{1}{2}\right)}{2\left[t-\left(1-\sigma_X^*\right)\lambda\right]^2}\left[2t - \left(1-\sigma_X^*\right)\lambda\right]
\end{aligned} \tag{47}$$

Since an interior solution requires $\theta < 0$ and $Q_A < \frac{1}{2}$, it follows that $\frac{\partial W}{\partial \sigma_X} < 0$ for all interior solutions. Thus, whenever firm A's network size is small enough that it chooses at least partial compatibility, it overinvests in compatibility.

Now we consider the corner solution corresponding to $\sigma_X = 0$. We begin by noting that $\frac{\partial \Pi_A}{\partial \sigma_X} \neq 0$ at $\sigma_X = 0$; therefore we may substitute (47) in for $\frac{\partial W}{\partial \sigma_X}$, but we must add $\frac{\partial \Pi_A}{\partial \sigma_X}$ back in. We do so and evaluate

the resulting expression at $\sigma_X = 0$:

$$\begin{aligned}
\frac{\partial W}{\partial \sigma_X} &= p_A \frac{\partial Q_A}{\partial \sigma_X} + Q_A \frac{\partial p_A}{\partial \sigma_X} - k\lambda - \frac{\frac{4}{3}\theta\lambda\left(Q_A - \frac{1}{2}\right)}{2\left[t - \left(1 - \sigma_X{}^*\right)\lambda\right]^2}\left[2t - \left(1 - \sigma_X{}^*\right)\lambda\right] \\
&= -\lambda p_A \frac{-2\left[t - \left(1 - \sigma_X\right)\lambda\right] + 2p_A}{4\left[t - \left(1 - \sigma_X\right)\lambda\right]^2} + Q_A\lambda - k\lambda - \frac{\frac{4}{3}\theta\lambda\left(Q_A - \frac{1}{2}\right)}{2\left[t - \left(1 - \sigma_X{}^*\right)\lambda\right]^2}\left[2t - \left(1 - \sigma_X{}^*\right)\lambda\right] \\
&= -\lambda p_A \frac{p_A - [t - \lambda]}{2[t - \lambda]^2} + \frac{p_A}{2(t - \lambda)}\lambda - k\lambda - \frac{\frac{4}{3}\theta\lambda\left(\frac{p_A}{2(t-\lambda)} - \frac{1}{2}\right)}{2[t - \lambda]^2}[2t - \lambda] \\
&= \frac{1}{2(t-\lambda)^2}\left[\lambda\left(t - \lambda + \tfrac{2}{3}\theta\right)\left(t - \lambda - \tfrac{2}{3}\theta\right) - 2k\lambda(t-\lambda)^2 - \frac{\frac{4}{9}\theta^2\lambda(2t-\lambda)}{(t-\lambda)}\right] \\
&= \frac{\lambda}{2(t-\lambda)^2}\left[(t-\lambda)^2 - \tfrac{4}{9}\theta^2 - 2k(t-\lambda)^2 - \frac{\frac{4}{9}\theta^2(2t-\lambda)}{(t-\lambda)}\right] \\
&= \frac{\lambda}{2(t-\lambda)^3}\left[-\tfrac{4}{9}\theta^2(t-\lambda) + (1-2k)(t-\lambda)^3 - \tfrac{4}{9}\theta^2(2t-\lambda)\right] \\
&= \frac{\lambda}{2(t-\lambda)^3}\left[(1-2k)(t-\lambda)^3 - \tfrac{4}{9}\theta^2(3t-2\lambda)\right]
\end{aligned} \tag{48}$$

So long as $k \le \frac{1}{2}$, $\frac{\partial W}{\partial \sigma_X} > 0$ for θ close to zero.

Appendix C

Proof of Proposition 2 and Derivation of Table 1

To begin, let us differentiate (40) with respect to λ, assume an interior solution (i.e., $\theta \in \left(-\frac{3t}{2}, -\frac{t}{2}\right)$ and $k < \frac{1}{9}$),

$$\begin{aligned}
&W = \Pi_A + [\lambda - t]Q_A{}^2 + [2\theta - p_A + t - \lambda]Q_A - \tfrac{t}{2} + v - \theta \\
&\Rightarrow \tfrac{\partial W}{\partial \lambda} = 0 + 2[\lambda - t]Q_A \tfrac{\partial Q_A}{\partial \lambda} + Q_A{}^2 - \left(\tfrac{\partial p_A}{\partial \lambda} + 1\right)Q_A + [2\theta - p_A + t - \lambda]\tfrac{\partial Q_A}{\partial \lambda}
\end{aligned} \tag{49}$$

Using (29) and (31), we find

$$\frac{\partial p_A}{\partial \lambda} = -\tfrac{1}{3}; \frac{\partial Q_A}{\partial \lambda} = \frac{Q_A - \frac{1}{3}}{2t - \lambda} \tag{50}$$

Substituting (29), (31), and (50) into (49) and factoring yields

$$\tfrac{\partial W}{\partial \lambda} = \frac{-\frac{1}{3}(2t-\lambda)^3 - \frac{4}{3}t(2\theta + t)(2t-\lambda) + \frac{1}{3}(4t-\lambda)(2\theta+t)^2}{3(2t-\lambda)^3} \tag{51}$$

Since $\lambda < 2t$ on $0 < Q_A < 1$, hence on c, it follows that $\frac{\partial W}{\partial \lambda} < 0$ at $\theta = -\frac{t}{2}$. If we can show that $\frac{\partial W}{\partial \lambda} > 0$ at $\theta = -\frac{3t}{2}$, then we will have proven that there exists $\underline{\theta}(k) \in \left(-\frac{3t}{2}, -\frac{t}{2}\right)$ such that, for $\theta < \underline{\theta}$, firm A sets λ too low. In the neighborhood of $\theta = -\frac{3t}{2}$, $\frac{\partial \Pi_A}{\partial \lambda}$ approaches $-k$. So, using (51), and substituting in $\theta = -\frac{3t}{2}$ and $\lambda = 0$, we obtain:

$$\begin{aligned}\frac{\partial W}{\partial \lambda} &= \frac{\partial \Pi_A}{\partial \lambda} + \frac{-\frac{1}{3}(2t-\lambda)^3 - \frac{4}{3}t(2\theta+t)(2t-\lambda) + \frac{1}{3}(4t-\lambda)(2\theta+t)^2}{3(2t-\lambda)^3} \\ &= -k + \frac{-\frac{1}{3}(2t-\lambda)^3 - \frac{4}{3}t(2\theta+t)(2t-\lambda) + \frac{1}{3}(4t-\lambda)(2\theta+t)^2}{3(2t-\lambda)^3} \\ &= -k + \frac{-\frac{8}{3}t^3 - \frac{4}{3}t(-2t)(2t) + \frac{1}{3}(4t)(-2t)^2}{3(2t)^3} \\ &= -k + \frac{-\frac{8}{3}t^3 + \frac{16}{3}t^3 + \frac{16}{3}t^3}{24t^3} = -k + \frac{\frac{24}{3}t^3}{24t^3} = -k + \frac{1}{3}\end{aligned} \tag{52}$$

So, $\frac{\partial W}{\partial \lambda} > 0$ if and only if $k < \frac{1}{3}$. This satisfies the interior solution requirement of $k < \frac{1}{9}$, so we have proven the first part for this case.

Now consider $\theta \in \left(-\frac{3t}{2}, -\frac{t}{2}\right)$ with $k \in \left(\frac{1}{9}, \frac{1}{3}\right)$. In this case, *k* is sufficiently large that a corner solution of $\lambda = 0$ holds for all $\theta < -\frac{t}{2}$. Note that $\frac{\partial \Pi_A}{\partial \lambda} \neq 0$ at $\lambda = 0$; therefore we may substitute (52) in for $\frac{\partial W}{\partial \lambda}$, but we must add $\frac{\partial \Pi_A}{\partial \lambda}$ back in. We do so and evaluate the resulting expression at $\lambda = 0$, simplifying:

$$\begin{aligned}\frac{\partial W}{\partial \lambda} &= p_A \frac{\partial Q_A}{\partial \lambda} + Q_A \frac{\partial p_A}{\partial \lambda} - k + \frac{-\frac{1}{3}(2t-\lambda)^3 - \frac{4}{3}t(2\theta+t)(2t-\lambda) + \frac{1}{3}(4t-\lambda)(2\theta+t)^2}{3(2t-\lambda)^3} \\ &= p_A\left(\frac{Q_A - \frac{1}{3}}{2t-\lambda}\right) - \frac{1}{3}Q_A - k + \frac{-\frac{1}{3}(2t-\lambda)^3 - \frac{4}{3}t(2\theta+t)(2t-\lambda) + \frac{1}{3}(4t-\lambda)(2\theta+t)^2}{3(2t-\lambda)^3} \\ &= \left(\frac{t+\frac{2}{3}\theta - \frac{1}{3}\lambda}{2t-\lambda}\right)^2 - \frac{2}{3}\left(\frac{t+\frac{2}{3}\theta - \frac{1}{3}\lambda}{2t-\lambda}\right) - k \\ &+ \frac{-\frac{1}{3}(2t-\lambda)^3 - \frac{4}{3}t(2\theta+t)(2t-\lambda) + \frac{1}{3}(4t-\lambda)(2\theta+t)^2}{3(2t-\lambda)^3} \\ &= \left(\frac{t+\frac{2}{3}\theta}{2t}\right)^2 - \frac{2}{3}\left(\frac{t+\frac{2}{3}\theta}{2t}\right) - k + \frac{-\frac{1}{3}(2t)^3 - \frac{4}{3}t(2\theta+t)(2t) + \frac{1}{3}(4t)(2\theta+t)^2}{3(2t)^3} \\ &= \frac{6t\left(t+\frac{2}{3}\theta\right)^2}{3(2t)^3} - \frac{8t^2\left(t+\frac{2}{3}\theta\right)}{3(2t)^3} + \frac{-3k(2t)^3 - \frac{1}{3}(2t)^3 - \frac{4}{3}t(2\theta+t)(2t) + \frac{1}{3}(4t)(2\theta+t)^2}{3(2t)^3} \\ &= \frac{\frac{8}{3}\theta t - 24kt^2 - 6t^2 + 8\theta^2}{24t^2}\end{aligned} \tag{53}$$

Differentiating this expression with respect to θ reveals that $\frac{\partial W}{\partial \lambda}$ is monotone in θ on $\theta \in \left(-\frac{3t}{2}, -\frac{t}{2}\right)$:

$$\frac{\partial^2 W}{\partial \lambda \partial \theta} = \frac{\frac{8}{3}t + 16\theta}{24t^2} = 0 \Rightarrow \theta = -\frac{t}{6} > -\frac{t}{2} \tag{54}$$

It remains to check the sign of $\frac{\partial W}{\partial \lambda}$ at the endpoints of the interval. At $\theta = -\frac{3t}{2}$, $\frac{\partial W}{\partial \lambda} = \frac{1}{3} - k$, which is positive for $k < \frac{1}{3}$. At $\theta = -\frac{t}{2}$, it can shown using (53) that $\frac{\partial W}{\partial \lambda} < 0$. Therefore, for $k \in \left(\frac{1}{9}, \frac{1}{3}\right)$, there exists $\underline{\theta}(k) \in \left(-\frac{3t}{2}, -\frac{t}{2}\right)$ such that, for $\theta < \underline{\theta}$, firm A sets λ too low. (It may be observed in passing that $k > \frac{1}{3}$ implies $\frac{\partial W}{\partial \lambda} < 0$ everywhere on $\theta \in \left(-\frac{3t}{2}, -\frac{t}{2}\right)$, so private and social incentives conform for setting $\lambda = 0$ when $\theta \in \left(-\frac{3t}{2}, -\frac{t}{2}\right)$ and $k > \frac{1}{3}$.)

Now consider $\theta \in \left(-\frac{t}{2}, \frac{3t}{2}\right)$. As noted in the text, this range corresponds to a corner solution in λ: firm A sets λ to achieve $Q_A = 1$ when the cost of increasing λ is small enough, and it sets $\lambda = 0$ otherwise. Using (31), we find that $\lambda = \frac{3}{2}t - \theta$ corresponds to $Q_A = 1$. Using (23) and comparing firm A's profits at $\lambda = 0$ with its profits when $Q_A = 1$ and $\lambda = \frac{3}{2}t - \theta$, we find that firm A will opt for $Q_A = 1$ when $k < \frac{2\theta}{9t}$, or, rearranging, when $\theta > \frac{9}{2}tk$. Thus, we are able to recast firm A's threshold in terms of a level of demand large enough to make increasing λ worthwhile.

The corresponding social threshold in θ for raising λ to set $Q_A = 1$ is derived by substituting $\lambda = 0$ into $\frac{\partial W}{\partial \lambda} = 0$ and solving for θ. Setting (53) equal to zero and solving for θ yields (using quadratic formula) $\theta = t\left[\frac{-1 \pm 2\sqrt{7+27k}}{6}\right]$. Here, only the positive-signed root corresponds to $\theta \in \left(-\frac{t}{2}, \frac{3t}{2}\right)$, so that is the relevant one. One can check that $\theta > t\left[\frac{-1+2\sqrt{7+27k}}{6}\right]$ corresponds to $\frac{\partial W}{\partial \lambda} > 0$ in (53).

Equating the social and private thresholds and solving for *k* :

$$t\left[\frac{-1+2\sqrt{7+27k}}{6}\right] = \frac{9tk}{2} \Rightarrow k = \frac{1 \pm 2\sqrt{7}}{27} \tag{55}$$

where only the positive-signed root corresponds to $k > 0$ and is therefore relevant. Thus, for $k > \frac{1+2\sqrt{7}}{27}$, the private threshold level of θ exceeds the social threshold, so that for $\theta \in \left(t\left[\frac{-1+2\sqrt{7+27k}}{6}\right], \frac{3t}{2}\right)$, firm A sets λ too low, while for $\theta \in \left(-\frac{t}{2}, t\left[\frac{-1+2\sqrt{7+27k}}{6}\right]\right)$, firm A's incentives conform with social incentives for setting $\lambda = 0$. Meanwhile, for $k < \frac{1+2\sqrt{7}}{27}$, the social threshold exceeds the private threshold, so that for $\theta \in \left(\frac{9tk}{2}, t\left[\frac{-1+2\sqrt{7+27k}}{6}\right]\right)$, firm A sets λ too high. When $\theta \in \left(-\frac{t}{2}, \frac{9tk}{2}\right)$, $k < \frac{1+2\sqrt{7}}{27}$ corresponds to firm A's incentives conforming with social incentives for setting $\lambda = 0$. Finally, $\theta \in \left(t\left[\frac{-1+2\sqrt{7+27k}}{6}\right], \frac{3t}{2}\right)$ and $k < \frac{1+2\sqrt{7}}{27}$ imply that private and social incentives conform for setting $\lambda = \frac{3}{2}t - \theta$ and $Q_A = 1$.

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Hedge Funds and Market Anomalies

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Abstract

This paper investigates whether hedge funds arbitrage market anomalies. A seven-factor model was utilized including traditional Fama and French (1993) and Carhart (1997) factors as well as other factors associated with the anomalies of earnings momentum, equity financing, and asset growth rates. The average hedge fund employs a strategy consistent with the asset growth rate anomaly factor and opposite that of the equity financing factor. On a strategy specific basis, it was found that many sectors of hedge funds successfully arbitrage the asset growth anomaly and a few successfully arbitrage the earnings momentum anomaly. Successful use of the equity financing anomaly was not found. Seven-factor model alphas tend to be positive and significant, indicating funds generate substantial returns unrelated to the seven factors.

Keywords: hedge funds, market anomalies, arbitrage, market efficiency, behavioral finance

1. Introduction

1.1 Hedge Fund Managers

Hedge fund managers typically are sophisticated investors and the expectation is that hedge funds should outperform their relative benchmarks. Agarwal, Boyson, and Naik (2007) show that hedge funds outperform traditional mutual funds as well as hedged mutual funds, which mimic hedge fund strategies. Capocci (2006) finds that three-fifths of hedge fund strategies generate positive alphas, but report that only one-third of all strategies significantly outperform the global hedge fund industry. Brown, Goetzman, and Ibbotson (1999) and Agarwal and Naik (2000) conclude that hedge fund returns persist only at quarterly, and not longer, horizons; however, Kosowski, Naik, and Teo (2007) report longer performance persistence for top performing hedge funds. At times, it is unclear if the average hedge fund outperforms benchmarks, suggesting that the fund may not offer investors any increased level of sophistication and higher returns.

Since hedge funds are not restricted to any particular investment style or asset class, they are in the best position to take advantage of market anomalies. There is substantial evidence, as noted by Fama and French (2007), of the persistence of several return anomalies, such as those associated with momentum, equity financing, and accruals. Given the relative freedom to invest and their purported sophistication, hedge funds should be in the best position to take advantage of such inefficiencies. Therefore, it is important to test whether hedge funds are trying to take advantage of market anomalies by specifically examining how they misprice certain factors. If so, they may help to improve market efficiency. If not, there must be other reasons why people invest in them. Another aspect of this research is whether hedge funds provide abnormal returns exclusive of all factors.

1.2 Derivation of Model

This study examines the performance of sectors of hedge funds consisting of a broad sample of individual funds. To determine whether or not hedge fund managers are arbitraging market anomalies, the four-factor model of Fama and French (1993) and Carhart (1997) was used along with three additional factors that have been associated with some capability of predicting anomalous behavior: earnings momentum, equity financing, and asset growth.

In our seven-factor model, numerous instances of significant loadings on the asset growth factor were found. Consistent with expectations, hedge funds tend to buy (short) low-growth (high-growth) firms. Also found were many significant loadings on the equity financing factor; however, they generally have the wrong sign, indicating that hedge funds may be doing the reverse of what the strategy suggests. Most loadings on the earnings momentum factor are insignificant, but there are a few significant loadings that indicate hedge funds buy (short) high (low)

earnings momentum firms, consistent with expectations. Finally, most seven-factor alphas are positive and significant, indicating that hedge funds successfully identify profitable trading strategies unrelated to the seven factors.

2. Literature Review

2.1 Market Efficiency

Market efficiency and anomalies have been studied extensively in the finance literature, as surveyed by Fama (1970, 1991), Keim and Ziemba (2000), Schwert (2002), and Fama and French (2007). Most reported anomalies are dismissed by subsequent literature through more rigorous or practical testing (see Fama, 1998; Mitchell & Stafford, 2000; Brav, Geczy, & Gompers, 2000; Eckbo, Masulis, & Norli, 2000; Boehme & Sorescu, 2002; Fama & French, 2007), or have seemingly disappeared after the market incorporated the information (see Dimson & Marsh, 1999; Schwert, 2002; Marquering, Nisser, & Valla, 2006). It may be, then, that hedge fund strategies claiming to exploit pricing inefficiencies may be inconsistent or misleading. Hedge funds are not required to make periodic reports under the Securities Exchange Act of 1934.

2.2 Market Anomalies

If some hedge fund managers are indeed able to exploit market anomalies, extant literature suggests that superior performance may be limited by capacity constraints (Fung, Hsieh, Naik, & Ramadorai, 2006; Naik, Ramadorai, & Strömqvist, 2007), managerial incentives (Ackermann, McEnally, & Ravenscraft, 1999; Liang, 1999; Edwards & Caglayan, 2001; Agarwal, Daniel, & Naik, 2007), managerial discretion (Agarwal, Daniel, & Naik, 2007), managerial experience (Boyson, 2005; Li, Zhang, & Zhao, 2005), and managerial talent (Grossman, 2005; Li, Zhang, & Zhao, 2005). Although these factors may affect some of our empirical findings, the main purpose of this study is to determine if these hedge fund managers are, on the margin, trading on known market anomalies. If so, in the long run this may help to make markets more efficient, in which case the price inefficiencies should disappear over time. Or, alternatively, managers may be trading on certain pricing inefficiencies not known to the market. This would be exhibited by a significant alpha after controlling for the specified market anomalies.

Although many studies focus on the performance of hedge funds and the persistence of alpha, this study examines whether the returns of hedge funds are linked to a specific market inefficiency exploitation.

3. Methodology

3.1 Baseline Data

Hedge fund data were obtained from Barclay Hedge Fund DataFeeder (hereinafter, Barclay) from January 1990 through December 2005. This fifteen year period reflects both high growth and low growth periods. Information on 3,068 individual hedge funds, including their monthly returns, monthly assets under management, fee structure, and hedge fund sector strategy (contact authors for Barclay hedge fund sector definitions). Only those funds were selected with at least 24 consecutive months of return data and reported in U.S. currency and as net-of-fees. The final sample included 1,460 individual hedge funds. Monthly return data for the Fama and French (1993) and Carhart (1997) four-factor model were obtained from Kenneth French's website. Data from Compustat, CRSP, and SDC Global New Issues are used to create the three additional anomaly factors.

Sample statistics on monthly return data for the 21 basic hedge fund strategies reported in Barclay were used. Table 1 has been condensed for brevity. The full table can be obtained by contacting: dlawson@iup.edu. Each month, available hedge fund returns are either equal or value-weighted. All strategies have, on average, positive monthly returns, most exceeding 1%. The average equal-weighted monthly return for the entire sample is 1.16% (1.22% value-weighted), with a standard deviation of 4.95% as reported in Table I. Table 1 has been condensed for brevity. The full table can be obtained by contacting: dlawson@iup.edu. For value-weighted returns, the top performing categories include hedge funds with strategies defined as PIPEs, Emerging Markets, and Sector, which report mean monthly returns of 2.36%, 1.68%, and 1.62%, respectively. Hedge funds with Equity-Short Bias and Equity Market Neutral strategies exhibit the worst performance with mean monthly returns of 0.14% and 0.74%, respectively.

Table 1. Sample statistics for all hedge fund strategies

	Mean Return %
Equal-weighted	1.16
Value-weighted	1.22

3.2 Research Design

Both equally-weighted and value-weighted portfolios of hedge funds were used. First, a portfolio was constructed encompassing all strategies of hedge funds (hereinafter, global portfolio) and use the monthly net-of-fees mean equally-weighted (value-weighted) excess returns as the dependent variable in a series of regressions. Next, strategy-specific portfolios of hedge funds were constructed and used their excess returns in the same series of regressions. In each part of the analysis, the returns are regressed on a Fama and French (1993) and Carhart (1997) four-factor model, and a seven-factor model that combines the four-factor with the three anomaly factors: earnings momentum, equity financing, and asset growth. Also presented are the results from a five-factor models that include the Fama and French (1993) and Carhart (1997) factors and one of the anomaly factors.

3.3 Model I

The first step was to regress the net-of-fees monthly mean equal-weighted (value-weighted) excess returns of the global portfolio on the Fama and French (1993) and Carhart (1997) four-factor model:

$$R_t - R_{Ft} = \lambda_0 + \lambda_1 MKT_t + \lambda_2 SMB_t + \lambda_3 HML_t + \lambda_4 UMD_t + \varepsilon_t \quad t = 1, 2,\ldots, T \tag{1}$$

where R_t is the net-of-fees monthly mean equal-weighted (value-weighted) return of the global portfolio in month t, R_{Ft} is the risk-free rate of return in month t, MKT_t, SMB_t, and HML_t are the Fama and French (1993) market, size, and value factors, respectively, UMD_t is the Carhart (1997) momentum factor, and ε_t is an error term. λs are coefficients to be estimated.

3.4 Model II

The second step was to regress the net-of-fees monthly mean equal-weighted (value-weighted) excess returns of the global portfolio on the four-factor model combined with the earnings momentum factor, PMN. The third step included regressing the returns on the four-factor model combined with the equity financing factor, UMO, and then on the four-factor model combined with the asset growth factor, AGF. We also examine RMI, the composite share issuance measure (Daniel & Titman, 2006), as an equity financing factor instead of UMO. Results did not materially change.Finally, we regress the returns on the full seven-factor model were regressed. The full model is:

$$\begin{aligned} R_t - R_{Ft} = {} & \lambda_0 + \lambda_1 MKT_t + \lambda_2 SMB_t + \lambda_3 HML_t + \\ & \lambda_4 UMD_t + \lambda_5 PMN_t + \lambda_6 UMO_t + \lambda_7 AGF_t + \varepsilon_t \end{aligned} \quad t = 1, 2,\ldots, T \tag{2}$$

where PMN_t is the earnings momentum factor (positive minus negative), UMO_t is the equity financing factor (under minus over), and AGF_t is the asset growth factor. The monthly mean equal-weighted (value-weighted) excess returns of the strategy-specific portfolios are regressed on all of the same specifications described above.

Anomaly factors based on prior literature were used to create the earnings momentum factor, PMN, similar to Chordia and Shivakumar (2006), the equity financing factor, UMO, based on Hirshleifer and Jiang (2007), and the asset growth factor, AGF, based on Cooper, Gulen, and Schill (2007). The following describes the construction of each anomaly factor.

3.5 Orthogonalization

Prior to estimating regression equations (1) and (2), the anomaly factors were orthogonalized to the market, size, value, and momentum factors to eliminate potential correlations. This allows viewing the independent contribution to returns by the anomaly factors. The orthogonalization was accomplished by regressing each anomaly factor on the traditional four factors:

$$ANOM_t = \lambda_0 + \lambda_1 MKT_t + \lambda_2 SMB_t + \lambda_3 HML_t + \lambda_4 UMD_t + \varepsilon_t \quad t = 1, 2,\ldots, T \tag{4}$$

where $ANOM_t$ is the anomaly factor PMN_t, UMO_t, or AGF_t. Next, we sum the residual and intercept to form the orthogonalized anomaly factor:

$$ORTHANOM_t = \lambda_0 + \varepsilon_t \quad t = 1, 2,\ldots, T \tag{5}$$

where $ORTHANOM_t$ is the orthogonalized variable PMN_t, UMO_t, or AGF_t. The regression results reported include only the orthogonalized values of these four factors.

4. Results

4.1 Descriptive Statistics

Descriptive statistics for the Fama and French (1993) market, size, and value factors, the Carhart (1997) momentum factor, and the four orthogonalized anomaly factors are provided in Table 2. Table 2 has been condensed for brevity. The full table can be obtained by contacting: dlawson@iup.edu. The annualized returns

range from approximately 7% for UMO, to 13% for PMN, and 24% for AGF and are similar to values reported by others. Chordia and Shivakumar (2006) find an annualized return for PMN of about 11% for the period 1972-1999, which is close to the value found in their strategy. Hirshleifer and Jiang (2007) report annualized returns of approximately 12% for July 1972 through December 2005, which is slightly greater than this study's return. The AGF return is slightly larger than the 20% return found by Cooper, Gulen, and Schill (2007) over the period 1968-2003.

Table 2. Mean percentage returns of orthogonalized regression factors

	MKT	SMB	HML	UMD	PMN	UMO	AGF
Observations	192	192	192	192	191	192	192
Mean %	0.598	0.199	0.364	0.911	1.076	0.567	1.964

4.2 Model I Regression Results

Table 3 reports the regression results of the net-of-fees monthly mean equal-weighted (Panel A) and value-weighted (Panel B) excess returns of the global portfolio. Table 3 has been condensed for brevity. The complete table can be obtained by contacting: dlawson@iup.edu. Overall, the factor model does a good job explaining the excess returns of the global portfolio, with adjusted R^2s of 0.795 and 0.622, for equal and value-weighted returns, respectively. For the four-factor model, the equal-weighted alpha is .650% per month and the value-weighted alpha is .497% per month. Both are highly statistically significant and are economically significant as well.

Table 3. Four factor model alphas

	Alpha %	R^2
Equal-weighted	.650	.795
Value-weighted	.497	.622

The equal-weighted regression results in Panel A of Table 3 reveal that the coefficients for the orthogonalized anomaly factors are statistically significant when individually added to the four-factor model. Coefficients for PMN and UMO are negative and statistically significant at the 10% and 5% levels, respectively, while the coefficient on AGF is positive and significant at the 5% level. The value-weighted regression results, in Panel B of Table 3, also reveal a negative coefficient for UMO that is significant at the 5% level, and a positive coefficient for AGF that is significant at the 10% level.

The negative coefficients for PMN and UMO are contrary to expectations and indicate that the average hedge fund implements, to a certain degree, a strategy opposite to those described earlier. This equates to going long negative SUE earnings and short positive SUE earnings for PMN, and going long new issues firms and short repurchase firms for UMO. When PMN and UMO are individually added to the four-factor model, the reported alphas rise to offset the negative impact of the anomaly factors.

The most important results are for the seven-factor model. For both equal and value-weighted specifications, coefficients on UMO are negatively significant, while the coefficients on AGF are positively significant. Coefficients on PMN are now insignificant. With all variables included, negative loadings on UMO continue to detract from equal- (value) weighted returns by .040% (.059%) per month. AGF adds .081% per month to equal-weighted returns and .100% per month to value-weighted returns.

4.3 Model II Regression Results

In Table 4, the focus is on the four-factor and seven-factor models. Regression results for hedge funds with equity long only strategies are reported in Panels A1 and A2 of Table 4. Table 4 has been omitted for brevity. The complete table can be obtained by contacting: dlawson@iup.edu. Coefficients on the Fama and French (1993) factors are significant at the 10% level or greater. Coefficients on the Carhart (1997) momentum factor are insignificant. In the seven-factor model, coefficients on PMN are positive and significant for both equal and value-weighted returns. This is different from the insignificant coefficients for PMN in Table 3 for all hedge funds. Thus, equity long only funds seem to hold firms with positive earnings surprises. With equal-weighted returns, using PMN contributes .115% per month to returns. With value-weighted returns, PMN contributes .261% per month to returns. Especially for large funds, this represents an important contribution to overall returns. In the

seven-factor model, the only other significant anomaly coefficient is for UMO with value-weighted returns. The coefficient is negative, indicating that, like for all hedge funds, funds tend to do the reverse of what the UMO anomaly factor suggests. Finally, the alphas are smaller than for all funds reported in Table 3. This is especially true when funds are equally-weighted. This indicates that these funds are somewhat less successful at identifying firm-specific characteristics that represent profitable opportunities.

Tables 3 and 4 reveal statistically and economically significant positive and negative loadings on the anomaly factors PMN, UMO, and AGF for different hedge funds. Although the coefficients on the PMN factor are statistically insignificant for the average hedge fund and most of the specific funds discussed above, it is clear that positive loadings on PMN provides economically significant returns for equity long only and equity long bias funds. The coefficients on UMO, like the average hedge fund, are negative and significant for a majority of the specific strategies of funds, indicating that these funds' returns are reduced by doing the opposite of what the UMO anomaly suggests. Fund timing funds and relatively larger equity long only funds are most affected by loading negatively on UMO. Coefficients on AGF are positive and significant for the average hedge fund and half of the specific strategies discussed above. The contribution to returns by loading positively on the AGF factor is economically significant for the average hedge fund, as well as for hedge funds with equity long short, event driven, fund timing, and convertible arbitrage strategies. Relatively larger equity short bias funds tend to load negatively on the AGF factor. By doing the opposite of what the AGF anomaly factor suggests, the returns of these hedge funds are significantly reduced. With a couple of exceptions, funds seem to be able to identify good investments based on firm-specific information; for the most part, alphas are large and statistically significant. For example, in Table 3 for all funds, and with a seven-factor model, annualized alphas are between five and eight percent.

Although certain strategies of hedge funds reveal statistically and economically significant loadings on the three anomaly factors, our results may underestimate the significance. It may be that the hedge funds in our sample heavily arbitrage on one or more of the anomaly factors, but the strategies these individual hedge funds employ may change over the observed time period. Changing market conditions and the discovery of new market anomalies may drive some fund managers to switch their strategies multiple times. In this case, our methodology may be insufficient in determining the extent to which these hedge funds arbitrage on these four market anomalies. Although regressions on subsets of the time period (1990 to 2005) may provide better insight, we are limited to monthly data. Regressions with a changing beta may best be equipped for examining such a scenario. This is our next area of research.

5. Discussion

The purpose of this research is to investigate whether hedge funds arbitrage market anomalies. We use a seven-factor model that combines the Fama and French (1993) and Carhart (1997) four-factor model with three anomaly factors that are based on previous literature. Our empirical results reveal that the returns of the average hedge fund can be explained in part by the asset growth factor, indicating that hedge funds tend to go long firms with low asset growth rates and short firms with high asset growth rates. We also find that the returns of the average hedge fund are hurt by doing the reverse of the equity issuance factor, indicating that the average hedge fund tends to go long firms with new issuances and short firms with repurchases.

On a strategy-specific basis, hedge funds with equity long only and equity long bias strategies are successful in arbitraging earnings momentum, while funds with equity long short, event driven, fund timing, and convertible arbitrage strategies are successful arbitraging the asset growth factor. Larger equity short bias funds are penalized for doing the opposite of what the asset growth factor suggests. Similar to the average hedge fund, many of the strategy-specific funds seem to employ a strategy that is reverse of what the equity issuance factors suggest. The largest reduction in returns by employing this reverse strategy is for fund timing funds and relatively larger equity long only funds.

Given their relative freedom to invest, and their purported sophistication, it is not surprising to find that some hedge funds are able to successfully arbitrage market anomalies. What is somewhat perplexing is that the average hedge fund employs, to some extent, a strategy that is opposite to what known market anomalies suggest. This raises questions as to whether or not the average hedge fund manager is aware of these well documented market anomalies, or whether it is possible to consistently or profitably arbitrage these market anomalies. Yet, at the same time, funds seem adept at generating positive alphas.

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Volatility Risk and January Effect: Evidence from Japan

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Abstract

We use a time-series GARCH approach to investigate the January effect in the Japanese stock market. We find that the January effect is more pronounced before the anomaly is released to the public. We provide some evidence that the decline in the degree of January effect can be partially attributed to the long-term Japanese economic recession during the entire 1990s. We find that volatility risk is higher in January. But the higher volatility risk is not the primary cause for January effect. We find some evidence that risk compensation can explain the average market returns in January.

Keywords: seasonality, January effect, Japanese stock market, volatility risk, GARCH model

1. Introduction

In a recent study, Sun and Tong (2010) use the U.S. stock market index to reexamine whether January effect is caused by market volatility risk and find that market volatility is not significantly higher in January. Rather, they provide evidence that January effect is caused by the higher risk compensation in January. This study applies Sun and Tong (2010)'s methodology to Japanese market and tests whether their findings are applicable to the stock market outside the U.S. The reason to choose Japanese market is that prior literature provides evidence about the capital market integration between the two countries (Campbell & Hamao, 1992).

Following Sun and Tong (2010), we use GARCH models to investigate the relation between volatility risk and January effect for the Japanese stock market. Our findings are as follows. Consistent with Kato and Schallheim (1985), we show that the January effect is pronounced for the Japanese stock market over the period from 1975 to 2008 (Note 1). The January effect is greater over the sub-period from 1975 to 1984, the time before the market anomaly is released to the public. Additional evidence indicates that the January effect is more pronounced for the stock portfolios consisting of large firms in the sub-period 1985-2008. Consistent with Rogalski and Tinic (1986), we find that volatility risk is priced in January. But the volatility risk is not the cause for January effect. We also find some evidence that risk compensation can explain the market returns in January over the sub-period 1985-2008.

This research adds to the literature on seasonal anomalies. We provide evidence that the degree of January effect declines after the release of the market anomaly. We argue that the long-term Japanese economic recession may also contribute to the lower degree of January effect from 1985 to 2008. We show that the market turnover declines sharply in the early 1990s and stays at a low level during the entire 1990s. Second, this research adds to literature by revealing that in the sub-period 1975-1984 volatility risk is lower but it is higher priced for large firms. It implies that investors can make more profits by bearing less risk if they take use of the anomaly. We provide evidence that the profit-making opportunity disappears in the following years. The result implies that market dysfunction does not persist in the long run. Third, this research adds to literature by providing evidence that although risk compensation cannot explain January effect for the Japanese stock market, it is able to explain the market returns in January.

The remaining of this paper proceeds as follows. Section 2 reviews literature. Section 3 presents the data and methodology. Section 4 reports the empirical results. Section 5 concludes.

2. Literature Review

The efficient market hypothesis posits that stock prices follow a random walk and therefore unpredictable (Fama, 1970). However, there is considerable evidence suggesting that some factors can be used to predict future stock

returns (Bernard & Thomas, 1989; Jegadeesh & Titman, 1993; Stickel, 1991). One of famous market anomalies is seasonality. Rozeff and Kinney (1976) reveal that for the firms listed in the New York Stock Exchange the average returns are higher in January compared to those of the remaining months (i.e. January effect). Gultekin and Gultekin (1983) investigate the existence of seasonality for major industrialized countries and find that the January effect also exists outside the U.S.

There are several explanations for the cause of January effect. Keim (1983) suggest that the January effect is related to firm size. Gultekin and Gultekin (1983) provide evidence that the tax-loss selling hypothesis can explain the January effect. Rogalski and Tinic (1986) show that the higher returns in January may be related to the higher risk undertaken by investors in January. Ogden (1990) show that the January effect can be partially attributed to the short-term increase in investors' liquidity at the end of year.

Recently, Sun and Tong (2010) predict that investors will demand higher compensation for risk in January. They use a time-series GARCH approach to control the influence of size effect. They find that the volatility is not higher in January. Although volatility risk is positively associated with stock returns, it does not influence the magnitude of January effect. When the variable that captures the risk premium in January is added, the January effect disappears. They conclude that the January effect is caused by the higher risk compensation demanded in January.

Gultekin and Gultekin (1983) and Kato and Schallheim (1985) provide evidence that the January effect exists in the Japanese stock market. We apply the methodology used by Sun and Tong (2010) to the Japanese market and test whether their risk compensation explanations can be extended to the Japanese stock market.

3. Sample and Methodology

Our sample consists of Japanese public firms over the period from 1975 to 2008. We use the basic GARCH (1, 1) model to test whether the volatility risk is higher in January. The model is as follows:

$$R_t=\alpha_0+\alpha_1 R_{t-1}+\alpha_2 JAN_t+\varepsilon_t,\ \ \varepsilon_t|\Phi_{t-1}\sim N(0,h_t)$$
$$h_t=\beta_0+\beta_1 h_{t-1}+\beta_2\varepsilon_{t-1}^2+\beta_3 JAN_t \quad (1)$$

The variables of interest are α_2 and β_3. If there is January effect, α_2 will be positive and significant. If the volatility risk in January is higher, β_3 will be positive and significant. R_t represents monthly returns. The variable JAN_t is an indicator. It is one when the month is January, and zero otherwise. The variable h_t is the variance of ε_t conditional upon the information set Φ at the month t-1 and follows an ARMA (1, 1) process.

To test whether volatility risk can explain the January effect, we use the following GARCH-M model:

$$R_t=\alpha_0+\alpha_1 R_{t-1}+\alpha_2 JAN_t+\alpha_3 h_t+\varepsilon_t$$
$$h_t=\beta_0+\beta_1 h_{t-1}+\beta_2\varepsilon_{t-1}^2+\beta_3 JAN_t \quad (2)$$

The variables of interest are α_2 and α_3. If volatility risk can explain the January effect, α_3 is predicted to be positive and significant and α_2 will decline or become insignificant.

To test whether risk compensation can explain the January effect, we use the following GARCH model:

$$R_t=\alpha_0+\alpha_1 R_{t-1}+\alpha_2 JAN_t+\alpha_3 h_t+\alpha_4 h_t*JAN_t+\varepsilon_t$$
$$h_t=\beta_0+\beta_1 h_{t-1}+\beta_2\varepsilon_{t-1}^2+\beta_3 JAN_t \quad (2)$$

The variables of interest are α_2 and α_4. If risk compensation can explain the January effect, α_4 is predicted to be positive and significant and α_2 will decline or become insignificant.

4. Empirical Results

We run model (1) to check the existence of January effect and whether volatility risk is higher in January. We also divide our sample period into two sub-periods: one is from 1975 to 1984 and the other is from 1985 to 2008. We report the results in table 1.

We use the firm level data to test our hypothesis. Panel A of table 1 reports the results of model 1. In column 1, the coefficient α_2 is positive and significant at the 1 percent level. The result indicates that in January the mean returns are 0.39% higher than the mean of remaining months. The evidence indicates that the January effect exists in the Japanese stock market, which is consistent with Gultekin and Gultekin (1983) and Kato and Schallheim (1985). The coefficient β_3 is positive and significant at the 1 percent level. The result suggests that the volatility risk is higher in January. In column 2, we use model 2 to test whether the higher volatility risk in January can explain the January effect. The coefficient α_3 is positive and only significant at the 10 percent level. The coefficient which captures the degree of January effect is similar. The evidence indicates that volatility risk

is not priced in the full sample period. Volatility risk cannot explain the January effect in Japanese market. In column 3, we use model 3 to test whether risk compensation can explain the January effect in Japanese stock market. The coefficient α_4 is negative and not significant. The results imply that risk compensation cannot explain the January effect in Japanese stock market.

Table 1. January effect in japanese stock market

	Panel A			Panel B			Panel C		
Period	1975-2008			1975-1984			1985-2008		
Model	1	2	3	1	2	3	1	2	3
α_1	0.0796***	0.0796***	0.0798***	-0.3152***	-0.3182***	-0.3180	0.0781***	0.0782***	0.0772***
	(2010.79)	(1978.86)	(1967.89)	(-486.6)	(-491.63)	(-490.84)	(1611.76)	(1600.55)	(1597.88)
α_2	0.0039***	0.0039***	0.0041***	0.0131***	0.0130***	0.0116***	0.0015***	0.0015***	0.0017***
	(12.72)	(12.70)	(11.38)	(24.77)	(24.39)	(13.5)	(4.11)	(4.03)	(4.07)
α_3		0.0083*	0.0083*		0.2753***	0.2693***		0.0106***	0.0111***
		(1.80)	(1.72)		(13.44)	(12.62)		(3.02)	(3.41)
α_4			-0.0129			0.1963**			0.0165
			(-1.16)			(2.14)			(1.45)
β_1	0.1997***	0.1997***	0.1997***	0.4639***	0.4598***	0.4587***	0.2056***	0.2058***	0.2056***
	(861.9)	(830.45)	(800.45)	(169.28)	(166.31)	(166.19)	(731.32)	(717.83)	(706.39)
β_2	0.7912***	0.7912	0.7914	0.5450***	0.5480***	0.5495***	0.7826***	0.7823***	0.7835***
	(3043.65)	(3041.47)	(3037.99)	(291.96)	(294.04)	(295.49)	(2473.88)	(2466.24)	(2457.41)
β_3	0.0012***	0.0012***	0.0012***	0.0006***	0.0006***	0.0006***	0.0015***	0.0015***	0.0015***
	(68.70)	(68.88)	(68.88)	(17.68)	(18.86)	(18.81)	(65.88)	(66.28)	(66.21)
N	688,046	688,046	688,046	170,070	170,070	170,070	517,976	517,976	517,976
DW	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00

Note. Significance at the 10%, 5%, and 1% levels is denoted by *, **, ***.

We divide the sample period into two sub-periods for the following two reasons. On the one hand, behavior finance literature implies that anomalies usually disappear after they are released to the public. On the other hand, the Japanese economy experiences a long-term recession in the entire 1990s as a result of the Plaza Agreement in September of 1985. The economic condition may have a significant impact on the Japanese stock market.

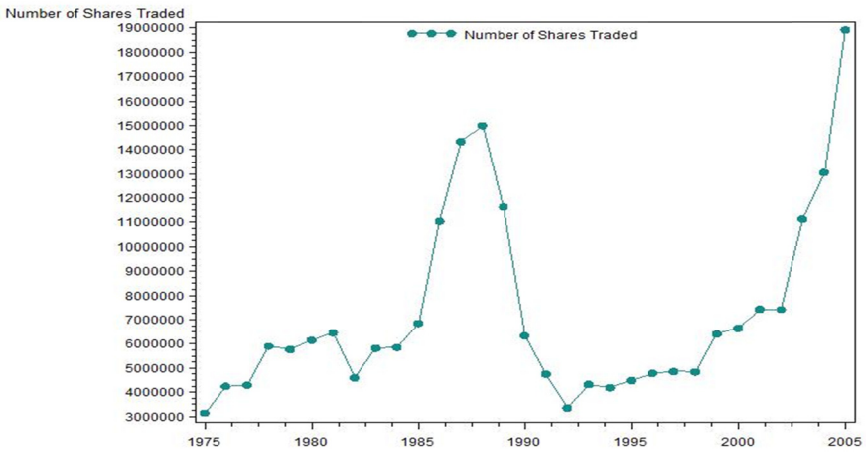

Figure 1. Market trading volume over the period 1975 to 2005

In Panel B of Table 1, we report the results of models 1-3 for the earlier period. We find that the volatility risk is lower and the degree of January effect is greater for this sub-period. The coefficient α_3 is positive and significant. The coefficient α_2 is similar after the volatility risk is added in GARCH model. The evidence

implies that the volatility risk is priced but it is not the primary cause for the January effect. In Panel C of table 1, we report the results of models 1-3 for the second sub-period. Evidence indicates that the volatility risk is higher in January but the January effect is much weaker compared to the earlier period. The volatility risk is also less priced in the second period.

We posit that the lower degree of January effect in the sub-period 1985 to 2008 may be related to Japanese long-term economic recession in the entire 1990s. We compute the average monthly trading volume of Japanese stock market for each year and present the result in Figure 1.

Figure 1 shows that the behavior of average monthly trading volume differs significantly before and after the year 1985. In the first sub-period, the trading volume climbs steadily and does not fluctuate much. The average trading volume is about 5 million shares per month. In the second sub-period, the trading volume rises to its peak of about fifteen million shares per month in 1988 and then declines quickly in the following four years. In 1992 the monthly trading volume drops to the bottom. For the entire 1990s the average monthly trading volume is below that of the first sub-period.

We argue that the behavior of monthly trading volume reflects the impact of economic slowdown on Japanese stock market. When the economic environment is bad, the uncertainty of corporate investment is high. It can explain why the market risk is higher in January in the second sub-period. Literature indicates that companies will reduce corporate investment when uncertainty is high (Chen, Goldstein, & Jiang, 2007; Foucault & Fresard, 2014). It implies that the demand for external financing is lower. As a result, the expected market returns will decline. It can explain why the degree of January effect in the second sub-period is lower.

Next we sort firms by size and form three stock portfolios. We run models 1-3 to each portfolio to examine how firm size influences our findings.

Table 2. January effect in Japanese stock market: evidence from firm size

Model	Small			Middle			Large		
	1	2	3	1	2	3	1	2	3
				Panel A: 1975-1984					
α_1	-0.3467***	-0.3485***	-0.3489***	-0.3313***	-0.3350***	-0.3354***	-0.2992***	-0.3023***	-0.3021***
	(-327.68)	(-327.23)	(-326.76)	(-200.07)	(-200.03)	(-200.23)	(-176.5)	(-177.78)	(-177.54)
α_2	0.0118***	0.0109***	0.0155***	0.0087***	0.0077***	0.0103***	0.0113***	0.0097***	0.0081***
	(7.43)	(6.77)	(4.59)	(7.59)	(6.65)	(4.16)	(11.63)	(9.96)	(5.25)
α_3		0.1471***	0.1657***		0.3942***	0.4186***		0.4709***	0.4475***
		(3.83)	(4.51)		(8.65)	(9.21)		(7.72)	(7.02)
α_4			-0.3301			-0.2703			0.3138
			(-1.57)			(-1.07)			(1.23)
β_1	0.6698***	0.6612***	0.6617***	0.5466***	0.5387***	0.5393***	0.3570***	0.3547***	0.3549***
	(94.43)	(94.03)	(93.16)	(67.86)	(66.86)	(66.73)	(80.11)	(78.58)	(78.50)
β_2	0.2794***	0.2864***	0.2849***	0.4009***	0.4078***	0.4064***	0.7298***	0.7307***	0.7309***
	(52.05)	(53.44)	(52.92)	(76.82)	(75.88)	(75.42)	(343.39)	(343.77)	(343.17)
β_3	0.0049***	0.0050***	0.0050***	0.0022***	0.0023***	0.0023***	0.0015***	0.0015***	0.0015***
	(39.02)	(38.63)	(38.67)	(19.41)	(20.18)	(20.12)	(43.52)	(43.62)	(43.47)
DW	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01
				Panel B: 1985-2008					
α_1	-0.2091***	-0.2107***	-0.2107***	-0.1267***	-0.1272***	-0.1265***	-0.1353***	-0.1357***	-0.1355***
	(-263.05)	(-236.16)	(-262.40)	(-214.82)	(-214.24)	(-211.70)	(-257.37)	(-271.06)	(-258.32)
α_2	-0.0040***	-0.0044***	0.0005	0.0034***	0.0028**	0.0105***	0.0049***	0.0048***	0.0073***
	(-4.19)	(-4.59)	(0.33)	(2.92)	(2.42)	(4.27)	(4.88)	(4.69)	(4.19)
α_3		0.2539***	0.2797***		0.1888***	0.2019***		0.1009***	0.1052***
		(8.02)	(8.18)		(11.89)	(14.33)		(7.42)	(7.99)
α_4			-0.3504***			-0.5050***			-0.2227*
			(-3.96)			(-3.53)			(-1.77)
β_1	0.3751***	0.3752***	0.3745***	0.2253***	0.2244***	0.2233***	0.2425***	0.2420***	0.2419***
	(121.31)	(116.12)	(116.14)	(132.21)	(130.69)	(130.74)	(205.45)	(195.36)	(188.27)
β_2	0.5583***	0.5568***	0.5575***	0.7060***	0.7066***	0.7080***	0.7227***	0.7230***	0.7231***
	(202.06)	(201.89)	(202.59)	(364.03)	(365.57)	(367.55)	(439.12)	(396.60)	(398.28)

β_3	0.0019***	0.0022***	0.0022***	0.0040***	0.0042***	0.0042***	0.0021***	0.0021***	0.0022***
	(19.55)	(21.22)	(21.31)	(88.15)	(91.57)	(91.03)	(38.65)	(39.32)	(39.25)
DW	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01

Note. Significance at the 10%, 5%, and 1% levels is denoted by *, **, ***.

Panel A of table 2 reports the results over the sub-period from 1975 to 1984. For each portfolio the coefficient α_2 obtained by model 1 is positive and significant. The result indicates that the January effect exists for both small and large firms. The magnitude of β_3 decreases as firm size grows. The result implies that for small firms volatility risk in January is higher than large firms. But the degree of January effect does not increases as firm size grows. In fact, the evidence indicates that the relation between firm size and the degree of January effect is U-shaped. The result is consistent with the view that the January effect is not mainly caused by firm size. In model 2 the coefficient α_3 captures volatility risk. When it is added, the degree of January effect only decreases a little. The evidence suggests that volatility risk can only explain a small proportion of January effect. We find that the magnitude of α_3 increases as firm size grows. It implies that for small firms volatility risk is less priced than large firms. In January, the volatility risk is lower but it is higher priced for large firms. The results suggest that investors can take use of this anomaly to make more profits by bearing lower risk. After January effect is released to the public, we predict that the profit-making opportunity will disappear in the second sub-period. In model 3, the coefficient α_4 is negative for small firms and positive for large firms. When the variable that captures risk compensation is added, the degree of January effect does not decline. The result is consistent with our findings that risk compensation does not explain the January effect in Japanese stock market. We notice that the risk compensation is higher for large firms but lower for small firms in January. The result provides additional evidence that in the first sub-period investing in large firms is more profitable than investing in small firms.

Panel B of table 2 reports the results over the sub-period from 1985 to 2008. In the sub-period, we find that the coefficient α_2 obtained by model 1 is negative and significant at the 1 percent level for small firms. For large firms, the January effect is positive and significant. In addition, the degree of January effect increases as firm size grows. The evidence implies that in the second sub-period the January effect can be partially attributed to firm size. In model 2, we find that the coefficient β_3 is positive and significant. The result suggests that volatility risk is higher in January. The coefficient α_3 is positive and significant, implying that volatility risk is priced. The degree of January effect does not change much when volatility risk is added. The evidence implies that volatility risk cannot explain January effect. In model 3, we find that for small firms the coefficient α_2 becomes insignificant when risk compensation is added. The coefficient α_4 is negative and significant at the 1 percent level. The results indicate that risk compensation can explain the lower average returns in January for small firms. For larger firms, we obtain similar results. The degree of January effect becomes more pronounced when the risk compensation term is added. The results indicate that although risk compensation is not the primary cause for January effect, it will influence the average market returns in January for the Japanese stock market.

We compare the coefficient α_3 between the two sub-periods and observe interesting phenomenon. For the first sub-period, volatility risk pricing increases as firm size grows. The result implies that higher returns are demanded to compensate for bearing volatility risk for large firms. In comparison, for the second sub-period, volatility risk pricing decreases as firm size grows. We interpret the findings as follows. Since the volatility risk is lower for large firms but the volatility risk is higher priced in the first sub-period, investors are more willing to buy the stocks of large firms to earn positive risk-adjusted abnormal returns in the second sub-period. As more and more investors engage in the profit-making transaction, the demanded returns to compensate for bearing volatility will decrease for large firms. At the same time, as fewer investors invest in small firms, the demanded returns to compensate for bearing volatility risk will go up. The evidence on the relations between the coefficient α_3 and firm size implies that investors take use of anomalies to make abnormal profits.

5. Conclusion

In this research we apply Sun and Tong (2010)'s methodology to the Japanese stock market. We find that the January effect is more pronounced for the sub-period 1975 to 1984. We provide evidence that the Japanese economic recession since the early 1990s may partially contribute to the phenomenon. We provide evidence that volatility risk is higher in January, although it is not the primary cause for the January effect. We show that risk compensation in January can explain the market returns in January. We also provide evidence that investors take use of seasonality to make abnormal profits.

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Note

Note 1. Our sample period ends at the year 2008 to avoid the influence of the 2008 financial crisis. The sample period of Sun and Tong (2010) is from 1926 to 2005, which excludes the 2008 financial crisis. To make our results comparable to Sun and Tong (2010), we do not include the 2008 financial crisis in our study.

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Cycles and Bank Credit Allocation in EU Countries: An Empirical Study

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Abstract

The increase in the amount of commercial papers and the real estate price boom before the 2007-2008 crisis witness a preference for speculative assets by banks. In contrast, after the crisis, banks tended to opt for safe assets, and especially during the Eurozone debt crisis with a sharp increase in deposit facilities from July 2011 to December 2011. This credit allocation can be at the detriment of productive assets; therefore, it can affect the real economy. This paper analyzes empirically the credit allocation of monetary and financial institutions in countries of the European Union over the period 1997-2013. Our results show that risk aversion stands as a main explanation of balance sheet movements. If risk aversion is largely influenced by monetary policy before the crisis, risk perception is uncorrelated to monetary policy afterwards.

Keywords: monetary policy, Eurozone, cycles, risk aversion, banking system

1. Introduction

The supply of bank credit over business cycle is largely studied with a significant increase in lending in the upward phase and a "credit crunch" after a crisis. These movements concerning the credit activity participate to the amplification of changes in economic activity, which means that the bank loan supply is procyclical. Nevertheless, there are few studies that take into account credit allocation (Berger & Udell, 2004). This paper proposes to analyze credit allocation between productive assets versus speculative ones and tries to consider the causes of this allocation over the cycle. We consider that, in regard to granting loan, bank behaviors depend on risk aversion, which varies over the cycle. Moreover, risk aversion is differently affected in the upward and the downward phases. According to the risk taking channel, monetary policy impacts risk perception and encourages risk taking by banks when interest rates are low. If this channel is effective before the crisis banks tend to flight to liquidity just after the crisis even if interest rates are maintained low because of a high risk aversion. The aim of our empirical study is to assess the impact of both monetary policy and risk aversion on credit allocation over the cycle.

In the following section, determinants of bank choices are identified. Before putting forward monetary policy and risk aversion in the credit allocation process, we define the concept of risk aversion in order to show that it is countercyclical. Section III describes data and variables. Section IV presents the empirical model. Finally, results and conclusions are presented in the last section.

2. Survey

Bank choices depend inter alia on bank risk aversion. In this paper, we consider that, even if risk aversion is an intrinsic element of the investor nature (Gai & Vause, 2004), it also depends on the level of uncertainty, so it can vary over the business cycle (it refers to the notion of "risk appetite"). Consistent with theoretical intuition, Smith and Whitelaw (2009), in an empirical study over the period 1952-2005, find, thanks to a time-varying risk aversion, that the price of risk varies counter-cyclically and increases substantially over the course of economic contractions. In the upward phase of the cycle, risks can be underestimated (Note 1). Indeed, a climate of confidence favors careless behaviors and excess of credit (Thornton, 1803). On the contrary, in the downward phase, banks revise their expectations and cause a reversal of risk aversion. The market refers to majority opinion and the rise in risk aversion is accentuated by a collateral increase. In summary, risk sensitivity is

exacerbated in the downward phase.

Bank behaviors relative to risk aversion can be also influenced by the action of other agents. Recent studies highlight the role of monetary policy in the risk taking of banks before the crisis. The risk taking channel describes « *the impact of changes in policy rates on either risk perceptions or risk-tolerance and hence on the degree of risk in the portfolios, on the pricing of assets, and on the price and non-price terms of the extension of funding* » (Borio & Zhu, 2012). Banks consider market perception (Gambacorta & Marques-Ibanez, 2011) and so react in function of the Central bank action. A decrease in interest rate by the Central bank can favor an excessive risk taking by banks because of the modification of risk perception. Low interest rates boost the net asset value and therefore increases the demand of investment and decreases the default probability, which allows an underestimation of risks (Gambacorta, 2009). In addition, low interest rates entail low expected yields, so encourage banks to choose more profitable assets, which are also more risky (Cardone-Riportella, Samaniego-Medina, & Trujillo-Ponce, 2010) (*see* "*search for yield*" in Rajan, 2006). The risk taking channel is confirmed in several empirical studies on different samples: for American (Altunbas, Gambacorta, & Marqués-Ibáñez, 2010), European (Delis & Kouretas, 2011; Maddaloni & Peydró, 2011), Bolivian (Ioannidou, Ongena, & Peydró-Alcalde, 2008), and Spanish banks (Jimenez et al., 2014).

On the contrary, after a crisis, we used to witness a credit rationing amplified by information asymmetries. The risk becomes a central element for banks, that face to liquidity risk and counterpart risk. Banks fear difficulties about refinancing in the future (Caballero & Krishnamurthy 2008; Allen, Carletti, & Gale, 2009), and are not confident about the ability of other banks to pay their debts, especially in a context of strong information asymmetries (Freixas & Jorge, 2008). After the 2007-2008 crisis, the monetary policy tend to reduce the credit rationing and avoid some bank failures by using unconventional methods. In addition to large cuts in official interest rates, Central banks, including the ECB, provided massive liquidity and purchased a wide range of assets (Bernanke, Reinhart, & Sack, 2004). Very low official interest rates are aimed at reducing the refinancing cost of banks and the all instruments are intended to reduce risk aversion. Using such measures witness the importance of risk aversion on bank decision and the inefficiency of low interest rates in bad times to encourage credit and especially productive credit. Some studies highlighted the impact of monetary policy on spreads after the 2007-2008 crisis. (Andritzky et al., 2009). According to Wu (2008), asset purchases and liquidity provisions seem to calm interbank strains, but the ECB interest rates policy tend to accentuate risk aversion, which could be explained by the prevalence of the liquidity and counterpart risks, that were dominant factors in the different stages of the 2007-2008 crisis, especially in the Eurozone (Angelini, Nobili, & Picillo, 2011).

To sum up, keeping low interest rates after the 2007-2008 crisis did not calm market tensions. So bank decisions concerning credit allocation are more guided by bank risk aversion than traditional monetary policy (which is justifying the use of unconventional monetary measures). Here, in the downward phase, high risk aversion leads to a credit rationing to the benefit of a "flight to quality" or "flight to liquidity" as evidenced, for example, by the preference for the TBill in United States, whose 3 month return reaches a zero level in the last quarter of 2008 (Banque de France, 2012). Concerning the Eurozone, flight to quality has another form since public assets are not anymore considered as safe in a special context of sovereign debt crisis at the end of 2010. If some Bonds, as German, continue to represent a safe haven, other Bonds, which have bad performance (Greece, Ireland), are neglected. The flight to quality in Eurozone actually plays an important role but occurs in the form of a rise in deposit facilities (Gilles et al., 2013) (see Figure 1).

Briefly, bank balance sheets are highly procyclical and reveal a preference for speculative assets in the upward phase and a flight to quality in the downward phase. These movements occur at the expense of productive assets, and depend on bank choices, which depend themselves on their risk perception, that is influenced differently over the cycle. On the one hand, risk appetite of banks is largely influenced by the monetary policy in the upward phase; on the other hand, risk perception is so sensitive to liquidity and counterpart risks in the downward phase that changes in interest rates do not affect behaviors in the downward phase.

This paper analyzes determinants of credit allocation by banks in European countries over the cycle. We will see that risk aversion is a large component of explanation. In the upward phase, risk aversion is largely influenced by the monetary policy and in the downward phase, risk perception is uncorrelated to monetary policy.

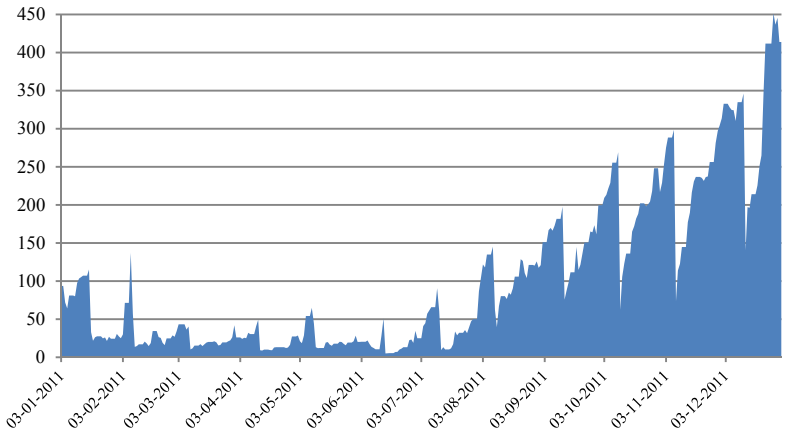

Figure 1. Deposit facilities in euro-zone, end of 2011 (ECB, Mds d'€)

3. Data and Variables

We choose to study aggregated balance sheets of Monetary Financial Institutions (MFI) in some European countries (Note 2), excluding the ECB, that is to say resident credit institutions and other resident financial institutions which receive deposits from other entities, grant credits and make investments in securities. According to Brissimis and Delis (2010), choosing European countries is appropriate to study the relationship between monetary policy and bank risk taking because "ECB pursues, more clearly than the Federal Reserve, the objective of price stability above all potential other objectives". Consequently, monetary policy is not used to influence performance of the banking sector. So, our study can effectively capture the impact of monetary policy on bank choices over the cycle. To consider the latter, our period of study starts in September 1997 and ends in December 2013 (with a break in August 2008, date of Lehman Brothers bankrupt).

The aim of the model is to analyze credit allocation over the cycle and its determinants. Most previous studies have modelled credit to private sector as a whole (Calza, Manrique, & Sousa, 2006; Rossi & Gambacorta, 2007). Our study differentiates assets according to their finality (productive asset *versus* speculative ones) and not according to their maturities (which could inform about the risk of run when the maturity structure of assets and liability is too much divergent). Consequently, we try to explain the evolution of three assets over the cycle: a "speculative asset", a "safe asset" and a "productive one". The difference between the speculative and the productive assets is that the first does not have any linkage with real activity and the second directly finances a productive project.

For the three dependent variables, data are provided by the ECB Statistical Data Warehouse in the category "MFI Balance Sheet Items Statistics". Data are collected monthly. First, concerning the speculative asset, we consider debt securities other than shares to MFI (heareafter referenced as *sec*). They are issued by EU countries residents and euro denominated issues issued by the Rest of the World and securities issued by residents of non-euro area EU Member States. We consider this asset as a speculative one since it does not finance productive project.

Second, concerning the safe asset, given the particularity of European countries in the context of sovereign debt crisis in 2010, government bonds are not a good proxy of safe assets (since our sample includes Greece, Ireland and Portugal that defaulted). We prefer to consider deposit facilities by MFI with the ECB. MFI can access the Eurosystem's standing facilities with an overnight maturity. Analyzing deposit facility (referenced as *deposit*) allows us to capture the flight to quality in the downward phase since banks prefer to choose safety and liquidity rather than profitability. We can note that considering this type of assets reflects also partially non-standard monetary policy measures. Indeed, "on 10 May 2010, the Central banks of the Eurosystem started purchasing securities in the context of the Securities Markets Programme (SMP), with a view to addressing the severe tensions in certain market segments which have been hampering the monetary policy transmission mechanism" (ECB).

Thirdly, our productive asset is approached by loans to Non Financial Corporations (named *nfc*). Using this variable permits to capture the effect on real activity since, in the European countries, bank lending is one of the major sources of financing for non financial corporations (Kok Sorensen, Marques-Ibanez, & Rossi, 2012).

All the data are provided by the ECB, except the VSTOXX given by the Data Center of Stoxx, GDP from World

Bank and inflation from Eurostat. First, we want to know how monetary policy impacts credit allocation over the cycle. We use the ECB policy rate (Note 3) (*ecbir*) as a measure of traditional monetary policy in the EU countries. The second determinant we want to assess over the cycle is risk aversion, which is approached by the Eurostoxx 50 Volatility (*VSTOXX)*. VSTOXX is the European VIX (Note 4), it measures the volatility of near term options on the Eurostoxx 50 index by analyzing the square root of the implied variance across all options of a given time to expiration. In the three equations, we control for the economic conditions by real GDP growth for European Union countries (denoted by *GDP*) and inflation (*inf*) (Note 5). Another control variable is the Dow Jones Euro Stoxx 50 Price Index, denoted *Index*, which takes into account the market capitalization-weighted stock index of 50 large European companies operating within Eurozone nations. As it is reconstituted annually and the weightings are updated once per quarter, using this index allows us to consider changes in market capitalizations and so cyclical variations. Another variable that considers the cycle is the monetary aggregate M3 (Note 6). Lastly, we use as control variable the Composite Indicator of Systemic Stress (*CISS*), which is a new indicator of financial stability in several markets (Bonds, equities, foreign exchange and money markets) in Euro area (see Hollo, Kremer, & Lo Duca, 2012 for the construction of this indicator).

4. The Empirical Model

We want to know how monetary policy and risk aversion impact credit allocation over the cycle. Concerning the choice of the adapted empirical model ("panel data" or "pooling"), we firstly verify if there are individual effects in the data, and then we formalize them in fixed and random effects.

In the Error Component Models, specific individual and temporal effects are random. In this study, we use the simplified model where it is supposed that the perturbation of the model is only composed by α_i, a specific individual effect and $e_{i,t}$, a random perturbation. According to Pirotte (2011), this presentation is usually used in the literature of applied economy with the panel data, because the available statistics frequently concern the individual dimension. Also, the sample is often mostly incomplete regarding the population analyzed. In this context, we have:

$$log(sec)_{i,t} = a + b_1\log(ecbir)_{i,t} + b_2\log(vstoxx)_{i,t} + b_3\log(gdp)_{i,t} + b_4\log(inf)_{i,t} + b_5\log(m3)_{i,t} + b_6log(index)_{i,t} + b_7log(ciss)_{i,t} + b_8(dv)_{i,t} + \varepsilon_{i,t} \quad (1)$$

With $i = 1, \ldots, N$, $t = 1, \ldots, T$ and $\varepsilon_{i,t} = \alpha_i + e_{i,t}$. $\varepsilon_{i,t}$ is composed by α_i, certain individual factors that are not taking into account in the model, and $e_{i,t}$, a random perturbation. They are independently and identically distributed: $\alpha_i \sim i.i.d.(0, \sigma_\alpha^2)$ and $e_{i,t} \sim i.i.d.(0, \sigma_e^2)$.

Note that we have three dependent variables (*sec*, *deposit* and *nfc*). Thereby, we will estimate three different models with the same explanatory variables. But, for simplicity, we only present one empirical specification. Concerning the explanatory variables, we have the ECB policy rate (*ecbir*) and the Eurostoxx 50 Volatility (*vstoxx)*. In the three equations, we control the estimated values of the dependent variables by real GDP growth and inflation in European Union countries (*gdp* and *inf*), the monetary aggregate (*m*3), the Dow Jones Euro Stoxx 50 Price Index (*index*), the Composite Indicator of Systemic Stress (*ciss*), and a dummy variable (*dv*) that captures the restrictive monetary policy adopted by the ECB from December 2005 to August 2008 to prevent inflation. This variable takes 1 in this period and 0 if not.

Moreover, the study is divided into two periods. The first period starts in September 1997 and ends in August 2008: it is the upward phase of the cycle and we call it "good times" in the regression. And the downward phase ("bad times") begins after the Lehman Brothers bankrupt in September 2008, and ends in December 2013. Thereby, the dummy variable is only used in good times.

In a second stage, contrary to equation (1), we suppose that the effects are not random but certain. Thereby, the model perturbation is a classical perturbation $e_{i,t}$. The individual and temporal specificities are represented by the individual and temporal constants that take into account certain unobserved characteristics of the individuals and/or the periods. In this study, we use the fixed effects model assuming that the relationships between the dependent and explanatory variables are the same for all the individuals.

$$log(sec)_{i,t} = a + b_1\log(ecbir)_{i,t} + b_2\log(vstoxx)_{i,t} + b_3\log(gdp)_{i,t} + b_4\log(inf)_{i,t} + b_5\log(m3)_{i,t} + b_6log(index)_{i,t} + b_7log(ciss)_{i,t} + b_8(dv)_{i,t} + \varepsilon_{i,t} \quad (2)$$

With e_{it} the standard errors, *i* the individual and *t* the time.

In the two specifications, the questions about correlation and heteroscedasticity are considered. Concerning the homoscedasticity assumption, we verify if the variance of the errors of each individual is constant. For each individual *i*, we have to know if $\sigma_{it}^2 = \sigma_i^2$ or $\sigma_i^2 = \sigma^2$ for all *i*. According to the Breusch-Pagan test, we have

heteroscedasticity, and according to the Wald test, we have particularly inter-individual heteroscedasticity. Furthermore, the same variance of the errors for all the individuals indicates that there is intra-individual homoscedasticity. Shortly, our data have the following structure: intra-individual homoscedasticity ($\sigma_{it}^2 = \sigma_i^2 \; \forall \; t$) and inter-individual heteroscedasticity ($\sigma_i^2 \neq \sigma^2 \; \forall \; i = 1, \dots, N$).

Then, we investigate correlation of residuals between individuals and residuals autocorrelation problems. Still according to the Breusch-Pagan test, the results suggest that there is no autocorrelation of errors. Thereby, we correct heteroscedasticity and a possible unobserved heterogeneity using cluster corrected standard errors (robust estimation). Then, the choice between fixed and random effect models is made by using the Hausman (1978) test. We have a p-value superior to 5% in the three estimations. Thereby, random effects models are not biased.

Lastly, to consider endogeneity problem caused by the possible errors in the measures of the variables, dual causality between dependent and explanatory variables and omitted variables bias, we estimate a second group of models with instrumental variables. In this context, we instrument log(*ecbir*) by the short term interest rate of ECB (log(*stir*)), the German interest rate (log(*gir*)) and spreads between swaps 6-month Euribor and benchmark bonds of 10-year maturity (*spread*) (the correlations between log(*ecbir*) with these variables are 98%, 98% and 80% respectively). In the case of a two-stage least-squares random-effects model, we use four estimators: G2SLS random-effects estimator (the default) (Balestra & Varadharajan-Krishnakumar, 1987), Baltagi's EC2SLS estimator (Baltagi, 2008), Baltagi-Chang estimator and an estimation where all the covariates are treated as exogenous and the instrument list ignored (CE). For the fixed effects model, we use two estimators: the fixed-effects (within) regression estimator (the default) and an estimation where all the covariates are treated as exogenous and the instrument list is ignored. According to Pirotte (2011), the comparison of several methods and estimators permits to ensure the validity of certain assumptions retained in the specification of the model.

5. Results and Conclusions

The ECB policy rate (*ecbir*) is relatively low since 1997 (good times). This *too low for too long* interest rate (November 2005-August 2008) favors an increase in debt securities other than shares to MFI (*sec*) and loans to Non-Financial Corporations (*nfc*). According to the values of elasticities, we observe that the impact on *sec* (0.582 and 0.6 in the models with instrumental variables) is higher than that on *nfc* (0.042 and 0.05 in the models with instrumental variables) (Tables 1&2). First, these results confirm the effectiveness of monetary policy on bank balance sheet. Moreover, they highlight a preference for speculative assets by MFI at the detriment of productive assets. The negative effect of an increase in *ecbir* on *sec* and *nfc* is particularly captured by the dummy variable (*dv*). All is consistent with the existence of a *risk taking channel* and the search for yield by banks in good times. On the contrary, an increase in the ECB policy rate positively impacts the deposit facilities by MFI with the ECB (*deposit*) because of the decrease in the opportunity cost of holding reserves. These empirical results confirm our assumption concerning bank behaviors according to monetary policy in good times. In other words, low interest rates can encourage banks to choose more profitable assets, which is even more accentuated in a context of underestimation of risks. In good times, banks consider market perception and so react in function of the Central bank action. Monetary policy, via its impact on risk aversion, does have an effect on bank balance sheets.

Table 1. Results in good times

	ln (deposit)		*ln (sec)*		*ln (nfc)*	
	RE	*FE*	*RE*	*FE*	*RE*	*FE*
ln (ecbir)	0.307***	0.403***	-0.592**	-0.592**	-0.042***	-0.042***
	-9.49	-5.01	(-2.31)	(-2.31)	(-4.76)	(-4.76)
ln (vstoxx)	0.018*	0.063*	-0.821***	-0.821***	-0.026***	-0.026***
	-1.85	-1.94	(-4.18)	(-4.18)	(-3.47)	(-3.46)
gdp	-0.034***	-0.044***	0.002**	0.002**	0.002***	0.002***
	(-8.5)	(-5.2)	-2.17	-2.17	-6.42	-6.42
inf	-0.054***	-0.122***	0.012	0.012	0.023	0.023
	(-4.48)	(-3.76)	-0.29	-0.31	-0.92	-0.92
m3	-1.631***	-1.55***	1.534***	1.534***	1.082***	1.082***
	(-57.1)	(-19.69)	-3.71	-3.7	-4.17	-4.17
ln (index)	-0.819***	-0.878***	0.464*	0.464*	0.303***	0.303***
	(-51.68)	(-25.19)	-1.69	-1.69	-3.95	-3.95
ln (ciss)	0.652***	0.64***	-0.023***	-0.023***	-0.016***	-0.016***

	-14.01	-53.01	(-4.02)	(-4.02)	(-2.48)	(-5.79)
dv	0.379***	0.33***	-0.036***	-0.036***	-0.031***	-0.031***
	-27.25	-9.15	(-5.79)	(-6.8)	(-2.53)	(-2.53)
cst	2.767***	2.59***	2.85***	2.85***	1.848***	1.848***
	-57.91	-18.8	-9.5	-10.13	-7.08	-8.98

Table 2. Results in good times with instrumental variables

			cst	*dv*	*ln (ecbir)*	*ln (vstoxx)*	*gdp*	*inf*	*m3*	*ln (index)*	*ln (ciss)*
ln (deposit)	*RE*	*GLS*	2.977***	0.396***	0.63***	0.069***	-0.018***	-0.057***	-1.605***	-0.498***	0.605***
			(6.035)	(25.05)	(20.78)	(4.82)	(-3.58)	(-3.66)	(-56.67)	(-25.58)	(14.059)
		Baltagi's EC2SLS	2.872***	0.395***	0.615***	0.065***	-0.018***	-0.057***	-1.607***	-0.513***	0.607***
			(5.501)	(25.68)	(24.56)	(3.5)	(-3.98)	(-4.4)	(-58.41)	(-21.91)	(13.49)
		Baltagi-Chang	2.877***	0.396***	0.63***	0.069***	-0.018***	-0.057***	-1.605***	-0.498***	0.605***
			(4.896)	(26.82)	(20.45)	(4.47)	(-4.47)	(-4.42)	(-45.98)	(-30.7)	(12.041)
		CE	2.574***	0.379***	0.607***	0.07***	-0.034***	-0.054***	-1.631***	-0.819***	0.652***
			(5.667)	(26.81)	(28.79)	(5)	(-6.2)	(-3.76)	(-54.74)	(-38.33)	(11.214)
	FE	*FE*	2.696***	0.344***	0.735***	0.062***	-0.028***	-0.119***	-1.52***	-0.558***	0.592***
			(5.89)	(19.09)	(6.99)	(6)	(-8.88)	(-4.72)	(-16.03)	(-13.11)	(15.44)
		CE	2.595***	0.33***	0.727***	0.063***	-0.044***	-0.123***	-1.55***	-0.878***	0.64***
			(5.93)	(18.06)	(6.7)	(5.4)	(-5.59)	(-4.12)	(-19.6)	(-24.42)	(17.28)
			cst	*dv*	*ln (ecbir)*	*ln (vstoxx)*	*gdp*	*inf*	*m3*	*ln (index)*	*ln (ciss)*
ln (sec)	*RE*	*GLS*	3.953***	-0.062***	-0.6*	-0.903***	0.075**	0.001	1.535***	0.244	-0.515***
			(8.16)	(-6.65)	(-1.83)	(-4.02)	(2.08)	(0.01)	(4.28)	(0.94)	(-4.47)
		Baltagi's EC2SLS	3.955***	-0.066***	-0.58*	-0.903***	0.075*	0.001	1.535***	0.244	-0.515***
			(10.11)	(-4.71)	(-1.76)	(-4.96)	(1.96)	(0.01)	(3.16)	(0.96)	(-4.72)
		Baltagi-Chang	3.953***	-0.036***	-0.56*	-0.903***	0.075**	0.001	1.535***	0.244	-0.515***
			(10.37)	(-5.66)	(-1.76)	(-5.42)	(2.1)	(0.02)	(4.39)	(0.96)	(-4.81)
		CE	2.85***	-0.036***	-0.591**	-0.821***	0.085***	0.006	1.534***	0.464*	-0.539***
			(10.16	(-4.71)	(-2.13)	(-3.47)	(2.22)	(0.11)	(3.33)	(1.81)	(-10.16)
	FE	*FE*	3.954***	-0.036***	-0.6*	-0.903***	0.075**	0	1.534***	0.244	-0.515***
			(10.72)	(-4.73)	(-1.73)	(-4.34)	(2.09)	0	(4.18)	(1.08)	(-4.22)
		CE	2.85***	-0.036***	-0.592***	-0.821***	0.085***	0.006	1.534***	0.464*	-0.539***
			(9.07)	(-5.17)	(-2.41)	(-3.73)	(2.4)	(0.13)	(3.8)	(4.17)	(-4.17)
			cst	*dv*	*ln (ecbir)*	*ln (vstoxx)*	*gdp*	*inf*	*m3*	*ln (index)*	*ln (ciss)*
ln (nfc)	*RE*	*GLS*	1.538***	-0.031***	-0.047***	-0.216***	0.035***	0.012	1.077***	0.17***	-0.09***
			(25.1)	(-4.73)	(-5.47)	(-4.13)	(5.79)	(0.44)	(4.71)	(2.73)	(-5.93)
		Baltagi's EC2SLS	1.538***	-0.037***	-0.05***	-0.216***	0.035***	0.012	1.019***	0.17***	-0.09***
			(32.23)	(-3.54)	(-6.41)	(-4.32)	(7.18)	(0.43)	(4.17)	(3.51)	(-6.65)
		Baltagi-Chang	1.538***	-0.031***	-0.052***	-0.216***	0.035***	0.012	1.077***	0.17***	-0.09***
			(26.95)	(-4.93)	(-7)	(-4.14)	(6.35)	(0.41)	(4.08)	(2.99)	(-5.31)
		CE	1.848***	-0.031***	-0.05***	-0.165***	0.049***	0.014	1.077***	0.303***	-0.096***
			(21.02)	(-3.15)	(-6.43)	(-4.15)	(6.46)	(0.6)	(4.04)	(4.19)	(-6)
	FE	*FE*	1.538***	-0.031***	-0.047***	-0.216***	0.035***	0.012	1.077***	0.17***	-0.09***
			(25.9)	(-4.41)	(-4.11)	(-3.08)	(5.75)	(0.51)	(4.76)	(2.86)	(-4.84)
		CE	1.848***	-0.031***	-0.049***	-0.165***	0.049***	0.014	1.082***	0.303***	-0.096***
			(24.08)	(-4.62)	(-4.84)	(-3.45)	(6.63)	(0.52)	(5.61)	(3.94)	(-5.79)

Secondly, an increase of European VIX (*vstoxx*) decreases *sec* and *nfc*, and conversely for a decrease. A low risk aversion implies an increase in the credit agreement (speculative and productive). As in the case of *ecbir*, the elasticities of *sec* (0.821 and 0.903 in the models with instrumental variables) are higher than the elasticities of *nfc* (0.026 and 0.216 in the models with instrumental variables). Again, the underestimation of risks in good times encourage banks to choose more risky and profitable assets. Moreover, an increase in *vstoxx* entails an increase in *deposit*, and conversely for a decrease. This result implies that a high risk aversion encourages banks

to seek sources of reliable liquidity. Here, we see that risk is a central element for banks after the crisis.

Table 3. Results in bad times with instrumental variables

			cst	*ln (ecbir)*	*ln (vstoxx)*	*gdp*	*inf*	*m3*	*ln (index)*	*ln (ciss)*
ln (deposit)	*RE*	*GLS*	2.56***	-1.849***	0.591***	-0.03***	-0.016***	-2.04***	-2.11***	1.962***
			(23.287)	(-67.35)	(119.84)	(-20.35)	(-3.83)	(-4.81)	(-77.07)	(85.14)
		Baltagi's EC2SLS	2.56***	-1.851***	0.591***	-0.03***	-0.016***	-2.04***	-2.11***	1.963***
			(17.371)	(-51.95)	(96.18)	(-14.34)	(-3.59)	(-4.92)	(-59.08)	(73.52)
		Baltagi-Chang	2.56***	-1.849***	0.591***	-0.03***	-0.016***	-2***	-2.11***	1.962***
			(12.268	(-39.31)	(104.15	(-13.55)	(-3.46)	(-5)	(-40.68)	(48.78)
		CE	2.566***	-1.308***	0.226***	-0.016***	-0.04***	-2.02***	-2.351***	1.12***
			(13.14)	(-39.23)	(23.05)	(-5.82)	(-3.49)	(-4.8)	(-53.34)	(48.11)
	FE	*FE*	2.563***	-1.83***	0.591***	-0.031***	-0.023***	-2.6***	-2.12***	1.952***
			(15.245)	(-45.87)	(95.39)	(-15.54)	(-3.77)	(-4.7)	(-50.31)	(53.32)
		CE	2.574***	-1.287***	0.232***	-0.018***	-0.057***	-2.62***	-2.37***	1.11***
			(8.064)	(-24.22)	(23.3)	(-4.04)	(-3.41)	(-4)	(-33.34)	(28.92)
			cst	*ln (ecbir)*	*ln (vstoxx)*	*gdp*	*inf*	*m3*	*ln (index)*	*ln (ciss)*
ln (sec)	*RE*	*GLS*	2.003***	0.123	-0.007**	0.018***	0.073***	2.21***	0.003***	-3.05**
			(10.64)	(0.53)	(-2.24)	(4.3)	(4.7)	(3.67)	(4.3)	(-2)
		Baltagi's EC2SLS	2.003***	0.123	-0.007***	0.018***	0.073***	2.21***	0.439***	-3.05**
			(5.93)	(0.52)	(-2.63)	(4.44)	(4.83)	(3.63)	(4.32)	(-2.01)
		Baltagi-Chang	2.003***	0.123	-0.007**	0.018***	0.0073***	2.21***	0.003***	-3.05**
			(10.59)	(0.56)	(-2.53)	(4.21)	(4.76)	(3.42)	(4.21)	(2.16)
		CE	2.006***	0.078	-0.007**	0.019***	0.072***	2.21***	0.003***	-3**
			(12.75)	(0.86)	(-2.26)	(4.57)	(4.77)	(3.49)	(4.51)	(-2.19)
	FE	*FE*	2.003***	0.123	-0.007**	0.018***	0.073***	2.21***	0.003***	-3.05**
			(10.51)	(0.61)	(-2.19)	(4.24)	(4.71)	(3.67)	(4.32)	(-2.2)
		CE	2.006***	0.078	-0.007**	0.019***	0.072***	2.21***	0.003***	-2.858***
			(11.82)	(0.96)	(-2.43)	(4.45)	(4.81)	(3.44)	(4.42)	(-2.16)
			cst	*ln (ecbir)*	*ln (vstoxx)*	*gdp*	*inf*	*m3*	*ln (index)*	*ln (ciss)*
ln (nfc)	*RE*	*GLS*	2.233***	0.039	-0.002***	0.002	0.023*	1.19	0.001	-0.54*
			(30.42)	(1.39)	(-2.72)	(0.66)	(1.85)	(0.5)	(0.41)	(-1.89)
		Baltagi's EC2SLS	2.232***	0.039	-0.002***	0.002	0.023*	1.19	0.001	-0.54*
			(25.24)	(1.11)	(-2.93)	(0.56)	(1.85)	(0.43)	(0.43)	(-1.89)
		Baltagi-Chang	2.232***	0.039	-0.002***	0.002	0.023*	1.19	0.001	-0.54*
			(25.21)	(1.46)	(-2.58)	(0.54)	(1.93)	(0.56)	(0.44)	(-1.79)
		CE	2.231***	0.025	-0.002***	0.002	0.022*	1.22	0.001	-0.582*
			(28.76)	(1.51)	(-2.84)	(0.51)	(1.99)	(0.66)	(0.27)	(-1.85)
	FE	*FE*	2.232***	0.039	-0.002***	0.002	0.023*	1.2	0.001	-0.54*
			(21.69)	(1.34)	(-2.69)	(0.46)	(1.85)	(0.64)	(0.4)	(-1.86)
		CE	2.231***	0.024	-0.002***	0.002	0.022*	1.23	0.001	-0.582*
			(21.63)	(1.2)	(-2.74)	(0.65)	(1.96)	(0.56)	(0.28)	(1.77)

Concerning the control variables, we observe that the bank portfolio choices are made in a cyclical way. In fact, there is a positive relation between *gdp*, *inf*, *m3* and *index* with *sec* and *nfc* (and negative with *deposit*) because these variables are indicative of a good economic conjuncture. "Productive" and "speculative" assets are procyclical and "safe" assets countercyclical. In the case of stress indicator (*ciss*), we have the inverse results; a negative relation with *sec* and *nfc*, and a positive relation with *deposit.* Indeed, in good times, this indicator of financial stability is at the lowest; promoting a preference for risk.

After the crisis, the results described above (Tables 1-4) tend to indicate that the expensive monetary policy adopted by the ECB after the crisis does not impact *sec* and *nfc*. This can partially be explained by the importance of the high risk aversion of MFI. In fact, liquidity and counterparty risks are so important, that monetary policy does not manage to influence bank choices. Indeed, *vstoxx* significantly impacts the three

explanatory variables. The higher risk aversion discourages banks to choose *sec* and *nfc* (with a superior effect on *sec*) and encourages them to prefer liquidity (positive sign with *deposit*). The higher elasticity of the variable *sec* witnesses a more procyclical characteristic of risky assets. In brief, risk aversion plays a role in determining bank choices along the cycle (in good times, via its reaction to monetary policy impact). In bad times, the interest rate policy looses its power on bank decisions, which can be explained in part by the central role of risk aversion.

Table 4. Results in bad times

	ln (deposit)		*ln (sec)*		*ln (nfc)*	
	RE	*FE*	*RE*	*FE*	*RE*	*FE*
ln (ecbir)	-1.303***	-1.279***	0.078	0.079	0.024	0.024
	(-38.6)	(-24.27)	-0.98	-0.97	-1.6	-1.64
ln (vstoxx)	0.233***	0.242***	-0.007***	-0.007***	-0.002*	-0.002*
	(15.31)	(11.86)	(-3.13)	(-3.13)	(-1.8)	(-1.86)
gdp	-0.016***	-0.018***	0.019***	0.019***	0.002	0.002
	(-5.46)	(-3.88)	(3.47)	(3.47)	(0.6)	(0.6)
inf	-0.044**	-0.064*	0.072***	0.072***	0.022*	0.022*
	(-2.03)	(-1.91)	(6.56)	(6.56)	(1.75)	(1.75)
m3	-2.251**	-2.346***	2.21**	2.21**	2.339	2.233
	(-2.74)	(-2.81)	(2.52)	(2.52)	(0.55)	(0.55)
ln (index)	-2.341***	-2.357***	0.003***	0.003***	0.001	0.002
	(-52.32)	(-34.14)	(7.09)	(7.08)	(0.3)	(0.3)
ln (ciss)	1.115***	1.103***	-2.858***	-2.858***	-0.582*	-0.582*
	(43.41)	(27.21)	(-5.29)	(-5.28)	(-1.86)	(-1.86)
cst	2.728***	2.798***	3.058***	3.057***	2.331***	2.231***
	(12.37)	(10.14)	(20.69)	(9.656)	(8.42)	(7.062)

In conclusion, our study has several results. First, it confirms a preference for speculative assets from MFI in European countries before the 2007-2008 crisis and a flight to liquidity afterwards. The second result concerns the determinants of this credit allocation. Bank choices are largely influenced by monetary policy in the upward phase. Before the crisis, via the impact on risk aversion, changes in policy rates modified risk perceptions, encouraging a preference by banks for more risky assets. This strategy answers also to a search for yield. After the crisis, traditional monetary policy becomes no effective because of a change in rationality of banks and the important role of high risk aversion. The fact that the official interest rate has no impact on productive loans after the crisis justifies the use of unconventional measures taken by ECB. Indeed, the fear of liquidity risk is so high that we could understand that measures to provide liquidity could limit the credit rationing by reducing risk aversion. So the following question concerns the effectiveness of unconventional measures to encourage credit distribution. To be effective, monetary policy has to produce a beneficial effect on risk aversion. According to Wu (2008), it could be counterproductive and accentuate tensions on financial markets. An extension of this study would be to analyze the effect of such measures on credit allocation, which could highlight the importance of a signal effect of monetary policy during bad times.

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Notes

Note 1. Note that underestimation of risks can be accentuated by their methods of valuation and especially since banks use securitization (Duffie, 2008; Gauthier & Tomura, 2011; Nijskens & Wagner, 2011). Moreover, rating agencies, on which the estimates are based, would give their note "through the cycle"(Borio & Drehmann, 2011).

Note 2. Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Spain, Portugal and United Kingdom.

Note 3. The Key ECB interest rate–Marginal lending facility–is expressed in Change in percentage points compared to previous rate.

Note 4. The CBOE Volatility Index, introduced in 1993, is a measure of market expectations of near-term volatility conveyed by S&P 500 stock index option prices.

Note 5. Inflation concern consumer prices and is expressed in annual rate of change.

Note 6. M3 is considered as Broad money and comprises, according to the ECB's definition, "M2 and marketable instruments issued by the MFI sector. Certain money market instruments, in particular money market fund (MMF) shares/units and repurchase agreements are included in this aggregate. A high degree of liquidity and price certainty make these instruments close substitutes for deposits. As a result of their inclusion, M3 is less affected by substitution between various liquid asset categories than narrower definitions of money, and is therefore more stable." This definition justifies the choice of M3 as control variable and not M1.

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Testing the Mixing Property of the Newcomb-Benford Profile: Implications for the Audit Context

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Abstract

Introduction: Circa 1996 Theodore Hill offered a definitive proof that under certain conditions a data generating process is likely to produce observations that follow the Newcomb-Benford Log10 (N-B) first digit profile. The central feature of Hill's proof is the mixing property from which seems to follow base invariance for scale transformations. Further, it has been observed that small datasets are often not part of the N-B profile set. **Study Precise**: This suggests that, if indeed the mixing process underlies the generation of the N-B profile, that one should be able to take small Non-Conforming base-invariant datasets that are generated by uncorrupted processes and aggregate them to form datasets that conform to the N-B profile. **Results**: We demonstrate mixing convergence and find a systematic movement from Non-Conformity to Conformity at a transition point on the order of 250 data points. **Impact**: We suggest the practical importance of the Hill-Mixing result for the certification audit. We have all of these tests, datasets and results coded in a Decision Support System in VBA: Excel™ that is available from the authors free without restriction to its use.

Keywords: theodore hill, newcomb-benford conformity, CapitalCube, base-invariance

1. Introduction

The historically available information on the Digit Frequency Profile (DFP) starts in 1881 when Simon Newcomb (1835-1909), Professor of Mathematics, Astronomer awarded *The Gold Medal of London's Royal Astronomical Society* (1874), and extensively published Political Economist (See: *American National Biography Online*: Newcomb, Simon, 19th century) notices a curious pattern of *Wear & Tear* of his logarithmic tables—his Decision Support System of the 19th century. He offers (1881, p. 39):

That the ten digits do not occur with equal frequency must be evident to any one making much use of logarithmic tables, and noticing how much faster the first pages wear out than the last ones. The first significant figure is oftener I than any other digit, and the frequency diminishes up to 9.

Newcomb's "curiosity-note" gathers archive dust for some fifty years until Frank Benford (1938), an electrical engineer with *General Electric Inc.* USA with many patents to his credit, who curiously never directly cites Newcomb, makes and records the same observation, Benford (1938, p. 551):

It has been observed that the pages of a much used table of common logarithms show evidences of a selective use of the natural numbers. The pages containing the logarithms of the low numbers 1 and 2 are apt to be more stained and frayed by use than those of the higher numbers 8 and 9.

Newcomb and Benford both arrived at a simple mathematical formula to characterize the likely distribution of the nine first digits. To wit the (N-B Profile Log10):

$$Frequency[d_i] = LOG10\ (1 + 1/d_i)\ for\ i = 1, 2, \ldots, 9 \quad (1)$$

Following on the work of Nigrini (1996), this simple formula, if it is the underlying generating process for digital frequencies in the Big Data milieu, can be used to benchmark particular *Observed* digital frequency profiles for the purpose of generating *variance information* that can pique the interest of the auditor to the possible end of launching an extended procedures examination of the particular dataset under audit examination.

The important questions begged by the "non-intuitive" observation of Newcomb and Benford are:

Why should EQ(1) work as a general DFP-generating process estimator? And under what conditions can an auditor reasonably expect to use EQ(1) as a profiling-screen for selecting accounts for possible extended procedures investigation?

The first research to address the theoretic underpinning of the Log10 formula (EQ1), as a reasonable and appropriate surrogate for un-perturbed data generating processes only starts to appear some 25 years after Benford's paper. In the 1960s, various aspects of the theoretical context of the Newcomb-Benford curiosity are offered by: Pinkham (1961), Adhikari and Sarkar (1968), Duncan (1969), and Raimi (1969). However, Hill (1995 a, b, 1996) is usually credited with providing the conclusive theoretical support for the *Why* and *Conditional* questions posed above. *En bref*, Hill (1998) and Fewster (2009), show by convincing argumentation and illustration respectively that: *Where there are datasets formed from (i) many differentiable sources, or (ii) a kernel data-generating process with many reasonably "orthogonal" variations that data generated subject to these idiosyncratic conditions/constraints seems to follow the first digital pattern sketched out by the Log10 formula*. We shall term this as *Hill-Mixing*. Additionally, Hill (1995b) shows that *Mixing* generates datasets that have the base-invariance property. Finally, Nigrini & Mittermaier (1997) and Durtschi, Hillison & Pacini (2004) observe that small datasets are usually not found to *Conform* to the N-B first digit profile. These three results/observations: (i) Hill-Mixing, (ii) Base-Invariance, (iii) Inherent small sample size *Non-Conformity* form the contextual basis for our research, the objectives of which are to:

1) Investigate the *implication* of these three facets of the Newcomb-Benford Profile that: *There should be a systematic transition from Non-Conformity to Conformity as one moves from Small Base-Invariant datasets to their aggregation*. This will be validation testing of the Hill-Mixing logic.
2) Find, for our test data, the *Point of the Conformity transition*, and
3) Discuss the *implications* of this *Conformity* Transition point for the *Auditor executing a PCAOB certification audit*.

Consider now the following three elements of this research investigation that are needed to effect this Hill-Mixing testing:

1) An alternative to the Newcomb-Benford Profile: Log10 Profile that will facilitate profile-testing of dataset *Conformity*.
2) Datasets of financial information that are likely to be from un-perturbed or non-corrupted data generating processes. In this regard, we downloaded four datasets of firms the data of which was subjected to a PCAOB audit; therefore, this data that was accepted by the SEC as free from material reporting error.
3) Two additional *Non-Conformity* & *Conformity* testing protocols measures that have been reported in the literature. These will be used as a robustness check on the *Conformity* Transition Point where the Small *Non-Conforming* datasets transition to *Conforming* datasets.

2. An Alternative to the Newcomb-Benford Profile: Log10 Profile

Remarkable thought it is, we will need a protocol to make the decision if the first digit profile is likely to be generated from a process that conforms to the N-B profile, because neither Newcomb nor Benford suggested a testing protocol for deciding **if a particular dataset is *Conforming* or *Non-Conforming* in nature**. In this regard, recent research of Lusk & Halperin (2014a) has offered an alternative benchmark to the Log10 model which is (i) related to the Log10 model, and (ii) based in the empirical realizations collected by Benford (1938, Table 1, p. 553). Lusk & Halperin (2014a) report that the mean frequency profile reported by Benford should be refined. They offer:

"Benford reports a curious measure: In Table 1, p. 553 we find the Average (Arithmetic Mean) for the 20 point measures for the first digit set. To produce this measure, he took the simple average of the point frequency measures as reported in Table 1. Actually, this has no useful statistical meaning. The correct frequency average is the number of digits in a particular first digital Bin as a ratio to the sample total of 20,229. For example, in Table 1, p.553 Benford has the frequency proportion average for "1" as: 30.6%. However, the correct frequency percentage is the unit-vector product of the 20 frequencies with the respective sample sizes for the first digit. This develops for the 20,229 observations that 5,849.295 were "1s" and the proper ratio is 5,849.295/20,229 = 28.9%."

This suggests that for the Newcomb-Benford profile one could use the N-B Log10 generating function or could use the Lusk and Halperin (2014a) corrected means for the 20 samples that Benford reports. These two

alternatives are presented in Table 1 following:

Table 1. The Benford practical profile (BPP) and the N-B log10 profiles

First Digit Array	Corrected Means of Benford Datasets	N-B Log10	Difference (ColB less ColC)
Digit 1	0.28919	0.30103	-0.01184
Digit 2	0.19462	0.17609	0.018530
Digit 3	0.12665	0.12494	0.001710
Digit 4	0.09061	0.09691	-0.00630
Digit 5	0.07544	0.07918	-0.00374
Digit 6	0.06431	0.06695	-0.00264
Digit 7	0.05408	0.05799	-0.00391
Digit 8	0.05487	0.05115	0.00372
Digit 9	0.05052	0.04576	0.00476

Source: Lusk and Halperin (2014a).

These two benchmarks are effectively the same as a perusal of the differences reported in Col4 supports. However, the corrected means of the BPP are most relevant to forming a testing interval as they are not point realizations but rather empirical observations and so will have a reliable measure of variation. Lusk & Halperin (2014a) use this empirical variation to form a *screening interval* as presented in Table 2:

Table 2. The Benford practical profile (BPP) screening interval

First Digit Array	Corrected Means of Benford Datasets, n=20	Lower Benford Screening Window (BSW) Value	Upper Benford Screening Window (BSW) Value
Digit 1	0.289189	0.275377	0.303001
Digit 2	0.194622	0.179919	0.209324
Digit 3	0.126650	0.111340	0.141960
Digit 4	0.090612	0.074990	0.106235
Digit 5	0.075436	0.059684	0.091189
Digit 6	0.064314	0.048467	0.080161
Digit 7	0.054081	0.038147	0.070014
Digit 8	0.054872	0.038945	0.070798
Digit 9	0.050522	0.034558	0.066485

Source: Lusk and Halperin (2014a).

This screening interval can be used to determine if the realized first digit profile is in the screening interval (ColC to ColD). The simple test, programmed into the DSS:Hill-Mixing is:

If a particular digital frequency is in the closed Screening BPP-Interval (ColC to ColD) then that digital frequency is judged to be: *Conforming*; otherwise, i.e., the frequency is not in the Screening BPP-Interval, then that frequency would be labeled as: *Non-Conforming*. Lusk and Halperin (2014a) find that if 2/3 of the frequencies or more, that is 6, 7, 8 or 9 specific digits are outside the Screening BPP-Interval that the dataset is likely to be *Non-Conforming*; otherwise, if 1, 2, 3, 4, 5 are outside the Screening Interval then the dataset is likely to be *Conforming*.

3. The Datasets Used to Test the Mixing Transition

As introduced above, in testing the Hill-Mixing result, we have selected commercial data as reported in the financial statements of PCAOB audited firms where the two opinions on their financial statements were judged by the SEC as indicating that the financials were reasonable reflections of the results of operations; this being the case the firms were "listed" on their trading exchanges. "Listing" is a critical accrual criterion as this suggests that there was no evidence that the data generating processes of the firm were inappropriately modified, corrupted, or constrained so as not to be representative of generating processes that would be expected to produce data that would conform to the Newcomb-Benford profile. Here the research of Ley (1996); Nigrini and Mittermaier (1997); Durtschi, Hillison and Pacini (2004); Reddy and Sabastin (2012) and Lusk and Halperin (2014b) taken together suggest that *Corrupted data generating processes often do not produce data that follows*

the "natural" Newcomb-Benford profile. Another reason for selecting commercial data as reported in the firm's financial statements is that most of the variables should be highly correlated which is a feature of base-invariance. Therefore, base-invariance will be a second accrual condition, to wit: that there is strong factor association among the selected variables.

Specifically, we selected the two dimensions that are most often used in classifying organizations. The first has to do with the nature of the GAAP-USA Lens elected by the firm to record the results of operation over the accounting period. This impact-aspect of these elections is usually labeled: *Discretionary Accruals* or simply *Accruals*, made by management. These accruals are the way that management can create their conception of the organization as report in the financials using the variety of rules in the GAAP-Lens. For example, revenue recognition rules are surprisingly varied and management can opt to follow an "Aggressive" recognition recording perspective relative to recording/recognizing revenue in the short-term resulting in a relatively large revenue influx; alternatively management could adopt a relatively "Conservative" view of revenue recognition that would give a very different revenue profile for the organization. These discretionary GAAP-recording issues are usually argued in the MD&A section of the 10-K, (*See EDGAR; Section 7 & 7a of the filed 10-K*) and so have, usually, the approval of the certification auditors as well as the SEC. See the following early works where Discretionary Accruals are carefully discussed and illustrated: Dechow, Sloan, and Sweeney (1995); Frankel, Johnson, and Nelson (2002); Gul, Chen, and Tsui (2003); Hodgson and Praag (2006); Doyle, Ge, and McVay (2007); and Dechow, Hutton, Kim, and Sloan (2012).

The specific set of definitions used in the category triage are offered by the *CaptialCube Inc.* as follows (Note 1):

***First Category**: **Conservative** or **Aggressive** application of Generally Acceptable Accounting Principles (GAAP)*:

Conservative is defined as: "*Company's net income margin and percentage of accruals are both higher than peer median. Usually indicative of a company with "understated" income because of a conservative accounting policy*."

Aggressive is defined as: "*Company's net income margin is higher than peer median while the percentage of accruals is lower than peer median. Usually indicative of a company with an aggressive accounting policy*."

***Second Category**: **High** or **Low** Accounting Fundamentals.*

Fundamentals is defined as: The Fundamental Analysis score is calculated by comparing the company's performance relative to peer companies across multiple attributes like relative valuation, valuation drivers, operations diagnostic, etc. The Fundamental Analysis score is computed daily, and incorporates the latest company and peer data as of the previous day.

For the classification partition, we selected, on 26 Oct 2014, the *CapitalCube* reported data and cross-classified Fundamental with Aggressive and Conservative Accounting. Specifically, we then took the Highest and the Lowest Fundamentals score for each of the GAAP categories. This resulted in the following accruals: Low Fundamentals and Conservative Accounting (LFCA), n=43; High Fundamentals and Conservative Accounting, (HFCA) n=49; Low Fundamentals and Aggressive Accounting, (LFAA) n=53 and High Fundamentals and Aggressive Accounting, (HFAA) n=44. These four exclusive datasets will each be investigated for their *Mixing-Transition* profiles. For these four datasets, we selected at least one *Income Statement* variable and at least one *Balance Sheet* variable and then randomly added between two and five additional variables including also *Cash Flow from Operations*. This then generated the following four test sets that are presented in Table 3.

Table 3. The four accrual datasets and the measurement variables (in millions)

	Current Assets	Total Assets	Current Liabilities	Total Liabilities	**Gross Profit/Loss**	**COGS**	*Cash Flow Operations*
LFCA, n=43; EV:3.5(89%)		49.1		40.6	3.5		1.8
HFCA, n=49; EV:5.7(95%)	3.5	7.8	1.6	3.9	2.6		1.2
LFAA, n=53; EV:3.6(89%)		21.6		16.4	1.2		0.5
HFAA, n=44; EV:4.1(82%)	0.7	1.6		0.8	0.6	0.07	

Source: Accrual Data.

We then computed the usual Harman (1976) eigenvalues (EV) that pertain to the un-rotated factor matrix based

upon Pearson Correlation Coefficients. This is the test for a Base-Invariance effect. The values that are reported in the cells are the Mean values of these variables. As one can observe these four accrual sets are certainly reasonable characterizations of "typical" firms in the trading milieu. For example, these groups are "not in a Stressed Equity Position" as Total Assets on average are greater than Total Liabilities. Finally, for these variables over the four groups, the first eigenvalues are reported and the percentage of variance therein accounted for is reported. The second eigenvalues for all four groups had as their Range: (0.20 to 0.53) clearly arguing for base-invariance. For example, for the Low Fundamentals & Conservative Accounting partition (LFCA) we randomly selected: Total Assets; Total Liabilities; Gross Profit/Loss; and Cash Flow from Operations. The lead eigenvalue was 3.5 and accounted for 89% of the total variance. Given these datasets consider now the testing our expectation of the Hill-Mixing process.

4. The Hill Mixing Process: Testing the Aggregation of Base Invariant Datasets

Using the results of Nigrini and Mittermaier (1997) and Durtschi, Hillison, and Pacini (2004) that small datasets are likely to be *Non-Conforming* and, on the other side of the partition offered by Durtschi, Hillison & Pacini (2004) that, under the usual conditions, large dataset are likely to be *Conforming*, we first tested each of the individual variables of the four datasets for *Conformity*. Then we systematically but randomly aggregated the various individual datasets and then re-tested this aggregation for *Conformity*; we continued these aggregations until there was one final aggregated dataset that was tested for *Conformity*. Using the Bayes-conditional expectation, derived from the initial testing of the individual datasets, we then offer an inferential context for these aggregation results. Finally, given the inferential evidence that there was support for the Hill-Mixing effect, we conducted a robustness calibration of the final results. All of this information is reported following in Table 4.

Table 4. The aggregation and staged results of the accrued datasets

Datasets	LFCA, n= 43	HFCA, n = 49	LFAA, n = 53	HFAA, n = 44
NonConform%	2/4: 50%	6/6; 100%	3/4; 75%	4/5; 80%
First Digits	N= 171	N= 287	N= 211	N = 215
1	0.309942	0.331010	0.312796	0.306977
2	0.187135	0.184669	0.170616	0.162791
3	0.128655	0.132404	0.137441	0.125581
4	0.122807	0.108014	0.099526	0.111628
5	0.052632	0.045296	0.080569	0.079070
6	0.058480	0.062718	0.075829	0.046512
7	0.040936	0.055749	0.033175	0.055814
8	0.046784	0.045296	0.028436	0.055814
9	0.052632	0.034843	0.061611	0.055814
Results	**C:[3]**	**C:[3]**	**C:[4]**	**C:[4]**

Source: Summary of Accrual Data.

There are a variety of interesting results that may be gleaned from Table 4. We tested the conformity of the individual datasets for the four accrual groups. The *Non-Conformity* percentage of these tests, is noted as NonConform%. For example, for the Low Fundamentals and Conservative Accounting (LFCA) of the four datasets each of which had 43 observations at download (Total Assets, Total Liabilities, Net Profit/Loss & Cash Flow: Operations) two variable sets of the four or 50% tested to be *Non-Conforming* according to the BPP screening test and so is noted as: NonConform% 2/4: 50%. Along the last row is the same screening information for the First Digit Profile for the aggregation of all the data from the various variables in a particular data group. The number in () is the number of digits that were outside the BPP interval as presented in Table 2. For example, the LFCA group had a final aggregated sample size of N = 171 values greater than zero and for that aggregated dataset the First Digit Profile as noted in Col2 had (3) digits that were outside the BPP screening interval. *See the Appendix for the details of this computation*. Therefore, the LFCA was noted as a *Conforming* Dataset as: C(3). The principal result is that all four datasets after complete aggregation tested to be *Conforming*. The inferential test of this result is the simple Bernoulli test of the directional disposition in the binary space: C or NC. To fix the benchmark which is, of course, the Bayes conditional estimate, we took the dataset mix as downloaded from which the aggregate was formed. In this case we use the weighted average NonConform% over the four groups to determine the *incidence* of *Conformity* at download. In this case, the weighted average Conform% was: 23.04% (1-76.96%); this produced a p-value for finding four aggregate datasets that were Conforming in nature for the

usual Null of: p = 0.0028 to four places. This is certainly convincing evidence that:

Mixing is associated with forming aggregate datasets that move from, in large part, Non-Conforming (in weighted average of 76.96%) to Conforming in nature.

Another important result of this testing is the likely False Positive Investigation Error (FPIE) signal relative to electing extended procedures testing. Recall that the sample sizes at download were in the range (43 to 53) and had overall a *Non-Conformity* profile of 77%. However, as these datasets were downloaded from firms that were listed on trading exchanges their data was tested by the Audit LLPs and also scrutinized by the SEC. In this case, these datasets as reported are NOT likely to have warranted extended procedures testing. Therefore, if the auditor used the BPP to screen these datasets as downloaded, then the Auditor would make a FPIE, investigating when it is not likely to be warranted, about 77% of the time. This is of course due to the "small-sample size" tendency to *Non-Conformity*. Looking at the results of the aggregation for these datasets, there is no indication that extended procedures are in fact warranted–in fact, all of the four datasets tested to be *Conforming* and so the FPIE is likely to have been very low for the aggregation profile. *Implication*: *The sample size Range for these four aggregation-datasets was (171 to 287). And so as one moves away from low sample sizes of around 50 to sample sizes around 250, one can expect the Hill-Mixing result to correctly produce a Conformity result thus reducing the FPIE dramatically.*

To enrich this result, we examined the robustness of this important validation of Hill's Mixing proof as conditioned on base-invariance; we examined the *Conformity* of the four datasets in Table 3 using two other *Conformity* testing models and also for the Log10 benchmark where applicable. Consider now these results.

5. Robustness Testing of the Principal BPP Result

To effect this robustness testing, we used the following two models to make the decision if the observed First Digital profile (O_i) is inferentially different from the BPP (BPP_i) or in some cases the Log10 (Log_i) profile:

Model A: The χ^2 model where the test is: if $\{(O_i)$ and $[BPP_i]\}$ or $\{(O_i)$ and $(Log_i)\}$ are different in FD-profile using the standard marginal expectation projections over all 18 digits. In this regard, Lusk & Halperin (2014b) argue that if the overall χ^2 computed is > 15.507 which is the 95% inferential cut-off, that the dataset is *Non-Conforming* in nature. Also in this regard, the χ^2 sample size anomaly does not come into play as the sample sizes were projected using the upper limit suggested by Lusk & Halperin (2104b) of 440.

Model B: This model uses the Nigrini (1996) z-test results and tests at what sample size does the 6th z-value move past 1.96. Lusk and Halperin (2014c) find that if this Critical Sample Size (CSS) is greater than their suggested triage point of 1,825, then the dataset is likely to be *Conforming*; and, if the CSS ≤ 1,825 then the dataset is likely to be *Non-Conforming*.

Using these two models the robustness results are presented in Table 5.

Table 5. Robustness testing of the Hill-Mixing result

Datasets	Low Conservative (LC)	High Conservative (HC)	Low Aggressive (LA)	High Aggressive (HA)
Overall χ^2 BPP	0.008798	0.018972	0.016098	0.012581
Overall χ^2 Log10	0.006542	0.017087	0.013684	0.013108
z-Test BPP	20,600	1,850	6,100	7,100
z-Test Log10	23,100	6,100	7,850	4,850

Source: Accrual Data.

The Overall χ^2values for the BPP or the Log10 profile relative to the (O_i) profile is remarkably low considering that the partitioning value is: 15.507. In this case, the χ^2 test results argue strongly for *Conformity* to the benchmarks. Further, the Critical Sample Size for the Nigrini z-test equations is, in all cases, greater than the triage point of 1,825 indicating that the datasets are likely to be *Conforming* in nature. These tests confirm the low FPIE result presented for the BPP testing. The last aspect that we wish to present is the implication of the validation of the Hill-Mixing result for the auditor.

6. Implications for the Auditor of the Hill-Mixing Results

The important implication of the empirical validation of the Hill-Mixing results is the need to condition the expectation of the auditor. Recall, the purpose of Digital Frequency testing is to identify candidates for possible discovery sample testing–it is, essentially, a screening protocol to ferret out, in an effective and efficient way,

those accounts that may warrant extended procedures testing in the audit. For example if *Non-Conformity* is detected this may be interpreted as indicating that extended procedures are warranted in the execution of the certification audit. However, the results reported above argue that first the auditor must consider the ***size of the datasets***, the Digital Frequency Profile (DFP) of which, has been developed. Small datasets, on the order of 50 observations, do not seem to provide sufficient observations to "fill in the digital" Bins so that their DFP can move towards the N-B or the BPP profile. In this case, the auditor invites, to be sure, the FPIE of selecting an account based upon its *Non-Conformity* profile where such *Non-Conformity* is driven by the small sample size rather than by a corrupted data generating process. With the results reported above the auditor can avoid this small-sample FPIE-anomaly by aggregating base-invariant, that is correlated, datasets to derive a sample of on the order of 250 observations, and then test such aggregations for *Non-Conformity*. This, we argue, will better approximate the FPIE consistent with the risk level of the audit as determined at the Analytic Procedures stages of the audit.

7. Summary, Conclusion and Outlook

7.1 Summary

The testing of the Hill-Mixing property has, for the datasets that we have collected, validated Hill's elegant proof (Note 2) of the Newcomb-Benford curiosity that leads to the first digit frequency profile popularized in the audit context by Nigrini (1996). We find that the observation of Nigrini and Mittermaier (1997) and Durtschi, Hillison, and Pacini (2004) that there is a small-dataset anomaly that by extension invites the FPIE in the audit context seems a valid concern. Finally, our results are conditioned on the fact that we, following Hill's results, used the base-invariance property to aggregate the small sample account dataset. Finally, we examined the robustness of these validation results by examining the DFP-nature of the finally aggregated datasets. In this regard, we used the DFT protocols that use the Overall χ^2 values for the BPP or the Log10 profile and the z-test calibration offered by Nigrini (1996).

7.2 Conclusion

The important recommendation that one may glean from these results is that aggregation of small correlated datasets of audit account variables, on the order of 50 observations, to form a single aggregate of at least 250 observations or so will move in the direction of avoiding testing based upon *Non-Conformity* where such an indication seems to result from the small sample size and so invites the FPIE.

7.3 Outlook

These results need to be replicated extensively to refine the FPIE small-sample size anomaly which is now initially set at 250 observations. In this regard, if auditors would contribute small un-corrupted datasets, on the order of 50 observations, drawn from the audit context, we would post these datasets on our *Commons* web-link for other researchers in this exciting Digital Frequency Profiling milieu. Additionally, one would extend this testing to non-base invariant aggregations. Finally, testing of the False Negative Investigation Error (FNIE), failing to investigate when it is likely needed, could enhance the DFP information for the audit context. Collecting such FNIE information will be very challenging as it assumes that there are corrupted data generating processes and that such data is available. In fact, in the usual audit context, such data is used to effect corrective actions and so the generating process is corrected and often the data from the corrupted process is lost. Possibly the only way to generate such data is to take *Non-Conforming* DFP reported in the literature and using these profiles run simulations of various sizes to examine the FNIE effect (Note 3).

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Notes

Note 1. These CapitalCube definitions are found on: (http://www.capitalcube.com/blog/index.php/glossary/fundamental-analysis-score/) which we last accessed: 10 Feb 2015.

Note 2.The proof of the N–B observation as a general data generating process is challenging. In speaking of Hill's theoretical proof of the First Digit Phenomena, Ken Ross, former president of the Mathematical Association of America, (2011, p. 571) offers: "*The most successful seems to be Theodore Hill's very nice, but sophisticated, analysis in Hill(1996). I found his analysis challenging, and I am reasonably acquainted with probability*."

Note 3. In this regard, Lusk & Halperin (2014c) have offered a reasonably comprehensive list of 30 *Non-Conforming* datasets that are part of the Decision Support System that they used in developing the information for this research paper. This set of data could be a valuable source of simulation information.

Appendix A. Illustration of the functioning of the Benford practical profile (BPP) screening interval

Digit	Lower Screening Boundary of the BPP	Gross Profit from Low Conservative Digital Profile	Upper Screening Boundary of the BPP
1	0.275377	0.34884	0.303001
2	0.179919	0.18605	0.209324
3	0.111340	0.06977	0.141960
4	0.074990	0.18605	0.106235
5	0.059684	0.04651	0.091189
6	0.048467	0.02326	0.080161
7	0.038147	0.02326	0.070014
8	0.038945	0.06977	0.070798
9	0.034558	0.04651	0.066485

Source Accrual Data.

Above we illustrate how the BPP was used in evaluating the digital profiles relative to their *Conformity* or *Non-Conformity*. We selected the dataset from the Low Fundamentals & Conservative Accounting (LFCA) where the Gross Profit was reported. This was a small dataset n = 43 and its DFP is reported in Col3. The DSS: Hill-Mixing evaluates these values relative to the Lower (Col2) and Upper (Col4) screening boundaries of the BPP. The shaded cells of the Gross Profit profile are NOT in the BPP. As there are six not in the BPP this dataset is labeled as *Non-Conforming*. All of the various datasets were so analyzed using the DSS: Hill-Mixing.

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Factors Affecting Mandatory Audit Rotation: Evidence from Jordan

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Abstract

The study aims to examine the effect of specific contingency variables upon mandatory audit rotation represented by external auditor rotation, namely; audit independence, financial interests, audit Fees, and litigation from the perception of external auditors. The study contribution based on tackling debatable subject and its importance as most the studies examined the external auditor rotation as independent variable and attempted to find out its effect on audit quality through audit independence. In addition, by examine the effect from the external auditor's perception. In order to attain the study objectives the study utilized a questionnaire.

The study population consists from the Jordanian audit firms including big four audit firms and the sample will be selected randomly with taking into account comprising the big four. The study distributed 80 questionnaires, the returned and accepted for analyzing questionnaires were 52 questionnaires which gives 65% respond rate.

The study indicated that the following variables audit independence, financial interests, litigation have a significant impact on the external auditor rotation in the Jordanian audit firms. In addition, the study indicated that there is insignificant impact of audit fees variable upon external auditor rotation. As accumulated impact of all the examined variables the study revealed that there is significant impact between on factors influence of the audit and external auditor rotation. Finally, the study suggested carrying out more studies on this subject by tackling more variables which might affect audit rotation.

Keywords: mandatory audit rotation, audit quality, audit independence, audit fees, Jordan

1. Introduction

Mandatory audit rotation is one of the debatable subjects which have been examined by many researchers, and recently the studies of this topic emphasis on the impact of the mandatory audit rotation on audit quality, audit independence, and audit roles.

Firth et al. (2012) argued that many countries have implemented rules that require an audit partner to rotate off the audit of a specific client after a certain period of time in the belief that rotation will improve independence and will allow for a fresh look at the audit.

The concept of mandatory audit rotation of audit firms is statutory prescription of the length of time an audit firm stays and renders professional services to its clients. It requires audit firms to be rotated after a specific number of years despite the efficiency, quality, independence, trust and the willingness of the shareholders to keep the audit firm (Onwuchekwa et al., 2012). Despite that the concept of mandatory auditor rotation came in as a result of highly publicized corporate failures that resulted in litigations which explains that rotation of external auditors was conceived to be a solution to possible familiarity threat between members of the audit firm and the client.

Mandatory audit firm rotation has been proposed as a potential solution to the possibility that long auditor tenure may lead to a deterioration of audit quality. Therefore, Audit quality determinants are a focus of the accounting and auditing literature. Researchers have debated the effect of auditor rotation on audit quality over the last half-century. As a result many studies conducted, to find out the effect of external auditor rotation on audit quality such as, (Sanders et al., 2009; Firth et al., 2012; Zeff, 2003; Habib, 2011; Jennings et al., 2008; Kim & Yi, 2009).

One the other hand, some studies linked the contemporary financial crisis to mandatory external auditor. Accordingly, this subject still a debatable topic in accounting filed as studies indicated that mandatory audit rotation would prevent auditors from becoming too close with managers, impacting on their independence and quality (Onwuchekwa et al., 2012).

Chanterelle and Johnston (2013) suggest how it can be useful of regulators as they consider the implementation of mandatory rotation. The study indicated that the conclusions reached about the possible effectiveness of mandatory audit firm rotation appear to depend on the type of data used (voluntary vs. mandatory auditor changes), suggesting that regulators should exercise care when drawing inferences from past audit firm rotation research.

Additionally, it has been argued that audit quality is diminished with long audit tenure, that mandatory rotation will reduces familiarity threat, ensures auditors independence and provides a greater skepticism and a fresh perspective that may be lacking in long-standing auditor client relationships as a consequence external auditor rotation enables auditors to take a new assessment at client risk and engagement issues which might increasing auditor independence.

Nevertheless, the opponents of mandatory audit rotation suggest that a loss of client knowledge when the auditor is forced to resign will ensure as auditors experience a significant learning curve with new clients (Knapp, 1991). Audit failures are generally higher in the first years of the auditor-client relationship as the new auditor understands the client's operations (Arel, Brody, & Pany, 2005).

As a result most of the studies examine the effect of external auditor rotation on the independence or on the audit quality; therefore, the current study will examine the external auditor rotation as dependent variable by examining factors which might affect eternal auditor rotation from the auditor perception.

1.1 Objective of the Study

The current study will examine the effect of specific contingency variables upon mandatory audit rotation represented by external auditor rotation, namely; audit independence, financial interests, audit Fees, and litigation from the perception of external auditors.

1.2 Research Question

According to the study objective, the current study will attempt to answer the following questions:

1) Does audit independence affect the external auditor rotation?
2) Does Financial Interests affect the external auditor rotation?
3) Does Audit Fees affect the external auditor rotation?
4) Does Litigation affect the external auditor rotation?

1.3 Significant of the Study

After reviewing the relevant literature concerning external auditor rotation, the study will be significant and tackling debatable subject and the following are the most importance of the study:

1) Most of the studies examined the external auditor rotation as independent variable and attempted to find out its effect on audit quality through audit independence.
2) One of the suggested reasons behind the recent financial crisis were the quality of audit services which effected directly by audit rotation.
3) The current study will examine the effect from the external auditors perception.

2. Literature Review and Hypotheses Development

Kalsom and Hazlina (2014) indicated that the Non-Big Four audit firms issued more qualified opinion. The association between reputable audit firm and the rotation of mandatory audit partner seemed significant in a study conducted in Malaysia to analyze the different types of audit report and audit rotation.

A study conducted by Sati P et al. (2014) in order to examines the audit quality consequences of China's mandatory audit partner rotation (MPR) regulation, which became effective in 2004. The study revealed that audit quality improves in the three years immediately following a client firm's MPR during the 2004-2011 periods for a sample of 273 Chinese publicly listed firms. The study highlighted that the improvement is most pronounced in those Chinese provinces with both low levels of audit market concentration and low levels of legal development .

Firth et al. (2012) argued that the Enron/Arthur Andersen scandal has raised concerns internationally about auditor independence, audit quality, and the need for regulatory action such as mandatory auditor rotation. In a study examined the effect of auditor rotation on audit quality and indicated that voluntary audit firm rotation although the significance level is much weaker than for mandatory partner rotation. Other forms of auditor rotations (i.e., mandatory audit firm rotation and voluntary audit partner rotation), have no effect on modified audit opinion.

Bobbie and Quinton (2011) attempted to explore loan officers' perceptions of auditors' independence and audit

quality under three experimental audit firm rotation scenarios. The study indicated that loan officers do perceive an increase in independence when the company follows an audit firm rotation policy. However, the length of auditor tenure within rotation fails to significantly change loan officers' perceptions of independence. Findings also indicate that neither the presence of a rotation policy nor the length of the auditor tenure within rotation significantly influences the loan officers' perceptions of audit quality.

On the other side a study conducted by Lu and Sivaramakrishnan (2009) to investigate the effects of mandatory audit firm rotation on companies' investment decision and auditor choice in a capital market setting. The study found that when firms engage in opinion shopping, mandatory audit firm rotation improves investment efficiency for some firms but impairs investment efficiency for other firms.

Blandón and Bosch (2013) Pointed that in 2010 Green Paper on Audit Policy by the European Commission has explicitly questioned the sufficiency of audit rotation rules established by European Union Members to guarantee auditor independence. In a study conducted to examine the effects of audit firm tenure on independence. Therefore, the study shown that there was not any significant effect of tenure on the opinion of the audit report.

Kouaib and Jarboui (2014) in a study examined the relation between external audit quality and ownership structure by using jointly external audit quality and ownership structure over managerial discretion in a largely unexplored, non-Western and emerging context. The study revealed that auditor reputation has a negative and significant effect on earnings management. In addition, revealed that there was effect of external audit quality variables and capital concentration on earnings management and the cross effect of this combined relation is negatively and significantly associated with earnings management of industrial firms but it has no significant effect on the earnings management of commercial firms .

Barbara et al. (2006) attempted to find out the Effects of Audit Firm Rotation on the Audit Process and indicated that auditors in the rotation condition are more likely to modify their audit report as contrasted to those in a situation in which a continuing relationship is expected.

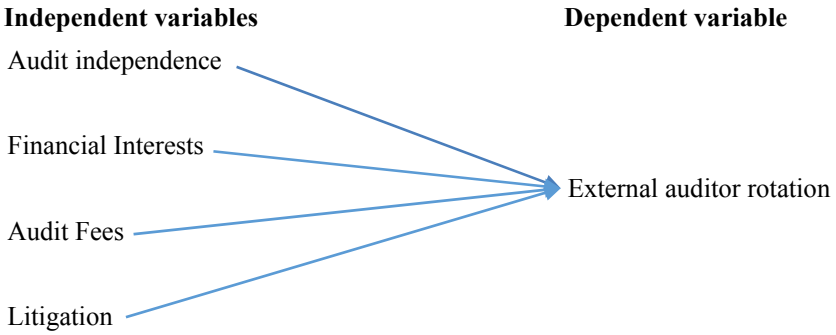
Chi and Huang (2005) examined how audit tenure affects earnings quality by investigating the effect of audit-firm and audit-partner tenure on the level of discretionary accruals. The study indicated that familiarity helps to produce higher earnings quality, but excessive familiarity results in lower earnings quality. Besides, Big 5 auditors are superior in obtaining learning experience in the initial period of engagement, which implies that the negative effect on earnings quality is more serious for clients of non-Big 5 auditors if audit-firm rotation is mandated.

A study conducted to examine the relation between auditor rotation and the appearance of independence and indicated that no statistically significant difference in beliefs about how much of an income reducing audit difference management will record, or in beliefs about auditor independence, between the two auditor rotation conditions. On the other hand, we find that non-professional investors do believe more of the audit difference will be recorded, and the auditors will be more independent, under a strong audit committee than a relatively weak audit committee. The second experiment provides further evidence on audit firm versus partner rotation by examining a setting involving a 26-year audit firm–client relationship. Again, no statistically significant differences between the two auditor rotation conditions were found. (Kaplan & Mauldin, 2008).

Tagesson et al. (2006) debated that Auditor independence is considered a key factor when ensuring high audit quality. Advocates for auditor rotation argue that rotation improves audit quality due to its positive influence on auditor independence. Opponents argue that rotation does not lead to improved audit quality, in a study and indicated that only weak support for the hypothesis that rotation influence audit quality. The weakness is partly due to measurement problems. In addition, they suggested that two main facets, perceived audit quality, which is significantly influenced by auditor rotation, and actual audit quality, which is not influenced by rotation. Benito and Paz-Ares (1997) examined the relation between Mandatory rotation and audit quality by analyzing the effect of requirement on audit cost and quality. The rule is shown to increase audit cost and price through the destruction of specific assets and the distortion of competition. The study indicated a negative impact on quality is also a highly plausible effect, as a consequence of the lower technical competence of auditors and fewer incentives for independent behavior-at least for diversified auditors.

According the preceding literature reviews most of the related literature concerning audit rotation, the studies focused on the effect of the audit rotation on many aspects of audit , mainly; audit quality, audit independence, qualified opinion, audit procedures and indicated that there is significant influence of the audit rotation on these variables , therefore, the current study will attempt to find out the converse effect by examine the effect of these variables on external auditor rotation in the Jordan. The following are the formula of the study theoretical study theoretical Framework followed by hypothesis of the study.

2.1 Study Theoretical Framework



2.2 Hypothesis of the Study

For the purpose of the current study and based on the relevant literature, the hypothesis is formulated in null form external auditor rotation.

2.2.1 The Main Hypothesis

H0: There is no impact between on Factors Influence of the audit and external auditor rotation.

2.2.2 The Sub-Hypothesis

H0:1: There is no impact between on the independence of the audit and external auditor rotation.

H0:2: There is no impact between on Financial Interests of the audit and external auditor rotation.

H0:3: There is no impact between on Audit Fees of the audit and external auditor rotation.

H0:4: There is no impact between on Litigation of the audit and external auditor rotation.

3. Study Methodology

The object of this study is to examine the impact of contingency variables upon external auditor rotation in Jordan. In order to achieve this objective the study will utilize a questionnaire as research collection method. The questionnaire will be entitled to the study respondents which represented by audit firms in Jordan. The study will distribute the questionnaire by handing the respondents y their copy in order to increase the respond rate and to cope with the Jordanian respondent's culture. The questionnaire will consist from three main sections; first section will design to collect general information regarding the auditors characters , second section will attempt to find out their perception regarding audit rotation and the last section will includes questions regarding gathering data concerning their perceptions of contingency variables. The data that will be collected will analyze utilizing tables and percentages. In order to testing the study hypothesis, the study will unitize simple and multiple regression technique.

3.1 Study Population and Sample

The study population consists from the Jordanian audit firms including big four audit firms and the sample will be selected randomly with taking into account comprising the big four. The study distributed 80 questionnaires, the returned and accepted for analyzing questionnaires were 52 questionnaires which gives 65% respond rate. The following table summarized the presented of returned questionnaires as shown in table No. 1 below.

Table 1. Study sample

Item	Frequency	Percentage
Big Four Company	26	50%
Non Big Four Company	26	50%

4. Analysis and Finding Discussion

4.1 Demographic Analysis of the Study

After gathering the data of the study, and built on what has been based upon the previous quarter of statistical methods, data were collected to draw conclusions for companies sample analysis, and includes this chapter on the three main sections, respect to the first section analysis of descriptive variables study utilizing several measures of statistical and descriptive Alost arithmetic standard deviation and the highest value and the lowest value. The

second section is related to the verification of the data for statistical analysis has expired, and the last section is to test hypotheses using simple regression model and discuss the results. As shown in table No. 2 below.

Table 2. Demographic results

Qualifications		
Percentage	**Frequency**	**Item**
Bachelor	49	94.20%
Masters	3	5.80%
Specialization		
Accounting	44	84.60%
Another specialization field	8	15.40%
Experience		
Less Than 5 years	32	61.50%
From 5-10	17	32.70%
From 11-15	3	5.80%
No. of Employees		
Up to 50	29	55.80%
Above 50	23	44.20%
Professional Certification		
ACPA	2	3.80%
CPA	9	17.30%
Another Identified	7	13.50%
There is no	34	65.40%

Table 2 above indicated to the high educated audit firm's staff and that influence the quality of audit services and the high level of awareness the employees of this firms.

Moreover, there is a reasonable indication of the staff to develop their education level by taken higher education. The result of specialization of the audit firms question indicated that almost 85% of the staff is specialized in accounting which gives them a high level of service quality and they have an applicable accounting background for processing audit services. The respondent's answers regarding their relevant experience in audit services indicated that almost 90% of the staff has at least 5 years' experience in audit field which provide them a decent opportunity to participate in different issues and give them more knowledge and skills. The table above indicated that audit firms in Jordan are small and medium size firms based on the number of employee were recruited.

Additionally, with respect to professional certification campaign there is 65% of respondents haven't possess professional certificates and 35% of them have possess professional certificates which gives a reasonable indication of the awareness of importance of these certificates in the practical life specially certificates related to audit field.

4.2 Reliability Statistics Test for Questionnaire

Table 3. Reliability test

Title	No. of Questions	Reliability	Validity
Opinion regarding auditor rotation	5	0.744	0.863
The Effect of audit independence on Auditor Rotation	14	0.942	0.971
The Impact of the Financial Interests on Auditor Rotation	6	0.882	0.939
The Impact of Audit Fees on Audit Rotation	4	0.915	0.957
The Effect Litigation on Auditor Rotation	7	0.913	0.956
Total	36	0.92	0.959

The reliability essential elements of a questionnaire tested by practical application by a group of experts chosen by the researcher in order to ensure racial stability and honesty in the questionnaire provide.

Therefore, where reliability coefficient (Reliability) the stability of the scale, non-contradiction with itself, that is, it gives the same results if re-applied to the same sample, while the mean honesty coefficient (Validity) that the

scale measures what has been developed to measure. To test reliability and honesty questions answers of the questionnaire was used Cranach's coefficient alpha (Cranach's Alpha) has reached the value of Cranach's alpha as follows: Table 3.

Notes from the above Table 3 that the alpha coefficient ratios indicate that there is a high degree of stability for the resolution of all questions, where alpha coefficient was statistically acceptable to all the constituent elements of the questionnaire and to the fact that such transactions is higher than (60%).

4.3 Test Hypotheses and Result Discussion

In order to achieve the study objectives the following section will represent the study hypothesis, preliminary the result of testing the individual independent variables with external audit rotation as dependent variable as shown below then determine the accumulated effect of all the independent variables on the depend variables.

4.3.1 Descriptive Analysis of the Contingency Variables

As show in table No. 4 below, the respondents were ranked the contingency variables and the answers indicated that financial interest consider as the most expected to effect the audit rotation followed by litigation variable , then audit independence. Moreover, the study revealed that audit service fees ranked to be the less variable which effect audit rotation.

Table 4. Contingency variables

Contingency variables	mean	S-deviation
The Impact of Audit Fees on Audit Rotation	3.53	0.947
The Effect of audit independence on Auditor Rotation	3.72	0.804
The Effect Litigation on Auditor Rotation	3.81	0.831
The Impact of the Financial Interests on Auditor Rotation	3.89	0.713

H0:1: There is no impact between on the independence of the audit and the external auditor rotation.

Table 5. Independence and external auditor rotation.

Sig	t- statistics	Coefficients	Constant B	audit independency B
0.039	6.894	-0.288	2.679	-0.217
Adjusted R Square			0.064	
Model F test			4.507	

Table displays (5) revealed the results of independence variable regression analysis and its impact on the external auditor rotation, The results showed that the value of (T TEST) calculated is greater than the value of (T tables), addition shows that the value of (sig>5%), which means that the independency affect the external auditor rotation, to be noted during the review of this table above that the coefficient of determination Adjusted R Square reached (0.064) which means that the external auditor rotation explain this rate of change independency.

H0:2: There is no impact between on Financial Interests of the audit and external auditor rotation.

Table 6. Inancial interests and external auditor rotation

Sig	t- statistics	Coefficients	Constant B	Financial Interests B
0.031	6.356	-0.302	2.879	-0.254
Adjusted R Square		0.073		
Model F test		4.926		

Table 6 displays the results of Financial Interests variable regression analysis and its impact on the external auditor rotation), The results showed that the value of (T TEST) calculated is greater than the value of (T tables), addition shows that the value of (sig>5%), and accordingly reject the hypothesis Ho ,which means that the Financial Interests affects the external auditor rotation, as the Adjusted R Square reached (0.073) which means that the external auditor rotation explain this rate of change Financial Interests.

H0:3: There is no impact between on Audit Fees of the audit and external auditor rotation.

Table 7. Audit fees and external auditor rotation

Sig	t- statistics	Coefficients	Constant B	Audit Fees B
0.360	6.653	-0.131	2.183	-0.083
Adjusted R Square			-0.003	
Model F test			0.855	

Table 7 displays the results of Audit Fees variable regression analysis and its impact on the external auditor rotation, The results showed that the value of (T TEST) calculated is greater than the value of (T tables), addition shows that the value of (sig> 5%), depending on the decision rule which states accept the hypothesis Ho if the calculated t value is less than the tabular value was the moral value sig greater than 0.05, which there is no impact for the audit fees on the external auditor rotation.

H0:4: There is no impact between on Litigation of the audit and external auditor rotation.

Table 8. Litigation and external auditor rotation

Sig	t- statistics	Coefficients	Constant B	Litigation B
0.015	7.464	-0.339	2.821	-0.245
Adjusted R Square			0.097	
Model F test			6.353	

Table 8 displays the results of Litigation variable regression analysis and its impact on the external auditor rotation, The results showed that the value of (T TEST) calculated is greater than the value of (T tables), addition shows that the value of (sig>5%), which means that the Litigation affects the external auditor rotation, to be noted during the review of this table that the coefficient of determination Adjusted R Square reached (0.097) which means that the external auditor rotation explain this rate of change Litigation.

H0: There is no impact between on Factors Influence of the audit and external auditor rotation.

Table 9. Contingency variables and external auditor rotation

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.412[a]	.170	.098	.57004

a. Predictors: (Constant), Independence , Financial Interests , Audit Fees, , Litigation

ANOVA[b]

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	3.065	4	.766	2.358	.042[a]
Residual	14.948	46	.325		
Total	18.012	50			

a. Predictors: (Constant), Seq6, Seq4, Seq5, Seq3

b. Dependent Variable: Seq2

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.094	.461		6.715	.000
Independence	-.077	.292	-.105	-.265	.022
Financial Interests	-.208	.175	-.247	-1.190	.240
Audit Fees	.227	.156	.358	1.455	.152

Litigation	-.239	.215	-.331	-1.114	.271
a. Dependent Variable: Seq2					

After discussing the sub-hypotheses given in Table 9 as the value sig (%42<%5) the hypothesis has been rejected the first main Hypothesis and this means that there is impact between on Factors Influence of the audit and external auditor rotation. It is worth mentioning that multiple regression analysis has shown that the factor analysis adjusted R Square (0.170) which means that the external auditor rotation explain the change in these Factors Influence.

5. Study Conclusion

Based on the study objective which emphasis on examining the effect of specific variables mainly; audit independence, financial Interests, audit fees, and litigation on the audit rotation from the perception of external auditors. The study indicated that the following variables audit independence, financial interests, litigation have a significant impact on the external auditor rotation in the Jordanian audit firms. In addition, the study indicated that there is insignificant impact of audit fees variable upon external auditor rotation. As accumulated impact of all the examined variables the study revealed that there is significant impact between on factors influence of the audit and external auditor rotation. The study support the preceding literature which examine the impact of these variables and audit rotation but from the perception of external auditors and examined the reverse impact as most the literature examined the audit rotation as independent variable and the current study examined it as depend variable . Accordingly, the study suggested carrying out more studies on this subject by tackling more variables which might affect audit rotation.

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Is the Welfare State Sustainable? Experimental Evidence on Citizens' Preferences for Redistribution

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Abstract

The sustainability of the welfare state ultimately depends on citizens' preferences for income redistribution. The major contribution of this paper is the novel elicitation of these preferences through a Discrete Choice Experiment performed in Switzerland. Attributes of the good are the share of GDP devoted to redistribution, its uses (the unemployed, old-age pensioners, people with ill health etc.), and nationality of beneficiary. Estimated marginal willingness to pay (MWTP) is positive among those who deem current social benefits too low, and negative otherwise. However, even those stating that government should reduce income inequality exhibit a negative MWTP on average. The estimated average WTP is maximum at 21 percent of GDP as of 2008, clearly below and significantly different from the current value of 25 percent. Thus, the Swiss welfare state does not appear sustainable in its present extent.

Keywords: income redistribution, welfare state, sustainability, preferences, willingness to pay, discrete choice experiments

1. Introduction

The sustainability of the welfare state is a hotly debated topic between politicians and interest groups. The economists' contribution to the debate traditionally has been to analyze the effects of redistributive policies on employment, output, and growth. However, in full cognition of these effects, a majority of citizens may still exhibit willingness to pay (WTP) for more redistribution of income. Conversely, its WTP may be negative even in a situation where these side effects of redistribution are unimportant. Ultimately, the sustainability of the welfare state therefore hinges on citizens' WTP for redistribution. Through a Discrete Choice experiment (DCE), this paper seeks to determine not only the desired amount of redistribution but also to test several hypotheses concerning the determinants of this WTP. The data come from a DCE performed in the fall of 2008 and involving more than 900 Swiss citizens.

Recently, there has been a great deal of research into the demand for redistribution and its determinants, which will be discussed in Section 2 below. One strand relates the measured amount of redistribution to economic, institutional, and behavioral factors. Examples are Alesina and Giuliano (2009) and Akkoyunlu et al. (2009). However, the observed amount of redistribution is the outcome of an interaction between demand and supply, with supply governed by a country's political institutions and processes. This classical identification problem would have to be addressed in order to make inferences about citizens' preferences for redistribution. A second strand of research, exemplified by Alesina and La Ferrara (2005) and Guillaud (2008), relies on surveys designed to measure attitudes towards redistribution. The problem with this approach is its failure to impose a budget constraint. It therefore cannot predict actual decision making (e.g. voting at the polls), where citizens take the consequences in terms of their own income and wealth into account. In the present paper, by way of contrast, an increased amount of income redistribution goes along with a higher share of personal income taxed away. A third approach seeks to solve this problem through Contingent Valuation (CV) studies (see e.g. Boeri et al., 2001; Boeri et al., 2002) (Note 1). The weakness of the CV approach is that it holds all the attributes of the good in question constant, varying its price only. However, one would want to vary other attributes of redistribution besides its tax price, viz. its uses (for health, old age, etc.) and the type of beneficiary (foreigner, national).

By way of contrast, a DCE allows measuring preferences uncontaminated by supply influences, it imposes the budget constraint through the price attribute, and it does so in a realistic way by making respondents choose

between alternatives where all attributes are allowed to vary. DCEs have been recently applied by Neustadt and Zweifel (2009), Neustadt (2011), and Neustadt and Zweifel (2011) for the case of Switzerland as well as by Pfarr (2013) and Pfarr et al. (2014) for the case of Germany.

There are two contributions whose methodology is similar to the one adopted in this paper. One is by Andreoni and Miller (2002), who test the consistency of altruistic revealed preferences in a dictatorship experiment, varying an implicit price. Their method of inferring preferences through estimating WTP values is close to this paper. The other is by Kuhn (2005), who asked Swiss respondents to estimate wages earned by different professions as well as to indicate the wages they deemed fair. The difference between these two values was then used as an indicator of the demand for redistribution. On average, preferences were for the wages of high-earning professions such as lawyers, physicians, and federal ministers to be reduced by 10 percent while those of low-income groups, to be increased by some 5 percent. Interestingly, such a redistributive scheme would roughly result in budget balance.

The remainder of this paper is structured as follows. Section 2 contains a literature review concerning general determinants of the demand for redistribution from which hypotheses to be tested are derived. Section 3 discusses behavioral determinants of the demand for redistribution with a focus on attitudes towards reduction of inequality. Section 4 presents a general description of the method of DCEs as well as the design of the present experiment. The descriptive statistics of the experiment follow in Section 5, and hypothesis tests, in Section 6. Section 7 summarizes the results and concludes with an assessment of the sustainability of the Swiss welfare state.

2. Literature Review

This section first presents research that defines the general background of this paper and then moves on to contributions that lead to a set of specific hypotheses to be tested. In their reviews, Alesina and Giuliano (2009) and Akkoyunlu et al. (2009) identify a wide set of factors that can be categorized as economic, political, and behavioral determinants of the demand for income redistribution. Whilst this section provides a review of the former two sets of factors, behavioral determinants are discussed in Section 3.

The simplest framework for the analysis of purely economic determinants is provided by a model focusing on current economic well-being, originally proposed by Romer (1975) and Roberts (1977) and extended by Meltzer and Richard (1981) (henceforth RRMR model). This model assumes non-altruistic utility-maximizing individuals differentiated by their income levels only. The government pays a lump-sum transfer to all citizens, financed by a linear uniform income tax. Individuals with an income below the mean favor taxation and transfers while those with an income above the mean oppose it. In a political equilibrium, the majority of voters support a positive tax rate corresponding to the value desired by the median voter (Note 2). The model's prediction is that the larger the gap between the mean and the median income, the higher the level of taxation and redistribution.

The empirical evidence is quite mixed. On the one hand, Alesina and Rodrik (1994), Persson and Tabellini (1994), and Milanovic (2000) find some supporting evidence. Furthermore, Guillaud (2008), conducting a cross-section analysis of survey data from four EU countries, shows that poorer and less educated individuals are more in favor of redistribution than richer and more highly educated ones. On the other hand, Alesina and Glaeser (2004), Perotti (1996), and Rodriguez (1999) fail to find supporting evidence for this model. Moreover, Neustadt and Zweifel (2009), relating WTP for income redistribution elicited from a DCE to measures of economic well-being, estimate WTP values to be negatively related to income and education, contradicting the RRMR model.

In Section 6.2 of this paper, we test a modified version of the RRMR model that relates the WTP for redistribution to a subjective measure of economic well-being, equal to one's self-positioning on the income ladder. The WTP values are shown to decrease with this subjective income measure for the lower steps on the ladder and, to increase, for the higher ones. Thus, the RRMR model cannot be confirmed even in its modified form.

Another economic explanation is the "Prospect of Upward Mobility" (POUM) hypothesis, suggested by Hirschman (1973) and dubbed 'tunnel effect'; more recently, it has been reformulated by Benabou and Ok (2001). It extends the RRMR model by introducing individuals' expectations, based on their observations regarding the income mobility of others in society. Expected upward mobility may dampen a poor but forward-looking voter's enthusiasm for income redistribution.

Empirical support of the POUM hypothesis is provided by Alesina and La Ferrara (2005) who, using an actual mobility matrix for the United States, show that people who can expect high future income do oppose

redistribution (Note 3). Rainer and Siedler (2008) employ probabilistic expectations data to show that individuals with a sufficiently large chance of occupational upward mobility exhibit a lower demand for redistribution; conversely, those with a sufficiently large risk of occupational downward mobility opt for more redistribution. Checchi and Filippin (2004), testing the POUM hypothesis by means of a within-subjects experiment, find corroborating evidence under several alternative specifications. According to Guillaud (2008), however, individuals who subjectively experienced upward mobility over ten years tend to be more (rather than less) supportive of redistributive policies. Moreover, upward intergenerational mobility in occupational prestige goes along with more positive rather than negative attitude towards redistribution. Alesina and Giuliano (2009) examine the empirical evidence for the United States and briefly across countries, concluding that social mobility (measured as the change in the occupational prestige) does decrease demand for redistribution once sociodemographic (age, gender, race) and socioeconomic characteristics (income, education) are controlled for. In their DCE-based study, Neustadt and Zweifel (2009) relate preferences for redistribution to mobility. They find partial empirical support for the POUM hypothesis.

Another economic explanation, suggested by the social contract literature, is that preferences for redistribution can at least in part be interpreted as a demand for insurance by risk-averse individuals. In a hypothetical situation, where individuals do not yet know their endowment as well as their future position in society ('veil of ignorance', cf. Rawls, 1999), they are predicted to exhibit positive WTP for an income transfer from more favorable future states to less favorable ones. Redistributive policies can thus be interpreted as reflecting this hypothetical demand for insurance. Beck (1994) investigates individual behavior under the 'veil of ignorance' in an experiment. By placing participants in a hypothetical society with random differences in income, represented by lotteries, he is able to derive the desired amount of income redistribution. Individuals indeed display risk aversion, albeit not of the extreme kind implied by the Rawlsian maximin rule (Note 4). Furthermore, they show no preference for income redistribution in excess of what can be explained by risk aversion.

As to the political determinants of the demand for income redistribution, the literature (Persson & Tabellini, 2000, 2003; Lizzeri & Persico, 2001; Milesi-Ferretti et al., 2002) predicts that proportional representation tends towards universal programs benefitting various groups (old-age pensioners, working poor, minorities, etc.), while majority rule results in targeted 'pork barrel' programs. Persson and Tabellini (2003) find supporting empirical evidence in that countries with proportional representation have GDP shares of government expenditure that ceteris paribus are 5 percentage points higher than countries with majority rule. Moreover, Akkoyunlu et al. (2009) present weak evidence of a positive correlation between the degree of proportional representation and the transfer share in GDP in OECD countries. Additional political determinants of redistribution include two-party vs. multiparty system, presidential vs. parliamentary democracy, and direct vs. representative democracy, with two-party systems, presidential, and direct democracies all predicted to induce less public redistribution. Since the present study is a DCE involving participants from one country only, it cannot test for the influence of these factors. Still, it is appropriate to provide some institutional background describing Switzerland along the dimensions cited. Switzerland with a population of 7.7 million people at the time of the DCE is characterized by (see e.g. Kriesi & Trechsel, 2008; Chapters 4 and 6).

- proportional representation rather than majority rule at the federal level and most member states (cantons);
- a multiparty system at both the federal and the cantonal level;
- extensive direct democratic control in the guise of popular initiatives and referenda.

3. Behavioral Determinants of Demand for Redistribution and Statement of Hypotheses

The mixed empirical evidence bearing on the economic determinants of preferences for redistribution calls for a detailed analysis of their behavioral determinants. One set relates to beliefs in luck or effort. The theoretical base is laid by Alesina and Angeletos (2005), who develop a model where society's belief whether effort or luck determines economic success gives rise to multiple equilibria with self-fulfilling predictions. Benabou and Tirole (2006) propose a model for the emergence and persistence of such collective beliefs. Depending on type, they can be seen as a source of altruistic preferences and inequality aversion. Fong (2001) presents evidence in line with Alesina and La Ferrara (2005) suggesting that beliefs about the role of luck in determining economic success are an important determinant of the demand for redistribution. She also considers the effects of incentives. If effort determines income, then an increased income tax rate causes an output loss due to its effect on incentives. This consideration is hypothesized to qualify the link between beliefs and the demand for redistribution. However, her data fail to support this hypothesis.

Neustadt (2011) uses Swiss data and shows that the estimated marginal WTP for income redistribution is positive among respondents who do not belong to a religious denomination, and negative otherwise, becoming more

marked with a higher degree of religiosity. Moreover, respondents who state that luck plays a decisive role in determining economic success exhibit significantly higher WTP values than those who deem effort to be decisive.

A second set of behavioral determinants is related to attitudes towards reduction of inequality based on interpersonal trust. Using data from Russia, Borisova et al. (2014) investigate the relationship between interpersonal trust and preferences for redistribution to different groups of recipients, confirming the hypothesis that people prefer less redistribution from the rich to the poor in an environment with a greater level of interpersonal trust. The estimated impact of trust on views on inequality is twice as large as that of female gender, and close to the (negative) effect of social expenditure in the particular region.

A third set of behavioral determinants has to do with attitudes towards reduction of inequality based on relative income. Taking the RRMR model as the benchmark, a higher amount of income redistribution is desired and hence sustainable if inequality aversion prevails, while the POUM hypothesis predicts the opposite, i.e. a lower sustainable amount of redistribution. Fehr and Schmidt (2006) provide a review of several models of social preferences, in particular, altruism, envy, inequality aversion, fairness, and reciprocity. Here, we focus on inequality aversion to derive hypotheses relating it to demand for income redistribution. In a simple model of inequality aversion, Fehr and Schmidt (1999) assume that individuals feel envy if their incomes are below that of others ('disadvantageous inequality', see second term of eq. (1)), but they feel altruistic when their income exceeds it ('advantageous inequality', see third term of eq. (1)). They posit a utility function for individual i of the form

$$U_i(x_1, \dots, x_n) = x_i - \frac{\alpha_i}{N-1} \sum_{j \neq i} \max\{x_j - x_i, 0\} - \frac{\beta_i}{N-1} \sum_{j \neq i} \max\{x_i - x_j, 0\}. \quad (1)$$

where x_k, $k = 1, \dots, N$, denotes individual k's income, α_i, the marginal disutility from disadvantageous inequality, and β_i, the marginal disutility from advantageous inequality. It is assumed that $0 \leq \beta_i \leq \alpha_i$ (the disutility from disadvantageous inequality is assumed to exceed that from advantageous inequality) and $\beta_i \leq 1$ (individuals are not willing to waste money in order to avoid being significantly richer than others). In this model, the decisive median voter demands more redistribution than in the conventional RRMR model. First, she has disutility from being richer than those with income $x_j < x_i$. Second, she has even more disutility from being poorer than those with income $x_j > x_i$. Thus in a political equilibrium, larger values of α_i, β_i (higher level of inequality aversion) lead to a higher demand for redistribution compared to that predicted by the RRMR model.

Since the DCE of this paper revolves around redistribution, inequality aversion is related to social benefits and government activity designed to reduce the income gap between rich and poor rather than the income distribution resulting from factor markets. One approach is backward-looking, measuring inequality aversion by asking respondents whether they deem the current level of social benefits to be too low, just sufficient, or too high. It leads to

Hypothesis 1: *Marginal willingness to pay for redistribution is expected to be:*

(A) ***negative*** *if the currently provided level of social benefits is considered* ***too high***.

(B) ***negative but less so than in*** (A) *if the currently provided level of social benefits is considered to be* ***just sufficient***.

(C) ***positive*** *if the currently provided level of social benefits is considered* ***too low***.

Alternatively, the approach can be forward-looking and normative, measuring inequality aversion by having respondents evaluate government activity. Here, respondents who state that the government should do more to reduce the income gap are expected to exhibit a positive MWTP for redistribution.

Hypothesis 2: *Marginal willingness to pay for redistribution is expected to be:*

(a) ***negative*** *if the individual thinks that the government* ***should not*** *reduce the income gap between the poor and the rich.*

(b) ***positive*** *if the individual thinks that the government* ***should*** *reduce the income gap between the poor and the rich.*

Note that while these two hypotheses may appear to be almost self-evident, they cannot be derived from either the RRMR or the POUM models, both of which are couched in terms of strictly individualistic preferences.

4. The Discrete Choice Experiment

4.1 Theoretical Foundations

Discrete Choice Experiments (DCEs) provide a tool for measuring individuals' preferences for characteristics of

commodities, the so-called attributes. In contradistinction to classical Revealed Preference Theory, originating with Samuelson (1938), DCEs allow individuals to express their preferences for non-marketed as well as hypothetical products. During a DCE, respondents are repeatedly asked to compare the status quo with several hypothetical alternatives defined by their attributes including a price. By varying the levels of attributes, different product alternatives are generated. Assuming that rational individuals always choose the alternative with highest utility, the researcher can infer the utility associated with the attributes from the observed choices. The proposed method, derived from the New Demand Theory of Lancaster (1971), is also known as Conjoint Analysis (Louviere, 2000).

The most prominent alternative to a DCE is Contingent Valuation (CV). A certain situation or product is described in detail, and respondents are asked to indicate their maximum WTP for this fixed product. Only its price attribute is varied, while in Conjoint Analysis all relevant attributes are varied simultaneously, making it a multi-attribute valuation method (Merino-Castello, 2003). A DCE describes the product in less detail than a typical CV study; in return, it allows for analyzing many product varieties by varying the levels of relevant attributes (Louviere, 2000, p. 344). Trade-offs among attributes can be explicitly taken into account and WTP values of attributes estimated separately (see below). Furthermore, strategic behavior of respondents is less likely than in CV with its exclusive emphasis on price, which facilitates strategic behavior. Finally, biases that easily occur when individuals are directly asked about their WTP are less frequently observed in DCEs (Ryan, 2004).

A particular advantage of a DCE in the present context is that it permits to explicitly impose the budget constraint through a price attribute in the guise of the tax share of income used to finance the transfers considered. Respondents can be made to simultaneously choose this share and hence the 'size of the pie' and the 'slices of the pie' devoted to different types of recipients and uses (health, old age, etc.; see Exhibits B1 to B3 in Appendix B). Thus, trade-offs among different attributes of redistribution can be calculated to assess the relative importance of the respective redistributive goals.

The econometric method used is based on Random Utility Theory (Luce, 1959; Manski & Lerman, 1977; McFadden, 1974, 1981, 2001; see Appendix 1 for details).

A simple model relating utilities and choice probabilities to attributes only (see Section 4.1 below), the deterministic part of the indirect utility function is postulated to be

$$w_i(a_j,p_j,y_i,s_i) = c_i + \sum_{k=1}^{K} \beta_k a_{kj} + \varepsilon_{ij}, \quad (2)$$

where c_i represents an individual-specific constant, a_k, $k = 1, \dots, K$, are the attributes of the alternative, and β_k, $k = 1, \dots, K$, are the parameters to be estimated. These parameters can be interpreted as the constant marginal utilities of the corresponding attributes. One obtains the following expression representing the difference in utility of individual *i* between alternative *j* and status quo,

$$\Delta V_{ij} = c_i + \sum_{k=1}^{K} \beta_k \Delta a_{kj} + \beta_p \Delta p_j + \varphi_{ij}, \quad (3)$$

where $\Delta a_{kj} = a_{kj} - a_{lj}$, $\Delta p_j = p_j - p_l$, $c_i = c_{il} - c_{ij}$, and $\varphi_{ij} = \varepsilon_{il} - \varepsilon_{ij}$ for each $j \neq l$. The marginal rate of substitution between two attributes *m* and *n* is given by

$$MRS_{m,n} = -\frac{\partial \Delta V / \partial \Delta a_m}{\partial \Delta V / \partial \Delta a_n}. \quad (4)$$

Therefore, the marginal WTP for attribute a_m can be calculated by dividing the marginal utility of this attribute by the marginal utility of the price attribute (in the present context, the income tax rate, see e.g. Telser (2002), p.56] (Note 5):

$$MWTP(a_m) = \frac{\partial \Delta V / \partial \Delta a_m}{\partial \Delta V / \partial \Delta p_j}. \quad (5)$$

For econometric inference, it is important to recall that the same individual makes several choices. The two-way random-effect specification takes this into account through $\varphi_{ij} = \mu_i + \eta_{ij}$ where μ_i denotes the component that varies only across individuals but not across the choice alternatives. The terms μ_i and η_{ij} are assumed uncorrelated with the product attributes $(a_{i1}, \dots, a_{iK})$ and between themselves. By a standard assumption in probit models, $\sigma_\eta = 1$. Hence $Var[\varphi_{ij}] = \sigma_\eta^2 + \sigma_\mu^2 = 1 + \sigma_\mu^2$ and $Corr[\varphi_{ij}, \varphi_{il}] = \sigma_\mu^2/(1 + \sigma_\mu^2) =: \rho$. The parameter ρ indicates how strongly the various responses of an individual are correlated with each other, or, equivalently, the share of the total variance that can be explained by the individual-specific error term. The random-effects specification is justified if ρ is high and significant.

4.2 Experimental Design

The experiment was conducted with a representative sample of 979 respondents in the fall of 2008. Respondents

were provided with full decision sets including graphical representations of the status quo and alternatives (see Appendix B for examples) and were asked to submit their binary choices during a telephone survey. In order to make sure that decisions were based on a homogeneous information set and made in a consistent way, respondents additionally received a detailed description of the attributes and their possible realizations. Appendix B shows the graphical representation of the status quo (Exhibit B1) and two selected alternatives (Exhibits B2 and B3). Data collection followed in a telephone survey some days later and additionally included a questionnaire covering a wide range of respondents' socioeconomic and behavioral characteristics.

Table 1. Attributes and their levels

Attribute	Label	Status Quo Level	Alternative Levels
Shares of benefits going to			
• Working poor	W_POOR	10%	5%, 15%
• Unemployed	UNEMP	15%	5%, 25%
• Old-age pensioners	PENS	45%	35%, 55%
• Families with children	FAM	5%	10%
• People with ill health	ILL	25%	20%, 30%
Shares of benefits going to			
• Swiss citizens	SWISS	75%	60%, 85%
• Western European citizens	WEU_FOR	10%	5%, 20%
• Other foreigners	OTH_FOR	15%	10%, 20%
Total amount of redistribution	REDIST	25% (of GDP)	10%, 20%, 30%, 40%, 50%
Income tax	TAX	25% (of personal income)	10%, 15%, 40%

Prior to the experiment, the attributes and their levels used to define 'income redistribution' had been checked in two pretests for their relevance. There are four types of attributes (see Table 1 and Appendix B),

1) Shares of the total redistribution budget to be spent on five types of recipients (viz. the working poor, the unemployed, old-age pensioners, families with children, and people with ill health);
2) Shares of the total redistribution budget to be spent on three groups (viz. Swiss citizens, western European foreigners, and other foreigners);
3) Total amount of redistribution, defined as a share of GDP;
4) Personal income tax rate to be paid by the respondent (the price attribute).

These attributes and their levels combine to form a total number of possible scenarios that is excessive for an experiment. The scenarios define the n rows of the observation matrix X, with associated covariance matrix $\Omega = \sigma^2(X'X)^{-1}$ of parameters β to be estimated. So-called D-efficient design calls for the minimization of the geometric mean of the eigenvalues of Ω,

$$D\text{-efficiency} = \left(|\Omega|^{\frac{1}{K}}\right)^{-1}$$

where K denotes the number of parameters to be estimated [Carlsson & Martinsson (2003)] (Note 6). Using this optimization procedure and incorporating several restrictions, the number of alternatives was reduced to 35 and randomly split into five groups. One alternative was included twice in each decision set for a consistency test, resulting in eight binary choices per respondent.

5. Descriptive Statistics

5.1 Socioeconomic Characteristics

The sample consists of 979 respondents, 70 percent of them residing in the German-speaking part and 30 percent in the French-speaking part of Switzerland. Some 94 percent are born in the country, 50 percent are men, 20 percent having monthly incomes below CHF 2,000 and 23 percent, above CHF 6,000, reflecting the structure of the Swiss population. However, only 1.5 percent of the respondents are unemployed. The survey was implemented by an organization that specializes in nationally representative surveys using a carefully developed sampling strategy.

Table 2. Answers to the question, "Do you think that the government is spending too much, too little or about the right amount on welfare?" by income group

	too little		right amount		too much		total valid answers		missing
Income group, CHF	No.	%	No.	%	No.	%	No.	%	No.
< CHF 2000	63	35	100	56	16	9	179	100	13
CHF 2000-3999	58	32	94	53	27	15	179	100	14
CHF 4000-5999	141	43	149	45	39	12	329	100	15
>CHF 6000	79	37	118	56	14	7	211	100	10
Missing	11		16		1		28		
Total answers	352	38	477	52	97	10	926		53

Note. CHF (Swiss franc) = 0.8 US$ at 2008 exchange rates.

Some 38 percent of the respondents stated that the current level of social benefits was too low, 10 percent stated that it was too high, and 52 percent found it exactly right (see Table 2). On the other hand, 45 percent agreed with the statement, "By increasing the income tax rates for rich families and financially supporting poor families, the government should try to reduce the income gap between the rich and the poor", while 55 percent disagreed (see Table 3).

Table 3. Answers to the question, "Do you agree with the following statement: *'By increasing the income tax rates for rich families and financially supporting poor families,the government should try to reduce the income gap between the rich and the poor'*?" by income group

	yes		no		total valid answers		missing
Income group, CHF	No.	%	No.	%	No.	%	No.
< CHF 2000	78	42	108	58	186	100	6
CHF 2000 - 3999	112	59	77	41	189	100	4
CHF 4000 - 5999	124	37	212	63	336	100	8
>CHF 6000	90	42	122	58	212	100	9
Missing	13		16		29		
Total answers	417	45	535	55	952		27

Note. CHF (Swiss franc) = 0.8 US$ at 2008 exchange rates.

The distribution of answers over income groups obviously contradicts the RRMR model. For instance, 35 percent of respondents with monthly incomes below CHF 2,000 (the 'poor') deem the current amount of social benefits too low, but this holds true for even 37 percent of those with incomes above CHF 6,000 (the 'rich') (see Table 2 again). Similarly, the percentage of those finding the current size of the welfare state excessive is 9 percent among the 'poor' but only 7 percent among the 'rich'. Moreover, the share of those supporting a reduction of the income gap by public redistribution is 42 percent both among the 'rich' and the 'poor' (see Table 3).

Table 4. Answers to the question, "What is your self-assessed position on the income ladder from step 1 (the poorest ones) to step 10 (the richest ones)?" by income group

	steps 1 to 3		step 4		step 5		steps 6 to 9		total valid answers		missing
Income group, CHF	No.	%	No.	%	No.	%	No.	%	No.	%	No.
< CHF 2000	46	24	79	39	56	29	10	5	191	100	1
CHF 2000 - 3999	69	36	71	37	41	21	12	6	193	100	0
CHF 4000 - 5999	61	18	177	52	82	24	22	6	342	100	2
>CHF 6000	20	9	72	33	79	36	50	23	221	100	0
Missing	5		6		12		4		27		2
Total answers	201	21	405	42	270	28	98	10	974		5

Note. CHF (Swiss franc) = 0.8 US$ at 2008 exchange rates.

However, it is essential to distinguish between the objective current income level and the subjective beliefs of the respondents concerning their relative income status. For example, those respondents who belong to a high income group may not think they are 'rich'. Table 4 supports this assertion, showing the correlation between the income levels and subjective socioeconomic status. Whereas 34 percent of respondents from the lowest income group think they belong to at least Step 5 of the income ladder, making them relatively 'rich', 42 percent of respondents from the highest income group think to be relatively 'poor' by placing themselves on Steps 1 to 4. With a rather low correlation coefficient of 0.26, the relationship between objective and subjective socioeconomic status suggests that it is more appropriate to relate inequality aversion to subjective beliefs regarding one's income rather than objective measures of income.

Table 5. Answers to the question, "Do you think that the government is spending too much, too little, or about the right amount on welfare?" by self-assessed position on the income ladder

	too little		right amount		too much		total valid answers		missing
Self-assessed economic status	No.	%	No.	%	No.	%	No.	%	No.
Steps 1 - 3	64	34	86	46	37	20	187	100	14
Step 4	163	42	192	49	35	9	390	100	15
Step 5	93	37	140	56	18	7	251	100	19
Steps 6 - 9	31	33	56	60	7	7	94	100	4
Missing	1		3		0		4		1
Total answers	352	38	477	52	97	10	926		43

Table 5 only partially confirms this assertion, showing that share of the status quo supporters among all respondents (column 'right amount', %) increases with self-assessed social status. However, share of those who support the reduction of the income gap between the rich and the poor by public redistribution is maximum (57%) among the respondents with highest self-assessed economic status while maximum opposition to the reduction of income gap (67%) prevails among those who deem themselves moderately poor (Step 4) (see Table 6). Therefore, the contradictions presented in Tables 2 and 3 are unlikely to be explained by failure of the rich to feel rich and the poor, to feel poor.

Table 6. Answers to the question, "Do you agree with the following statement: *'By increasing the income tax rates for rich families and financially supporting poor families,the government should try to reduce the income gap between the rich and the poor'*?" by self-assessed position on the income ladder

	yes		no		total valid answers		missing
Self-assessed economic status	No.	%	No.	%	No.	%	No.
Steps 1 - 3	97	50	97	50	194	100	7
Step 4	133	33	265	67	398	100	7
Step 5	131	50.4	129	49.6	260	100	10
Steps 6 - 9	55	57	41	43	96	100	2
Missing	1		3		1		
Total answers	417	45	535	55	948		27

These findings motivate examining explanations of the demand for income redistribution based on beliefs and inequality aversion. However, as noted in Section 3, inequality aversion could be due to risk aversion in front of the 'veil of ignorance'. Indeed, 56 percent of respondents state 'insurance' as their main motive for redistribution, compared to 44 percent citing 'inequality reduction' (see Table 7). Attitudes clearly differ between the two groups, too. Only one-third of respondents with the 'insurance' motivation support the idea of inequality reduction to be brought about by government, compared to 55 percent of those with the 'inequality reduction' motive. In sum, 'true' inequality aversion in the sense of Fehr and Schmidt (1999) may well be relevant, at least in the present sample.

Table 7. Answers to the questions, "Do you agree with the following statement: *'By increasing the income tax rates for rich families and financially supporting poor families,the government should try to reduce the income gap between the rich and the poor'*?" and "What is your main motive for redistribution: insurance or inequality reduction?"

	yes		no		total valid answers		missing
Redistribution motive	No.	%	No.	%	No.	%	No.
Insurance	164	33	339	67	503	100	10
Inequality reduction	219	55	181	45	400	100	13
Missing	34		15		49		
Total answers	417	45	535	55	952		27

5.2 Respondents' Choice Behavior

Table 8. Total number of choices

Choices	No.	in percent
Alternative	1,562	19.94
Status quo	6,088	77.73
No decision	182	2.32
Total	7,832	100

There is a total of 979 · 8 = 7,832 choices, of which almost 20 percent were made in favor of an alternative over the status quo (see Table 8). There are at least three explanations for this low percentage. First, in spite of checking in the pretests, the levels of the attributes in the experiment might not have been sufficiently spaced apart to make respondents switch. Second, some attributes (e.g. benefits going to the unemployed; see Table 10), might not have been important enough to cause a switch. Finally, there may be errors in decision making because a test (presenting the same choice twice) revealed 14 percent of choices to be inconsistent. However, there may be simply a marked status quo bias in the face of highly complex decision-making situations, as suggested by the large negative constant in Table 10. Nonetheless, only 21 percent of respondents never opted for an alternative [see Table 8 again), implying that almost 80 percent departed from the status quo at least once. No more than 11 percent of respondents stated that the DCE was difficult or very difficult, a figure in the usual range (see e.g. Telser, 2002, Ch. 4, who reports a share of 28 percent).

Table 9. Distribution of the number of chosen alternatives per respondent

# choices for alternative	No.	in percent
0	209	21.35
1	309	31.56
2	226	23.08
3	131	13.38
4	57	5.82
5	16	1.63
6	10	1.02
7	0	0.00
8	5	0.51
Total valid answers	965	98.57
Missing	14	1.43
Sample	979	100

6. Estimation

6.1 Simple Model: Product Attrubutes Only

Estimation of equation (3) includes the quadratic term $REDIST^2$ to allow for possible non-linearity of the indirect utility function (predicated by risk aversion and the insurance motive for redistribution, see Section 3) with regard to the GDP share of redistribution *REDIST*. Moreover, the fact that uses and types of beneficiaries add up

to 100 percent needs to be taken into account (see Table 1). In order to avoid perfect collinearity, *PENS* (Pensioners) and *OTH_FOR* (Other foreigners) were dropped to obtain the specification (see Table 1 for variable definitions).

$$\Delta V = c_0 + \beta_1 \Delta W_{POOR} + \beta_2 \Delta UNEMP + \beta_3 \Delta ILL + \beta_4 \Delta FAM +$$
$$+\gamma_1 \Delta SWISS + \gamma_2 \Delta WEU\_FOR + \delta_1 \Delta REDIST + \delta_2 \Delta REDIST^2 + \eta \Delta TAX + \varphi \quad (6)$$

Estimation of a subset of the 5 · 3 = 15 specifications with alternative exclusions produced results similar to those displayed in Table 10. Specifically, they agree in that alternatives with additional redistribution are chosen with a lower probability (for details with regard to 'slices' of the pie, see Neustadt and Zweifel, 2011). Also, note the sizeable and highly significant coefficient of the price attribute *TAX*, which is important for the estimation of MWTP values (see eq. (5)). The MWTP value for redistribution is given by

$$MWTP_{REDIST} = \frac{\partial \Delta V / \partial \Delta REDIST}{\partial \Delta V / \partial \Delta TAX} = -\frac{\delta_1 + 2\delta_2 \, REDIST}{\eta} \quad (7)$$

According to Table 10, this amounts to -0.25 percentage points of income share per additional percentage point of GDP devoted to redistribution in excess of the status quo. Evaluated at the mean personal income of the sample, this equals CHF -11.78 per month. However, this figure is dwarfed by the compensation one would have to pay respondents to depart from the status quo, amounting to an estimated 63 percent of their monthly income, or 5.27 percent of their annual income (see the large negative constant in Table 10).

Table 10. Random effects probit estimates of the simple model

Variable	Coefficient	Standard error	*z*	*p*-value	Marginal effect
Recipient's social group					
W_POOR	0.02784	0.00714	3.90	0.000	0.00697
UNEMP	0.01134	0.00452	2.51	0.012	0.00284
ILL	0.01600	0.00463	3.46	0.001	0.00400
FAM	0.06378	0.00942	6.77	0.000	0.01596
Recipient's nationality					
SWISS	0.03656	0.00552	6.63	0.000	0.00915
WEU_FOR	0.02925	0.00869	3.37	0.001	0.00732
REDIST	-0.00523	0.00176	-2.97	0.003	-0.00131
REDIST^2	-0.06619	0.01174	-5.64	0.000	-0.01656
TAX	-0.02053	0.00183	-11.21	0.000	-0.00514
Constant	-1.29878	0.06132	-21.18	0.000	n.a.

Where: # observations: 7,650; Log likelihood: -3,566.76; $\chi^2(0)$: 108.87; Prob >χ^2: 0.000; σ_u: 0.41610; ρ: 0.14759.

Equation (7) serves as the basis for checking the sustainability of the welfare state. Construction of the (quadratic) WTP function yields a maximum (with MWTP=0) at 21.05 percent of GDP, definitely below the current value of 25 percent. Therefore, the Swiss welfare state can be said to be too big in the light of citizens' mean preferences.

6.2 Extended Model: Preference Heterogeneity

6.2.1 Subjective Beliefs about Income Status and Preferences for Redistribution

Here, the simple model is extended by including the self-positioning on an income ladder as well as its interactions with the attributes. The four groups of respondents are represented by three dummy variables, *STEP1-3*, *STEP5* and *STEP6-9*. For instance, the dummy variable *STEP6-9* is set to be equal to 1 if the respondent belongs to steps 6, 7, 8 or 9 on the income ladder, or equal to zero otherwise. The reference category is *STEP4*, indicating that the respondent believes that he belongs to step 4 on the income ladder. Since an attribute's marginal utility may vary with attitude, eg. (6) is modified to contain interaction terms involving the attitudinal variables, resulting in

$$\Delta V' = c_0' + \cdots + \alpha_1' STEP1-3 + \alpha_2' STEP5 + \alpha_3' STEP6-9 + \alpha_4' \Delta REDIST + \alpha_5' \Delta REDIST^2 + \ldots$$
$$+\lambda_2' \Delta REDIST \cdot STEP1-3 + \lambda_3' \Delta REDIST^2 \cdot STEP1-3 + \ldots$$
$$+\lambda_4' \Delta REDIST \cdot STEP5 + \lambda_5' \Delta REDIST^2 \cdot STEP5 + \ldots$$
$$+\lambda_6' \Delta REDIST \cdot STEP6-9 + \lambda_7' \Delta REDIST^2 \cdot STEP6-9 + \cdots + \varphi'. \quad (8)$$

As opposed to the classical RRMR model that lacks empirical support, there is partial evidence concerning the effects of subjective beliefs about income status on MWTP for redistribution. As shown in Table 11, which summarizes MWTP values for different groups of respondents, resistance against redistribution seems to increase from the lowest to group No. 2 of the subjective income ladder. Yet, the difference between Groups 1 and 2 is not significant (t = -1.20). However, MWTP for redistribution increases from group No. 2 (whichincludes the median respondent) to the highest. Therefore, the contradictions in Tables 2 and 3 (see Section 5.1) cannot be explained by failure of the rich to feel rich and the poor, to feel poor.

Table 11. Marginal WTP values for redistribution (in percent of monthly personal income and CHF) derived from the model extended to include the subjective belief about the position on the income ladder

Variable	MWTP, % of income	MWTP, CHF	Standard error, CHF
Social group 1 (steps 1 to 3)	-0.40762	-14.72	8.49***
Social group 2 (step 4)	-0.65405	-28.45	8.81***
Social group 3 (step 5)	-0.30303	-15.06	12.36*
Social group 4 (steps 6 to 9)	0.25550	17.61	11.01*

Note. *** (**,*) denotes statistical significance at the 1 (5, 10) percent level.

6.2.2 Ex-Post Evaluation of the Current Level of Social Benefits and Preferences for Redistribution

The simple model is now extended by one attitudinal variable at a time. The first is respondents' ex-post evaluation of the current level of social benefits (SB, see Table 2). The three levels of SB are represented by two dummy variables, *SB_TOOHI* and *SB_TOOLOW*. For instance, the dummy variable *SB_TOOLOW* is set to be equal to 1 if the current level of benefits is deemed too low, and equal to zero otherwise. The reference category is *SB_RIGHT*, indicating that the respondent deemed social benefits to have the right size. Since an attribute's marginal utility may vary with attitude, eg. (6) is modified to contain interaction terms involving the attitudinal variables, resulting in

$$\begin{aligned}\Delta V' = {} & c_0' + \cdots + \alpha_1' SB\_TOOLOW + \ \ldots + \alpha_2' \Delta REDIST + \alpha_3' \Delta REDIST^2 \ + \ \ldots \\ & + \lambda_2' \Delta REDIST \cdot SB\_TOOLOW + \lambda_3' \Delta REDIST^2 \cdot SB\_TOOLOW + \ \ldots \\ & + \lambda_4' \Delta REDIST \cdot SB\_TOOHI + \lambda_5' \Delta REDIST^2 \cdot SB\_TOOHI + \ \varphi'. \end{aligned} \tag{9}$$

Table 12. Marginal WTP values for redistribution (in percent of monthly personal income and CHF) derived from the model extended to include ex-post evaluations of the current level of social benefits

Variable	Expected sign	MWTP, % of income	MWTP, CHF	Std. error, CHF
Social benefits too high (Group A)	-	-0.55946	-26.75	16.70***
The right amount (Group B)	≈ 0	-0.41789	-19.61	8.34***
Social benefits too low (Group C)	+	0.05487	2.47	8.09

Note. *** denotes statistical significance of MWTP in % of income at the 1 percent level.

Hypothesis 1(A) of Section 3 states that demand for redistribution is expected to be negative if the currently provided level of social benefits is considered too high. It is confirmed, with MWTP for a one percentage point increase of the total amount of redistribution amounting to CHF -26.75 (see Table 12). Hypothesis 1(C), stating that the demand for redistribution should be positive if the level of social benefits is considered insufficient, finds some empirical support by a positive but insignificant MWTP of CHF 2.47. However, Hypothesis 1(B), predicting the demand for redistribution to be negative but close to zero for individuals who deem the current level of benefits just sufficient, cannot be confirmed. In fact, the average respondent in this group exhibits a significantly negative MWTP for redistribution of CHF -19.61 per month. A t test indicates that the difference in MWTP values between respondent groups A and B is not significant, again contradicting Hypothesis 1(B).

As a check on the sustainability of the welfare state in the presence of preference heterogeneity, group-specific WTP functions are constructed. Group A is found to have their maximum WTP at a GDP share of 15.89 percent devoted to redistribution. The values of Groups B and C are 18.45 percent and 25.52 percent of GDP, respectively. Therefore, attitudes with regard to the amount of social benefits do go along with heterogeneous preferences with regard to income redistribution. These discrepancies point to sharp conflicts of interest in the

event that the current amount of redistribution were to be reduced to 21 percent, the value preferred by the average citizen.

6.2.3 Assessment of the Government's Role in Dealing with Inequality and Preferences for Redistribution

Next, the simple model is extended by including the dummy variable *GOV_REDUCE* (=1 if the respondent thinks that the government should reduce the income gap between the rich and the poor, =0 otherwise) as well as its interactions with the attributes. Thus, eq. (6) is modified to read,

$$\Delta V' = c_0'' + \cdots + \alpha_1'' GOV\_REDUCE + \ldots + \alpha_2'' \Delta REDIST + \alpha_3'' \Delta REDIST^2 + \ldots + \kappa_2'' \Delta REDIST \cdot GOV\_REDUCE + \kappa_3'' \Delta REDIST^2 \cdot GOV\_REDUCE + \ldots + \varphi''. \quad (10)$$

Table 13. Marginal WTP values for redistribution (in percent of monthly personal income and CHF) derived from the model extended to include the assessments whether the government should reduce the income gap between the rich and the poor

Variable	Expected sign	MWTP, % of income	MWTP, CHF	Standard error, CHF
Should not reduce (Group a)	-	-0.34515	-16.68	6.35***
Should reduce (Group b)	+	-0.08417	-3.63	9.25

Note. *** denotes statistical significance of MWTP in % of income at the 1 percent level.

Hypothesis 2(a) states that demand for redistribution is expected to be negative if a respondent believes that the government should not reduce the income gap between the rich and the poor. It is confirmed because MWTP in Group (a) is CHF -16.68 and statistically significant. Hypothesis 2(b) with its prediction for MWTP to be positive if a respondent wants the government to reduce the income gap cannot be confirmed. If at all, MWTP is negative in Group (b) but lacks statistical significance. Thus, individuals who stated support for inequality reduction by the government seem to exhibit inconsistent behavior by having negative MWTP for this reduction. However, the framing of the question posed prior to the DCE, "Do you agree with the following statement: *'By increasing the income tax rates for rich families and financially supporting poor families, the government should try to reduce the income gap between the rich and the poor'*?" does not evoke the trade-off between the reduction of the income gap and the respondent's own income. By way of contrast, the MWTP values come from the Discrete Choice Experiment (DCE), where the budget restriction is inevitably present. Addressing the sustainability issue once more, recall that the average respondent would prefer a share of GDP devoted to redistribution of 21 percent rather than the current value of 25 percent. The difference between these values is statistically significant. However, group-specific WTP functions indicate that optimal values of *REDIST* differ, with 19.21 percent of GDP for Group (a) and 24.09 percent for Group (b), respectively. Therefore, demand for income redistribution as measured by this DCE, while below the amount provided by the government, once more differs importantly between subpopulations, rendering a reform of the Swiss welfare state difficult.

7. Discussion and Conclusion

In this paper, a Discrete Choice experiment (DCE) performed in 2008 served to elicit citizens' willingness to pay (WTP) for income redistribution. The main advantage of a DCE in the present context is that it permits to explicitly impose the budget constraint through a price attribute, defined as the tax share of income used to finance income redistribution. Respondents are made to simultaneously choose the total 'size of the pie', i.e. the total amount of income redistribution as a share of GDP, and the 'slices of this pie' devoted to different types of recipients and uses for different levels of the personal income tax (see Appendix B).

Based on a simple model relating choices to the attributes of redistribution only, the average Swiss citizen would have to be paid a compensation of CHF 11.78 (some US$ 9.40) per month (0.25 percent of monthly income) for an additional percentage point of GDP devoted to public redistribution. In addition, a very marked status quo bias would have to be overcome by payment of another 63 percent of monthly income.

The experiment also permits to test several hypotheses concerning the determinants of the demand for redistribution without any confounding supply-side influences. In particular, Hypothesis 1 states that it is negative (close to zero) among citizens who think that public welfare currently provided welfare is excessive (sufficient). An extended model that includes the pertinent attitudinal variable as a regressor yields confirming evidence for the 'excessive' category; however, the 'sufficient' category is also associated with a negative marginal willingness to pay (MWTP) value, contradicting the hypothesis. Hypothesis 2 predicts that citizens who do (not) want government to reduce the income gap between the rich and the poor exhibit positive (negative)

MWTP for redistribution. Here, the extended version of the model supports the 'not' component of the hypothesis whereas those in favor of closing the gap fail to exhibit positive MWTP. The major finding of the paper, however, is that estimated average WTP is maximum at 21 percent of GDP devoted to redistribution, clearly below and statistically significantly different from the current value of 25 percent. Moreover, this value differs importantly depending on attitudes toward the desirable amount of redistribution and the government's role in dealing with inequality. Thus, there is reason for concern with regard to the sustainability of the Swiss welfare state in its present extent.

The analysis presented in this paper is subject to several limitations. First, several behavioral explanations of the demand for redistribution (risk aversion, other beliefs, religiosity) were not tested. However, recent research suggests that up to 90 percent of cross-country differences in public spending can be related to institutional and behavioral factors (see e.g. Alesina and Glaeser, 2004; Akkoyunlu et al., 2009). Thus, future work should be devoted to find out whether these factors also influence stated WTP for redistribution. A first step in this direction has been undertaken by Neustadt (2011), linking MWTP for redistribution to religiosity. Furthermore, as suggested by recent contributions to the public choice literature, citizens' preferences can be importantly influenced by political institutions, in particular by party programs (see e.g. Schläpfer et al., 2007). Thus, future work should be devoted to a detailed analysis of political preferences in order to find out whether these factors also influence stated WTP for redistribution. This analysis would, however, require addressing the identification problem once again, since the supply of public redistribution is governed by political institutions.

Second, the status quo bias found in this paper calls for more detailed analysis. To the extent that it reflects risk aversion, it should induce demand for redistribution–contrary to the results presented here. One possible explanation of why it is so high may be the fact that some preferences are not fully formed prior to a choice experiment (see e.g. Stutzer et al., 2007). Another explanation may be redistribution illusion, i.e. the fact that some respondents fail to correctly perceive the actual status quo. Finally, the evidence only relates to a point of time in one country and thus may be subject to transitory shocks and country-specific influences. Still, by appealing to citizens' stated preferences, the present contribution does shed light on the question whether a welfare state laying claim to one quarter of the GDP is sustainable.

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Appendix A

Random Utility Theory

Individual *i* values alternative *j* according to the utility V_{ij} attained, which is given by

$$V_{ij} = v_i(a_j, p_j, y_i, s_i, \varepsilon_{ij}) \tag{A.1}$$

Here, $v_i(\cdot)$ denotes *i*'s indirect utility function, a_j, the amount of attributes associated with alternative *j*, and p_j, price. The individual's income and sociodemographic characteristics are symbolized by y_i and s_i, respectively. Finally, ε_{ij} denotes the error term, which is due to the fact that the experimenter will never observe all the arguments entering v_i, imparting a stochastic element to observed choices.

As usual, the utility function is additively split into a systematic component $w(\cdot)$ and a stochastic one,

$$V_{ij} = w_i(a_j, p_j, y_i, s_i) + \varepsilon_{ij}$$

A utility-maximizing individual *i* will prefer alternative *j* to alternative *l* if and only if

$$w_i(a_l, p_l, y_i, s_i) + \varepsilon_{il} \leq w_i(a_j, p_j, y_i, s_i) + \varepsilon_{ij} \tag{A.2}$$

Due to the presence of the stochastic term, only the probability P_{ij} of individual *i* choosing alternative *j* rather than alternative *l* can be estimated, with

$$P_{ij} = Prob\left[w_i(a_l, p_l, y_i, s_i) + \varepsilon_{il} \leq w_i(a_j, p_j, y_i, s_i) + \varepsilon_{ij}\right] \tag{A.3}$$

$$= Prob\left[\varepsilon_{il} - \varepsilon_{ij} \leq w_i(a_j, p_j, y_i, s_i) - w_i(a_l, p_l, y_i, s_i)\right]. \tag{A.4}$$

Thus, the probability of choosing *j* amounts to the probability of the systematic utility difference $w_i[j] - w_i[l]$ dominating the 'noise', $\varepsilon_{il} - \varepsilon_{ij}$. The error terms $\{\varepsilon_{il}, \varepsilon_{ij}\}$ can be assumed to be normally distributed with mean zero and variances σ_l^2 and σ_j^2 as well as covariance σ_{lj}. Under these assumptions, $\varphi_{ij} := \varepsilon_{il} - \varepsilon_{ij}$ is also normally distributed with mean zero and variance $\sigma^2 := Var[\varphi_{ij}] = \sigma_l^2 + \sigma_j^2 - 2\sigma_{lj}$. Thus, equation (A.4) can be represented as

$$P_{ij} = \Phi\left(\frac{w\_i(a\_j, p\_j, y\_i, s\_i) - w\_i(a\_l, p\_l, y\_i, s\_i)}{\sigma}\right) \tag{A.5}$$

where $\Phi(\cdot)$ denotes the cdf of a standard normal distribution. This model is known as the binary probit model [Ben-Akiva & Lerman (1985)]. Hensher et al. (1999) provide empirical evidence suggesting that a linear specification of the function $w(\cdot)$ leads to good predictions in its middle ranges.

The simple model (3) in the body of the paper can be extended by including various socioeconomic variables (e.g. income group, level of education, social mobility). These variables need to be interacted with the product attributes as well as with the constant, giving rise to the extended model specification which allows to check for preference heterogeneity and thus to test Hypotheses 1 and 2 of Section 6.2. By means of a *t* test one can investigate whether the differences in marginal WTP values between different socioeconomic groups are statistically significant. The computation of the variance of the marginal WTP values is performed by the delta method [Hole (2007)]. The estimate of the variance is given by

$$Var\left[-\frac{\hat{\beta}_k}{\hat{\beta}_p}\right] = \left[\frac{\partial\left(-\frac{\hat{\beta}_k}{\hat{\beta}_p}\right)}{\partial\hat{\beta}_k}\right]^2 Var[\hat{\beta}_k] + \left[\frac{\partial\left(-\frac{\hat{\beta}_k}{\hat{\beta}_p}\right)}{\partial\hat{\beta}_p}\right]^2 Var[\hat{\beta}_p] - 2\frac{\partial\left(-\frac{\hat{\beta}_k}{\hat{\beta}_p}\right)}{\partial\hat{\beta}_k}\frac{\partial\left(-\frac{\hat{\beta}_k}{\hat{\beta}_p}\right)}{\partial\hat{\beta}_p} Cov\left[\hat{\beta}_k, \hat{\beta}_p\right]$$

$$= \frac{1}{\hat{\beta}_p^2} Var\left[\hat{\beta}_k\right] + \frac{\hat{\beta}_k^2}{\hat{\beta}_p^4} Var[\hat{\beta}_p] + 2\,\frac{\hat{\beta}_k}{\hat{\beta}_p^3} Cov\left[\hat{\beta}_k, \hat{\beta}_p\right]$$

The confidence interval can thus be created as follows,

$$-\frac{\hat{\beta}_k}{\hat{\beta}_p} \pm z_{\alpha/2}\sqrt{Var\left(-\frac{\hat{\beta}_k}{\hat{\beta}_p}\right)}.$$

Appendix B

Status Quo and Selected Alternatives

Exhibit B1: Status Quo Card (current state of redistribution)

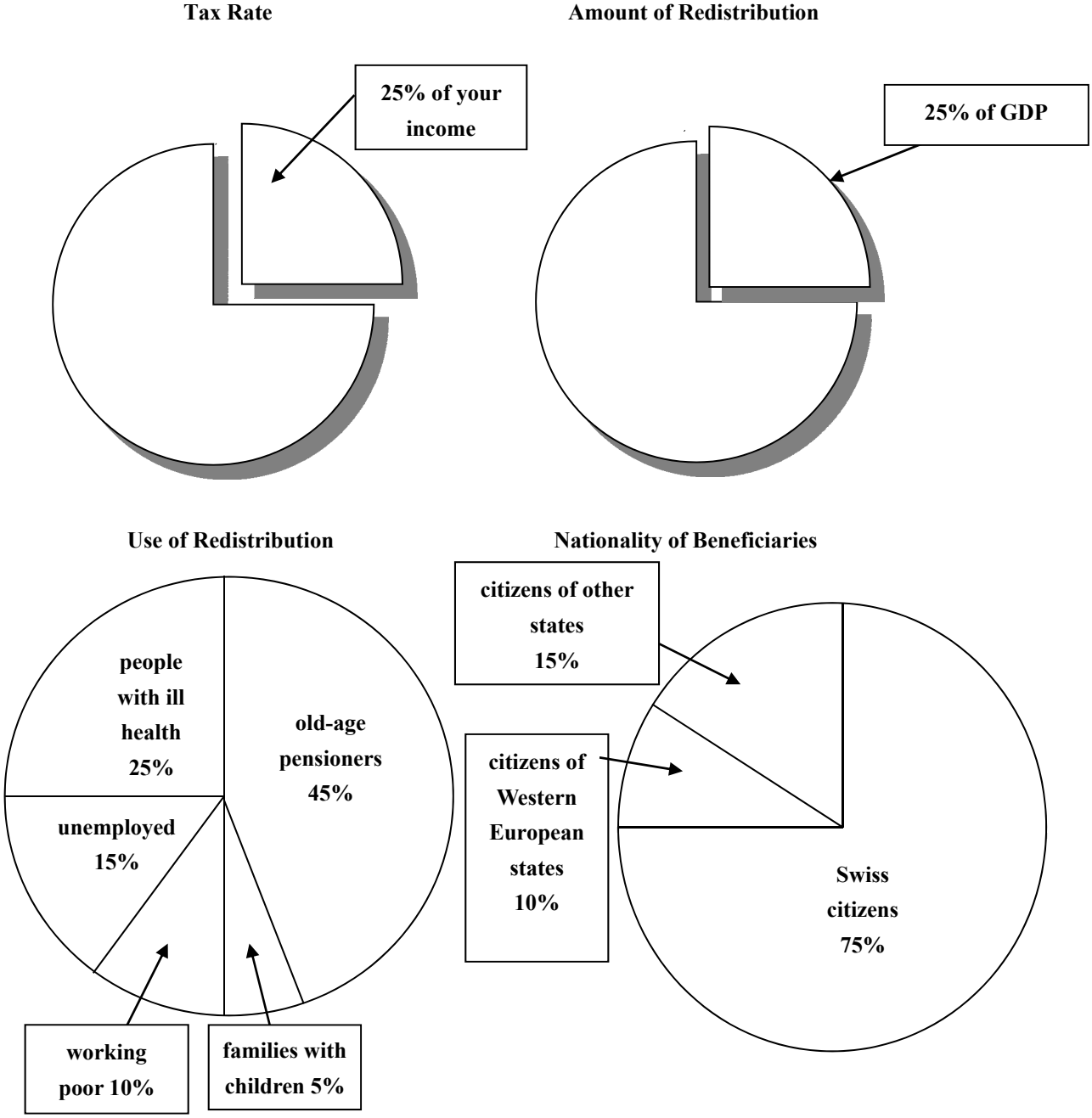
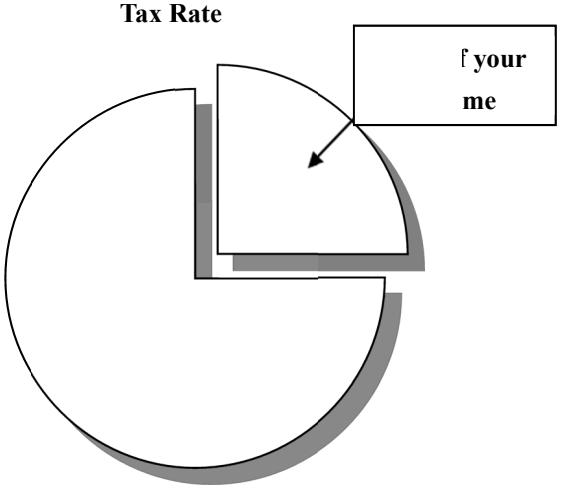
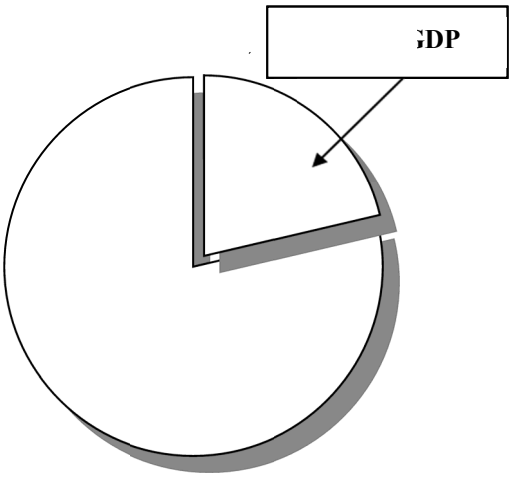


Exhibit B2: Card for Alternative No. 1

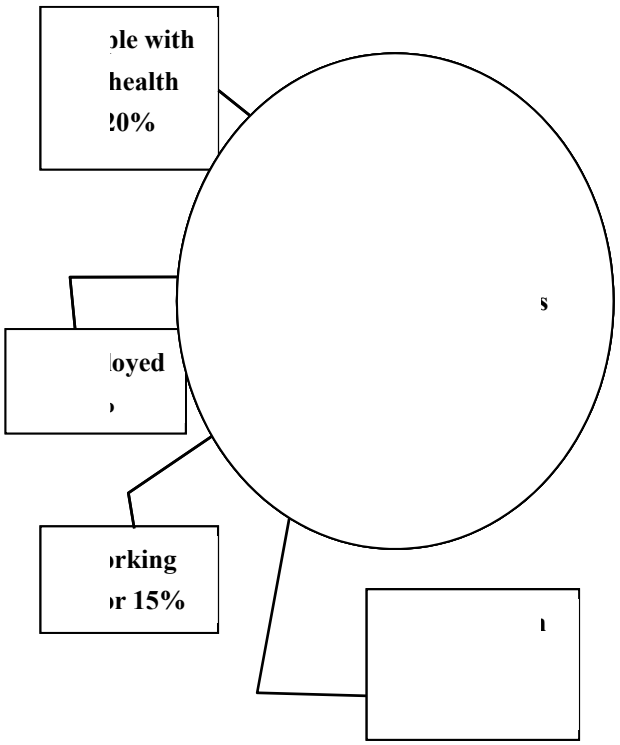
Tax Rate



Amount of Redistribution



Use of Redistribution



Nationality of Beneficiaries

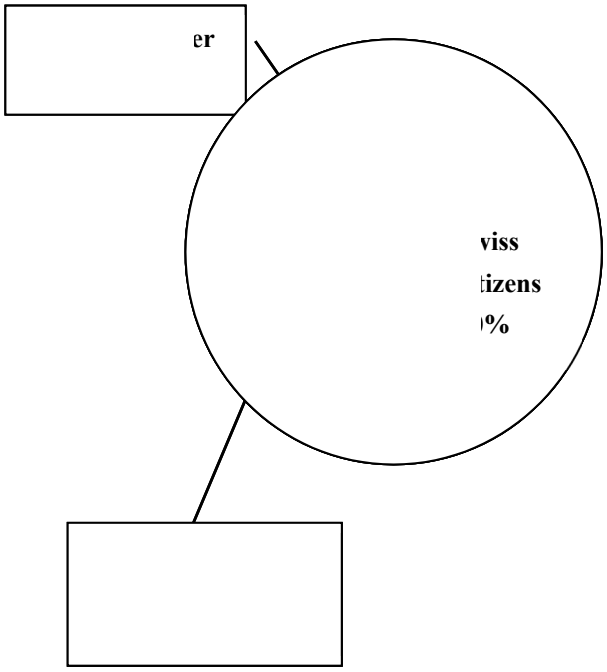
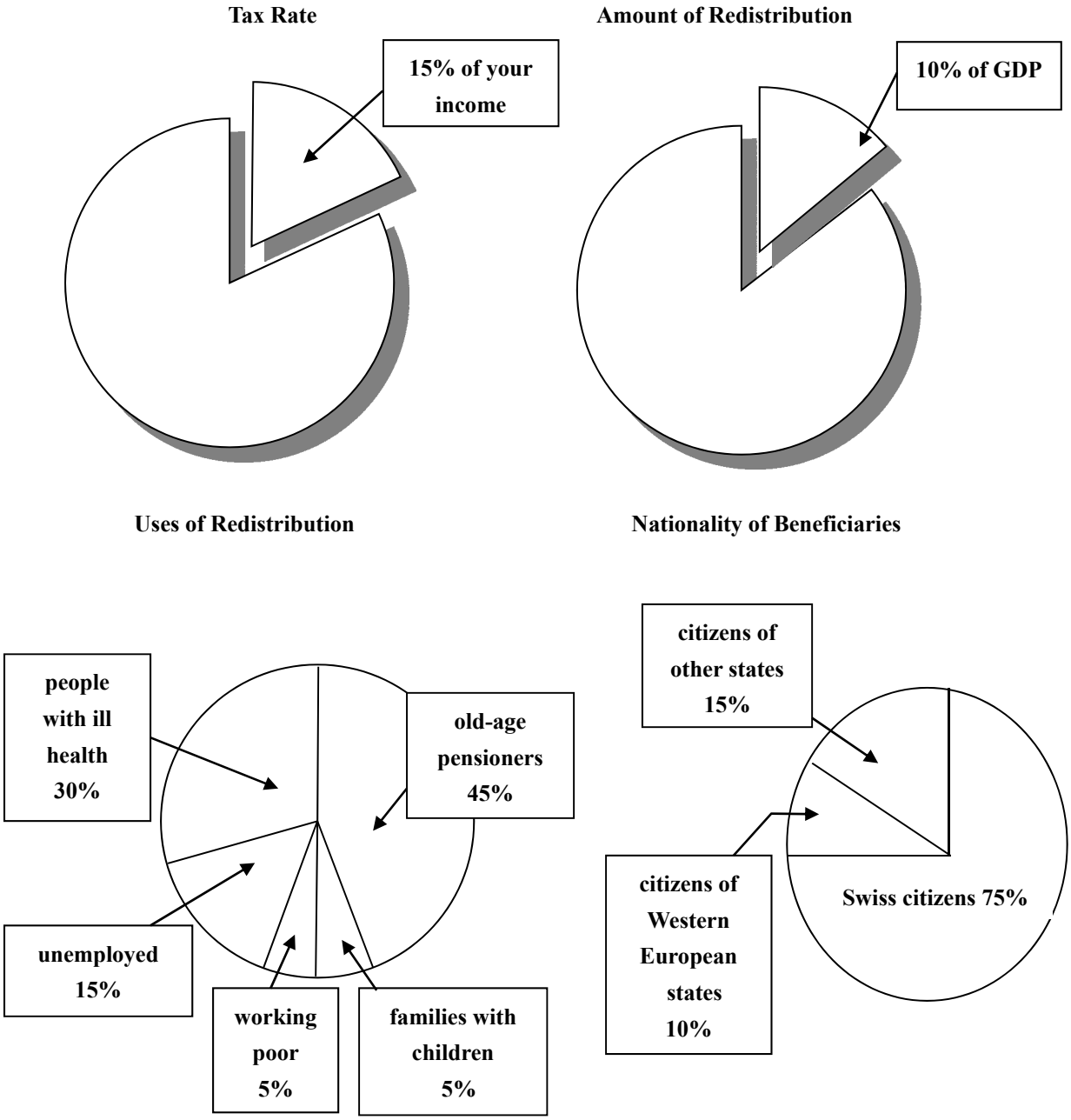


Exhibit B3: Card for Alternative No. 2



Notes

Note 1. Boeri et al. (2001) study international attitudes towards redistribution with a focus on pension and unemployment schemes in France, Germany, Italy, and Spain. They also perform CV experiments that impose an explicit trade-off between income and social insurance coverage on respondents, finding that people oppose an extension of the welfare state, with conflicts between young and old, rich and poor, and insiders and outsiders creating significant hurdles to welfare reform.

Note 2. The median voter's income is assumed to be below the mean. This assumption is satisfied for most economies.

Note 3. The 'tunnel effect' also works in the opposite direction, causing forward-looking agents with high incomes but downward mobility expectations to be in favor of redistribution. This prediction is confirmed by Ravallion & Lokshin (2000) using a data set from Russia. Furthermore, Molnár & Kapitány (2006a,

2006b) show that individuals who lack clear expectations about their future income favor redistribution even more than those with negative but clear expectations.

Note 4. The Rawlsian maximin rule uses the maximum improvement of the individual with minimum initial wealth as the sole criterion.

Note 5. By Roy's Identity, $x_{ij} = -\frac{\partial v(\cdot)/\partial p_j}{\partial v(\cdot)/\partial y_i}$, the (uncompensated) demand of individual *i* for commodity *j* corresponds to the negative ratio of partial derivatives of the indirect utility function with respect to price p_j and income y_i. If one alternative is chosen, then the optimal quantity demanded is equal to one, i.e. $x_{ij} = 1$. Therefore, Roy's Identity yields $\frac{\partial v}{\partial y_i} = -\frac{\partial v}{\partial p_j}$, i.e. the marginal utility of income is equal to the negative derivative of the indirect utility function with respect to price.

Note 6. For a recent discussion of alternative optimal designs in choice experiments, see Louviere et al. (2011).

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The Empirical Analysis for the Spread of Soya Oil and Soybean Meal Based on Wavelet Neural Network

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Abstract

For the sake of a better cross-commodity arbitrage in the futures market, WNN (wavelet neural network) is adopted to analyze the previous spread and predict the future in this paper. Firstly, the correlation coefficient of previous prices between the two goods is calculated in order to examine whether there is arbitrage opportunity. Considered that the spread could be affected by many nonlinearity factors and BP neural network has slow convergence rat, BP neural network is combined with wavelet analysis which has excellent partial analysis ability.In this way, the prediction model about soya oil and soybean meal spreads is built based on WNN Compared the result calculated through that method with only BP neural network's: WNN is superior to neural network in predicting rapid fluctuation and secular trend.

Keywords: spread-prediction, cross-commodity arbitrage, WNN, BP neural network

1. Introduction

Cross-commodity arbitrage is a means of exchange through the unreasonable price difference between futures in order to make venture profits. Tang (2006) summarized various types of spread arbitrage, including intertemporal arbitrage, cross-market arbitrage and cross-commodity arbitrage. With the continuous development of China's commodity futures market, cross-commodity arbitrage is appealing to investors, after calendar spread arbitrage and cross market arbitrage (Li, 2010).

Ma (1988) had a research on gold's and silver's spot and futures market, finding that price have consistency in the two stages, where there are short-term arbitrage opportunities caused by spread. Tse and Booth (1995) studied the relationship between Treasury bonds futures and eurodollar futures, and the result is that there is a cointegration relationship between the two futures markets. Tian (2013) used market data to prove that there existed arbitrage opportunities relying on soybean crush, while he also noted that the market and trading risk should not be ignored owing to the immature domestic futures market. Effective analysis and trend prediction are important means of controlling price risk and getting revenues, which makes the domestic market continue to mature.

Moving average method, exponential smoothing method and grey prediction are generally used to predict price changes in futures market. Due to nonlinear factors, such as economic policy and investor psychology, which could affect futures price, the results of traditional prediction method are unsatisfactory. Neural network, with strong nonlinear approximation, can deal with nonlinear relationship between input variables and output variables better (Wang, 2009). Grudnitski and Osburn (1993) used neural network to predict the spread between S&P index and gold price. Shaikh A. Hamid and Zahld Iqbal (2004) used neural network to predict the S&P 500 index futures price. Neural network is likely to be caught into a local optimum in the learning process, so wavelet analysis with strong local analytical capacity is introduced to improve neural network, which makes the

new model possess the ability of flexible and effective approximate function and fault tolerance(Zhang, Yu, & Li, 2010). In this paper, WNN was employed to forecast spread, compared with the prediction result of BP neural network in the short term and the long term.

2. Spread-Prediction Model

The correlation coefficient between one good and another in price can reflect the fluctuation relationship of each price (Lu, 2011), which is crucial to cross commodity arbitraging. The prediction of spread can contribute to investors' decision-making, so the model where the spread is predicted through the past data is proposed. And then this paper have reasoned the application feasibility of WNN to the spread.

2.1 Correlation Test

Cross-commodity arbitrage of commodity futures affects the contract price in futures market according to the co-movement in market demand and supply, which causes strong correlation between different commodities in future price. So the price correlation between commodity future through correlation coefficient is analyzed to judge the arbitrage feasibility between commodity futures. The correlation coefficient is calculated as follows:

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(y_i - \bar{y})^2}} \tag{1}$$

Where, x_i, y_i are the future price series of relevant commodities respectively, $\bar{x}, \bar{y}$ are the average price respectively, r is the correlation coefficient between the futures price trend of relevant commodities. As to cross-commodity arbitrage in commodity futures, it doesn't mean that it is better if the correlation is higher, for example, when the relation is 1, the arbitrage chance is lost because the tendency of two commodities is the same. By looking up relevant books, when the correlation coefficient is between 0.7 and 0.85, the arbitrage effect is fine.

2.2 Wavelet Neural Network

BP neural network, put forward in 1986, is a multi-layer and feed-forward neural network, which trains data in accordance with error back-propagation algorithm. Through Continually learning and storing large amounts of information, BP neural network forms a mapping relation model with a large number of input-output, and weights and thresholds are improved and amended constantly during training. Because of slow convergence rate, scholars would like to introduce other methods to offset the shortcoming and improve the prediction accuracy.

Wavelet analysis is a method of time-frequency analysis according to signals, where, in the fixed window, signals can be partially analyzed through changing their waves, which makes them have fine frequency resolution in the low frequency part and fine temporal resolution in the high frequency part. When wavelet analysis is introduced into BP neural network, wavelet neural network(WNN) can take full use of strong local learning ability of wavelet analysis and self learning ability of BP neural network, to make it possess a better ability of approximation and fault tolerance. Based on topological structure of neural network, WNN takes it as the transfer function of the hidden layer. The structure is as followed:

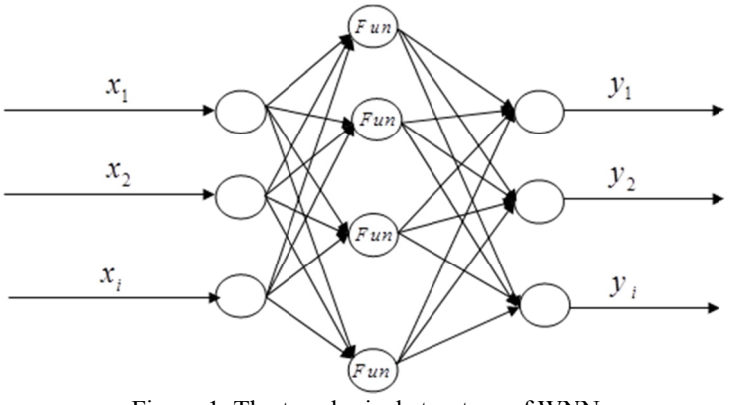

Figure 1. The topological structure of WNN

Where, x_1, x_2, …, x_i are the input parameters of wavelet neural network, y is the predicted output value, *Fun* is wavelet basis function, w_{ij} and w_{jk} are the weight of wavelet neural network. when the input signal's series is x_i(i = 1, 2, …, k), the calculate equation for hidden layer is:

$$h(j) = h_j\left(\frac{\sum_{i=1}^{k} w_{ij}x_i - b_j}{a_j}\right) \qquad j = 1,2,\cdots,l \tag{2}$$

Where, $h(j)$ is the output value in hidden layer's j th nodes; w_{ij} is connected weight between input layer and hidden layer; b_i is the horizontal shift factor of wavelet basis function h_i; α_j is contraction-expansion factor of wavelet basis function h_j. The wavelet basis function used in this model is Morlet.

$$y = \cos(1.75x)e^{x^2/2} \tag{3}$$

The calculate equation of wavelet neural network's output layer is:

$$y(k) = \sum_{i=1}^{l} w_{ik}h(i) \qquad k = 1,2,\cdots,m \tag{4}$$

Where, w_{ik} is the weight from hidden layer to output layer; $h(i)$ is the output of the i th hidden layer node; l is the node number in hidden layer; m is the node number inoutput layer.

In the process of modification,the weight need be modified according to the error of WNN when the weight meets the requirement of wavelet neural network. Prediciton error $\Delta y(k)$ is calculated by:

$$e = \sum_{k=1}^{m} yn(k) - y(k) \tag{5}$$

Where, $yn(k)$ is the expected output value; $y(k)$ is the forecast value of wavelet neural network. The modify the weight of wavelet neural network and the coefficient of wavelet neural network according to e obtained.

$$w_{n,k}^{i+1} = w_{n,k}^{i} - \eta\frac{\partial e}{\partial w_{n,k}^{i}} \tag{6}$$

$$a_k^{i+1} = a_k^i - \eta\frac{\partial e}{\partial a_k^i} \tag{7}$$

$$b_k^{i+1} = b_k^i - \eta\frac{\partial e}{\partial b_k^i} \tag{8}$$

Where, η is learning velocity. The training process is as followed:

Step1: define the contraction-expansion factor a and the shift factor b of wavelet neural network randomly, and set connected weight w_{ij}, w_{jk} and the learning velocity η. Then initialize all of the grid.

Step2: divide the samplse into a training set and a test set. The training set is used to train the network, and the test set is used to analyze the forecast result of the grid.

Step3: obtain the forecast result and output, and calculate the deviation between them.

Step4: decide whether it is necessary to re-modify the weights and parameters according to deviation. And decrease deviation constantly and let it close to actual value until we find the best forecast result (MATLAB Chinese Forum, 2010).

3. Empirical Analysis for Spread Prediction of Soya Oil and Soybean Meal

Soya oil and soybean meal are two kinds of main products after soybeans are crushed, belonging to the same industry chain, so there are arbitrage opportunities in the futures market. Through the correlation analysis from historical datum, we can judge the possibility for arbitrage. WNN is adopted to predict the spread between soya oil and soybean meal, and then the spread trend and predict outcomes should be objective analysed so as to make profits from the spread. The data of soya oil futures and soybean meal futures is from Dalian Commodity Exchange between 2009 and 2012(total 973 workdays), The result by WNN is compared with that by neural

network in long term and short term.

3.1 The Correlation Coefficient between Both Futures Prices

Soya oil and soybean meal belong to the same industry chain, so there is co-movement between both futures prices to some extent. Pearson Correlation Coefficient is engaged in quantitative analysis of relationship between soya oil futures prices and soybean meal futures prices:

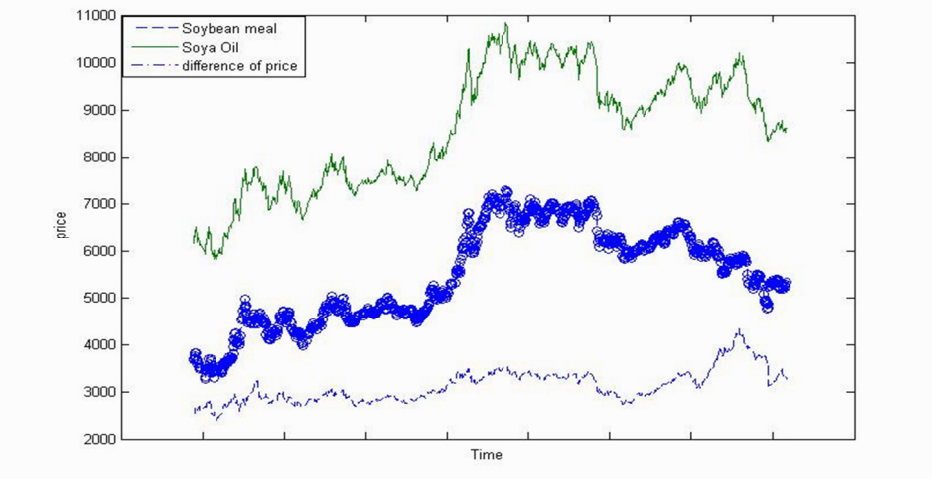

Figure 2. The price trend of soya oil and soybean meal

In Figure 2, the solid line above stands for soya oil futures prices, and the dotted line below stands for soybean meal futures prices. Although the volatility of the two futures prices is different(volatility of soya oil is greater than that of soybean meal), their price trends are similar. Apparently the fluctuation range of spread is broad, with the minimum value at about 3000 yuan and maxmum value at around 7000 yuan, which provides many arbitrage opportunity.

Table 1. The correlation coefficient

		Soybean Meal	Soya Oil
Soybean Meal	Pearson correlation	1	0.767**
	Significant(two-sided)		0.000
	N	973	973
Soya Oil	Pearson correlation	0.767**	1
	Significant(two-sided)）	0.000	
	N	973	973

**. 0.01 level (bilateral) is significantly related.

Table 1 shows the Correlation Coefficient of both futures prices is 0.767 based on the 973 future prices in these trading days of the past four years, meeting the range of the coefficient coefficient, which is feasible to guarantee the security and feasibility of spread arbitrage. To gain profits from price fluctuation and to control price risk, it is vital to predict the spread accurately (Lu, 2011).

3.2 The Spread Prediction Based on WNN

There is a database about futures prices of soya oil and soybean meal, where it contains 973 elements each of which reprsent a relevant work-day datum. WNN and BP neural network are employed to forecast spread in both short term and long term. Due to the difference of the prediction length, raw elements in the database form respectively short-term prediction set whose length is 972 and long-term prediction sets whose length is 953. Short-term prediction means forecasting the next workday's spread based on historical elements, and the first 922-workday elements are used as a training set, then we train these elements by WNN. The next 50 elements will be used as a test set to test predictive ability of this model; On the other hand, the long-term prediction means forecasting the next 20 workdays' spread.The first 933 elements are considered as a training set, the rest is

used as a test set in the long-term prediction. The number of input nodes is 12, namely opening price, high price, low price, closing price, volume and open interest for each; and output node number is 1: the second day's spread; number of hidden nodes is 17.

Table 2. Training set and test set

		Training set				Test set		
Soya oil	Opening price	6220	6300	6600	···	8606	8562	8620
	High price	6288	6520	6726	···	8650	8636	8674
	Low price	6160	6226	6442	···	8542	8524	8610
	Closing price	6240	6470	6490	···	8572	8634	8642
	volume	554070	701442	680826	···	552382	692036	507182
	Open interest	154364	159354	142176	···	547060	537370	507428
Soybean meal	Opening price	2500	2560	2628	···	3316	3315	3362
	High price	2574	2632	2674	···	3358	3370	3374
	Low price	2494	2525	2616	···	3309	3306	3332
	Closing price	2568	2609	2621	···	3333	3368	3336
	volume	578608	778132	751362	···	2280378	2155590	1649790
	Open interest	209878	217790	210822	···	1270114	1391796	1257114
spread		3672	3861	3869	···	5239	5266	5306

Table 2 provides concrete datum, such as opening price and closing price of soya oil and soybean meal. In order to avoid effects of different dimensions and different ranges of fluctuations, datum should be normalized firstly. The dimension of input vectors is 12, including opening price, high price, low price, closing price, volume and open interest of soya oil and soybean meal respectively; The dimension of output vector is 1, namely is the spread. The datum in the front belong to the train set and the latter datum belong to the test set in Table 2. Then we compare results with the results by BP neural network.[4] The test is carried out based on WNN and neural network 200 times for both short-term prediction and long-term prediction. One of results is shown in Figure 2 and Figure 3.

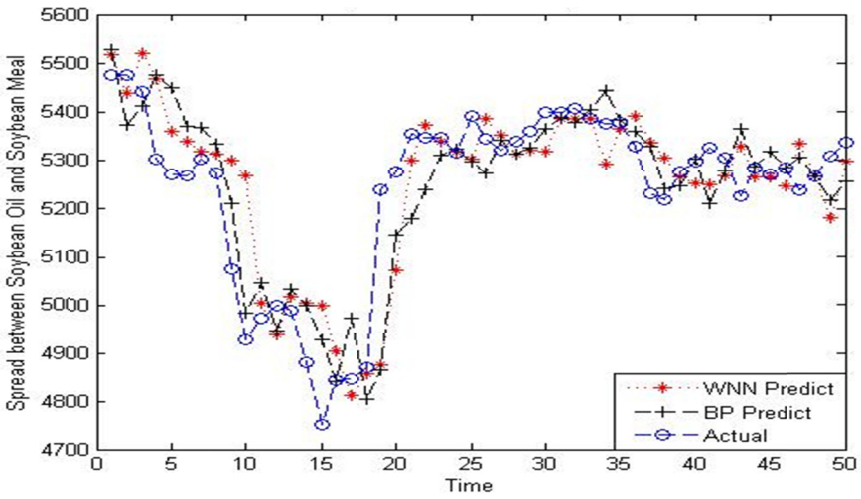

Figure 2. Short-term spread-prediction

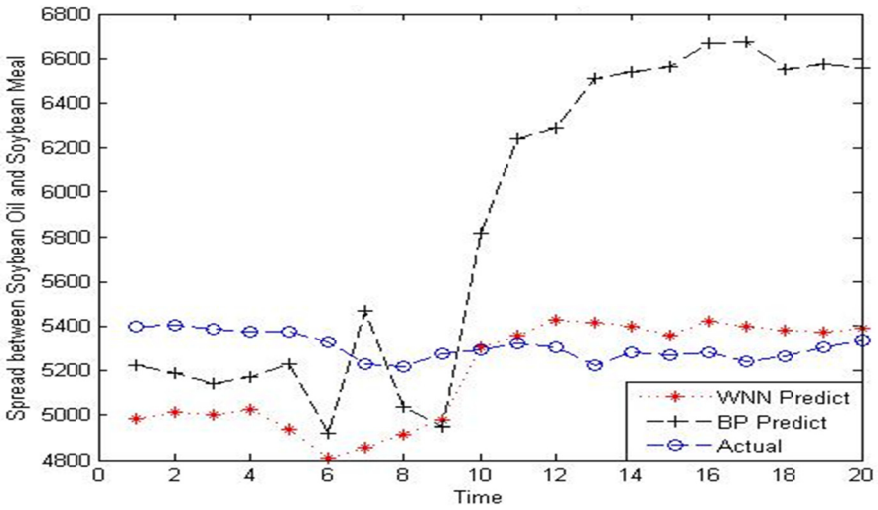

Figure 3. Long-term spread-predition

Figure 2 shows that WNN and BP neural network can predict the spreads with high precision in the short term. In Figure 3, WNN and BP neural network do poor in long-term prediction, although in the field of trend prediction, the prediction results by WNN is better. The fluctuation predicted by WNN is smoother than the actual one, while that by BP neural network is greater than the actual one. To analyze the prediciton results precisely, the following indicators are adopted: mean absolute percentage error(MAPE) and root mean squared error(RMSE) (Li, Xu, & Chen, 2009):

$$\text{MAPE}=\frac{1}{N}\sum\left(\frac{1}{n}\sum\left|\frac{f_i-\hat{f}_i}{f_i}\right|\right) \tag{9}$$

$$\text{RMSE}=\frac{1}{N}\sum\left[\frac{1}{n}\sum\left(\left|\frac{f_i-\hat{f}_i}{f_i}\right|-\left(\frac{1}{n}\sum\left|\frac{f_i-\hat{f}_i}{f_i}\right|\right)\right)\right]^{\frac{1}{2}} \tag{10}$$

Where, f_i is the i th actual value in the training set, and f_i represents the i th predicted value. The results are given in Table 2.

Table 3. Results of indicators

	Short-term prediction		Long-term prediction	
	MAPE	RMSE	MAPE	RMSE
WNN	0.0013	0.0133	0.0188	0.0466
BPNN	0.0095	0.0149	0.1408	0.1495

Table 3 shows that, in the shor-term prediction, MAPEs of both WNN and BP neural network are under 1%, which means each forecast accuracy is as high as 99%, with MAPE of WNN at 0.0013, less than that of BP neural network at 0.0095; RMSE of WNN is 0.0133, also less than that of BP neural networks (0.0149). Results of WNN is better, the majorization where wavelet analysis is used in BP neural network is effective, with increase by 0.83% in precision. In the long-term prediction, MAPE and RMSE of WNN are significantly smaller than those of BP neural network. The precision is increased by 14.19%. The result in Fig3 also shows that WNN predicts the trend, more accurately than BP neural network does. WNN performs better than BP neural network in both short-term and long-term prediction.

4. Conclusion

In order to grasp market better, to guarantee the feasibility and safety, and to increase the possibility of cross-commodity arbitrage, WNN is employed to forecast the spread, guiding operation of spread-arbitrage, then take the spread between soya oil and soybean meal for the example.

Firstly, by analyzing the correlation between soya oil and soybean meal, arbitrage opportunity can be figured out. According to opening prices, high prices, low prices, closing prices, volumes and open interests,WNN and BP neural network are employed to predict the spread in the long term and short term. Then we compared the difference in precision between the two different methods. The result shows that WNN is superior to neural network in the process of long-term and short-term predictions.

Although WNN is superior to neural network, it is necessary to improve accuracy of long-term prediction. because the number of factors that affects spread is more than that of individual commodity, and the spread is predicted merely according on opening price, high price low price and so on that, the information is not taken full useof.For sake of accurate prediction, more factors shoud be taken into consideration, such as import and export of related goods and interest rate. In additon, the prediction model should be connected with reality, so that the accuracy of it would be higher.

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Factors Influencing College Students' Financial Behaviors in Turkey: Evidence from a National Survey

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Abstract

The purpose of this study was to investigate the factors influencing financial behaviors among college students in Turkey. Data was obtained from a nationwide survey of 1539 students (748 women, 791 men; *M* age = 22.01 yr., *SD* = 2.44) and three financial behaviors were analyzed: paying bills on time, having a budget in place, and saving for the future. Logistic regression results showed that students who are more financially literate are more likely to exhibit the three positive financial behaviors. Parental teaching of finance and positive attitudes towards money were also found to be significant predictors of positive financial behaviors. A significant difference between male and female students was only observed for budgeting behavior and male students were found to be less likely to have a budget in place to control their finances. Finance courses taken in college or high school and work experience were positively related to saving behavior, but unrelated to timely payment or budgeting. Finally, students' class rank was not found to be significantly related to any of the financial behaviors. Policy implications are provided.

Keywords: financial behavior, financial literacy, college students, Turkey

1. Introduction

University or college students are in a distinct period of their lives where they start to manage their money independently without parental supervision. The majority of these young people start to deal with monetary challenges such as paying bills, keeping a budget, or having a credit card to their own names for the first time. The financial behaviors that college students learn during these years are likely to influence the decisions they make in the future (Shim, Xiao, Barber, & Lyons, 2009). Research has shown that positive financial behaviors are related to improved financial well-being (Joo & Grable, 2004), decreased financial stress (Hayhoe, Leach, Turner, Bruin, & Lawrance, 2000) and higher self-esteem (Lange & Byrd, 1998). Because of these far-reaching consequences of financial behaviors, it is important to investigate which factors have a significant impact on them in order to increase students' general quality of life in later years (Gutter & Copur, 2011; Xiao, Tang, & Shim, 2008).

Previous literature contains some investigation of college students' financial behaviors and mostly focuses on developed countries such as the USA. In one such study, Cude et al. (2006) investigated credit card behavior using data collected from a sample of 1,891 college students in two universities in the USA. Results showed that students having a credit card, minorities and senior students were more likely to be financially distressed. On the other hand, students with higher GPAs and married parents were more likely to be financially fit. Students reported that the most significant influence on their financial management behaviors was their parents. In another study, Hancock, Jorgensen, and Swanson (2012) used data collected from 413 students in seven universities in the USA and found that students who were juniors or seniors, who had parents arguing about finances at home and who were comfortable making the minimum payments were more likely have higher levels of credit card debt. Using the same dataset, Jorgensen and Savla (2010) found that parental influence had an indirect effect on the financial behaviors of college students mediated through financial attitudes. The importance of parental involvement for credit card behaviors of college students was also confirmed by Palmer, Pinto, and Parente (2001) who used data from a sample 355 college students in the USA and showed that parental involvement prior to the acquisition of the credit card reduces students' outstanding card debt while post-acquisition involvement has the opposite effect.

In another study, Hayhoe et al. (2000) collected data from a sample of 480 students in six state universities in the USA and found that female students, those with higher incomes and those with positive attitudes towards the use of credit were more likely to display risky credit card behaviors. Later on, Lyons (2004) investigated credit card practices in a sample of 835 college students and found that gender, ethnicity, financial independence, total amount of debt and credit card acquisition prior to the college were significant predictors of risky financial behaviors. In a more recent study, Xiao, Ahn, Serido, and Shim (2014) used data collected at two points in time from a group of college students in a state university in the USA and analyzed risky borrowing and paying behaviors. Results showed that subjective and objective finance knowledge reduced the likelihood of displaying negative financial behaviors. In addition, higher GPA was correlated with fewer risky paying behaviors and male students were found to display more risky financial behaviors in general.

In a study focusing on psychological variables, Norvilitis, Merwin, Osberg, Roehling, and Kamas (2006) investigated the factors affecting credit-card debt in 448 students from five US universities. Older students, students with more credit cards and those who are less knowledgeable about financial issues reported a higher amount of credit card debt. In addition, delay of gratification and attitudes towards credit card use were positively related to debt levels. In another study focusing on psychological variables, Shim et al. (2009) found that self-actualizing personal values and financial education at home or at school had important roles in shaping financial attitudes and intentions among young adults. This finding was also confirmed by Shim, Barber, Card, Xiao, and Serido (2010) who, through structural equation modeling, found that parents, work experience and high school financial education were significantly related to young adults' financial attitudes and behaviors. The authors further showed parents played a greater role than work experience and school education as financial socialization agents. The findings of the study also supported a four-level model where early financial socialization is correlated with financial learning which affects financial attitudes, which in turn, affect financial behaviors.

In one of the rare studies using data from developing countries, Sabri, MacDonald, Hira, and Masud (2010) collected data from 11 universities in Malaysia and showed that higher financial literacy levels were positively related to saving behavior and negatively related to financial problems among college students. They also found that financial experience before college can create bad financial habits for students. In a subsequent study, Sabri, Cook, and Gudmunson (2012) found that saving habits, financial literacy and financial socialization agents increase students' financial well-being levels including their current financial situation and financial management skills.

As is clear from the preceding discussion, empirical evidence on the financial behaviors of college students in developing countries is limited. However, students in these countries might be affected by unique regional and cultural factors that shape their financial behaviors. Hence, it is important to test whether the findings obtained within the US context apply to other countries as well. In that respect, Turkey constitutes a useful example. First, in the Turkish culture, parents tend to isolate their children from monetary issues and financially support them until they get married (Yesilada & Ucel, 2009). Accordingly, factors affecting financial behaviors among the young in Turkey might differ from the factors in developed countries. Second, consumers in Turkey have limited experience with formal financial systems (OECD, 2012). Hence, analyzing the predictors of positive financial behaviors among Turkish financial consumers, especially the young, has both theoretical and practical significance. The issue is even more important considering the fact that Turkey has experienced an increase in the number and complexity of financial products in recent years (Financial Corps, 2014). Finally, despite the fact that Turkey has been one of the fastest growing countries in the world in the recent decade, its average savings rate remains low (IMF, 2013). Hence, encouraging positive financial behaviors would have macro-level effects for the country as well.

Despite the importance of university or college students as a customer segment for financial products and services in Turkey, research on their financial behaviors is very limited. In a study on adults, Sevim, Temizel, and Sayılır (2012) demonstrated that higher financial literacy results in less likelihood of excessive borrowing behavior using data from a sample of 550 adults in the city of Eskişehir in Turkey. In another study, Akben-Selcuk and Altiok-Yilmaz (2014) analysed a sample of 853 students from a Turkish university and found that their financial literacy is low as evidence by an average of 45% of correct responses on a 27-item financial knowledge scale. The authors further demonstrated that formal finance education in college, a deep approach to learning, and financial teaching by parents were significant predictors of better financial literacy scores. However, no direct investigation of students' financial behaviors was made. To the best of our knowledge, no studies to date specifically focused on the financial behaviors of college students in Turkey. The present study attempts to fill this gap in the literature. The specific objectives of the study are to analyze the factors affecting

the following three behaviors: paying bills on time, having a budget in place to control finances, and saving for the future. Based on the findings of previous studies in the literature, the following three hypotheses were developed.

Hypothesis 1. Students who are more financially literate will be more likely to display positive financial behaviors.

Hypothesis 2. Financial socialization through courses taken, parental direct teaching of finance, and work experience will have a positive impact on the likelihood of displaying positive financial behaviors.

Hypothesis 3. Students with positive attitudes towards money will be more likely to display positive financial behaviors.

2. Method

2.1 Participants and Procedure

The data for this study comes from a nationwide survey of 1539 college students in Turkey. The sample consists of 748 female and 791 male students from 3 private and 14 public universities. The average age of the students in our sample is 22.01 years (*SD* = 2.44 years). The percentages of freshmen, sophomore, junior and senior students in our sample are 27%, 21%, 19% and 33% respectively. Data were collected on campus, through face-to-face interviews, which lasted approximately 20 minutes per respondent. The survey form included questions related to students' financial behaviors, financial attitudes and financial knowledge levels as well as questions on socio-demographic factors and several psychological variables. Before being administering the survey to the final sample, a pilot study was conducted on 50 respondents in order to refine the items and eliminate ambiguities.

2.2 Measures

2.2.1 Dependent Variables

Three financial behaviors were the focus of this study: paying bills on time, having a budget in place and saving for the future. Students were asked to state how often they "pay their bills on time", "have budget in place to manage their finances", and "have been actively saving for the future" on a scale from 1 to 5 (1: never, 5: always). Students putting themselves at 4 or 5 on the scale were considered to display a given behavior while those putting themselves at 1, 2 or 3 were assumed not to display the behavior. Accordingly, three dummy variables were constructed for each of the three financial behaviors. The dummies take the value of "1" for those who display a given behavior and "0" otherwise.

2.2.2 Independent Variables

The first independent variable, which was considered as a potential predictor of positive financial behaviors, is students' financial literacy levels. To measure financial literacy, students were asked to answer 27 multiple choice questions on several personal finance domains including general money management, saving and borroring, investment and insurance. The items came from previously validated international financial literacy surveys in the literature (Chen & Volpe, 1998, 2002; Danes & Hira, 1987; Hancock et al., 2012; Jorgensen & Savla, 2010; Mandell, 2009; Volpe, Chen, & Pavlicko, 1996). The questions were first translated into Turkish and then independently back translated into English in order to check for any inconsistencies. Students' financial literacy scores were calculated as the percentage of correct responses to the 27 questions. Missing responses were treated as incorrect. The reliability of the financial literacy scale as measured by Cronbach's alpha was found to be 0.68, which is considered acceptable (Kline, 2000).

The second group of independent variables includes financial socialization agents, which are the school, the family and work experience. In order to capture the effect of school on financial behaviors, the variable *Course* was defined to take the value of "1" for students who took at least one finance related class in college or high school. Direct teaching of finance by parents was measured as in Shim et al. (2009) by asking the students to indicate whether their parents talked to them about the following personal finance topics while growing up: the importance of savings, the family spending plan, the student's own spending, and the use of credit. Based on the responses, the variable *Parental* ranging from 0 to 4 was generated, where a score of 0 indicates no discussion in any of the areas, while a score of 4 indicates discussion in all 4 areas. Students were also asked whether they have already worked in a paid job, either part-time or full-time. Based on their responses, the dummy variable *Work experience* was defined to take the value of "1" for respondents who have already been employed and "0" otherwise.

Thirdly, students' attitude towards money was considered as a potential factor affecting financial behavior. To

operationalize that construct, the 12-item "Money Ethic Scale" developed by Tang (1995) was used. Students were asked to indicate the extent to which they agree with the 12 statements on a scale from 1 to 5 (1: completely disagree, 5: completely agree). The scale comprised 3 major components: affective (e.g. "Money is the root of all evil"), cognitive (e.g. "Money is a symbol of success") and behavioral (e.g. "I budget my money very well"). Students' money attitude scores were calculated as the average of their responses to the 12 statements. Two of the items representing negative attitudes were reverse coded so that higher scores represent more positive attitudes towards money. The Cronbach's alpha value of the scale in our sample was 0.72, which is considered good (Kline, 2000).

Finally, students' gender and class rank were included into the analysis as control variables. The variable *Gender* takes the value of "1" for male students and "0" for female students. For class rank, four dummy variables were constructed as follows: *Class1* takes the value of 1 if the student is a freshman or is in the English preparatory class, *Class2* takes the value of 1 if the student is a sophomore, *Class3* takes the value of 1 if the student is a junior and *Class4* takes the value of 1 if the student is a senior. *Class1* was left out of the regression analysis as the reference category.

2.3 Analysis

The categorical dependent variables of the study necessitated the use of logistic regression analysis. Three separate equations were fitted to predict the probability of paying bills on time, the probability of budgeting, and the probability of saving from selected predictors described previously. A maxium likelihood estimation procedure was used to obtain parameter estimates.

Since the interpretation of coefficients is difficult in the case of logistic regression, model results are reported in terms of odd ratios which are defined as the ratio of the probability that an event will occur (in our case a behavior will be displayed) to the probability that it will not. Values greater than 1 indicate that a given factor will increase the odds while values less than 1 indicate that the factor will decrease the odds (Hair, Black, Babin, & Anderson, 2009).

Before proceeding with the analysis, multicollinearity among predictor variables was checked by ensuring that tolerance values did not exceed 0.1 and that variance inflation factors were below 10 as suggested by Hair et al. (2009).

3. Results

3.1 Descriptive Statistics

According to the results of our survey, 52% of the respondents reported that they pay their bills on time, 43% indicated that they have a budget in place to control their finances and only 33% reported that they have been actively saving. When the descriptive statistics for independent variables are analyzed, it can be seen that the average financial knowledge score in the sample is 42.87% (*SD* = 15.19%) meaning that an average student could not answer even half of the questions correctly. Regarding financial socialization sources, 23% of the students have taken a finance class while 68% reported having some type of work experience. The average parental teaching score is 1.81 (*SD* = 1.02) out of 4. Finally, the mean score on the money ethic scale is 3.11 (*SD* = 0.54) out of 5.

3.2 Logistic Regression Results

Table 1 that follows contains the results of our first logistic regression predicting the likelihood of paying bills on time. The full model was statistically significant, χ^2 (9, N = 1539) = 39.45, $p < 0.001$, meaning that it could discern differences between students who pay their bills on time and those who do not. The model was able to explain between 11.85% (Cox and Snell R-square) and 15.68% (Nagelkerke R-square) of the variance and correctly classified 75% of the cases.

Three of the independent variables analysed were found to be statistically significant. The strongest predictor for paying bills on time was financial literacy, with an odds ratio of 2.01. This result indicates that for a one-point increase on the financial literacy score, students were 2.01 times more likely to report paying their bills on time. Direct teaching of finance by parents also has a positive and significant effect on the probability of timely payment. For every additional financial issue discussed with parents, students were 1.81 times more likely to pay their bills on time. Finally, students with positive attitudes towards money are more likely to pay their bills on time. For every additional unit on the money ethic scale, students were 1.31 times more likely to report timely payment.

Table 1. Logistic regression predicting likelihood of paying bills on time

	Odds ratio	S.E.	z	P>z	95% CI for odds ratio	
					Lower	Upper
Gender	1.02	0.11	0.15	0.88	0.82	1.25
Financial literacy	2.01	0.00	2.85	0.00	2.00	2.02
Parental teaching	1.81	0.04	4.08	0.00	1.74	1.90
Sophomore	0.85	0.13	-1.11	0.27	0.63	1.14
Junior	0.84	0.13	-1.11	0.27	0.62	1.14
Senior	0.87	0.12	-1.05	0.29	0.66	1.13
Work experience	0.99	0.11	-0.10	0.92	0.79	1.24
Course	0.86	0.12	-1.12	0.26	0.66	1.12
Money attitudes	1.31	0.13	2.77	0.01	1.08	1.58
Constant	0.55	0.20	-1.64	0.10	0.27	1.12

Table 2 below presents the results of the second regression analysis predicting the likelihood of having a budget in place. The full model was statistically significant, χ^2 (9, N = 1539) = 65.17, p < 0.001, meaning that it could discern differences between students who have a budget to control their finances and those who do not. The model was able to explain between 13.1% (Cox and Snell R-square) and 18.87% (Nagelkerke R-square) of the variance and correctly classified 77% of the cases.

Four of the independent variables were found to be statistically significant. First, as in the first model, students with higher financial literacy scores were more likely to have a budget. The odds ratio was 2.02 meaning that for a one-point increase on the financial literacy score, students were 2.02 times more likely to report having a budget in place. Direct teaching of finance by parents also had a positive and significant effect on the probability of budgeting. For every additional financial issue discussed with parents, students were 1.79 times more likely to have a budget. Thirdly, students with positive attitudes towards money were more likely to budget. For every additional unit on the money ethic scale, students were 1.54 times more likely to report having a budget. Finally, the odds ratio for gender was 0.82. Since it is lower than 1, this indicates that male students are 0.82 times less likely to report having a budget.

Table 2. Logistic regression predicting likelihood of budgeting

	Odds ratio	Std. Err.	z	P>z	95% CI for odds ratio	
					Lower	Upper
Gender	0.82	0.09	1.84	0.07	0.66	1.01
Financial literacy	2.02	0.00	4.49	0.00	2.01	2.02
Parental teaching	1.79	0.04	4.43	0.00	1.71	1.88
Sophomore	1.25	0.19	1.43	0.15	0.92	1.69
Junior	1.28	0.21	1.55	0.12	0.94	1.76
Senior	1.28	0.18	1.54	0.12	0.97	1.68
Work experience	0.93	0.11	-0.61	0.55	0.74	1.17
Course	0.82	0.10	-1.53	0.13	0.64	1.06
Money attitudes	1.54	0.15	4.36	0.00	1.27	1.87
Constant	0.15	0.06	-5.06	0.00	0.07	0.31

Table 3 that follows presents the results of the third and final regression analysis predicting the likelihood of saving for the future. The full model was statistically significant, χ^2 (9, N = 1539) = 63.13, p < 0.001, meaning that it could discern differences between students who have save for the future and those who do not. The model was able to explain between 13.23% (Cox and Snell R-square) and 19.61% (Nagelkerke R-square) of the variance and correctly classified 78% of the cases.

Five of the independent variables were found to be statistically significant. First, students with higher financial literacy scores were more likely to save. The odds ratio was 2.01 meaning that for a one-point increase on the financial literacy score, students were 2.01 times more likely to report saving. Direct teaching of finance by parents also had a positive and significant effect on the probability of saving. For every additional financial issue discussed with parents, students were 1.78 times more likely to save. Thirdly, students with positive attitudes

towards money were more likely to save. For every additional unit on the money ethic scale, students were 1.69 times more likely to report saving. The odds ratio for work experience was 1.69, meaning that students who have already worked in a paid job were 1.69 times more likely to save than those without any work experience were. Finally, students having taken finance related classes are 1.7 times more likely to report saving.

Table 3. Logistic regression predicting likelihood of saving

	Odds ratio	Std. Err.	z	P>z	95% CI for odds ratio	
					Lower	Upper
Gender	1.07	0.12	0.62	0.54	0.86	1.34
Financial literacy	2.01	0.00	1.86	0.06	2.00	2.01
Parental teaching	1.78	0.04	4.30	0.00	1.70	1.88
Sophomore	1.23	0.20	1.30	0.19	0.90	1.68
Junior	0.99	0.17	-0.04	0.97	0.71	1.39
Senior	1.03	0.15	0.22	0.83	0.77	1.38
Work experience	1.69	0.08	3.10	0.00	1.54	1.87
Course	1.70	0.09	2.86	0.00	1.55	1.89
Money attitudes	1.69	0.18	5.03	0.00	1.38	2.08
Constant	0.13	0.05	-5.10	0.00	0.06	0.29

4. Conclusion and Discussion

The objective of the present study was to investigate the factors, which influence financial behaviors of college students in Turkey. The focus was on three behaviors, namely, paying bills on time, having a budget in place to manage finances and actively saving for the future.

Several important findings emerged from our analysis. First, financial literacy of the students, as measured by their scores on a financial knowledge test, had a positive and significant impact on students' likelihood of displaying each of the three positive financial behaviors. Hence, the first hypothesis was supported. Based on this result, policy makers and educators should try to take actions to increase financial knowledge among Turkish college students so that they display more positive financial behaviors in the future.

Second, parental teaching of finance was found to have a positive impact on the probability of displaying all three financial behaviors, providing support for the second hypothesis. This result is very important and implies that financial education should start at home. Parents need to be aware of the role they are playing in the financial socialization of their children and should discuss financial matters with them while growing up, instead of isolating them from realities of real life as is a common practice in the Turkish culture. The finding also means that policy makers should find ways to include parents in the financial education of their children. Informing parents on personal finance issues so that they acquire sound financial knowledge to transmit and encouraging them to discuss those issues with their children would be good ways to encourage positive financial behaviors among the young in Turkey (Lusardi, Mitchell, & Curto, 2010). Freshmen orientations on campuses including finance sessions for students and parents or online resources for parents and college students could also be particularly useful ideas (Cude et al., 2006).

Attitude towards money was also found to be a significant predictor of college students' financial behaviors, providing support for the third hypothesis. Students with more positive attitudes towards money were more likely to report paying bills on time, having a budget in place and saving for the future. This result implies that while it is important to talk about money with children while they are growing up, it is crucial to make sure that this is accomplished in a positive manner. Parents and educators should be encouraged to show positive and favourable attitudes about money to students.

Another finding that emerged from our analysis is that male students are less likely to have a budget in place to control their finances. However, gender did not have a statistically significant impact on the likelihood of paying bills on time and saving for the future. Finance related courses taken in high school or college had a positive impact on the probability of saving for the future but did not have an impact on the likelihood of displaying the other two behaviors. Another factor, which had a positive and significant impact on saving behavior, was work experience. Based on these results, offering more courses to students as electives or as a requirement to graduate seems a useful option to improve students' financial behaviors. Similarly, universities should find ways to increase work experience of students by offering internship or on-campus employment opportunities.

The present study suffers from the following limitations. First, due to the cross-sectional design of the study no causal relationships can be assumed. Another limitation is that only student data were collected. Data from both students and parents could be useful to operationalize parental influences. Third, social desirability bias might have affected some of our results since students might be reluctant to report negative financial behaviors in an attempt to appear socially correct. In addition to addressing these limitations, further research could investigate the effect of additional explanatory variables such as motivational factors as well as how financial attitudes mediate the relationship between knowledge and behavior among college students in Turkey.

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Amman Financial Market under the Impact of External Public Debt

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Abstract

This study adopted an analytical approach, using the ordinary least squares (OLS) method, in order to demonstrate the response of AFM to the external public debt and to the key economic factors, while there is incessant effort by the governments to keep developing the main economic sectors during the last 15 years. Subsequently, the study attempted to prove that a country without abundant of natural resources, like Jordan, can prosper and develop similar or close to the developed and petroleum countries, while it suffers a high external public debt. The statistical analysis concluded that at level (0.10) there is a significant negative impact of external public debt on the development of AFM, which is a magnet for Jordan governments to direct the future external public debts, if it is unavoidable toward financing the infrastructure projects and capital investments.

Keywords: financial markets, external public debt, economic development, Jordan

1. Introduction

Jordan is a small country with limited resources, but the economy continues to improve since the declaration of independence in 1946. The per capita GDP increased by 35% in the seventies, and slightly declined to only 30% during the eighties, and returned to rise again by 30% in the nineties (CBJ, 2000). About 10% of the territory of Jordan is arable, groundwater resources are limited, and rainfall is low and significantly uneven between one region to another and from one year to another. A lot of ground water resources are non-renewable sources. The most important resources in Jordan are phosphate, potash, fertilizers, as well as tourism and remittances from abroad, along with foreign aid.

The economy of the Kingdom depends mainly on the services sector, trade, tourism, and some extractive industries such as fertilizers, and medicines; Jordan is poor in natural resources. There phosphate mines, south of the Kingdom, make Jordan the third-largest source of this material in the world. Among the most important resources are extracted potash and other minerals, natural gas and limestone.

In 1999, the government introduced liberal economic policies, which led to a boom lasted for a decade and continued until 2009. Jordan is now one of the most competitive economies and liberty in the Middle East.

The banking sector in Jordan is advanced and modern, and thus became the preferential destination for investment as a result of conservative policies that have helped the Central Bank of Jordan (CBJ) to avoid the global financial crisis in 2009. Jordanian economy grew at a rate of 10% during the period 2002 to 2007 (CBJ, 2009).

Jordan's economy is a knowledge-based economy on the path of education development, privatization, economic liberalization, with economic restructuring to ensure a knowledge-based economy. The main obstacles for Jordan's economy are scarce water sources, and complete reliance on oil imports in order to obtain energy, in addition to regional instability.

Concerning the financial markets in many developing and developed countries, there are many international studies which demonstrate this relation during different time periods. Before a mid-century, the economists argued theoretically this correlation under the structure of neo-classical theory, (Williams, 1985). Recently, many studies regarding this issue have been conducted because of the availability of essential data and literature.

In this perspective, there are many imperative analytical studies on different fields in the world; some of them are captivating economically developed countries and others are captivating developing countries. This study tries to address the situation of Jordan after reviewing different studies on a number of countries in the Middle

East and North Africa (MENA) region, at which a number of these studies concluded that it is unnecessary that there is a significance correlation between external public debt and financial markets development with the existence of infrastructure development, the presence of oil and mineral wealth in these states as well (Okeahalam, 2005). Therefore, the substantial of this study has come out to demonstrate the relationship between the external public debt and economic development on one side, and the development of financial market on the other given that Jordan is still suffering a large external public debt compared with its GDP and limited in natural resources and oil. Meanwhile, this study concentrates on the impact of external public debt and the role of economic development on the improvement of Amman financial market, while Jordan endures a large external public debt for a long time.

For the purpose of this study, the study dealt with a methodology based on quantitative analysis to link the independent variables represented by the external public debt and the size of several economic sectors with the dependent variable that represents the development of Amman financial market.

2. The Problem of the Study

Since the main obstacles to Jordan's economy are scarce in natural sources, and totally rely on oil imports in order to obtain energy, in addition to regional instability, Jordan tries to keep its economy as a knowledge-based economy focused on the development of education, financial sector, economic liberalization, with economic restructuring to ensure a knowledge-based economy. In addition, as stated by literature the reality that most of the Middle East countries are reliant on depleting oil resources and used them in developing their economies during the last few decades. To examine the case of Jordan regarding the impact of external public debt on the performance of AFM while there is a continuous effort by the governments to keep developing the main economic sectors during the last 15 years, the study will demonstrate the response of AFM to the external public debt and to the key economic factors.

3. The Aim of the Study

This study attempted to demonstrate whether external public debt in Jordan has a clear negative or positive impact on the development of Amman financial market during the time period 1998-2012, noting that Jordan suffers from a scarcity of natural resources in general and oil in particular. Although, previous studies which dealt with linking financial markets development and economic sectors in the Middle East region focused on the countries that have no government debts and have the benefit of an abundance of natural resources especially oil, which brought out a concrete positive relationship between these sectors and the development of the financial markets.

4. Hypotheses

To accomplish the objectives of the study, a number of the following assumptions have been developed:

H1: There is a statistically significant effect of the external public debt on the development of AFM.

H2: There is a statistically significant effect of education on the development of AFM.

H3: There is a statistically significant effect of water supply on the development of AFM.

H4: There is a statistically significant effect of the roads network on the development of AFM.

H5: There is a statistically significant effect of the combined independent variables on the development of AFM.

5. Methodology

This study explained the effect of the external public debt on the AFM performance during the period 1998 until 2011. The analytical approach is followed in this study. The study started with the related literature review that covered the same period of time which enclosed available data collected for the variable of the trading volume of Amman stock exchange and the independent variables, namely external public debt, the development of education represented by the female students' enrollment in schools, length of roads in kilometers, and the volume of water supply in cubic meters. All these variables are believed to affect the dependent variable. These data are derived from reports issued by the official institutions in Jordan during the time period covered in the study. Finally, essential data were analyzed statistically using the ordinary least squares (OLS) method to derive the analytical and the statistical results.

6. Literature Review

Regarding the international literature, limited literature on developing countries was found and focused on a specific issue similar to the one taken by this study. However, the literature related to this study will be addressed in this part.

Aktham Maghyereh and others (2002) examined in their paper the impact of external public debt on the performance of the Jordanian economy and found out its optimum level using econometric techniques that afford proper measures for estimation and deduction. The conclusion of their study points out that the optimal level of external indebtedness is about 53 percent of GDP. It means, when the external debt goes above this level, its impact on the performance of the Jordanian economy becomes negative.

Mustafa (2009) in his study regarding the conditional effects of external debt on inflation tested the following hypotheses: the external debt is less inflationary when financial markets are well developed. The results of his study support the hypothesis proposing that the debt is less inflationary in economies with well developed financial markets. Hence, the results in the literature are subject to the development level of the financial sectors of the countries.

Levine (1997) illustrated the significance of the factors that influenced the relationship between financial sector's improvement and economic development. These factors played an essential role in the improvement of financial markets in many countries.

Bahamani-Oskeeoo (1998), Aryamehr and Jsber (1999), and Sarno (2000), concluded that the reality of all Middle East countries and the strategies practiced by them which are concerned about the development of their economies, as well as financial markets did not robust the requirements of economic development and the improvement of their financial markets, particularly those strategies practiced by oil countries.

On the other hand, Keefer and Knack (1997) confirmed the economic and other risks that had a pressure on the development of the financial markets and the necessity to take additional actions to improve these sectors to reveal the performance of the financial markets, particularly in the developing countries.

Hassan (2003) exemplified the importance of risks caused by economic sectors and their impacts on the development of the financial markets in ten (MENA) countries during (1984-1999). It illustrated the magnitude of developing the financial and economic sectors and their positive impact on the improvement of the financial markets.

Charles C. Okeahalam (2005) attempted to examine the correlation between a number of variables that have an impact on the development of the economy as well as the performance level of the financial markets in the Middle East region. It demonstrates that the improvement of infrastructure (Roads, water supply and others) had strong indicators in the development of the financial markets in some petroleum countries in the Middle East region. In the meantime, the study revealed the vital role of the quality of education, represented by female education, which had a strong correlation with the improvement of the financial markets.

In the same issue, the study of Thomas and Brian (2008) was on the opposite of the earlier studies, which is based on the examination of the impact of the financial markets development on the growth of the economic sectors in seven countries within the MENA region. The conclusion of the analysis showed heterogeneity of the effect of the financial markets development in these countries on the economic growth.

A study by Muhsin, Saban, and Huseyin (2011) investigated the correlation between the development of the financial sector and the development of other economic sectors in the MENA region. Their study subjected the data for many countries in the MENA region together for statistical analysis during the period 1980-2007. They did not find a correlation, similar nor had the same trend, between the financial sector development and the economic sectors in all countries and it recommended staying away from studying these countries together, but it is preferable to study them separately.

7. Theoretical Framework

This part deals with the theoretical phenomenon for all variables included in the study. These variables consist of the AFM and the main economic factors, specially the external public debt which believed that they may have a serious impact on it during the last 15 years.

7.1 Economic Status

In spite of the subsistence of the outstanding external public debt, the GDP during the first three quarters of 2013 recorded a real growth rate of 2.8% at constant prices, thereby it is maintaining the same growth rate achieved during the same period in 2012 and came as a reflection of the political and economic situation, afflicting the region as a result of the repercussions of the Arab Spring and the political unrest that continues to cast a shadow on the Jordanian economy (CBJ, 2013).

The majority of economic activities has seen a varying degrees of real growth where the construction sector was the most growing sector, which grew by 8.4% in constant market prices during the first three quarters of 2013

compared with the same period in 2012, followed by transportation and communications sector which grew at a rate of 4.0%, then the services sector, finance, insurance and real estate at a rate of 3.8%, then the trade sector, hotels and restaurants at a rate of 3.6%, followed by the manufacturing sector at a rate of 1.7%, while the agriculture sector recorded a growth of 1.1%. Despite the fact that the sectors of mining and quarrying, electricity and water declined by 10.5% and 0.7%, respectively compared with the same period in 2012, it is noteworthy that the economy real growth rate for 2012 has reached 2.7 % (CBJ, 2013).

7.2 Financial Markets

Most Arab stock markets have seen an improvement in their performance during the year 2013. For the purpose of the study, the financial markets were divided into two sections, the Arab stock markets and Amman stock market.

7.2.1 Arab Stock Markets

The Arab Monetary Fund Composite Index for Arab stock exchanges denominated in USD increased by 18.6% during the year 2013. The S&P AFE40 Index, which was created and launched by S&P Indices in cooperation with the Arab Federation of Exchanges (AFE) during the year 2013, has increased by 18.7% (Amman Financial Market, 2013).

By comparing the performance of stock prices denominated in local currencies, the Dubai Financial Market index, compared with the most other Arab financial markets, increased by 107.7% compared with 2012. The Abu Dhabi Securities Exchange ranked the second with a 63.1%, and then the Kuwait Stock Exchange ranked 27.2%, followed by the Saudi Financial Market with a 25.5%. Stock indices rose in each of the Qatar Exchange, Stock Exchange in Egypt, Muscat Securities Market, Bahrain Stock Exchange, Stock Exchange of Palestine and Amman Stock Exchange by 24.2%, 24.2%, 18.6%, 17.2%, 13.4% and 5.5%, respectively. On the other hand, the stock price indices in each of Casablanca Stock Exchange and Tunis Stock Exchange have dropped by 2.6% and 4.3% respectively compared with 2012 (Amman Financial Market, 2013).

7.2.2 Amman Stock Market

Trading values in the secondary market, the first, the second and the third market, in addition to the rights of underwriting market, the bond market and transfers excluded from trading reached 3138 million dinars in 2013 compared with 2022 million in 2012, an increase of 55.2%. The traded shares value in the stock market accounted for 96.5% of total trading values in the secondary market (Amman Financial Market, 2013).

Regarding the volumes of shares traded in the year 2013, trading shares rose by 53.0%, a number of shares traded by 13.5%, and a number of contracts executed by 10.2% compared with the year 2012. The volume of Amman Stock Exchange as shown in Table 1 increased from 464.4 million JD in 1998 to 1978.8 million JD in the year 2012 (Amman Financial Market, 2013).

Table 1. Amman stock exchange (million JD)

Year	1998	2000	2002	2004	2006	2008	2010	2012
Amman stock Exchange	464.37	334.73	950.27	3793.25	14209.87	20318.02	6689.99	1978.81

Source: Amman Financial Market, annual report 2013.

Concerning the rates of daily trading in 2013, the average daily trading volume reached 12.4 million dinars, an increase of 56.7% compared to the daily average for 2012 which was 7.9 million dinars .About the rate of turnover of shares, the financial sector has occupied the first rank at turnover rate amounted 42.9%, followed by the industrial sector at a rate of 34.3%, and finally came the services sector at a rate of 26.9%. As a whole, turnover is stood at 38.0% in the stock exchange during the year 2013 (Amman Financial Market, 2013).

7.3 Balance Outstanding External Public Debt

The balance outstanding external public debt at the end of 2011 reduced by 124 million dinars, or 2.7% from its level at the end of 2010 to reach 4.4868 billion dinars (21.9% of GDP) compared to 4.6108 billion dinars (24.6% of GDP) the end of 2010. As presented in Table 2, the external public debt as a percentage of GDP decreased from 43.3% in the year 2007 to 22.5% in 2012 (Ministry of Finance, 2013).

Table 2. The external public debt as a percentage of GDP

	2007	2008	2009	2010	2011	2012
Balance outstanding external public debt	5253.3	3640.2	3869.0	4610.8	4486.8	4932.4
External public debt to GDP (%)	43.3	23.3	22.9	24.6	21.9	22.5

Source: Ministry of Finance, Annual Report 2013.

The loans, as shown in Table 3, from Arab and foreign governments are the largest part of the total external public debt in Jordan which is equal to 48.2% at the end of 2011. However, Japan comes at the forefront of the creditor countries and its loans accounted for 23.7% of the total external debt. The loans from regional and international institutions have accounted for 37.9% of the total external public debt and most of it financed by the World Bank, which equal 14.9% of the total external public debt. Other sources are from bonds and leases and foreign banks accounted for the remainder of the total external public debt amounting 13.9% (Central Bank of Jordan, Annual Report, 2011).

Table 3. Balance outstanding external public debt (Million JD)

	2007	2008	2009	2010	2011	2012
- Arab and foreign governments	3684.0	2141.5	2091.6	2189.4	2163.9	-
- Regional and international Institutions	1466.3	1395.6	1674.3	1788.7	1700.5	-
- Foreign banks	0.2	0.1	0.1	7.5	7.5	-
-Euro-Bonds	102.8	103.0	103.0	625.2	614.9	-
Balance outstanding external public debt	**5253.3**	**3640.2**	**3869.0**	**4610.8**	**4486.8**	**4932.4**

Source: Central Bank of Jordan, Annual Report 2013.

7.4 The Educational System

The educational system in the Hashemite Kingdom has witnessed a continuous improvement since the mid-twentieth century. An efficient educational system played a major role in transforming the country from a predominantly agricultural to about industrial nation. The educational system in Jordan ranked as the first in the Arab world, and is one of the best educational systems in the developing world.

In 2003, the share of the budget allocated for education was 6.4 percent of total government spending, and spending on education amounted 13.5 percent of GDP in the same year. With regard to illiteracy in Jordan, as we see in Table 4, the female enrollment increased from 85% in the year 2003 to 94% in 2012. In order to eliminate illiteracy in Jordan; Ministry of Education has opened centers for adult education, females constitutes the largest percentage of the total enrollment and this shows women's awareness and their recognition of the importance of education (Ministry of Education, 2013).

Table 4. Literacy enrollment in adult educational centers by gender (2003-2012)

Year	Male	Female	Both
2003/2004	618	3582	4200
2004/2005	406	3415	3821
2005/2006	397	3163	3560
2006/2007	827	4809	5636
2007/2008	455	6002	6457
2008/2009	598	5530	6128
2009/2010	350	5233	5583
2010/2011	355	5523	5878
2011/2012	513	5637	6150
2012/2013	318	4956	5274

Source: Ministry of Education, Annual Report, 2013.

The illiteracy rate in Jordan was 8.9 percent, the third lowest in the Arab world after Kuwait and the Palestinian territories. The gross enrollment ratio in primary education increased from 71 percent in 1994 to 98.2 percent in

2006. During the same period, the proportion of the transition to secondary education increased from 63 percent to 97 percent and the transition to higher education ranged between 79 and 85 percent of high school graduates. In addition to the enrollment ratios and the higher transition, Jordan has achieved equitable in opportunities by 90 percent in the area of literacy and a full equitable of opportunities to enroll in primary and secondary education. The female enrollment as in Table 5 increased from (665771) in the year 1998 to (849828) in 2012 (Ministry of Education, 2013).

However, there is a need to increase government spending on higher education to meet the growing demand for this type of education. Instead, the decline of public spending on higher education during the years, accounting for 14.7 percent of the total expenditure on education, or 0.65 percent of GDP, which is low when compared to other middle-income countries. Money transferred to universities fell from JD 60.4 million in 2004 to 52.6 million in 2007 and to 45 million in 2008.

Table 5. Female enrollment

Year	1998	2000	2002	2004	2006	2008	2010	2012
Female enrollment	665771	694636	727316	745444	785081	808297	815751	849828

Source: Ministry of Education, annual report 2013.

7.5 The Development of Roads Network

The literature confirmed the rule of the development of infrastructure such as roads and water supply net-works on the improvement of financial markets, especially in the developing countries. The roads network had a major development in terms of design, construction and maintenance. Although, as presented in Table 6 the total length of the network of paved roads in Jordan in 1950 reached (895) kilometers of main, secondary and rural roads, while in the end of 2012 reached (7201) km, noting that the adoption of new standards for the classification of roads began in 2010, according to the study of the master plan for roads (Ministry of Public Works and Housing, 2013).

The substantial of maintenance of the roads within the master plan is to maintain their durability and public safety by allocating sufficient financial funds and to have a large number of projects in different governorates. The Government increased its interest in the development of the provinces through the achievement of the construction, rehabilitation and maintenance of most roads and provided traffic safety elements (Ministry of Public Works and Housing, 2013).

Table 6. Roads network

Year	Major Roads (KM)	Secondary Roads (KM)	Rural Roads (KM)	lengths of roads (KM)
1950	540	174	181	895
1997	2894	1984	2144	7022
1998	2906	2000	2227	7133
2000	2911	2059	2261	7245
2002	2954	2060	2288	7302
2004	3057	2078	2365	7500
2006	3187	2112	2395	7694
2008	3231	2139	2446	7816
2010	2718	1832	2488	7038
2012	2718	1876	2607	7201

Source: Ministry of Public Works and Housing, Annual Report 2013.

7.6 Water Supply

The water sector went through several overlapping phases and witnessed a remarkable development of all water services despite the challenges faced by the sector specially in the beginning of the nineties, which is characterized by the scarcity and the weakness of its ability to meet the growing daily needs beside the increase in population growth, as well as the rising in standard of living and economic, social and tourism development in Jordan.

During the time when water services in the Kingdom, especially in the household sector, were traditionally provided by water wells and springs, were supplied by rainwater and provided the agricultural sector. We recently see that water supply covered more than 98% of the kingdom's residents. The water supply as shown in Table 7 increased from 241.5 million M3 in 1998 to 341.1 in 2012, along with increased sanitation services to provide 63% of the total citizens where the recent programs and plans attempt to increase the sanitation services percentage to reach 70% in the coming years.

Table 7. Water supply

Year	1998	2000	2002	2004	2006	2008	2010	2012
Water supply Million(M3)	241.5	235.4	245.6	275.7	286.3	310.4	327.7	341.1

Source: Ministry of Water and Irrigation, Annual Report 2013.

8. Statistical Analysis

In this regard, a simple and multiple regression analysis were applied on the available data of all variables between 1998 and 2011 in order to test subsidiary and main hypotheses of the study. The analytical technique is used to demonstrate the effect of the independent variables on the dependent variable. Data of dependent and independent variables underwent for normal distribution and (OLS) statistical analysis, simple and multiple regression tests were used as well. This analysis carried out each variable in accordance with the assumptions listed below:

First independent variable: External Public Debt.

H0: There is no statistically significant effect at level (0.10) of external public debt on the development of AFM.

H1: There is a statistically significant effect at level (0.10) of external public debt on the development of AFM.

The preceding assumptions were tested by t-test and ended with the results shown in the appendix Table A1. According to the statistical decision rule which supposes that if the P-value is less than or equal to the significance level, the null hypothesis (H0) should be rejected and the alternative hypothesis (H1) should be accepted. As a result P=.057; β=-.519; t=-2.101, (H0) is rejected, but (H1) states that there is a statistically significant effect at level (0.10) of external public debt on the development of AFM which is accepted.

Second independent variable: Development of Education.

H0: There is no statistically significant effect at level (0.10) of the education development on the development of AFM.

H1: There is a statistically significant effect at level (0.10) of the education development on the development of AFM.

The preceding assumptions were tested by t-test and ended with the results shown in Table A2. According to the statistical decision rule and the given results, P=.017; β=.626; t=2.77, (H0) is rejected, but (H1) argues that there is a statistically significant effect at level (0.10) of education on the development of AFM which is accepted.

Third independent variable: water supply.

H0: There is no statistically significant effect at level (0.10) of water supply on the development of AFM.

H1: There is a statistically significant effect at level (0.10) of water supply on the development of AFM.

The preceding assumptions were tested by t-test and ended with the results in Table A3. According to the statistical decision rule and the given results P=.004; β=.738; t=3.631, (H0) is rejected, but (H1) says that there is a statistically significant effect at level (0.10) of water on the development of AFM that is accepted.

Fourth independent variable: Roads network.

H0: There is no statistically significant effect at level (0.10) of roads network on the development of AFM.

H1: There is a statistically significant effect at level (0.10) of roads network on the development of AFM.

The preceding assumptions were tested by t-test and ended with the results in Table A4. According to the statistical decision rule and the given statistical results P=.003; β=.736; t=3.769, (H0) is rejected, but (H1) states that there is a statistically significant effect at level (0.10) of roads network on the development of AFM which is accepted.

The dependent variable: The development of AFM.

H0: There is no statistically significant effect at level (0.10) of the combined independent variables represented by external public debt, development of education, water supply, and roads network on the dependent variable represented by development of AFM.

H1: There is a statistically significant effect at level (0.10) of the combined independent variables represented by external public debt, development of education, water supply, and roads network on the dependent variable represented by development of AFM. The preceding assumptions were tested by F-test and ended with the results in Table A5.

Statistically, if the P-value is less than or equal to the significance level, the null hypothesis (H0) should be rejected and the alternative hypothesis (H1) should be accepted. As a result, (H0) is rejected, but (H1) states that there is a statistically significant effect at level (0.10) of all combined independent variables on the development of AFM which is accepted.

The result of the ANOVA table analysis shows a significant effect of all independent variables on the development of AFM, where R2 equals 0 .588 indicates that the independent variables explained 58.8% of variance in the development of AFM ($F = 3.215$, $P < .10$), at which the coefficient analysis shows the effect of external public debt ($\beta = -.519$, $P < .10$), education ($\beta = .626$, $P < .10$), water supply ($\beta = .738$, $P < .10$), and roads network ($\beta = .736$, $P < .10$).

We noted that the effect of each independent variable represented by development of education, water supply, and roads network on the dependent variable is positive except the external public debt which has a negative effect ($\beta = -.519$).

9. Results and Recommendations

The results of the theoretical and statistical analysis followed in this study tried to show the impact of the external public debt on the development of AFM, while on the other side this analysis tried to demonstrate the nature of the relationship between a number of economic sectors and the AFM during the time period 1998-2011. In general, the analysis ought to explain the significance and whether there is a positive or negative effect of the external public debt on AFM, while there is a desire from many Jordanian governments to obtain a high level of economic development. Subsequently, the study attempted to prove that a country without abundant of natural resources, like Jordan, can prosper and develop similar or close to the developed and petroleum countries while it suffers a high external public debt. In this context, we can set our results and recommendations as follows:

- The existence of a significant negative impact of external public debt on the development of AFM, which is a magnet for the governments of Jordan to direct the future external debts if it is unavoidable to the main economic projects and capital investments.

- There is a clear positive impact of studied sectors on the AFM which draw attention to develop these sectors by creating new investments and improve the existed ones.

- We conclude from the statistical analysis that Jordan suppose to rely on its human capital resources beside the development of the main economic sectors, and tries to minimize the amount of external public debts during the coming years.

- Despite the limited natural resources specially oil, Jordan is still like other developed and many oil countries has the potentiality to develop its economic sectors which at the end has a constructive reflection on the financial market.

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Appendix

Table A1. Summaries of the statistical results of the regression analysis of the first hypothesis

Coefficients [a]					
Model	Un-standardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
Constant	3.708E10	1.463E10		2.534	.026
EPD	-6194754.394	2947786.314	-.519	-2.101	.057

a. Dependent Variable: AFM.

Table A2. Summaries of the statistical results of the regression analysis of the second hypothesis

Coefficients [a]					
Model	Un-standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-5.481E10	2.212E10		-2.478	.029
Education	81380.203	29281.596	.626	2.779	.017

a. Dependent Variable: AFM.

Table A3. Summaries of the statistical results of the regression analysis of the third hypothesis

Coefficients [a]					
Model	Un-standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-3.707E10	1.217E10		-3.047	.011
Water	160.504	44.210	.738	3.631	.004

a. Dependent Variable: AFM.

Table A4. Summaries of the statistical results of the regression analysis of the fourth hypothesis

Coefficients [a]					
Model	Un-standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-1.269E11	3.541E10		-3.582	.004
Roads	1.783E7	4730779.472	.736	3.769	.003

a. Dependent Variable: AFM.

Table A5. Summaries of the statistical results of the regression analysis of the fifth hypothesis

ANOVA [b]					
Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	3.653E20	4	9.133E19	3.215	.067[a]
Residual	2.557E20	9	2.841E19		
Total	6.210E20	13			

Note. $R^2 = 0.588$.

a. Predictors: (Constant), External debt, Education, Water, Roads.

b. Dependent Variable: AFM.

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The Economic Impact of Climate Change on Optimal Allocation of Water Resources in Agricultural Sector

(Case Study: Sarbaz River Basin of Sistan and Baluchestan Province)

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Abstract

Agriculture as the largest user of water resources and providing for human needs, water resources management is faced with many challenges. On the other hand, climate change and weather conditions resulted in the production of agricultural products subject to this change. Scarcity of water resources due to reduced precipitation patterns change and global temperature has increased agricultural production and food supply is affected. Due to the adverse effects of climate change on various sectors of production, ecological and human communities, of climate change could be one of the most important environmental challenges mentioned century. Sistan and Baluchestan Province, one of which, unfortunately, has witnessed successive droughts and livelihood and economic problems it has caused, therefore, water management and determine an optimal cropping pattern is consistent with climate change; step is useful for planning and development of the agricultural sector. The aim of this study is to investigate climate change in the southern zone using the GCM, the effects of climate change (precipitation and temperature) crops into the region and a consistent pattern of socio-economic optimization using fuzzy multi-objective programming model is presented.

Keywords: climate change, crop patterns, fuzzy multi-objective programming, Sistan and Baluchestan

1. Introduction

Abnormal increase in greenhouse gases is only one factor that affects the Earth's climate system. Check the status of emissions suggests that the Industrial Revolution in the mid-18th century, due to the increasing industry and by the increased use of fossil fuels, the balance amount of greenhouse gases in the atmosphere is particularly confused and amounts of carbon dioxide has increased. The infrared radiation emitted by the Earth's rise has caused more warming caused by greenhouse gases absorbed by the Earth's atmosphere. Warming the planet, in turn, on the other components of the climate system is affected by the phenomenon of climate change causes (Vaseghi & Esmaeili, 2008). Several factors have been caused by phenomena such as climate change, population growth and the widespread use of fossil fuels, land use change and industrialization ... that gradually changes in Earth's climate have caused today, the average increase in global temperatures and an increase in natural disasters such as floods, hurricanes, melting polar ice caps and rising sea levels and thereby increasing the frequency, duration and intensity of droughts have (Redsma, Lansink, & Ewert, 2009). But as the supply and demand for water is the source of life, are related to climate change is happening on Earth, so Effects and this phenomenon it is necessary. Iran's climate due to its condition has caused water shortages and inadequate spatial distribution of the distant past, when it is faced. So only 0.37 percent of the world's freshwater resources is belonging to Iran. It is clear that due to this phenomenon and the allocation of water resources in the country is of particular importance and it is necessary in addition to the problem of water supply and extraction, to discuss its management should be considered. On the other hand, the agricultural sector as the largest user of water resources between sectors and providing for human needs is water resources management is faced with many challenges and changes in climate and weather conditions in the production of many products, it has changed. On the one hand, the main factor of production in this sector, "water", which is heavily influenced by climate and the availability of other products in this section, time, location and acreage, yield, dry matter, and it, is all affected by climate changes. So that not only can reduce the intense rainfall for crop production per unit area

affected; but basically it can disrupt the cultivation and harvesting of crops.

Sistan and Baluchistan province with an area of over 181 square kilometers; in hot and arid region where little rainfall, scattered and uncertain times on the one hand and high levels of evaporation on the other hand has been facing a severe shortage of water resources. The hydrological, climatic conditions and water resources management in special circumstances as hydrological phenomenon is less relevant in this province is not updated. In the northern province of Helmand is plain that our catchment area, the utilization of water resources is limited to surface water resources which stems from neighboring Afghanistan. While in the central part of almost all the exploitation of water resources, groundwater is limited because of the special geological and resource potential of the area are not but are generally stable sources (Sistan and Baluchistan province Regional Water Company, 2002) in the southern province of a combination of surface and ground water resources however, despite the fact that these resources are heavily dependent on the surface and therefore sensitive resources and vulnerability of climate change are considered. The river brought the region may be in a day to reach three million cubic meters a year, or even water in the river is not. It is obvious that water management is essential in this area and determine an optimal allocation of water resources and the optimum model is consistent with climate change; an important step in planning for the future of agriculture in the region and is compatible with these conditions.

More research in this area focuses on long-term relationships between climate and hydrological parameters based and have tried the effects of climate change in the parameters of water resources through climate-hydrological modeling relationships between variables estimate the occurrence or non-occurrence of the phenomenon of climate change. And most of those studies that include: Shen (2010) in a study to demonstrate the relationship between climate change, water resources management, changes in Water Resources in China during the past 50 years. Climate change and water resources in the selection of the seven river basins in the country are according to their predictions for the future. Wang, Huang, and Rozelle (2010) investigated the effect of climate change on water resources and agriculture in China Tanlarj River Basin; the climate effects with the use of general circulation models under three scenarios were simulated. The results showed that climate change will have a significant effect on water supply in the area under the A2 and B2 scenarios arises more serious water shortages. Their results also showed that if farmers are able to reallocation of water between the products, then there will be the possibility of moderating the effects of climate change (Matondo, Peter, & Msibi, 2004).

Effects of climate change on hydrology and water resources in Switzerland using the model output and in three catchment rainfall-runoff models are examined. Their results showed that the annual discharge of the river basin from 4 to 23 percent decline in the future Angavama while there will be little change in the other basins. Research in the area of climate change Aanjam which includes the study of (Nazari, 2012) paid in their study to evaluate the economic impacts of climate change on agriculture in Iran. He works with the simulated precipitation and temperature parameters of the main water sources and its effects on agricultural sector in equilibrium studied and analyzed. Other studies can also be used to study and understand perspective, in 2003 noted that the effects of climate change on water resources are studied. In this study, based on the results of climate change switches shown that with increasing temperature, evaporation increases in most river basins and degree temperature increase of 2 to 6, 6 to 12 percent increase in evaporation and precipitation change the search will be 78-71 percent. Agricultural sector and regional culture model depends heavily on rainfall. Various studies with regard to this issue, the effects of climate change on crops. Including Gupta and Harboe (2000) in their study using fuzzy multi-objective model of the Narmada River in India simulated data to determine the optimum model of the area is water. Model provided timely irrigation will reduce the risk of failure. The study is in accordance with a reduced risk of failure due to the uncertainty on the water, especially in arid regions to provide the appropriate cropping patterns can be seen as very useful.

Bostani and Mohammadi (2011) in a study with the aim of designing optimal utilization in city corruption by integrating multi objective programming and planning phase questionnaire among 90 operators in fuzzy optimal selection of the city studied. The results of their study showed that the optimal fuzzy contour patterns are a definite improvement. It was also demonstrated using fuzzy mathematical programming model to select the appropriate and optimal combination of multiple targets and gives a lot of flexibility. There is conflict between utilization and environmental goals. Alvanchy and Sabouhi (2009) in his study in the Gulf region of Iran using multi-objective decision-making model with three objective maximization gross margin, minimization risk and irrigation water showed interactive crop pattern in the pattern of cropping patterns available to f armers to grow more close agreement in addition, it had better results in the area of agricultural planning. Bostani and Mohammadi (2009) in a study to develop crops at risk, with regard to the reduction of water consumption in the city of Shiraz in Fars province began using multi objective programming approach. Note that targets three goals to reduce water consumption reduce risk and increase the efficiency. Results showed that there was an exchange

between the aforementioned purposes. The pattern of the area planted was increased with increasing levels of risk. In these models, vegetables, corn acreage was higher than the current model, but the atmosphere was reduced cultivation. Bean acreage was also close to its current level. The results showed that the optimal pattern of increasing risk with increasing distance between the current models.

2. Method

Agricultural sector is increasingly influenced by the climate, availability of space and time in this sector, and the acreage of crops, dry matter and all of it is affected by climate changes. Therefore, in this study the effects of climate change on water resources in the region, using general circulation models under three switching CGCM3T63 B1, A2, Mix of switching provided by the Inter-governmental Committee on climate change simulations and then the demand for water (irrigation requirements) using the water of reaction was calculated FAO Finally, comparison of baseline and simulation for performance and the demand for water (irrigation requirements) for different products in each of the switches of climate change and the effect of climate change on aquatic products is required. Then the normal application of the product in the area of crop irrigation requirements and to obtain the optimal allocation model is introduced. To the anticipated effects of climate change for water resources, the effects of these changes on the demand, levels and cropping patterns, as determined by the pattern of the ship is consistent with climate change. The basic algorithm for optimizing the allocation of water between different sectors is the linear programming. Accordingly, given the general framework of linear programming can be defined objective of maximizing gross margin business.

$$Z = \sum_{i=1}^{n} \frac{S_i * GER_i}{AW * GER_{maz}} \tag{1}$$

Therefore, it is necessary first of all gross economic returns are calculated for each sector.

2.1 Limitations

A) The limitation of water:

The water supplied to the water sector does not exceed:

$$\sum_{i=1}^{n} S_i + K \leq Aw \tag{2}$$

AW (the volume of water available), due to the volume of water available for allocation between the various competing and technical feasibility, K the amount of water entering the ecosystem (environment) and Si is the share of each of the competing water.

B) Restrictions on water demand:

Share of water allocated to the normal water section shall apply to the portion below the minimum size is the minimum demand.

$$D_{ni} \geq S_i > D_{mi} \tag{3}$$

That Dn (normal demand) for each sector, the conventional demand for water supply, and the demand may be met or not and Dm (demand a minimum): request to the terms of the minimum that must be met.

C) Limitation of water supply:

Total water should be allocated to the different demands of water is normal.

$$\sum_{i=1}^{n} S_i \leq D_{ni} \tag{4}$$

D) Environmental constraints:

According to the characteristic of irreversibility of natural resources if the development process from the initial state to get them back to a previous state is difficult or impossible, it seems that the environmental benefits of the benefits of development in many cases surpass. Because the development of water resources has caused irreparable damage to the ecosystem is the actual utilization of water resources associated with externalities. Therefore, regarding the appropriateness of the use of water resources, a series of future benefits will be lost. The total loss of future profits (ρ) can be a function of the amount of water (w) and the amount of water entering the ecosystem (K) and the lack of value in the form of irreversible (ρδ) is considered:

$$\rho = \alpha W - \beta K + \rho\delta \tag{5}$$

The above discussion leads to a rule-oriented as environmental protection with regard to services that should be protected. If it is assumed irreversibility not is allowed to grow, a stable base for the use of resources will be achieved. This means that to achieve sustainable rule should $\rho = 0$ and it is possible that the irreversibility of

time there before the course:

$$\rho = \alpha W - \beta K = 0 \quad \Rightarrow \quad \sum_{i=1}^{n} S_i \ = W = \frac{\beta}{\alpha} \text{ K} \tag{6}$$

The amount of water for different sectors, as a proportion of the amount of water released in the ecosystem is defined. But because of the irreversibility of time before developing countries are due to lack of attention to environmental issues is evident, there is a solution that is not allowed to expand. Or in other words the situation is not worse than it is. β is the rate of compensation irreversibility of preventive measures because due to the economic needs have to use water resources (harvest) and must be greater than zero and also the amount shall not exceed the resource capacity. Since, at best, preventive measures (allocation of water to ecosystems) can only be irreversible values are taken from the source block. So it is smaller than α. Therefore:

$$0 < \beta < \propto$$

After β simulated by the fact that the amount of water allocated to the ecosystem is the source, different scenarios can be picked up in the water as the ratio of the volume of water allocated to ecosystem determined.

E) Non-negative constraints of activities:

$$S_i \geq 0, \quad D_{ni} \geq 0, \quad D_{mi} \geq 0 \tag{7}$$

As noted with regard to the importance of agriculture in the use of water resources and special effects that affect the climate in this section in particular, this section will be taken into consideration and then, aims to determine the optimal cropping pattern in the study area.

General context of regional planning several criteria: In this research for decision making in the agricultural environment using fuzzy mathematical programming by Professor Lotfi Zadeh was presented for the first time; according to previous research has been followed. Currently one of the most known among models, mathematical programming models; mMulti-objective programming model (prototype) that this type of model to use in the decision-making process has been introduced in the 70's. Then use these models as models for developing a systematic logic of the institution and different types of them were based on theoretical issues. Zeleny (1982) analyzed several criteria included multiple criteria and multiple targets knows (Manus et al., 2009).

Then Lotfi Zadeh (1965) and after that, Zimmerman (1978) fuzzy sets in multiple criteria mathematical programming into the way in terms of the issues that have been resolved by non-MCDM methodology usual, were flat. Many other studies in this regard that has great influence on the MCDM methods such as research studies Lohani et al. (2004); Panda et al. (1996); Anigrahi and Majumda (2000); Zimmerman (1987); Zimmerman (1990); Inuiguchi et al. (1990); Hannan (1981); Sakawa (1987); Yano and Sakawa (1985). Ultimately, these studies point to be known as the fuzzy mathematical programming. Following the decision proposed by Bellman and Lotfi Zadeh fuzzy or minimum operator in 1970, along with various membership functions led to the development of the equivalent linear programming problem. The objective function of fuzzy membership function is known and therefore is bound. The constraints for the optimization of objective functions, one decision at a fuzzy environment is defined as an analogy with a non-fuzzy environment, such as the selection of activities that simultaneously optimizes the objective function and constraints. Making in a fuzzy environment is the intersection of fuzzy constraints and fuzzy objective functions. There is a relationship between constraints and objective functions perfectly symmetric fuzzy environment (Bellman & Lotfi, 1970). The general framework of the model as follows:

The first vector is defined as the maximum of the following form:

$$Max\ Z(x) = \{Z(x) | x \in X\}$$

Where $Z(x)=Z_1(x),\ldots,Z_k(x)$ is operation value. Efficient solution set is defined as the set of all solutions of $\bar{x} \in X$ given the objective function $Z_t(x)$.

$\bar{x}$ An efficient solution would be if there is no $\acute{x} \in X$.

$Z_t(\acute{x}) \geq Z_t(\bar{x}), t = 1, \ldots, k$ and $t \in (1, \ldots, k)$ for at least one of. $Z_t(\acute{x})\ Z_t(\bar{x})$.

Optimal answer to this way you get the full set of answers is a member.

2.2 Objective Functions

1). The profit maximization:

General economic goal of profit maximization by any decision of the planning process is followed. Although the pattern of ships for which farmers would prefer to create greater financial returns. Therefore, this objective can

be formulated as follows:

$$Max\ Z1=\sum_i N_i \times A_i \quad \forall i \tag{8}$$

2). Minimize the need for capital:

Investment is needed for production and investment plays a key role for selected products in particular, this study investigated the farmers in the area have very little financial capacity and cropping patterns that require little capital is generally preferred. So we have:

$$Max\ Z2=\sum_i I_i \times A_i \quad \forall i \tag{9}$$

A_i: Area under cultivation per hectare for each product and I_i investment product.

3). Minimize water consumption:

According to government policies can reduce water consumption is one of the objectives of the study and this can result in water resource management and extension services to farmers are a special place:

$$Max\ Z3=\sum_i D_w \times A_i \quad \forall i \tag{10}$$

Where D_w is the need for irrigation water every product.

Limitations of the model:

1) Limit the area:

At the planning level assigned to the various products in each month shall be equal to the total arable area:

$$\sum_j B_i^j \leq A, \quad \forall j \tag{11}$$

Water restrictions are required:

Irrigation water demand in any month shall not exceed the total water in the particular month:

$$\sum_i W_i^j \times A_i \leq SW^j + GW^j, \quad \forall j \tag{12}$$

Limit the extraction of underground water resources:

The use of groundwater resources should be higher than the total amount of allowed extraction of these resources:

$$\sum_j GW^j \leq TAGW \tag{13}$$

2). The activities are non-negative constraints:

The basic assumption of linear programming is that all decision variables should be negative.3. The activitiesare non-negative constraints:

The basic assumption of linear programming is that all decision variables should be negative. A_i

$$A_i \geq 0 \text{ and } GW^j \geq 0 \tag{14}$$

2.3 Membership Functions

Membership in the context of multi-objective function is a special deputy preference in determining optimal results for each of the roles that and the t-th target $\mu_{Z(x)}$ is shown. Membership is subject to the following conditions exist:

$$\mu z(x) = \begin{cases} 1 & if \quad Z_t(x) \geq Z_t^* \\ 0 \leq \mu z(x) \leq 1 & if \quad Z_t^m \leq Z_t(x) \leq Z_t^* \\ 0 & if \quad (x) \leq Z_t^m \end{cases} \tag{15}$$

$Z_t(x)$: The result is that the t-th target.

If a solution with the highest degree of membership in a fuzzy decision as to maximize the definition, then the fuzzy optimization problem can be expressed as follows:

$$Max\ Z(x)=(Z_1(x),\ Z_k(x))^T \tag{16}$$

Where:

$$AX \leq b$$

$$X \geq 0$$

All objective functions are defined by their membership functions.

This will be followed by all objectives simultaneously optimized membership functions. For the general public:

$$\mu_D(x) = \mu_D\big(\mu_{z1}(x), \dots, \mu_{zk}(x)\big) \tag{17}$$

And general optimization problem is to maximize μD (x). Will become $\bar{x} \in X$ based on defining the optimum vector fuzzy linear optimization problem is called if and only if 17 is an optimum solution for the equation as:

$$\mu_D(x) \leq \mu_D(\bar{x}).\ \forall\, x \in X$$

Using the operator minimum (Lotfi Zadeh, 1965) Basic functions of $\mu_D(x)$:

$$\mu_D(x) = min\left(\mu_{zt}(x)\right) = min\left(\mu_{z1}(x), \dots, \mu_{zk}(x)\right) \tag{18}$$

Equation 9 can be written as follows:

$$Maximin\ \ (\mu_D(x)) \tag{19}$$

$$S.t:$$

$$AX \leq b$$

$$X \geq 0 \tag{20}$$

Zimmerman (1978) showed that the relation 19 is equivalent to the following schedule:

$$Max\ \lambda$$

$$S.t:$$

$$\lambda \leq \mu_t^H Z_t(x)$$

$$AX \leq b$$

$$X \geq 0, \lambda \geq 0 \tag{21}$$

Multidisciplinary model for determining the optimum model using a fuzzy linear programming:

Formulation of linear programming model based on fuzzy multi-criteria decision-making is quite logical that the nature of the membership function is hyperbolic. Because the marginal utility of decision-making in the real world, however it is reduced utility level (degree of membership) with respect to increases the achievement of the target. Nonlinear Hyperbolic the membership function for the fuzzy goals of the decision maker imagine:

$$\mu_t^H Z_t(x) = \frac{(tanh(\left(Z_t(x) - b_t\right) + 1)}{2} \tag{22}$$

That αt and bt slope parameter value $Z_t(x_t)$ is the way to $\mu_t^H Z_t(x) = 0.5$. Worst and best objective function value of t th respectively Z_t^*, $Z_t^m$and $b_t = (Z_t^m + Z_t^*)/2$. Using the membership function of the fuzzy hyperbolic shown above for the express purpose of fuzzy making decisions Lotfi Zadeh and Bellman (1970), the general form of the problem can be stated as follows:

$$Max\ \lambda$$

$$S.t:$$

$$\lambda \leq \mu_{zt}^H(x), t = 1,2, \dots, k$$

$$AX \leq b$$

$$X \geq 0,\ \lambda \geq 0 \tag{23}$$

This formulation $\lambda \leq \mu_{zt}^H(x)$is a nonlinear function and therefore is faced with a nonlinear programming problem. Librling (1981) showed that such nonlinear hyperbolic nonlinear membership functions can be introduced by the linear programming problem becomes routine. Equation 23 can be written as:

$$Max\ \lambda$$

$$S.t:$$

$$\lambda \leq \frac{(\tanh((Z_t(x) - b_t) + 1)}{2},\ t = 1, 2, \dots, k$$

$$AX \leq b$$

$$X \geq 0,\ \lambda \geq 0 \tag{24}$$

That is synonymous with:

$$Max\ \lambda$$

$$S.t:$$

$$((Z_t(x)-b_t)\alpha_t \geq tanh^{-1}(2\lambda-1) \quad t = 1, 2, \ldots, k$$
$$AX \leq b$$
$$X \geq 0, \ \lambda \geq 0 \tag{25}$$

If you define that:

$$x_{n+1} = tanh^{-1}(2\lambda - 1), \ \lambda = (tanh^{-1}(x_{n+1}) + 1)/2 \quad \lambda = \frac{(\tan h^{-1}(x_{n+1}) + 1)}{2}$$

So tanh (x) is a strictly increasing monotonic function with respect to x is equal to the maximum λ peak x_{n+1} is the vector of values of multi-objective optimization problem can be transformed into the crisp model:

$$Maximize \ x_{n+1}$$

Subject to:

$$\propto_t \ Z_t(x) - (x_{n+1}) \geq \propto_t \ b_t \ , t=1, \ldots, k$$
$$AX \leq b$$
$$X \geq 0, \ x_{n+1} \geq 0 \tag{26}$$

An optimum relationship between 26 (x_{n+1}^*, x $*$) to get the optimal solution of the original problem can be obtained:

$$(\lambda, x^*) = \frac{tanh^{-1}(x_{n+1})+1}{2} \tag{27}$$

The regional allocation model multi-objective fuzzy membership functions Hyperbolic can be formulated as follows:

$$Maximize \ A(n+1)$$

Subject to:

1) Constraints by equations 1 -7 as a target allocation model;

2) Restrictions on membership hyperbolic one for each target were investigated:

- Maximizing efficiency program:

$$-\propto_1 \sum_{i=1}^{n} N_i A_i + A_{n+1} \leq -\frac{\alpha_1(Z_1^m + Z_1^*)}{2} \tag{28}$$

- Minimum capital requirements:

$$-\propto_2 \sum_{i=1}^{n} I_i A_i + A_{n+1} \leq -\frac{\alpha_2(Z_2^m + Z_2^*)}{2} \tag{29}$$

- Minimize water consumption:

$$-\propto_3 \sum_{i=1}^{n} W_i A_i + A_{n+1} \leq -\frac{\alpha_3(Z_3^m + Z_3^*)}{2} \tag{30}$$

- Non-negativity constraints:

$$A(n+1) \geq 0$$

3. Results and Discussion

As noted in this study the historical data for the period 1982-2011; hydrometric station and synoptic River basin catchment soldiers in southern Baluchestan were collected. The available water resources among competing sectors (agriculture, water and environment) are assigned. Following the model of optimal planning of land under cultivation in the proposed dam the optimal solution based on the historical conditions for the periods presented. In the second phase of the study with the use of models called general circulation model (GCM) climate data were simulated catchment soldiers in southern Baluchestan and then with respect to the data presented in this large-scale data model are therefore, using purposive sampling techniques were fine-scale view and the discharge capacity of the river soldier using rainfall-runoff model was simulated. This part of the investigation into the exogenous information into fuzzy multi-objective planning model presented in this study has been killed. With regard to the effects of climate change (temperature and precipitation) in the pattern of changes in the volume of water entering the model is, the proposed model is based on the proposed changes, and is adapting to climate change. Differences in the pattern created by cropping patterns based on historical observations of the effects of climate on crops in the basin are studied.

Optimal allocation of water resources in river basins soldier:

After examination of the phenomenon of climate change by examining the homogeneity of the studied basin, using CGCM3T63 model simulation results of climate change during the study Tale 3 is. According to the IPCC (2007) general circulation models under different scenarios of economic, social and environmental considerations offered in which greenhouse gas emissions under different scenarios of population growth, economic growth, technological progress, and the simulation result. As can be seen in the area of climate change simulation study under three scenarios A1B, B1, A2 is done.

Table 1. Simulation results under three scenarios of climate change

Scenario variable	*A1B*	B1	A2
The Maximum Temperature	+1.99	+1.06	+1.9
The Average Temperature	+1.82	+1.17	+1.77
The Minimum Temperature	+1.64	+1.27	+1.69
Rainfall	-12.8%	+5.5%	-10.5%

Resource: Finding Research.

Can be seen that the maximum temperature, minimum and average under all scenarios examined during the 50 years leading up to the year (1440) will increased. Unlike the other two scenarios under the B1 scenario rainfall will decrease 12.8%. Generally, many of compete in the water, should be involved in planning for the allocation of this resource includes 1 Agriculture 2 Industry 3 home 4 Ecosystem 5 Energy. In this paper, according to the conditions prevailing in southern Baluchistan and the absence of any facilities to produce energy (electricity) in area, this part of the program is eliminated. However, given the small size of the industry and the lack of integration of the home ultimately, this lack of information and statistics can also be evaluated separately Planning and so it is with the water sector (domestic and non-domestic) has been studied. Table (1) River Basin Water Allocation Model has been soldiers. Optimal allocation of water for the purpose of maximizing economic efficiency of water use has been the efficiency of agriculture and home the inverse demand function derived from this Shahraki & et.al (2008) in the Helmand river basin is calculated. To prevent the destruction of the environment, preservation of environmental constraints in the form of three scenarios defined for the allocation of water to ecosystems, following fierce study (2012), ith values of 0.25, 0.5 and 0.75 = β% of water allocated to this sector.

Table 2. Monthly allocation model of water in the river basin soldiers in the base period using historical data

Scenario	Section	April	May	June	July	August	September	October	November	December	January	February	March
	Agriculture	795.00	548.06	394.03	398.30	381.49	118.96	162.80	178.47	174.46	1296.62	1780.40	1038.44
B=0.25	Home	1710	1710	1710	1710	246	246	246	246	246	246	246	246
	Environment	626.25	564.51	526	527.07	156.87	91.24	102.20	106.12	105.11	385.65	506.6	321.11
	Agriculture	795	548.06	394.03	398.30	246	246	246	246	174.46	1296.62	1780.40	1038.44
B=0.5	Home	1710	1710	1710	1710	246	246	246	246	246	246	246	246
	Environment	1252.5	1129.03	1052.01	1054.15	313.74	182.48	204.40	212.23	210.23	771.31	1013.20	642.22
	Agriculture	795	548.06	394.03	398.3	381.49	118.96	162.8	178.47	174.46	1296.62	1780.40	1038.44
B=0.75	Home	1710	1710	1710	1710	246	246	246	246	246.	246	246	246
	Environment	1878.75	1693.54	1578.02	1581.23	470.62	273.72	306.60	318.35	315.34	1156.96	1519.8	963.33

Source: research findings.

As such, according to the available water, in all three scenarios, the amount of water allocated home is clearly equivalent to the normal demand of the sector which has been fully answered. It is according to the rules of water management in the country in terms of drinking water supply shortages priority is quite consistent. With the aim of maximizing the efficiency of water use, thanks to the higher efficiency of the agricultural sector is the largest amount of water allocated to this sector. Furthermore, changes in simulated discharge capacity of the former dam and assess the impact on water supply, again, the pattern of resource allocation of water between agriculture, water and the environment provided the summary of changes in the allocation of water before and

after climate change is provided in the following table.

Table 3. Effects of climate change on water allocation in various sectors

Scenario	Section	After climate change	Before climate change	Change (percent)
	Agriculture	551.34	605.59	8.95
β=0.25	Home	550.5	734	25
	Environment	251.17	334.89	24.9
	Agriculture	386.72	617.44	37.36
β=0. 5	Home	550.5	734	25
	Environment	502.34	669.79	25
	Agriculture	457.82	605.59	24.39
β=0.75	Home	550.5	734	25
	Environment	753.51	1004.69	24.9

Source: research findings.

As can be seen, the model to changes in demand for home normal; an average annual increase of 25% allocation to a certain level is considered. As for the environmental sector also increased by roughly 24.9% and different values for the agricultural sector in different scenarios, 9, 38 and 24% increase in water allocation is considered. With regard to the optimal amount of water allocated to agriculture in three studied target and multi-objective fuzzy optimization model for the subdivision of agricultural crops in the following table:

Table 4. Optimal cropping pattern for agricultural catchment soldier

Existing model		Minimize water consumption		Maximizing of benefit		minimizing the need for capital		Fuzzy multi-objective model	
Product	Cultivated Area	Before applying climate change	After the climate change	Before applying climate change	After the climate change	Before applying climate change	After the climate change	Before applying climate change	After the climate change
Wheat	450	120	120	125	125	125	118	125	125
Barley	150	75	75	75	75	75	75	75	74
Lentil	5	2.5	2.5	2.5	2.5	393.25	393.25	2.5	2.5
Watermelon	500	3000	3000	6002.5	5170	3000	3000	6603	6271.8
Potato	6000	2500	25.5	29040	123.3	2500	25.5	55.219	96
Onions	1700	850	850	2379.9	1653.3	850	850	2963	2067
Tomato	51	850.75	460	711.97	639.6	460	850.75	460	780
Alfalfa	920	250	250	250	250	250	250	250	250
Total	9776	7648	4783	38586.87	8038.7	7653.25	5562.5	10533.7	9666.3

Source: research findings.

The results show in spite of low water consumption in terms of wheat, barley and lentil, cultivation for the reason that they have low productivity, should be reduced by half in Fuzzy multi-objective model.Cultivation of potatoes from 6,000 hectares reduced to 55 hectares, alfalfa reduced from 920 to 250 acres of hay while the multi-objective optimization model for increasing the area under cultivation of crops from 3000 to 6603 hectares of watermelons, 1700 to 2963 hectares of onions, tomatoes from 51 to 460 acres offers. Table 4 the percentage change in the area of climate change for product improvement shows patterns. Can be seen in the multi-objective optimization model, due to climate change, model 8 shows the percentage change in the total of the single-objective optimization models, model with the objective of minimizing the need for capital changes caused by climate change have the lowest (27%), while the optimal model for maximizing the profit most from climate change is accounted for (75%) and climate change effect caused to 37% in water consumption minimizing model. Therefore capital problem is not preference of farmers in this region while maximizing of profit is prior to other goals. Thus, as expected, the impact of climate change on agricultural sector (of resources and the performance of the products) will have profound effects on farmers' profit.

The result of water consumption minimization model shows that cultivation of some crops such as potatoes and tomatoes because of high need for water should be reduced, while watermelon crop because of to be cash and sowing dates increased. Also the result of profit maximization model inhabits that for all of crops except wheat, barely and alfalfa, cultivation areas decreased. Therefore Cultivate more area of winter crops is a one of the most recommendation we learned from this project. The early planting date is a good adaptation option for cultivating the summer crops to avoid heat stress for the summer crops and consuming less water at the same time. The water use efficiency for the crops cultivated at the early sowing date are more the water use efficiency of crops which cultivated in the late sowing date at the same climatic region. It is also recommended that we cultivate the major field crops to improve food security, using rain water plus supplemental irrigation water at winter.

Table 5. Percentage changes in cropping pattern for agricultural catchment soldier

Product	Model changes aimed at minimizing water consumption	Model changes with profit	Model changes aimed the need for capital	Fuzzy multi-objective optimization model changes
Wheat	0	0	-6	0
Barley	0	0	0	-1
Lentil	0	-25	0	0
Watermelon	0	-14	0	-5
Potato	-99	-100	-99	74
Onions	0	-31	0	-30
Tomato	-46	-10	-85	70
Alfalfa	0	0	0	0
Total	-0/37	-75	-0/27	-8

Source: research findings.

What is more important is that with regard to the objectives of this study, there are huge differences between the cultivation areas of the existing and proposed so that for some products should be more than 11-fold increase in acreage (watermelon) and 9-fold reduction (tomato) will be provided to these goals. So in order to meet the objective of this study is that the concerns of farmers and policymakers in the region and it is necessary to restructure agriculture and water management in the region.

Thus, as policy recommendations, made aim to improve productivity of crops and ensure that the water resources are managed to meet the local demands and to reduce water consumption.

Iran needs to produce more cereal yield with use less water volume, because increase the population makes the available water for the agriculture sector decrease. In the same time the higher population need to more food. These challenge need to adopt climate change strategies and produce the best varieties that are agreeable to high temperatures and low rainfalls. It is mean improve the food security issue for the Iranian especially with the more cultivate of wheat that means self sufficiency of wheat. This work need to improve the on farm management to control the water quantity in the farm level, improve water use efficiency and save water for the new reclaimed land, this work is not applicable without improve the water management in the old land and adopt modern irrigation system in the new reclaimed lands and planning for adoption of climate changes strategies.

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Examining Causality Relationships among Energy Consumption, Economic Growth and Islamic Banking System Performance in Jordan

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Abstract

Various studies have been conducted to examine the causal relationship between economic growth and energy consumption among the countries that export and import energy sources but the discussions on the causal relationship between Islamic banking system performance and energy consumption are still lacking. The first aim of this paper is to provide some clarifications on the causal relationship between economic growths, GDP is used as a proxy of Jordan's economic growth and energy consumption, and also between Islamic banking system performances, and Murabaha is used as a proxy of Jordanian Islamic Bank performance and energy consumption. The second aim is to explore how far the Islamic banking system direction from the economic growth direction when affected by some macroeconomic variables such as energy consumption. Jordan has been chosen as the country under study because it heavily relied on imported energy sources to meet its needs. In order to analyze the long and short-run relationship, the annual time series data were used by employing the autoregressive distributed lag model (ARDL). Meanwhile, the Augmented Dickey Fuller (ADF) (1987) and the Ng-Perron (2001) were used for stationary test. Additionally, the Bounds *F*-statistics test was employed for testing co-integration among the variables. The ARDL approach was used to analyze the long-run and short-run relationships and for exploring the causal relationship among variables, the Granger causality test was employed. Results from the analyses show that the economic growth and energy consumption as well between Islamic banking system performance and energy consumption indicate unidirectional causal relationships but not vice versa. Another main finding is that Islamic banking system direction moves with the same economic growth direction in Jordan when affected by the energy consumption.

Keywords: energy consumption, GDP, Murabaha, Granger causality, Jordan

1. Introduction

Energy sources are an active element that helps the producing countries to exist among the political and economic powers globally. Thus, energy sources are an important economic pillar of a country. Somehow, it is also energy sources that have clearly become the primary reason for most wars that have recently occurred, such as the Iraq war in 2005. Nonetheless, the rise in the prices of energy sources by the oil and gas producing countries has affected the importing countries such as Jordan, weakening the economies of these importing countries.

Like some countries, Jordan also depends on other countries to meet its oil and gas needs. For instance, Jordan has relied on the oil imports from Iraq for a long time, and more recently from Saudi Arabia, as well as gas from Egypt. Recently, due to political situation in Egypt, Jordan has chosen Qatar to be its new gas supplier. Importing oil and gas from other countries has affected Jordan's economy where now the country is experiencing high external debt and budget deficit. In addition to that, poverty and unemployment rates have also increased in the country.

The relationship between energy consumption and economic growth has been greatly discussed in the last few decades and numerous scholars have attempted to study the causal relationships between energy consumption and economic growth whether the economic growth for the country is represented by gross domestic product,

national domestic product, income or employment.

In this study, countries that fully rely on other countries for their energy sources such as oil and gas are presented as an example. Further, this study also examines the causality between energy consumption and economic growth and between energy consumption and Islamic banking system performance. There are many studies on the causal relationship between energy consumption and economic growth (Cheng & Lai, 1997; Aqeel & Butt, 2001; Narayan & Popp, 2012) and results indicated that there exists a strong causal relationship between energy consumption and economic growth. However, the results are mixed; some studies concluded a bi-directional causality while some studies documented a unidirectional causality and the rest indicated no causal relation among the variables. However, to the best of the author's belief and knowledge, this study is the first to investigate the causal relationship between energy consumption and Islamic banking system performance.

The organization of this paper is as follows: The next section highlights the literature review and the past studies in the same field; section 3 illustrates the dependent and independent variables; section 4 describes the methodology and data sources; section 5 reports the empirical results and the last section discusses the conclusion, policy implication and further study.

2. Literature Review

The causal relationship between energy consumption and economic growth has been the focus of many studies in the last few decades. In this section, the previous studies are classified based on the three directions of the causality test: unidirectional, bidirectional, and no causality relationships among variables. First, the unidirectional causality relationship between energy consumption and economic growth was documented in various developed and developing countries such as the study by Kraft and Kraft (1978) which indicated unidirectional causality running from GNP to energy consumption in the United States. In India, using annual data for the period of 1950-1997, Ghosh (2002) discovered a unidirectional Granger causality from economic growth to electricity consumption. Unidirectional causality relationship from energy consumption to economic growth was also found in some studies such as a study in India by Asafu-Adjaye (2000) which showed unidirectional Granger causality running from energy consumption to GDP, and also unidirectional Granger causality running from energy and price to income in the long run. Additionally, there is also unidirectional causality running from electricity supply to economic growth in Sri Lanka (Morimoto & Hope, 2004) and thus, Sri Lanka's economic growth is seriously impacted by power shortages. More recent studies that indicated unidirectional causality relationships are the studies by Odhiambo (2009), Tsani (2010), Wang et al. (2011), and Yazdan and Hossein (2012).

There are also many studies that found bi-directional causality relationship between energy consumption and economic growth. For instance, in the study on growth of energy consumption and growth national product in the Taiwan province of China, Hwang et al. (1991) found a bidirectional causality relationship, while the study by Ghali and El-Sakka (2004) based on data from Canada found that the short-run dynamics of variables indicated that Granger's causality is running in two directions between output growth and energy consumption. The study on the causality relationships between energy consumption and economic growth in India indicates that there is bi-directional causality between energy consumption and economic growth (Paul & Bhattacharya, 2004).

With regard to the third classification which is no causality relationship, among other researchers, Masih and Masih (1997) reported that energy conservation policies may be implemented without leaving any adverse effect on growth and employment. Meanwhile, Jumbe (2004) stated that if both directions show no causality (known as the 'neutrality hypothesis) then it suggests that there is no correlation between energy consumption and GDP and thus, the policies of energy conservation may be pursued without adversely impacting the economy. Further, a number of studies found no causality relationship between energy consumption and economic growth. For instance, a study by Yu et al. (1988) indicated that in the United States, there is no relationship between energy and GNP.

In case of Islamic banking, Ahmed et al. (2015) analyzed the relationship between Murabaha and macroeconomic variables using ARDL approach and they found that there is a positive relationship between Murabaha and GDP, FDI and M2.

Nonetheless, the causality relationship between energy consumption and Islamic banking system in order to ascertain if energy consumption leads to Murabaha in Islamic banking system or vice versa, have yet to be addressed by the scholars.

3. Variables Description

3.1 Gross Domestic Product (GDP) as a Proxy of Economic Growth

Gross domestic product (GDP) is the variable that has been used in most studies. In other words, the overall market value of all final goods and services produced in a country in a given year has become the indicator of the economic growth and development. An example of the use of GDP can be seen in the study by Yacoubian and Dagher (2012). Meanwhile, the study by Ozun and Cifter (2007) employed gross national product (GNP) which basically gauges the value of goods and services produced by the country's citizens irrespective of of their location, as a proxy of economic growth. In the context of this study, GDP is used as a proxy of Jordan's economic growth. Figure 1 shows the GDP of Jordan for the 1978-2012 period as an indicator for Jordan's economy. For the period of 1978-2012, the annual growth rate of Jordan's GDP achieved a value of 5.8% and towards the targeted period, the figures show a slight increase. In 2012, Jordan's GDP reached $31.35 billion albeit global financial crisis, political events, inflation and other challenges faced by countries in the Middle East in general.

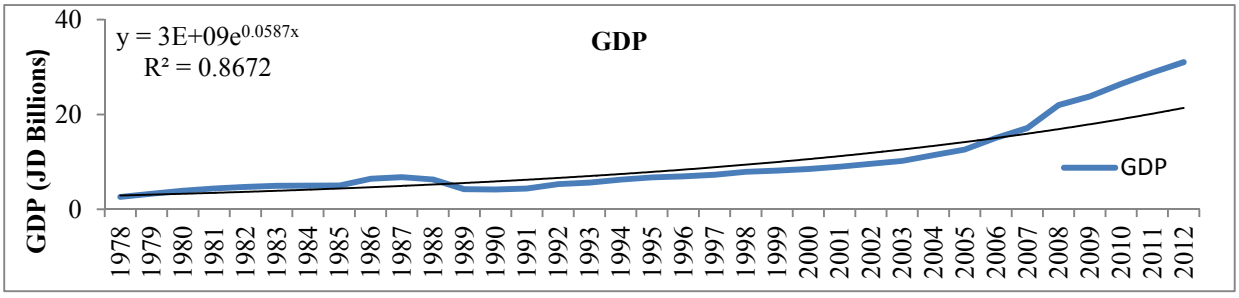

Figure 1. Gross domestic product in Jordan for the 1978-2012 period

Source: The World Bank, Jordanian Development Indicators Databases (2013) available online at: http://data.worldbank.org/country/jordan

3.2 Murabaha (MU) as a Proxy of Islamic Banking System Performance

Jordan is one of the first countries in the Middle East to establish Islamic bank offering Sharia compliant operation, services and financial instruments such as Musharaka, Mudaraba and Murabaha. Jordan's first Islamic bank was established in 1978 under the name of Jordan Islamic Bank (JIB).

Islamic banking and finance operate based on Sharia principles which forbid payment or receipt of Riba, a term that is generally misinterpreted as interest (Pryor, 2007), and the most popular and most common mode of Islamic financing is the Murabaha (MU). This mode of Islamic financing is also known as mark up or cost plus financing. Originating from the Arabic word Ribh, which means profits, Murabaha was initially a contract of sale in which a commodity is sold on profit. In this type of contract, the seller has the obligation to inform the buyer his cost price and the profit he is making. After a small modification for application in the financial section, the new Murabaha is now globally the single most popular technique of financing amongst the Islamic banks where an estimate of 80 to 90 percent of financial operations of some Islamic banks belong to this category.

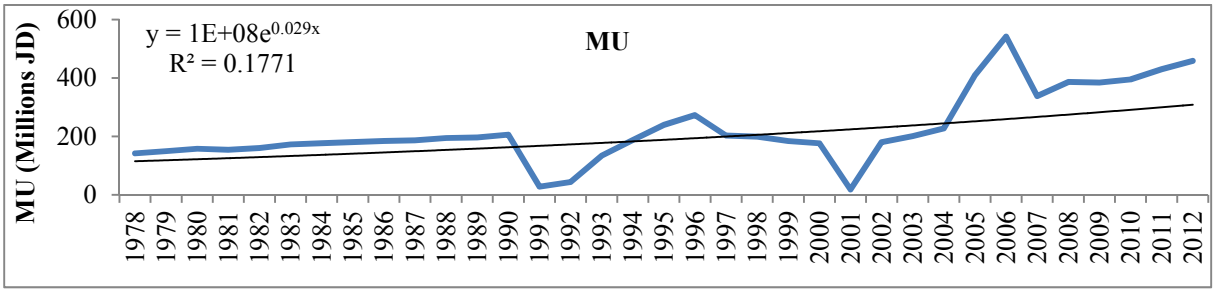

Figure 2. Murabaha in Jordan for the1978-2012 period

Source: Jordan Islamic Bank for Finance and Investment, Annual Reports, 1978-2012.

Figure 2 illustrates the Murabaha (MU) in JIS for the period 1978-2012. From the figure, MU had reached a yearly growth rate of 3% % for the period, and the increasing rate was notable before GFC and during the period of Arab Spring. This shows that global financial crisis and political events also affect Islamic banks. For the current study, MU is used as a proxy of the Islamic banking system.

3.3 Energy Consumption (EC)

Unlike its close counterparts, Jordan does not own significant energy resources. As proof, as of January 2014, the Oil & Gas Journal estimated that Jordan's oil reserves was only at 1 million barrels while the country's natural gas reserves was at slightly more than 200 billion cubic feet (Bcf). However, Jordan could significantly increase its oil reserves by the use of oil shale resources and thus, the country plans to build the first oil shale-fired electricity generation facility in the Middle East after 2017.

Since Jordan has insufficient significant energy resources, the country heavily depends on imports of crude oil, petroleum products, and natural gas to meet its domestic energy demand. As indicated by the government sources, imports of energy for Jordan meet more than 90% of the country's energy demand, and those imports make up for more than 40% of the country's budget.

Figure 3 illustrates Jordan's energy consumption for the period of 1987 to 2012. The annual growth rate is 1.4%. The government statistics showed that in 2012, Jordan's consumption of crude oil and oil products accounted for approximately 88% of the country's total primary energy demand. However, with regard to the domestic sources of oil and natural gas, only less than 2% of the demand was met.

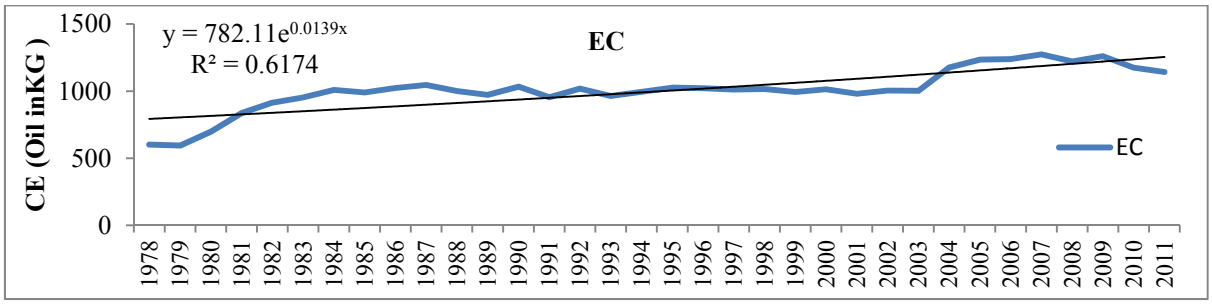

Figure 3. Energy consumption in Jordan for the 1978-2012 period

Source: The World Bank, Jordanian Development Indicators Databases (2013) available online at: http://data.worldbank.org/country/jordan

Energy imports are usually affected by financial crisis and political situation that occur in the exporting countries and since the middle of 1990s, the political situation in the countries surrounding Jordan (the Middle East) has not been stable especially Iraq and Egypt; this especially refers to Iraq war in 2004 and the Arab Spring since 2010. All these impart great impact to Jordan's energy imports.

4. Methodology and Data Sources

The aim of this paper is to analyze the effect of energy consumption on economic growth and the effect of energy consumption on Islamic banking system performance in Jordan over the period 1978-2012. The first step is to perform the empirical analyses related to the study. However, the diagnostic tests have to be conducted to ascertain the adequacy and closeness of fit of the model to the data. As indicated by Pesaran and Pesaran (2009) there are different diagnostic statistics available to estimate the possibility of normality, autocorrelation, hetrosecedasticity for disturbances in a small sample size as well as the appropriateness of the functional form. The current study employs the Augmented Dickey Fuller (ADF) (1987) and the Ng-Perron (2001) to test the stationary for the data while the bounds *F*-statistics test uses for testing the co-integration among the variables. Additionally, the autoregressive distributed lag ARDL approach by Pesaran *et al.* (2001) also employs to analyze the long-run and short-run relationships between the variables. The data on energy consumption and GDP were gathered from the database of the World Bank database while data on Murabaha were collected from the JIB annual reports (printed copies) for the period of 1978-2012.

However, the ARDL approach for the current models is illustrated in Equation: (1), (2), (3) and (4).

The First Model:

$$\Delta LEC_t = \beta_{1+} \delta_{11} LEC_{t-1} + \delta_{12} LGDP_{t-1} + \sum_{t=s}^{h} v_{11} \Delta LEC_{t-s} + \sum_{t=s}^{h} v_{12} \Delta LGDP_{t-s} - \tau_1 ecm_{t-1} + \varepsilon_{1t} \quad (1)$$

$$\Delta LGDP_t = \beta_2 + \delta_{21} \Delta LGDP_{t-1} + \delta_{22} LEC_{t-1} + \sum_{t=s}^{h} v_{21} \Delta LGDP_{t-s} + \sum_{t=s}^{h} v_{22} \Delta LEC_{t-s} - \tau_2 ecm_{t-1} + \varepsilon_{2t} \quad (2)$$

The Second Model:

$$\Delta LEC_t = \beta_{1+} \delta_{11} LEC_{t-1} + \delta_{12} LMU_{t-1} + \sum_{t=s}^{h} v_{11} \Delta LEC_{t-s} + \sum_{t=s}^{h} v_{12} \Delta LMU_{t-s} - \tau_1 ecm_{t-1} + \varepsilon_{1t} \quad (3)$$

$$\Delta LMU_t = \beta_2 + \delta_{21} \Delta LMU_{t-1} + \delta_{22} LEC_{t-1} + \sum_{t=s}^{h} v_{21} \Delta LMU_{t-s} + \sum_{t=s}^{h} v_{22} \Delta LEC_{t-s} - \tau_2 ecm_{t-1} + \varepsilon_{2t} \quad (4)$$

Where, β_1 and β_2 denote the intercept terms while δ_i (i= 11,…22) denote the long-run coefficient. v_i (i= 11,…22) represent the short-run coefficient while τ_i (i= 1,...,2) represent the coefficient of error correction terms, i,e., (ecm_{t-1}). ε_{it} represents the error terms. *h* Indicates the lag length selected. *t*, which denotes the lag order.

5. Results Analysis

5.1 Descriptive Statistics of the Variables

Table 1 illustrates the descriptive statistics for the variables. As indicated in the table, EC has the highest mean among the variables with the value of 1015 followed by GDP and MU by 22.78 and 2.26 respectively. Further, the Jaque-Bera test, one of the diagnostic tests, indicates there is normality in distribution for the models.

Table 1. Descriptive statistics of the variables

	LGDP	LEC	LMU
Mean	22.78	1015	2.26
Median	22.63	1011	1.88
Maximum	24.15	1273	5.42
Minimum	21.67	594	1813
Std. Dev	0.64	159	1.21
Skewness	0.66	-0.81	0.79
Kurtosis	2.58	4.18	3.23
Jaque-Bera	2.82	5.94	3.77
Probability	0.24	0.52	0.15

Sources: Output of E-Views package, version 7.2.

5.2 Stationary Tests

Verifying the stationarity of the data series is the second step of the analysis and for this purpose the ADF and Ng-Perron tests were employed. The unit root property of the data series is vital for the analyses of causality. The non-stationary variables can be made stationary by differencing the number of differencing (d) required so that the order of integration 1(d) can be identified by the series stationarity.

As shown in Table 2.1 and 2.2 the results of unit root tests indicate that the null hypothesis of unit root for EC, GDP and MU was not rejected at levels. However, at first differentiation, all series were found to be stationary and integrated at the order of one *1(1)*, thus, from this point the co-integration can be employed as the next step.

Table 2.1. Stationary tests for LGDP model

Integration	Variables	ADF test	Ng- Perron test	ADF asymptotic critical values		
				1%	5%	10%
	ΔLGDP	3.72**	6.89***	4.33	3.58	3.22
I(1)	ΔLEC	5.60***	5.58**	Ng-P asymptotic critical values		
				1%	5%	10%
				4.03	5.48	6.67

Table 2.2. Stationary tests for LMU model

Integration	Variables	ADF test	Ng- Perron test	ADF asymptotic critical values		
				1%	5%	10%
	ΔLMU	6.30***	5.63**	4.33	3.58	3.22
I(1)	ΔLEC	5.60***	5.58**	Ng-P asymptotic critical values		
				1%	5%	10%
				4.03	5.48	6.67

As the order of integration tests was completed with desirable results, a co-integration test is conducted next in order to ensure that co-integration exists among the variables before the researchers could analyze the long-run and short–run relationships and conclusively ascertain if causality relation between GDP and EC, UM and EC exists.

Table 3 presents the results of the bounds F-statistics test which indicate the co-integration of all variables and thus, the equilibrium relationships in the models can be analyzed as the next step.

Table 3. Co-integration test results for LGDP and LMU model

Bound F-statistics critical values with Intercept					
1% significance level		5% significance level		10% significance level	
I(0)	*I(1)*	*I(0)*	*I(1)*	*I(0)*	I(1)
5.15	5.53	3.47	4.33	2.84	3. 62
OLS Bound F-statistics values:					
Model		Calculated F-statistics		Decision	
LGDP		6.55***		Co-integrated	
LEC		5.71***		Co-integrated	
Model		Calculated F-statistics		Decision	
LMU		9.37***		Co-integrated	
LEC		5.89***		Co-integrated	

Note. (1) The bound F-statistic critical values were obtained from Narayan (2005) statistical tables. (2) ***, **, * represent significance at the 1%, 5% and 10% levels, respectively. (3) The output of OLS Bound F-statistics values were extracted from the Micro-fit econometric software package version 4.1.

5.4 Long-Run and Short-Run Results

As shown in Table 4, LEC_t has positive association with the $LGDP_t$ model in the short-run with 10% significance level also it is positively related to the $LGDP_t$ model in the long-run at the 10% significance level. As indicated by the long-run result, the 10% increase in LEC_t will increase the $LGDP_t$ model by 0.34%. The findings of the $LGDP_t$ model show consistency with the findings of Ouedrago (2012) who studied the long-run relationships between GDP and EC among 15 African countries. The error correction term ECM_{t-1} carries the expected negative sign at 1% significance level, which implies that there is a an adjustment mechanism, which forces the dependent variable to the equilibrium.

Table 4. Equilibrium relationships analysis for the LGDPt model

33 observation used for estimating the long-run relationships in the $LGDP_t$ Model					
Variables	Coefficients	Standard errors	T-ratios	P-values	Significance Levels
Intercept term	21.56	11.28	1.91	0.06	10%
LEC_{t-1}	0.34	0.19	1.8	0.08	10%
33 observations for estimating the short-run relationships and ecm_{t-1} in the $\Delta LGDP_t$ Model. The selection of ARDL (1,0) approach is based on SBC.					
Variables	Coefficients	Standard errors	T-ratios	P-values	Significance Levels
Intercept term	11.08	4.03	2.75	0.01	1%
ΔLEC_t	0.29	0.16	1.83	0.07	10%
Ecm_{t-1}	-0.28	0.06	-4.3	0	1%

Diagnostic test: χ^2 Autocorrelation (1) = [0.33]; χ^2 Heteroscedasticity (1) = [0.25]; χ^2 Normality (2) = [0.24]; R2= 0.65; $\bar{R}^2$= 0.76; F-statistic = 6.75; p-value= 0.00

Note. (1) Figure in parentheses denotes the p-values of F-statistics. (2) Figure in brackets denotes the p-values of the chi-square (χ^2). (3) SBC presents Schwarz Bayesian Criterion that calculates the lag length and order. (4) The output was sourced from the Micro-fit econometric software package version 4.1.

Table 5 reveals the equilibrium relationships analysis for the LEC_t model, the results show that $LGDP_t$ is negatively related to the LEC_t model in the short-run while positively related in the long-run at 5% significance level. As indicated by the findings. The ECM_{t-1} coefficient is negative and highly significant, the coefficient of (-0.27) suggests that the speed of the adjustment back to equilibrium is not very fast. For instance, only 27% of the adjustment is completed in a year due to a short-run adjustment.

Table 5. Equilibrium relationships analysis for the LEC_t model

33 observation used for estimating the long-run relationships in the LEC_t Model					
Variables	Coefficients	Standard errors	T-ratios	P-values	Significance Levels
Intercept term	36.81	13.73	2.68	0.01	1%
$LGDP_{t-1}$	-0.19	0.1	-1.92	0.06	10%
33 observations for estimating the short-run relationships and ecm_{t-1} in the ΔLEC_t Model. The selection of ARDL (1,0) approach is based on SBC.					
Variables	Coefficients	Standard errors	T-ratios	P-values	Significance Levels
Intercept term	24.52	9.25	2.65	0.01	1%
$\Delta LGDP_t$	0.26	0.12	2.18	0.06	5%
Ecm_{t-1}	-0.27	0.08	-3.22	0	1%
Diagnostic test: χ^2 Autocorrelation (1) = [0.35]; χ^2 Heteroscedasticity (1) = [0.27]; χ^2 Normality (2) = [0.28]; R^2= 0.70; $\bar{R}^2$= 0.68; F-statistic = 6.91; p-value= 0.00					

Note. (1) Figure in parentheses denotes the p-values of F-statistics. (2) Figure in brackets denotes the p-values of the chi-square (χ^2). (3) SBC presents Schwarz Bayesian Criterion that calculates the lag length and order. (4) The output was sourced from the Micro-fit econometric software package version 4.1.

However, Table 6 shows that LEC_t is positively related to the LMU_t model in the short-run and long-run at the 10% and 5% significance level, respectively. As indicated by the findings, a 10% rise in LEC_t will increase the LMU_t model by 56% in the short-run and 38% in the long-run, and vice versa. The table also shows that the lagged error correction term ECM_{t-1} has the expected negative sign with 1% significance level and the coefficient is (-0.35) indicating there is a quick adjustment to disequilibrium in the short-run.

Table 6. Equilibrium relationships analysis for the LMU_t model

33 observations used to estimate the long-run relationships in the LMU_t Model					
Variables	Coefficients	Standard errors	T-ratios	P-values	Significance Levels
Intercept term	-6.28	2.35	-2.67	0.01	1%
LEC_{t-1}	0.38	0.22	1.72	0.09	10%
33 observations to estimate the short-run relationships and ecm_{t-1} in the ΔLMU_t Model The selection of ARDL (1,0) approach is based on SBC.					
Variables	Coefficients	Standard errors	T-ratios	P-values	Significance Levels
Intercept term	-2.9	1.27	2.72	0.03	5%
ΔLEC_t	0.56	0.24	2.33	0.03	5%
Ecm_{t-1}	-0.35	0.12	-2.91	0	1%
Diagnostic test: χ^2 Autocorrelation (1) = [0. 65]; χ^2 Heteroscedasticity (1) = [0.21]; χ^2 Normality (2) = [0.15]; R^2= 0.62; $\bar{R}^2$= 0.42; F-statistic = 26.19; p-value= 0.00					

Note. (1) Figure in parentheses represents the p-values of F-statistics. (2) Figure in brackets denotes the p-values of the chi-square (χ^2). (3) SBC presents Schwarz Bayesian Criterion that calculates the lag length and order. (4) The output was sourced from the Micro-fit econometric software package version 4.1.

Table 7 represents the short-run and long-run relationships analysis between LMU_t and LEC_t. The results show that the LMU_t is positively associated to the LEC_t model in short-run and long-run at 10% significance level. For the error correction term ECM_{t-1}, the results show that there is a correct sign with coefficient (-0.34) and significance level at 1%, that means the magnitude of the coefficient lagged error term is 34 % speed to return back the dependent variable to the equilibrium.

Table 7. Equilibrium relationships analysis for the LEC_t model

33 observations used to estimate the long-run relationships in the LEC_t Model					
Variables	Coefficients	Standard errors	T-ratios	P-values	Significance Levels
Intercept term	22.1	5.25	4.21	0	1%
LMU_{t-1}	0.45	0.23	1.95	0.06	10%
33 observations to estimate the short-run relationships and ecm_{t-1} in the ΔLMU_t Model The selection of ARDL (1,0) approach is based on SBC.					
Variables	Coefficients	Standard errors	T-ratios	P-values	Significance Levels
Intercept term	15.5	5.75	2.69	0.01	1%
ΔLMU_t	0.22	0.12	1.84	0.07	10%
Ecm_{t-1}	-0.34	0.07	-4.52	0	1%
Diagnostic test: χ^2 Autocorrelation (1) = [0. 67]; χ^2 Heteroscedasticity (1) = [0.24]; χ^2 Normality (2) = [0.25]; R^2= 0.62; $\bar{R}^2$= 0.47; F-statistic = 10.53; p-value= 0.00					

Note. (1) Figure in parentheses represents the p-values of F-statistics. (2) Figure in brackets denotes the p-values of the chi-square (χ^2). (3) SBC presents Schwarz Bayesian Criterion that calculates the lag length and order. (4) The output was sourced from the Micro-fit econometric software package version 4.1.

5.5 Granger Causality Results

The results of the Granger causality test and the null hypothesis of causality relationships among the variables are shown in Table 8. As indicated in the results, if the *P*-value is less than the 5% level of significance, the null hypothesis will be rejected. The results indicate that there is unidirectional causality relationship between GDP and EC and the direction runs from LGDP to EC while there is no causality relationship running from EC to GDP. The LMU model also shows similar results where unidirectional causality exists between LMU and LEC and the direction runs from LMU to LEC but not vice versa. Simply put, the GDP and MU affect EC, but EC has no effect on GDP and MU. These findings are consistent with past studies such as the study by Paul et al. (2004) which examined the causality relationship between energy consumption and Economic growth in India.

Table 8. Granger causality relationships among the variables

Causality Direction	F-statistic	P-value	Decision
LGDP Model			
LGDP → LEC	0.87	0.04	Unidirectional Causality
LEC ≠ LGDP	1.12	0.33	No Casualty
LUM Model			
LUM → LEC	1.78	0.03	Unidirectional Causality
LEC ≠ LUM	0.96	0.39	No Causality

Note. The (→, ↔ & ≠) represent the unidirectional, bidirectional and no Granger causality respectively. Sources: Output of E- Views Package, version 7.2.

6. Conclusion, Policy Implication and Further Research

This study is an empirical study and the main objective is to examine the causal relationship between economic growth and energy consumption as well between Islamic banking system performance and energy consumption in Jordan, the study used GDP as a proxy of the economic growth and Murabaha as a proxy of the Islamic banking system performance for a country that imports oil, over the period of 1978-2012. Moreover, another main objective is to explore how far the Islamic banking system direction from the economic growth direction when affected by some macroeconomic variables such as energy consumption. In this study, the annual times series data were used and by using the ARDL approach, the long-run and short-run relationships among the

variables were examined. The data then went through the diagnostic tests and stationary tests and passed. The bounds F-statistics test was also employed in this study to ascertain the co-integration between the variables while the Granger causality test was used to identify the causality relationships and the causal direction between the variables. Further, the results of the ADF and Ng-Perron indicate stationarity of variables at *I(1)*, and based on the result of F-bound test, the variables are also co-integrated. Further, both models also show positive relationships between the variables in the long run, and as indicated by the Granger causality test, there is unidirectional causality from GDP to EC also from MU to EC but not vice versa. Another main finding is that Islamic banking system direction moves with the same economic growth direction in Jordan when affected by the energy consumption. The analysis results of this study indicate that there is a positive correlation between GDP, energy consumption and Islamic Banking system performance. That means, when the GDP which concerned as the main indicator for economic growth raises, the energy consumption especially those used in the productivity processes will increase. In the other side, the Islamic banking system performance as one of the main economic cycle in Jordan will be improved.

These results are in line with the findings of Kraft and Kraft (1978) and Ghosh (2002) who documented in their study a unidirectional causality from economic growth to energy consumption.

This study illustrated one of the rational relationships between economic growth and energy consumption and it also indicated that economic growth causes the increase in energy consumption. As such, the policy makers in Jordan's government as well as the Islamic banking system should be more aware of this phenomenon. Also, they should motivate the industrial and services sectors by supporting their development through channeling substantial amount of energy into these sectors. Further study could be focused on the relationships between other macroeconomic variables on the other Islamic banking instruments such as Musharaka and Mudaraba.

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Driving Forces of Remittance Inflow in Bangladesh: An Empirical Study

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Abstract

This paper empirically investigates the major driving forces of remittance inflow in Bangladesh. Using annual data over the period from 1977 to 2011 the paper concludes that gross domestic products of host country and domestic country, exchange rate, petroleum price and skill of labour significantly influence remittance inflow in Bangladesh. One finding of the research is that skilled labour force rather sends smaller amount of remittance to the home country than the unskilled labour. This is due to the fact that skilled people do not maintain close tie with the home country because they often take their families with them to foreign countries where they work. Because of narrow opportunities, unskilled labour cannot take their families with them and hence send money to their families. The study also identifies the reason behind migration of manpower from Bangladesh to foreign countries. Presence of surplus labour, slim job opportunity, unfavourable working environment, poor wage rate, inadequate social security and political instability largely induce people to migrate abroad.

Keyword: devaluation, elasticity, foreign currency reserve, migration, remittance, stationarity

1. Introduction

Remittance inflow in Bangladesh is one of the prime sources of foreign currency reserve. A certain amount of foreign currency reserve is indeed a vital need for the country because of its high degree of dependency on import. Inflow of remittance depends on the amount of manpower migration. International migration is a worldwide phenomenon through which remittance is channeled into the respective country from which migration takes place. In Bangladesh remittance is the second largest sector of foreign exchange earnings after readymade garments (RMG) sector (Kuntal, 2010). According to the recent statistics, on average there is a fifteen to twenty percent annual increase in remittance. World Bank reports that in 2012 Bangladesh retained its position as the seventh most remittance-earning country. A study conducted by International Organization for Migration (IOM) reveals that remittance earned by Bangladesh is nearly five times the size of foreign aid and nine times the size of foreign direct investment (FDI) and contributes more than 10 percent to gross domestic product (GDP). The IOM study also reports that the migrants are less skilled, inefficient in English language and lack certified training. The remittance sent by the migrants, however, contributes a great deal to economic development of Bangladesh. It is therefore important to identify the determinants of remittance inflow in Bangladesh.

The number of papers investigating the determinants of remittance is very few. However, several papers have examined inflation, migration, GDP of host countries, financial sector development etc. as the determinants of remittance. This paper examines the determinants of remittance empirically. The rest of the paper is organized as follows. Section 2 describes the objectives of the study. Section 3 presents the previous literatures on the current issue. Section 4 reveals the source of data and illustrates the methodology used. Empirical results have been discussed in section 5 and section 6 concludes with some policy recommendations.

2. Objective of the Study

The main purpose of the study is to find out the determinants of remittance inflow in Bangladesh for which it is necessary to build up a theoretical framework first. Empirical determination of the determinants requires the use of a suitable regression model. In order to assess the degree of dependency of remittance on the relevant variables, elasticity of remittance with respect to the corresponding variable would be estimated. This step will also help to test whether relationships among variables are statistically significant or not. These tests will be

done applying econometric techniques. Finally the paper aims at presenting the best possible ways to ensure stability of economic growth through the stability of remittance inflow.

3. Literature Review

3.1 Theory of Remittance

Theories of remittances are based on pessimistic and optimistic views. An optimist says remittance is a gain to the receiving countries that could alleviate poverty and stimulate economic development and ease pressure on governments burdened with large external deficits. Conversely, a pessimist says that remittances should not be encouraged, as it is disadvantageous to the growth and development of the receiving countries. From a pessimists point of view remittances are responsible for excessive consumption, import dependency and unproductive investment in housing and land.

Neoclassical theory says that free labour migration would lead to inadequacy of labour, higher marginal productivity of labour and increase in wage levels in migrant-sending societies. Neo-Marxist theory states that migration and remittances produce and reinforce the capitalist system based on inequalities. This is because migration changes the local taste of migrants' families and increase the demand for foreign goods.

Social network theory emphasizes the social rather than the economic role that remittances play in the lives of the migrants and their families, where social network is defined as a set of recurrent association between groups of people linked by occupational, familial, cultural or affective ties.

3.2 Causes of Migration

People migrate for diverse reasons. These reasons can be classified as economic, social, political or environmental. Push and pull factors are often used to explain the reason behind migration. Push factors are the reasons why people leave an area, i.e. what pushes them away from their home. Push factors take account of lack of services, lack of safety, crime, crop failure, drought, flooding, poverty and war. Rapid growth of population may be viewed as a push factor for migration. Pull factors are the reasons why people move to a particular area, i.e. what pulls them to a new place. Pull factors include higher employment, abundance of resources, better services, good climate, safety and security, political stability, fertile land, lower risk of natural hazards. Migration usually happens as a result of a combination of these two factors.

Ratha (2004) stated that fiscal incentives are also responsible for migration. The paper argues that the majority of developing countries offer tax incentives to attract remittances. Because of various reasons for migration, remittances have become a significant source of resource transfer in the Bangladesh economy. Bangladesh has continued as a trade deficit country in most of the years since independence but from 2000 it has been endlessly posting current account surplus which is the gap between exports and imports of goods, services, and unrequited transfers but mainly because of remittance income (Munim, 2012).

3.3 Recruitment Process of Workers Abroad

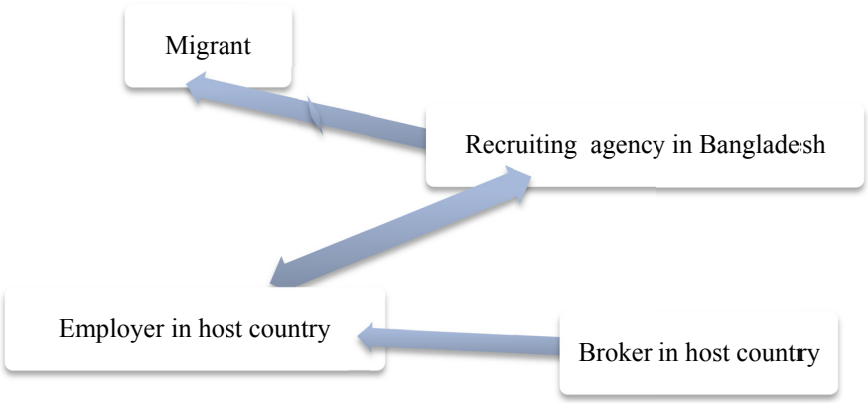

Figure 1. The process of migration

The migrants are the remittance senders. But the process of migration in the context of Bangladesh is not smooth, sometimes it is not fair even. The process of migration involves a number of persons, institutions and agencies.

These institutions are both governmental and private or local and foreign. The private agencies avail license from the government and collect information on foreign demand for labour. The agencies then recruit workers as per specifications of the foreign employers and then process their cases for placement.

The recruiting agencies are organized under the Bangladesh Association of International Recruiting Agencies (BAIRA). The Association was formed in December 1984 with representatives of twenty-three recruiting agencies. Figure 1 shows the process of migration in Bangladesh.

3.4 Channels of Remitting

Both formal and informal channels are being used by Bangladeshi migrants to send their remittances to their relatives at home. Remittance is sent formally through various ways such as demand draft, traveller's check, telegraphic transfer, postal order, and direct transfer, Automatic teller machine (ATM) etc (Roy, 2010). Bangladesh Bank issues licenses to commercial banks to make transaction with foreign banks and exchange houses for assisting in sending remittances by Bangladeshi nationals living abroad. Persons who are willing to remit money to their families through formal channels can simply buy either Taka draft or US dollar draft from these foreign banks and exchange houses. Bangladeshi nationals who are living abroad can also send foreign exchange very easily and directly to their own bank account or to their nominated person's bank account in Bangladesh. Currently this banking service has become more proactive towards crediting the proceeds of remittances to beneficiary's account.

Among the informal ways, the widely used one is *hundi* system. *Hundi* refers to the illegal money transfer system which involves tax evasion and it is devoid of foreign exchange rules and regulations. As opposed to the informal way of sending remittance the formal means including mobile banking are getting popularity among the remitters.

3.5 Proper Utilization of Remittances

Remittances have both productive and unproductive use. Productive use refers to the use that increases the productive capacity and generates income to the households. And the unproductive use does not help accumulate capital or generate further income. Barai (2012) views consumption as the unproductive use of remittance and investment as productive use of remittance.

A Bangladesh Bank survey results are documented in Table 1, which shows the sector-wise spending of remittances pertaining to consumption alone.

Table 1. Overall scenario of uses of remittances in Consumption

Description	Percentage uses of remittance in different categories	Number of families
To buy food	75	2265
To repayment of loan	42	1276
Educational expenses of family members	65	1949
Medical and health	57	1701
Marriage and other occasions	40	1205
Court cases	4	112

Source: Bangladesh Bank, Research department.

Table 2 shows the use of remittances for investment purposes. This is evident that the families of the migrants prefer to buy land or flat. To them, this type of investment is less risky.

Table 2. Overall scenario of uses of remittances in investment sector (productive and unproductive sector)

Classification of Investment	Number of families using remittance	Percentage of number of families using remittance
Investment in Productive Sector		
Buying land or flat	1252	42
Bond	392	13
Savings in Bank/institutions/time deposit and insurance	638	21
loan giving based on interest	20	1
personal business	371	12

Joint business	74	2
Sending family members abroad	547	18
Investment in Non-Productive Sector		
To reconstruct houses	1182	39
Buying car/motorcycle	136	5
Investing money in capital market	226	8
Spending money to create employment for others.	89	3

Source: Bangladesh Bank, Research department.

3.6 Challenges Faced by Bangladeshi Migrants

People who are migrating play a significant role in the national economy through earning foreign currency but they face multiple problems at home and abroad. Because of lack of education they do not know how to accomplish official formalities properly. Moreover, during their stay in abroad they fail to comply with the host countries rules and requirements. Due to this latter loophole they become illegal in the host countries at a certain point of time. In practice most of the labours who migrate abroad are poor and therefore it is very tough for them to bear the expenses of migration. Some of them sales land, mortgage their houses, take loans from relatives or banks etc. A survey conducted by Bangladesh bank research team finds the following sources of financing migration cost.

Table 3. Sources of collecting money to bear migration cost

Description	Number of families	Percentage (families)
Land Sale/ Mortgage	1244	41
Institutional/non-institutional loan	321	11
Borrow money from relatives	1415	47
Contract signed to repayment of loan from earning of migrant's	266	9
Sales ornaments	218	7
Cash from own family	348	12
Others	108	4

Source: Bangladesh Bank Research.

3.7 Source of Remittance

Most of the expatriates work in Saudi Arabia, the UAE, the UK, Kuwait, and the USA. Besides, new employment opportunities for Bangladeshi workers have also been created in Libya, Qatar, Oman, Singapore, Germany, Bahrain, Iran, Japan and many other countries. Since 1993 Malaysia and since 2001 Australia, Italy, South Korea and Hong Kong are also importing workers from Bangladesh. Saudi Arabia absorbs highest number of labour from Bangaldesh. Malaysia is the second largest employer of Bangladeshi workers. Figure 2 displays the comparative picture of migrant receiving countries.

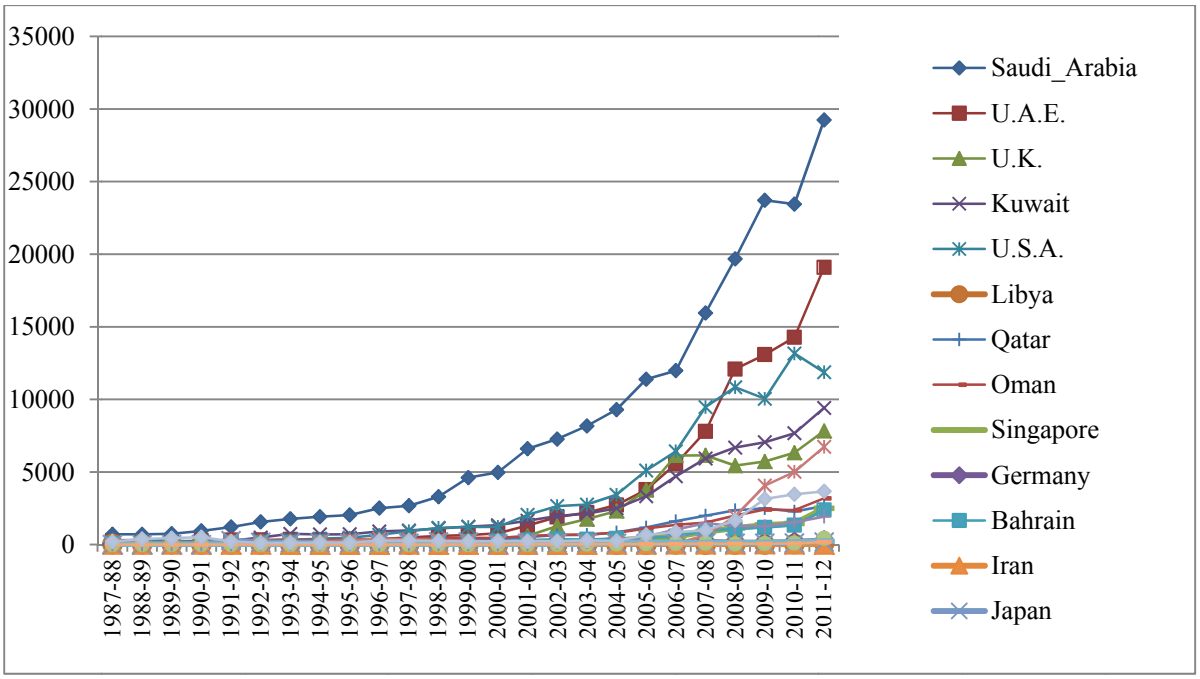

Figure 2. Trend of country- wise migration

Source: Bangladesh bank 2012.

3.8 Flow of Remittance Earning

Remittance income is incredibly important for any developing country like Bangladesh as the country endeavors to lower the dependence on foreign aid. Rahim (2013) states that remittances have been identified as one of the three factors that have been responsible for reducing the overall incidence of poverty in Bangladesh. According to Bangladesh bank report, Bangladesh has received about Taka 101882.7786 Crore in 2011. According to BMET, during the last 35 years (1977-2011) Bangladesh has experienced a steady rise in remittance growth. It was only $101.98 million in 1977, whereas it has reached at $ 12843.43 million in 2011. Figure 3 shows the trend of remittance inflow in Bangladesh since 1977.

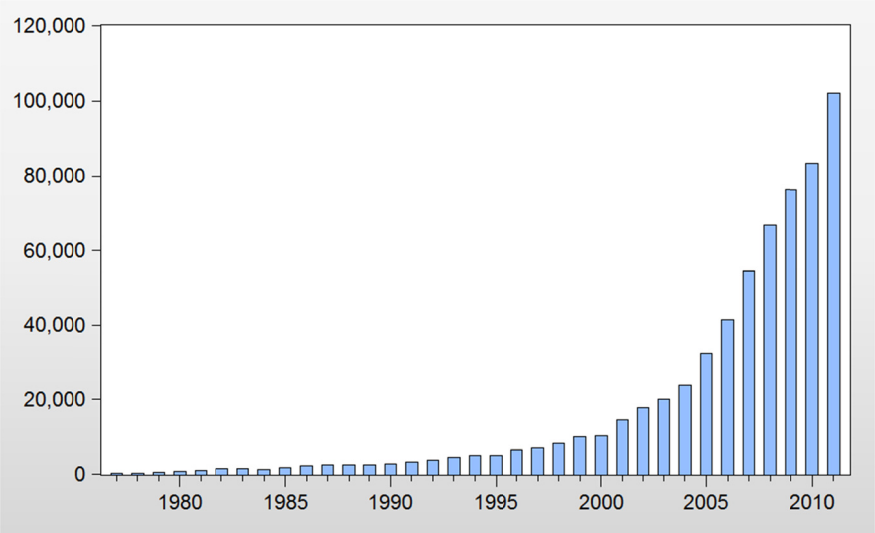

Figure 3. Flow of remittance earning (in Crore Taka)

Source: BMET(Bureau of Manpower, Employment and Training).

A few studies investigated the prime determinants of remittance. Among many others, home and host country income, exchange rate, financial sector development and inflation rate have significant impacts on remittance inflows in Bangladesh. There are, however, a few microeconomic determinants of remittance like the size of the household of the remitter, sex of the migrant etc.

Barua (2007) conducted an empirical study in which it has been deduced that there is a positive correlation between income differential of home and host country and inflow of remittance. On the other hand inflation differential shows the opposite relation. Author also considered devaluation of domestic currency as a macroeconomic variable which is also positively correlated with remittance inflow. Hasan (2008) found the significant impact of inflation, interest rate, exchange rate of Bangladesh and GDP of five remittance sending countries. The paper concluded that if the domestic interest rate goes up by 1 percent on average then the remittance will increase by 1.94 percent. Again if the GDP of five countries increases by 1 percent, then remittance will increase by 3.06 percent. Emmanuel, William, Gladys, and Yuni (2012) said, the working status of the migrant may depend on the macroeconomic conditions in the country of residence. Mahtab (2012), in his empirical research, found that income of household, household size do not influence foreign remittance sent by migrant workers but duration of staying abroad, exchange motive and investment motive do influence workers' remittance. Singh, Haacker, and Lee (2009) found that the wealthier the country of origin of the expatriates the higher the remittances they send back home. Naufal and Termos (2009) examined the responsiveness of remittances to oil price in GCC countries. They examined this responsiveness in remitting countries and found that oil price elasticity of remittances is around 0.4.

Some studies concentrate on migrant's efficiency as because remittance depends not only on number of migrants but also on their efficiency level. Microfinance Institutions (MFIs) can train migrant workers according to their importers' demand which will help workers to improve their efficiency (Alam, 2012).

Nurnaher Rani (2012) studied the behavior of remittance inflows in Bangladesh and tried to find out its determinants. Using yearly data from 1981 to 2011, the paper concludes that various regulatory and institutional arrangements taken by the government and the Bangladesh bank influence remittance flow in Bangladesh. Faini and Riccardo (2007) finds that skilled migrants remit less than unskilled migrants as skilled migrants bring their families abroad and spend more time there. Migration of skilled labor is the brain drain of developing countries and reduces the flow of remittances. Manuel (2009) identifies global recession as a major hindrance to remittance inflow. Migrants lose their jobs, earn less and become direct victims of the housing crisis during recession. The U.S. economic recession has affected all workers, migrants including the skilled ones. Correct identification of the determinants of remittance inflow in Bangladesh has important bearing on individuals and on the economy as a whole. In this paper we put effort to identify the factors that influence remittance earning of Bangladeshi expatriates. Econometric techniques have been employed in reaching the goal of the study.

4. Data and Methodology

4.1 Source of Data

Data employed in the research paper are secondary in nature. The annual data for the period 1977-2011 have been used in the research. 1977 has been selected as the starting year because Bangladesh started migrating workers from this year. The annual data have been collected from various sources as follows.

- WDI (World development Indicators) database;
- Economic trend (Bangladesh Bank);
- Bangladesh Economic Survey (Ministry of Finance);
- Organization of the Petroleum Exporting Countries (OPEC);
- Bureau of Manpower, Employment and Training (BMET).

In our paper Remittance Inflow (REM) refers to transfer of money by a foreign worker to his or her home country or simply sending amount from one country to another. Money sent home by migrants constitutes the second largest financial inflow for many developing countries exceeding international aid. For Bangladesh the most manpower importing countries are: KSA, UAE, Kuwait etc. Main source of data is Bangladesh Bank. Exchange rate (EXC) refers to Taka/dollar exchange rate. Data for exchange rate has been collected from WDI (official rate). If the exchange rate of the home country depreciates the remittance inflow will increase. Migration (MIG) refers to the number of persons staying abroad for their family and livelihoods. It is commonly believed that increase in the number of migrant workers abroad is positively correlated with remittance inflow implying that growing number of migrants abroad contribute to higher level of remittances. Petroleum price (PP)

has been used to estimate the elasticity of remittances with respect to price of crude oil. It is expected that there is a positive relation between petroleum price and remittance inflow. Bangladesh started to export manpower abroad, particularly in Middle East countries, following oil price boom in the early 1970s. Because of labor shortage during 1977-2011, countries had to import foreign labor to gear up huge development activities financed by surplus oil revenues. Since then the number of migrants has been growing steadily. So petroleum price is the likely determinant of remittance inflows. GDP of host country (GDPh) is a simple average value of 7 countries GDP. The countries where most of the migrants are destined are viewed as the host countries. The host countries are Saudi Arabia, United Arab Emirates, United Kingdom, United States, Kuwait, Oman, and Qatar. There is a positive relationship between host country's GDP and remittance inflow. If the host country's GDP increases, the remittance inflow in domestic country will increase. Domestic country's GDP is denoted as GDPd.

Since the paper uses time series data, unit root tests have been performed in order to check the stationarity of the variables.

4.2 Specification of the Model

Log-log model used by Nurnaher and Rama (2012) as well as Nabi (2011) has been used in this research to identify the determinants of remittance inflow in Bangladesh. The following two models have been estimated in pursuance of the objective of the study.

$$\text{Model 1: } \log(REM) = \alpha_0 + \alpha_1\log(MIG) + \alpha_2\log(EXC) + \alpha_3\log(GDPd) + \alpha_4\log(GDPh) + \alpha_5\log(PP) + \alpha_6\log(skilledlabor) + \alpha_7\log(unskilledlabour) \quad (1)$$

$$\text{Model 2: } \log(REM) = \beta_0 + \beta_1\log(DGPd) + \beta_2\log(PP) + \beta_3\log(EXC) + \beta_4\log(unskilledlabour) \quad (2)$$

Here,

log (EXC) = Log of exchange rate;

log (REM) = Log of remittance inflow;

log (GDPh) = Log of simple average of six country's GDP;

log (GDPd) = Log of domestic GDP;

log (MIG) = Log of number of person migrated;

log (PP) = Log of petroleum price;

log (skilledlabor) = Log of skilled labor migrated;

log (unskilledlabor) = Log of unskilled labor migrated.

In order to mitigate the problem of irrelevant variable, model 2 has been estimated. Empirical test justifies the irrelevance of several variables included in model 1. Ordinary least square (OLS) method has been used to estimate the proposed models above. In this context, statistical software E-views 7 has been used for estimation purposes.

4.3 ADF Unit Root Test

Test for stationarity of data is very important in time series data because of the possibility of spurious regression. A random time series Y_t is said to be stationary if its mean and variance are constant over time and the value of covariance between two time periods depends only on the distance between the two time periods and not on the actual time at which the variance is computed (Gujarati,1995). Augmented Dickey–Fuller (ADF) unit root test has been used to check whether the variables are integrated.

Here, the null and alternative hypotheses are:

H_0: The residual series has a unit root (remittance, migration, petroleum price, skilled labor, unskilled labor, GDP host countries, GDP domestic countries series are not co-integrated).

H_a: The residual series has no unit root (remittance, migration, petroleum price, skilled labor, unskilled labor, GDP host countries, GDP domestic countries series are co-integrated)

Table 4. ADF test results for a unit root on the level and first difference of the original series

Variable	ADF test statistic	p-value	5% critical value	10% critical value	Decision
Log(REM)	-1.56	0.49	-2.95	-2.61	Non-Sationary
Δ log(REM)	-4.42	0.0014	-2.95	-2.62	Stationary
Log(EXC)	-2.37	0.158	-2.96	-2.62	Non-stationary
Δ log(EXC)	-3.88	0.005	-2.96	-2.62	Stationary
Log(MIG)	-1.54	0.499	-2.96	-2.62	Non stationary
Δ log(MIG)	-4.82	0.000	-2.96	-2.62	Stationary
log(PP)	-0.61	0.855	-2.95	-2.61	Non-stationary
Δ log (PP)	-5.66	0.000	-2.95	-2.61	Stationary
Log (GDPh)	-2.93	0.05	-2.95	-2.61	Non-stationary
Δ log(GDPh)	-3.89	0.005	-2.95	-2.61	Stationary
Log(GDPd)	0.45	0.982	-2.95	-2.61	Non-stationary
Δ log(GDPd)	-4.82	0.000	-2.95	-2.61	Stationary
log(skilledlabor)	-1.98	0.290	-2.95	-2.61	Non-stationary
Δ log(skilledlabor)	-6.79	0.000	-2.95	-2.61	Stationary
Log(unskilledlabor)	-1.79	0.37	-2.95	-2.61	Non-stationary
Δ log(unskilledlabor)	-5.05	0.000	-2.95	-2.61	Stationary

Note. Δ means first difference.

The decision rule here is if the *p*-value from ADF test > 0.05 then null hypothesis will not be rejected. Otherwise, the null hypothesis will be rejected. Rejection of the null hypothesis would mean that all the variables are co-integrated.

The results of the ADF for the variables in their levels and first differences are reported in Table-4. Reported ADF test indicates that none of the variables represents a stationary process in level form but they are stationary in the first differences which is statistically significant at 5% level of significance.

5. Empirical Results

5.1 Ordinary Least Squares Estimation Output

Table 5 documents the estimation output of model 1.

Table 5. Regression results for model 1

Model-1				
Variable	**Coefficient**	**Std. Error**	**t-statistic**	**Prob.**
Constant	-29.65970	14.72750	-2.013898	0.0545
log(MIG)	-0.321109	0.214995	-1.493560	0.1473
log(EXC)	1.225503	0.469238	2.611687	0.0148
log(GDPh)	1.030388	0.693180	1.486465	0.1492
log(GDPd)	0.509654	0.619773	0.822323	0.4184
log(PP)	0.368220	0.100239	3.673409	0.0011
log(skilledlabor)	0.080695	0.138758	0.581552	0.5659
log(unskilledlabor)	0.320093	0.188004	1.702583	0.1006
R-squared	0.992236	Adjusted R-squared		0.990146
F-statistic	474.7039	Durbin-Watson		1.295565
Prob(F-statistic)	0.00000	Dependent variable		log (REM)

From the above results it is clear that petroleum price significantly influences remittance. Exchange rate also shows significant result. Migration shows negative impact on remittance but it is not a significant one. Though all other variables show expected sign but from the view of significance we may ignore all other variables except exchange rate and petroleum price. Durbin-Watson value confirms that the model is not spurious and shows 99% fitness.

As a better counterpart, Model 2 has been estimated. Estimation outputs corresponding to the following model are summarized in Table 6.

$$\log(REM) = \beta_0 + \beta_1 \log(DGPd) + \beta_2 \log(PP) + \beta_3 \log(EXC) + \beta_4 \log(unskilledlabour) \quad (3)$$

Table 6. Regression Results for Model 2

Variable	Coefficient	Std. Error	t-statistic	Prob.
Constant	-8.118167	1.001069	-8.109496	0.0000
Log(GDPd)	1.230726	0.405932	3.031857	0.0050
Log(PP)	0.351748	0.100346	3.505355	0.0015
Log(unskilledlabor)	0.184625	0.102618	1.799140	0.0821
Log(EXC)	1.502729	0.401762	3.740350	0.0008
R-squared	0.990873	Adjusted R-squared		0.989656
F-statistic	814.2105	Durbin-Watson		1.084025
Prob(F-statistic)	0.000000	Dependent variable		Log(REM)

In model 2 every single variable shows significant result at 1% significant level except unskilled labor but it is acceptable at 10% level of significance. Model 2 shows that these four variables could independently explain about 99 percent variation in remittance inflow. If the coefficients of two models are examined, the effect of unskilled labor is now significant in Model 2 when migration, host country GDP and skilled labor variables are excluded.

The second column of Table-6 shows estimated coefficients of GDPd, PP, Unskilled labor and exchange rate. The explanation of the sign and magnitude of these coefficients and their implications are presented below.

The estimated co-efficient of Domestic country (GDPd) is positive (1.230726) and highly significant at less than 1 percent level of significance. The values of *t*-statistic and the probability of rejecting the null hypothesis, H_0: $\beta_1 = 0$, are 3.031857 and 0.0050 respectively. The positive coefficient suggests that an increase in domestic GDP increases remittance inflow in Bangladesh.

Here the main objective is to estimate β_2. As outlined above, it is expected that there would have a positive relationship between the price of crude oil (PP) and remittance inflow ($\beta_2 > 0$). The coefficients of the oil price, that are the main focus of this study, in both specifications are positive and significant at 1 percent level of significance. The values of *t*-statistic and the probability of rejecting the null hypothesis, H_0: $\beta_2 = 0$, are 3.505355 and 0.0015 respectively. The positive coefficient (0.351748) suggests that an increase in price of oil increases remittance inflow in Bangladesh. Theoretically a higher price of oil stimulates more investment and consequently higher economic growth. This increase in aggregate demand is coupled with a parallel increase in demand for labor (both skilled and unskilled) and is converted into more income for emigrants and outpouring in remittances.

Skill of labors considerably influences remittance inflow. As discussed earlier, most of the labour migrated is unskilled. As per the estimation result of Model-1 the relationship between skilled labour and remittance is positive but statistically insignificant. Conversely, unskilled labor in Model 2 shows significant relationship with t-statistic and probability of rejecting null hypothesis H_0: $\beta_3 = 0$, are 1.79914 and 0.0821 respectively The positive coefficient (0.184625) signifies that positive changes will happen for any positive changes in unskilled labor.

The elasticity of the remittance inflows with respect to exchange rate is 1.502729, which is positive and greater than unity. The values of t-statistic and the probability of rejecting the null hypothesis, H_0: $\beta_4 = 0$, are 3.740350 and 0.0008 (below 1%).The effect of exchange rate is significant at less than 1 percent level of significance revealing that currency depreciation promotes inward remittances in Bangladesh. The depreciation of the home currency makes the citizen living abroad wealthier as it increases the purchasing power in the home country and provides incentives to buy goods including residential real estate. This has multiplier effects. This result is also consistent with Guljare Nabi (2011) but Nurnaher Rama (2012) found the relation insignificant.

5.2 Cointegration Test

Since the variables are integrated of order one, cointegration test has been performed in order to examine the cointegration between the variables, we use the Engle-Granger method. Engle-Granger test shows that the residual is stationary at the level form. Variables are cointegrated which indicates that the long run relationship exists among variables. Cointegration test results have been presented in Table 7.

Table 7. Test for cointegration of all the variables series

Model Residuals	Data based value of the test statistic	Critical value at 5% level	Results
Constant and trend	-4.094032	-2.951125	Reject H_0
Conclusion	The residuals series does not have a unit root. Hence, remittance, exchange rate, petroleum price, unskilled labor, GDP domestic country series are cointegrated.		

5.3 Normality Test

Normality tests are performed in order to determine whether a data set follows a normal distribution or not. If the distribution of the residuals is not normal, then obtained *t*-ratios are substandard and inferences may not be valid. Therefore, normality test has to be carried out with proper attention. The null hypothesis of this test is that the residual series is normally distributed.

Here Jarque-Bera (JB) test statistic is the appropriate test statistic,

$$JB = n[\frac{S^2}{6} + \frac{(K-3)^2}{24}]$$

where S and K are Skewness and Kurtosis respectively. Figure 4 shows the result of normality test.

The decision rule here is-

- Perfectly Symmetric residuals will have zero skewness.
- For a normal distribution the kurtosis value is 3.

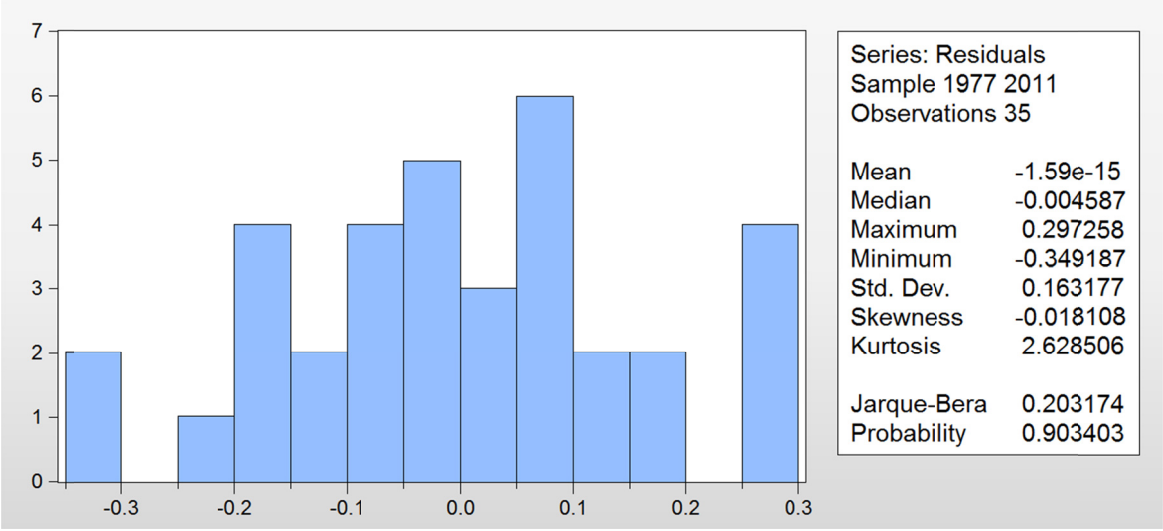

Figure 4. Test for normality the Jarque-Bera test

E-views estimation shows the skewness and kurtosis are -0.018108 and 2.628506 respectively. Jarque-Bera value is 0.203174.

It can be concluded that null hypothesis cannot be rejected as JB statistics follow the chi-square distribution and the critical value is 5.991 at 5% level of significance with 2 degrees of freedom. So the residuals are normally distributed and inferences are valid.

5.4 Heteroskedasticity Test

White's Heteroskedasticity test has been performed to detect heteroskedasticity.

Null hypothesis H_0: there is no heteroskedasticity

The decision rule here is if computed χ^2 value > critical value, null hypothesis will be rejected.

Estimated results obtained by using EViews7 are as follows:

Table 8. Test for heteroskedasticity

Model	Obtained χ^2 ($n*R^2$)	Critical value at different significance level	Decision
	24.10225	23.6848(5%)	Reject Null
		26.8728(2%)	Accept Null
Conclusion	Obtained χ^2 < Critical value of χ^2 at 2% level of significance. So, the model is free from Heteroskedasticity at 2% level of significance. Finally, we can conclude that there is no Heteroskedasticity.		

5.5 Chow Break Point Test (Structural Stability Test)

To apply Chow test, the data set has been divided into two parts - one is from 1977 to 1994 another from 1995 to 2011.

Hypotheses are:

H_0: no structural change;

H_0: structural change.

Test results are presented in Table 9 below.

Table 9. Chow breakpoint test (structural stability test)

Model	F-Calculated value	Critical value at 5% level	Prob F(5,25)	Status
Constant and trend	1.762749	2.60	0.1573	Accept null
Conclusion	Here, F-critical ≻F-calculated. Evidence does not support to reject the null hypothesis, thus we can say that null hypothesis of "No structural change" is accepted. That is our model is found structurally stable over time.			

5.6 Autocorrelation Test

Autocorrelation refers to the correlation of a time series with its own past and future values. Autocorrelation is also sometimes called "lagged correlation" or "serial correlation", which refers to the correlation between members of a series of numbers arranged in time. Here we use Breusch-Godfrey Serial Correlation Lagrange Multiplier test for autocorrelation.

Null hypothesis H_0: There is no autocorrelation.

Results for autocorrelation test have been presented in Table 10 below.

Table 10. Test of autocorrelation

Model	F-Calculated value	Critical value at 5% level, F(1,29)	Prob. F (1,29)	Results
Constant and trend	5.710266	4.18296	0.0236	Reject Null
Conclusion	Here *p*-value 0.02 <0.05 (5% level of significance) and F-calculative value > F-critical value. Null hypothesis is rejected.			

Since null hypothesis is rejected, there is autocorrelation. In the presence of autocorrelation, Heteroskedasticity and Autocorrelation Consistent (HAC) standard errors or Newey-West approach can be applied to obtain the correct standard error. HAC standard errors are rather larger than the incorrect standard errors. This implies if autocorrelation is not taken into account, the reliability of usual least square estimates would be overstated.

HAC standard errors and co-variance estimations are presented in Table 11 below.

Table 11. HAC standard errors and co-variance estimations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-8.118167	0.930742	-8.722249	0.0000
LogGDPd	1.230726	0.544843	2.258865	0.0313
LogPP	0.351748	0.123291	2.852995	0.0078
Logunskilledlabor	0.184625	0.126365	1.461050	0.1544
LogEXC	1.502729	0.418802	3.588159	0.0012

R-squared	0.990873	Adjusted R-squared	0.989656
Durbin-Watson	1.084025		

5.7 Multicollinearity Test

Multicollinearity is a statistical phenomenon in which two or more explanatory variables in a multiple regression model are correlated, meaning that one can be linearly predicted from the others with a non-trivial degree of accuracy. In such instances a simple and effective way to detect Multicollinearity is to estimate the so called auxiliary regressions. For example, a general auxiliary regression for EXC is

$$pp = \beta_2 GDPd + \beta_2 EXC + \beta_5 unskilledlabor + \varepsilon_t$$

If R^2 from this artificial model is above 0.80, then it imply that a large portion of the variation in EXC is explained by variation in the other explanatory variable.

Estimated results are shown in Table 12 below.

Table 12. Multicollinearity test (auxiliary regressions)

Model	**Expected R^2**	**Artificial Model R^2**	**Decision**
	> 0.80	0.747416	Absence of Multicollinearity
Conclusion	We see that our artificial model's R^2 is less than 0.80. Therefore, we can conclude that the model does not suffer from the problem of multicollinearity.		

6. Conclusion and Policy Recommendation

Remittance is a mammoth source of foreign currency reserve of Bangladesh. The analysis shows that unskilled labor migrants' are the principal source of remittance flows in Bangladesh. The remittances received from the migrant workers have been steadily increasing in recent years. In Bangladesh, the stability of remittance inflow has become an important issue. This paper along with trend analysis empirically examines various determinants of remittance inflow and finds that for the period 1977-2011, variables like exchange rate, economic activity of home country, skill of labors and most importantly petroleum price significantly influence remittance inflows.

Extant literatures do not identify the determinants of remittance empirically. Unlike the past studies our current paper investigates the determinants of remittance econometrically. We observe that if exchange rate depreciates remittance increases. This is because migrants have to send more money to their families to fulfill their livelihoods when cost of living increases. Besides, the petroleum price has considerable effect on remittance. Higher price of oil instigates more investment and consequently higher economic growth. The response of remittance to changes in price of oil is inelastic. Elasticity coefficient is found to be 0.35.

Based on the findings, this paper concludes that Bangladesh as a labor abundant country can influence the inflow of remittances through appropriate policies. Government of Bangladesh should take necessary steps to enrich this sector by lessening the limitations on migration. This is to be mentioned here that Bangladeshi labour force gets easy access to a very small number of countries. Manpower export from Bangladesh is therefore prone to huge uncertainty due to narrow base. Policymakers should pay due attention to search new countries that will agree to hire the labour from Bangladesh.

There remains ample scope for further research on the current topic. Many other factors might have caused remittance inflow in Bangladesh. Our current study did not resolve a controversy regarding the pre-migration economic status of the migrants. Some argue that the poor section of the society opts for migration with the aim of improving their distressed status and others argue the opposite. The latter school opines that financially solvent ones can only afford the migration cost. Further research may be carried out by using cross-country data at the macro level and household surveys at micro level to resolve the controversy.

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Measuring the Effectiveness of Banking Risk Balanced Scorecard in Enhancing Bank Value

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Abstract

The purpose of this paper is to contribute to the body of knowledge in the area of risk balanced scorecard, particularly in the banking sector which faces variety complex types of risk. The authors develop a conceptual framework for measuring the effectiveness of Banking Risk Balanced Scorecard (BRBS) across and beyond Basel requirementsin addition to its essential role to maximize both of: stakeholders' value and competitive advantage. Stakeholders include shareholder value (investors) and intellectual capital (customers, employees and regulators). Competitive advantage can be measured by the market share, as a proxy of it. The authors adopt quantitative approach for this purpose.

Keywords: banking risk balanced score card, basel requirements, market based measures, economic value added, tobin's Q, market share

1. Introduction

There is not a universal definition of risk; every author addresses the risk from a different perspective. Traditionally it has been defined in terms of the possibility of danger (Collier & Gay, 2005).

Gallati (2003) defines risk as a condition in which there exist an exposure to a diversity, or a condition in which there exists a possibility of deviation from a desired outcome that is expected or hoped for. To be more precise, it can be defined, as in finance, the volatility emanating from the market that cannot be diversified away (Sharpe, 1964). Unlike the field of goods, services industries are governed by the philosophy of process- based orientation, in the sense that every service industry is concerned with a set of characteristics that reflect a range of risks associated with the main features of this industry, which may not fit to the application of the same measures for risk.

The concept of risk was explicitly appeared for the first time in finance by the Nobel award winner, Harry Markowitz, he argued to include riskin the portfolio and diversification discussion, as well as, he linked terms such as return and utility with the concept of risk (Markowitz, 1952).

In banks, risks are usually defined by the adverse impact on profitability of several distinct sources of uncertainties (Bessis, 1998). The unique nature of the banking industry, as financial intermediator, doesn't leads only to besubject to a wide array of risks, but the risk is in the core of its business. The bank is a "risk machine", it takes risk, it transforms them, and it embedded them in banking products and services (Bessis, 1998).

As the same pace of risk definition, literature shows different classifications of risks. There is an important distinction between measurable risk and subjective, perceived risk, by other words ,risk can be thought about by reference to the existence of internal or external events (Collier et al., 2007).banks in the process of acting as intermediaries are confronted with various kind of financial & non-financial risk (Srivastav, 2013). In the banking universe, risks are multidimensional. The main banking risks are credit risk, market risk, liquidity risk and operational risk (Bessis, 1998).

2. Literature Review

Risks and doing business go hand in hand since the beginning of humanity. The roots of risk management can be found in corporate insurance industry (Collier et al., 2007). The concept of risk management was first introduced into business strategy in 1916 by Henry Fayol. But it became formalized after (Gallagher, 1956) published his article "Risk Management: A new Phase of Cost Control" and argued that the professional insurance manager should be a risk manager.

Risk management can be regarded as an active, strategic, and integral process that encompass both the measurement and the mitigation of risk, with the ultimate goal of maximizing the value of a bank, while minimizing the risk of bankruptcy (Schroeck, 2002). On other words, the proper risk management is essential for bank survival as its primary function is to ensure that the total risk being taken is matched to the bank's capacity for absorbing losses and to help the CEO direct the scarce resource of capital to the opportunities that are expected to create the maximum return with the minimum risk (Marrison, 2002).

As a result of the dynamic and volatile economic environment, many bodies (regulatory, supervisory, and reporting) are concerned with the issuance of guidelines that govern the practices of risk management. The literature shows ample regulations and perspective frameworks for enlightened risk management including Tunbull Report, The COSO Enterprise Risk Management Framework and the international standards organization's ISO (Mike & Kaplan, 2013). In the banking industry Basel Committee on Banking Supervision (BCBS) is concerned since 1980s with ensuring the soundness and safety of the banking sector by setting an international framework for banking risk management (BCBS, 1988). It is observable that BCBS broadens and develops its framework each decade in respect of the types of risks to measured and managed effectively in order to determine the capital adequacy ratio of the bank. In 1988, Credit risk was addressed, in 1996 Market risk was added as an amendment to Basel I, (BCBS, 1996).The International Convergence of Capital Standards and Measurement issued in 2004 (Basel II) not only added a new type of risk- Operational Risk but also stated three approaches for the measurement and management of credit and operational risk (BCBS, 2004).The subprime crisis 2007-2008 and the bankruptcy of several banks as a consequences of this crisis, leads the usefulness of Basel II requirements to be susceptible, so to overcome this criticism BCBS issued new requirements (Basel III) to address the standards to be followed for the liquidity risk management and set certain criteria to improve the quality and quantity of the capital base (BCBS, 2010).

Four ideal types form the risk management mix in a given bank: Risk Silo management, Integrated Risk management, Risk and value management and Strategic Risk Management (Mike, 2008). The first type is concerned by the measurement and control of market, credit and operational risks in 'silos' across the organization, Integrated Risk management focused on developing a common denominator measure of market, credit and operational risks to aggregate their quantifiable risks into a total risk estimates, Risk and value management advocate the idea of using risk based internal capital allocations for performance measurement and control in order to enhance the shareholder value and Strategic Risk Management advocate ERM framework and as a result, risk management framework to be gradually expanded to incorporate non- quantifiable risks in addition to those can be quantified (Mike, 2005). The two latter types of risk Management practices in banks justify the importance of moving towards Enterprise wide risk management in the banking sector (Mike, 2008).

As a response to the requirement of an integrated, robust and more comprehensive approach to managing risks, ten years ago, the Committee of Sponsoring Organizations of the Tradeway Commission (COSO) issued a separate framework for the Enterprise Risk Management (ERM) (COSO, 2004). The COSO ERM framework made the ERM an independent function and not just a component of the internal control process as its first introduction in The COSO framework of internal control process (COSO, 1992). ERM is defined as a process, affected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives (COSO, 2004). ERM gains a widespread practice in the recent years, not only to ensure the effectiveness of the control process or to help in achieving goals but also as a tool of creating value. ERM helps create a comprehensive approach to anticipating, identifying, prioritizing, and managing material risks of the company (Jalal et al., 2011).ERM is a discipline, by which an organization in any industry, assess, control, exploits, finance and monitors risks from all sources for the purpose of increasing the organizations short-and long-term value to stakeholders (Mickinsey & Co., 2013; Srivastav, 2013).

Risk Management became a vital subject in the recent years and its importance was developed rapidly during the last two decades, risk management was formalized as an overlay, an additional objective that should complement

whatever expected return strategy the business unit has chosen (Kaplan & Norton, 1996). One decade later, due to the turbulences took place across several economies in the world, it was clear that risk management cannot be viewed any more as additional objective, it was argued that operational, technological and environment risk measures can be included in a balanced scorecard (Kaplan & Norton, 2004).

Literature shows that financial firms took the initiative to include risk management in the balanced scorecard (BSC) (Nagumo, 2005).The financial firm Swiss Re included in its strategy map certain objectives related to risk management two objectives in the client (Customer) perspective and three objectives are included in the internal perspective,as well as, the international banking giant Bank of Tokyo Mitsubishi (BTM) undertook a groundbreaking in its application of BSC by incorporating in the internal perspective a risk management process, this linkage is a result of BTM's goal to enhance its corporate governance (Kaplan & Norton, 2004). However, this linkage between risks and performance evaluation by including the risk as a component, an overlay or an additional objective did not address the risk in a comprehensive way, as well as, it was not in line with some major financial scandals which resulted in the collapsing of some banks such as Barings and Daiwa banks, was a result of poor risk management (Waring & Glending, 1998).

Due to increased risks and the severe competition, risk management was evolved to be viewed as a third leg of shareholder value creation along with revenue growth and productivity, a three -level hierarchy of risks and the risk indicator scorecard were introduced, a parallel to the strategy scorecard that Kaplan and Norton conceived two decades ago (Kaplan, 2009). Unfortunately, introducing a working example of complete actual risk scorecard was missed for the reason that the development of a risk scorecard is more conjecture and concept than actual fact, as well as, measuring and managing risks differs so substantially from measuring and managing strategy, that it may be preferable to develop a completely separate risk scorecard (Kaplan, 2009).

In 2010, Kaplan upon his comments and analysis of the consequences of the subprime crisis, concluded that there was one thing missing that has been revealed in the last four years is that there is nothing about risk assessment and risk management and the companies need a parallel scorecard to their strategy risk- a risk scorecard (Kaplan, 2010). So it is concluded that in the recent business environment, ERM cannot be applied by just linking the performance and risk evaluation, the need for a separate scorecard addressing the risk in a comprehensive way became vital and necessary.

In a unique study by (Clandro & Lane, 2006) suggested the application of Enterprise Risk Scorecard and they indicated that a scorecard framework could be an effective risk measurement, management and communication tool. And this is assumed to be the first formal paper on risk and scorecard framework.

Banks have identified and started adapting the Enterprise Risk Management released by COSO to drive their initiatives in risk management beyond Basel norms and regulatory compliances (Srivastav, 2013). The COSO ERM framework has all the components that could help banks to stand a chance to drive business value while meeting compliance requirements (Vaiduyla & Kavala). The COSO ERM model ,in banking, is a common risk management framework that is generally accepted by regulators external and internal auditors and banking executives (Srivastav, 2013). As a result regulatory supervision policies in many advanced countries such as the US and Japan and the supranational regulatory bodies such as the Bank for International Settlement (BIS) arefundamentally based on the COSO framework (Nagumo, 2005). So,in the recent years, banks are urged not to only comply with Basel II&Basel III requirements but to address the other risks which are not included in Basel framework such as marketing, growth and learning.

The Authors goes beyond the boundaries of Basel requirements and inspired the essence of this unique work of Enterprise Risk Scorecard in designing the banking balanced risk scorecard BBRSC which encompass financial risks (market, credit, operational and liquidity) and non-financial risks including: internal process which represent the operational risk included in Basel framework, in addition to customer, learning and growth which represent new types of risks addressed by the banking industry.

3. Types of Risks in Banking

The literature shows different classifications of risks, this paper will follow the categorization applied in the balanced scorecard, as risk is categorized in four dimensions: financial, operational, customer, learning and growth.

3.1 Financial Risks

In the banking industry financial risks is categorized into market, credit and liquidity risks.

3.1.1 Market Risk

Market risk was defined as the risk of loss in on and off- balance- sheet positions arising from movement in market prices. The risks subject to this requirement are: the risks pertaining to interest rate related instruments and equities in the trading book; foreign exchange risk and commodities risk throughout the bank (BCBS, 1996).

Interest Rate risk is the potential negative impact on the net interest income and it refers to the vulnerability of an institution's financial condition to the movement of interest rate which affects earning, value of assets, liabilities, off–balance sheet items and cash flow (Grenuing & Baratanovic, 2009; Marrison, 2002).

Equity risk arises from adverse deviations of the mark- to- market value of the equity position.Asany decline in value will therefore result in a market loss for the corresponding period equal to the difference between the beginning and the ending mark- to- market value (Bessis, 1998; Marrison, 2002).

Foreign exchange risk is the risk of holding or taking positions in foreign currencies, including gold (BCBS, 1996). Currency risk results from changes in exchange rates and originates in mismatches between the value of assets and liabilities denominated in different currencies (Bessis, 1998).

Commodity risk is the risk of holding or taking positions in commodities, including precious metals, but excluding gold (BCBS, 1996).

The market risk can be quantified by several tools; the most common approach is the value at risk (VaR) which represents the maximum expected loss during severe adverse market fluctuations during the holding period with a certain confidence level. (Marrison, 2002). The value at risk can be calculated for the whole trading portfolio as well as for each market risk factor (interest rate Value at risk, foreign exchange value at risk, equity value at risk), or by instrument (bonds, shares…). Some other measures can be applied by the bank such as: the change in net interest income, the change inprofits from foreign exchange transactions (Bessis, 1998).

3.1.2 Credit Risk

Credit risk is paramount in terms of the importance in the banking industry. It was defined by Basel committee as the potential that a bank borrower or counterparty will fail to meet its obligation in accordance with agreed terms (BCBS, 1988). On other words, credit risk can be defined by the losses in the event of default of borrower, or in the deterioration of borrower credit quality or the decline in the credit standing of counterparty. Several factors affect the credit risk, but the major risk components are: probability of default (PD), loss given default (LGD) and exposure at default (EAD) (Waring & Glenden, 1998).

There are several aspects of credit risk, the most common two: credit default risk and credit spread risk. The default risk is measured by the probability that the default occurred during a given period of time. Counterparty risk refers to the possibility that a trading counterparty will fail to pay if it loses money on a deal. Settlement risk occurs if a bank fails to settle its side of a trade (Bessis, 1998; Marrison, 2002).

Basel committee distinguish between two broad approaches;thestandardized approach which rely on the credit assessment provided by external credit rating agenciesandtheinternal rating based approach which rely on the bank's own credit assessment.In general, banks are using several tools or approaches in order to quantify the credit risk, the most common are: credit value at risk, the ratio of non-performing loans to the total portfolio, the ratio of doubtful loans provision to the total portfolio (Bessis, 1998; Crouhy et al., 2005).

3.1.3 Liquidity Risk

Liquidity Risk was defined as the risks that demands for repayment outstrip the capacity to raise new liabilities or liquefy assets (BCBS, 2001). An evaluation of whether or not a bank is sufficiently liquid depends on the behavior of cash flows under different conditions. Accordingly, for the proper liquidity risk management, the ability to readily convert assets into cash and access to other sources of funding in the event of liquidity shortage are very important (Crouhy et al., 2005). Liquidity risk management must therefore involve various scenarios: the going concern (ordinary scenario), bank's liquidity crisis situation and general market crisis (Grenuing & Baratanovic, 2009).

The Basel committee introduced a global liquidity standard that includes a 30-day liquidity processing (liquidity Coverage Ratio) requirement underpinned by a longer-term structural liquidity ratio (Net Stable Fund Ratio) (BCBS, 2010). However the Egyptian banks are not applying the two ratios required by Basel III till the present time. Egyptian banks are relying on the traditional liquidity ratio analysis in analyzing the liquidity risk faced by the bank. The most common liquidity ratios include: the ratio of liquid assets to deposits and stable funding, the ratio of net loans to total assets and the ratio net loans to deposits and stable funding.

The following table summarizes the main financial risk measures.

Table 1. Financial risk measures

Risk	Measures
MarketRisk	Value at Risk (totalVaR, IR VaR, F.X VaR).
	Change in net interest income
	Change in profits from foreign exchange transactions.
	Change in trading shares market value.
Credit Risk	Credit Value at risk
	% Nonperforming loans to credit portfolio
	% Loans Provision to credit portfolio
Liquidity risk	liquid assets /deposits and stable funding
	Net loans/ total assets
	Net loans/ deposits and stable funding

3.2 Operational Risk

Operational Risk was defined as the risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events (BCBS, 2001). Following severe operational failures which affected a number of financial institutions such as: Natwest, Allied Irish Bank and LTCM the importance and the emphasis of operational risk within banks are increased (Helbok & Wanger, 2006). Operational risk can be viewed as the risk associated with the problems of accurately processing, settling and taking or making delivery on trades in exchange of cash (Santomero, 1997).

Basel committee provide Detailed three level Classification of theLoss Events which expose the bank to operational losses (Internal fraud, External fraud, Employment Practices and Workplace Safety, Clients, Products&Business Practices, Damage to Physical Assets, Business disruption and system failures andExecution&Delivery Process Management (BCBS, 2004).

Basel II sets three approaches for calculating the capital charge of the operational risk: Basic indicator approach (BIA), Standardized Approach(SA), and the advanced measurement approach (AMA). According to BIA the operational risk capital charge is equals to 15% of average gross income over three years, SA is not so different from BIA, instead of the gross income of the whole bank, the average gross income of each business line as identified by Basel committee is multiplied by risk factor, ranging from 12%to18%, assigned for each business line (12%-18%), the third approach, AMA, relies on using the risk factors related to operational risk : probability of event PE, loss given Event LGE, and the exposure indicator EI in calculating the operational value at risk (Marrison, 2002).

Table 2. Operational risk measures

Risk	Measures
OperationalRisk	Operational Value at Risk
	15% Average Gross Income
	Ratio of operation risk provision to operating income

Learning and Progress Perspective.

The capability of bank to progress and learning that represent as direct ties with firm's value thereforetheinnovation and learning objectives are intended to drive improvement in financial, customer and internal process performance (Kaplan & Norton, 1993).

The innovationand learning objectives should be linking with bank'sstrategywhichdetermined by boardof directors to translatethemaximumacceptable level of risk in light of their knowledge about market and return risks (Woods, 2008) that expressed as risk appetite of bank.

This strategy set hypothesesabout cause and effect that can be expressed by sequence of IF–Then statements (Kaplan & Norton, 1996), howeverthe increase ofemployee's awareness of risk causesincrease in effectivenessof risk management and in the same time the progress of employee awareness of risk result from increasing of employee training about risk technique and tools.

In light of the link between cause and effect bank can be able to set objectives of progress and learning risk

perspectives that reflect its strategy.

The effectiveness of achievement these objects should be measured by Common measurements includinga bank's ability to innovate, improve, and learn that classify as follows:

Table 3. Learning & growth risk measures

Risk	Measures
Learning Increase employee awareness of risk management.	Risk Training Hours per employee compared with bank leader in market.
Progress Increase the employee'scapabilityin define, measure and monitoringrisk by achievingthe highest profitability and acceptable risk	The progress of Risk adjusted return measure.

3.3 Customer Risk Perspective

Customer risk pertains to the risk of bank's overall portfolio of customers. The risk of losing these customers can be measured in several ways (Clandro & Lane, 2006). It has become increasingly important to view customers as risky assets (Hogan et al., 2002), because the firm's life existence and value is a function of its ability to satisfy their customers' needs and desires (Calandro & Scott, 2006) in the light of customer asset management perspective that may generate cash flow consistently over time.

The valuable of customer asset including the acquisition, retention, developing and deletion costs (Blatberg et al., 2001).

The sources of risk pertain to the risk of banks overall portfolio of customers can be classified into a Varity of factors such as follows:

Table 4. Customer risk measures

Risk	Measures
Customer defection	Decreasing Customer Base Decreasing loan's portfolio Decreasing deposit's portfolio
Poor customer quality	Increasing the percentage of provision comparison to increasing the percentage of loan's portfolio
Customer acquisition	Stability of customer base comparison to increasing customer base of competitors

4. Research Problem

Kaplan (2010) state that firms need a parallel scorecard to their strategy scorecard- a risk scorecard and it was one thing missing that has been revealed in the last few years.

The risks are categorized into: financial and non-financial risks (Srivastav, 2013). In other words the portfolio of risk balanced scorecard includes objective and subjective elements (Collier et al., 2007). Recognizing this risks and managing them appropriately enhance the ability of the firm to make better decisions, delivers bank's objectives and hence subsequently improve performance (Jalal, 2011), so banks invested a significant amount of money in risk management programs, However it is questionable if these programs do really pay off for them, in the same time the literature doesn't supply enough information about the role of (BRBS) in adding value to banks, also the effectiveness of (BRBS) still remains untested because of lack of suitable framework and techniques.

The research question is: Does the adoption of Banking risk balanced scorecard that consists of financial and non financial risk measures lead to enhance both of bank's competitive advantage and stakeholder value? This paper provides evidence on effectiveness of this issue.

5. Research Objectives

This research aims to achieve the following objectives:

- Measuring the effectiveness of Banking Wide Risk Scorecard,
- Identifying the other value driver of the banks,

- Developing a conceptual framework of measuring the benefits of(BRBS).

6. Methodology

In addition to providing dimensions of (BRBS) framework and its measures to maximize Bank value, we decompose Economic value add to measure the benefit of shareholder value and Tobin' s Q to measure the benefit of other stakeholder value, while using Market share indicator as a proxy of measuring competitive advantage.

6.1 Market-Based Measures

There are many based measures that can be used to explain and manipulate market capitalization or shareholder value (Srivastava et al., 1998). previous studies had widely used Economic value added (EVA), Market Value Added (MVA) and Tobin's Q which are widely accepted as reliable and strong measures in additional reflect future or long term of firm economic value (Chen, 2010), one that is forward looking cumulative (Anderson et al., 2004), change/flow measures (Hogan et al., 2002).

The authors use the following measures of bank value.

6.1.1 Economic Value Added (EVA)

Economic value added is an operating profit after taxes less a charge for capital equal to the product of capital and its cost.

EVA = net operating profit after tax (NOPAT)- (capital x the cost of capital) (Hogan et al., 2002).

EVA is closely related to MVA - the difference between the market value of the firm and the economic value of the capital it employs. The Increased interest in EVA and related performance measures reflects a heightened awareness by corporate managers that their task is to create 0value for shareholders (Lhen & Makhija, 1996).

EVA can be created in four ways: by enhancing operating efficiency, asset management, 09increasing profitability growth and by reducing the cost of capital (Lilley et al., 2008).

Firm level risk management can increase shareholder value by facilitating investor-based risk management. In the same time industries which are rapidly evolving and changing, and which have few tangible assets might also be good candidates for risk exposure targeting (Meulbroek, 2002).

The main objective faces the managers in firm who seeks to implement risk management is to reduce earning fluctuations or to reduce fluctuation in firm value (Welssenriden, 1997). So the fundamental goal of risk management is maximizing shareholder and firm value.

Following this reasoning we state the following mean hypothesis.

H1: the greater the ability of a bank to manage (BRBS), the greater its Economic value added.

We estimated EVA efficiency by postulating a relationship among EVA and BRBS. This relationship is summarized in the EVA function for a given bank of time t (Equation 1), which models the logarithm of a bank's EVA where EVA_{iT} as a linear function of the logarithms of variable input.

$$Ln\ (EVA_{iT}+\Delta) = F\ (LnEVA_{iT-1},\ LnMr_{iT},\ LnCr_{iT},\ LnLQ_{iT},\ LnIr_{iT},\ LnLgr_{iT},$$
$$LnGr_{iT},\ LnCdr_{iT},\ LnCpr_{iT},\ LnCAr_{iT},\ Ln\lambda_{iT-1},\ Lnu^{v}_{iT}) \quad (1)$$

Where Ln ($EVA_{iT}+\Delta$) is economic value added we add a constant, Δ, to EVA of all banks to ensure that the values are positive (Kirasnikov et al., 2009). $LnEVA_{iT-1}$ refers to one- year lagged value of economic value added (x1), Mr_{iT} refers to the market risk(x2), Cr_{iT} refers to credit risk(x3), LQ_{iT} refers to liquidity risk(x4), Ir_{iT} refers to internal risk(x5), Lg_{iT} refers to learning risk(x6), Gr_{iT} refers to growth risk(x7), $LnCdr_{iT}$ refers to customer defection(x8), $LnCpr_{iT}$ refers to poor banks portfolio of clients(x9), $LnCAr_{iT}$ refers to customer acquisition(x10), λi_{T-1} refers to economic condition by using 90-day Egy. Treasury bills interest rate(x11).

We estimated equation 1 for every time period $_T$ over a five year period which include twenty quarterbalance sheetconcerning 3 Egyptian commercial banksto capture efficiency, as the first step, we completed a time series of residuals for every bank (Kirasnikov et al., 2009).

Banks with higher residuals from the EVA function demonstrated superior EVA because they earn higher EVA than an average bank (Barger et al., 1993); we measured EVA efficiency as the distance between the EVA of the focal bank and that of the most EVA bank in the sample. As such, EVA efficiency is the difference between the maximum residual obtained from fitting the EVA function of and the residual for the focal bank. Therefore, higher values of EVA_{iT} correspond to lower values of EVA efficiency:

$$EVAEF_{iT} = EXP\ (Lnu^{v}max - Lnu^{v}_{iT}) \quad (2)$$

Measures of variables we measured Mr_{iT} using value at risk, Cr_{iT} using credit value at risk and LQ_{iT} using Net loans/ Total assets we measured internal risk Ir_{iT} using 15% average gross income. We measured learning Lgr_{iT} using risk training hours per employee and progress Gr_{iT} using the progress of risk adjusted return measure.

We measured customers as risky assets by accessing the relevant information from Egyptian Central Bank, personal visits, telephone conversation with marketing executives. We created two groups of banks after reviewing all the information: Banks with high:

Cd_{iT} = 1 and low Cd_{iT} = 0 degree of customer defection.

Cd_{iT} = 1 and low Cd_{iT} = 0 degree of poor bank's portfolio of clients.

Cd_{iT} = 1 and low Cd_{iT} = 0 degree of customer acquisition.

$$Z = F\left[\sum^{j}_{j=1} W_j^{(2)} F_j\left(\sum^{i}_{i=1} W_{ij}^{(1)} X_i\right)\right] \quad (3)$$

Z = multilayer perception (MLP) outputs ($EVAEF_{iT}$);

F = the transfer function in the output layer;

W_{ij} and W_i = connection weights from input layer (i) to hidden layer (^{j}) to output layer respectively.

Xi = is the inputs (eleven variables as mentioned above).

6.1.2 Tobin's Q

Is the ratio of the market value of the firm to the replacement cost of each tangible asset.

It considers an intangible firm value measure (Lu et al., 2010). A Q value greater than one indicates that the bank has intangibleassets. it enables a firm to create earnings in excess of the return of its tangible assets and to achieve an abnormal return on invested capital relative to its competitors (Hogan et al., 2002), using its resources more effectively (Anderson et al., 2004), creates value for its share holder (Matzelar et al., 2005).

A firm that doesn't create incremental value has A Tobin s Q equal to one .According to prior literature (Anderson et al., 2004; Lu et al., 2010) there are practical problems associated with implementing the previousdefinition so according to manyprior researches (Lu et al., 2010; Matzelar et al., 2010), suggest modifying function to be come as following:

$$Q = Market\ value\ of\ equity + book\ value\ of\ debt\ /\ total\ assets$$

In this paper, the Q is dummy variable,taking 1if the ratio is more than1 which means a firm owns higher intangible firm value,otherwiseis0 .

Lastly the literature (Archary & Mutenga, 2013; Hyot, 2011) Found positive relationship between implementing ERM and firm value. However the authors believe that the insurance sector deferent from banking sector and this will reflect on design a Banking risk balanced scorecard framework (BRBS), to evaluate the add value by (BRBS).

Following this reasoning we state the following mean hypothesis.

H2: the greater the ability of a bank to manage (BRBS), the greater the possibility that Tobin's Q will be more than one.

As we noted previously,T'sQEF$_{iT}$ has the form that is similar to that of the EVAEF$_{iT}$, as the following :

$$LnT'sQ_{iT} = F\ (T's\ Q_{iT-1},\ LnMr_{iT},\ LnCr_{iT},\ LnLQ_{iT},\ LnIr_{iT},\ LnLgr_{iT},\ LnGr_{iT},\ LnCdr_{iT},\ LnCpr_{iT},\ LnCAr_{iT},\ Ln\ \lambda_{iT-1},\ Lnu^{v}_{iT}) \quad (4)$$

$$T's\ QEFiT = EXP\ (Lnu^{v}max - Lnu^{v}_{iT}) \quad (5)$$

$$Z = F\left[\sum^{j}_{j=1} W_j^{(2)} F_j\left(\sum^{i}_{i=1} W_{ij}^{(1)} X_i\right)\right] \quad (6)$$

Where:

Z = multilayer perception (MLP) outputs (T's QEF_{iT});

F = the transfer function in the output layer;

W_{ij} and W_i = connection weights from input layer (i) to hidden layer (^{j}) to output layer respectively.

Xi = is the inputs (eleven variables as mentioned above).

6.1.3 Market Share

Firms sales don't indicate how will is performing versus its reviles; so management needs to track its market share

(Kotler, 2004) which can be measured throw a firm's sales in relation to full industry sales for a certain period.

Market share is a key indicator of market competitive advantage it indicates firms transient probabilities against its reviles. it enables management to judge not only total market growth or decline but Also trends in customers 'selections among reviles (Siggle, 2007) also the change in market share can be taken as dynamic indicator of competitive advantage.

The main advantage of using market share as a measure of competitive advantage or business performance it is dependent on micro-environmental variables rather than macro environmental variables, micro economic concept indicators of competitive advantage have a more solid theoretical base because they focus on the essential characteristic of producers in competition for market share and the profits or the ability to export this ability could be measured by the size or increase of market share.

Lastly the literature indicates that competitive advantage in the second key benefit – the other is shareholder value –of enterprise risk management (Ashary, 2008) and the authors adopt market share as a proxy of competitive advantage.

Following this reasoning we state the following mean hypothesis.

H3: the greater the ability of a bank to manage (BRBS), the greater its competitive advantage.

As we noted previously, T'sQEF$_{iT}$ has the form that is similar to that of the Ln MSHEF$_{iT}$, as the following:

$$LnMSH_{iT} = F\ (LnMSH_{iT\text{-}1},\ LnMr_{iT},\ LnCr_{iT},\ LnLQ_{iT},\ LnIr_{iT},\ LnLgr_{iT},\ LnGr_{iT},\ LnCdr_{iT},\ LnCpr_{iT},\ LnCAr_{iT},\ Ln\lambda_{iT\text{-}1},\ Lnu^{v}_{iT}) \quad (7)$$

$$LnMSHEF_{iT} = EXP\ (Lnu^{v}max - Lnu^{v}_{iT}) \quad (8)$$

$$Z = F\left[\sum^{j}_{j=1} W_{j}^{(2)} F_{j}\left(\sum^{i}_{i=1} W_{ij}^{(1)} X_{i}\ \right)\ \right] \quad (9)$$

Where:

Z = multilayer perception (MLP) outputs (LnMSHEF$_{iT}$);

F = the transfer function in the output layer;

W_{ij} and W_i = connection weights from input layer (i) to hidden layer (j) to output layer respectively.

Xi = is the inputs (eleven variables as mentioned above).

7. Artificial Neural Networks

Inspired by the previous research, the study uses a neural network based on a multilayer perception (MLP). MLP is a feed- forward back- propagation that utilizes a supervised learning algorithm and widely employed in the management science.

The calculation of the MLP weights is known as training process (Wang 2005). MLP is trained by the backproagation learning algorithm. The purpose of the training is to permit the MLP to learn some general features that may exist in the training set and to find the weights that minimize the overall error measure. This process is done by adjusting the connection weights by propagating the error backward through the network to determine how to best update the interconnection weights between neurons. Once adequately trained, the network will be capable of predicting patterns from the testing data set that were independent of the training data set (Detienne et al., 2003).

Unlike statistical methods, artificial neural networks (ANNs) models don't make dependency assumptions among input variables and solve multivariate problem with nonlinear relationship among variables (Binli 2002).In other words, NNs have the ability to make it possible to forgo strict statistical assumptions and specifications problems, and to process data by means of a flexible statistical tool.

7.1 Results from Artificial Neural Networks

Neural MLP has run eleven inputs 11 independent variables, 3 coded and 8 numerical also, neural MLP has run 3 dependent variables (EVA ,T's Q, MSH). The statistical parameters of significance generated by SPSS22 at the end of the training and testing calculation, to evaluate the performance and effectiveness of the neural network, are presented in table 1 and are explained as follows:

Relative Error: is the preceptor values of the error and predicted values (Mahbub et al., 2013). The lower the relative error is, the better the accuracy of the model.

SSE sum squared error and its statistical measures of the difference between the actual and predicted outputs.

The lower the value of these errors, the better is the performance of the neural network, and vice versa as regards the first hypothesis, data analysis is shown in Table 1:

Table 1. Statistical parameters of significance generated of EVA by MLP in three banks

Bank	CIB		ALEX		UNBE	
IV	Importance	Normalized Importance	Importance	Normalized Importance	Importance	Normalized Importance
LnCd	0.051	28.70%	0.1	61.50%	0.108	71.70%
LnCp	0.056	31.70%	0.053	32.70%	0.084	56.10%
LnCA	0.045	25.30%	0.026	15.90%	0.097	64.60%
$LnEVA_{iT-1}$	0.123	69.10%	0.087	53.30%	0.15	100.00%
LnMr	0.099	55.70%	0.104	63.60%	0.067	44.70%
LnCr	0.058	32.50%	0.124	76.10%	0.075	49.70%
LnLQ	0.104	58.30%	0.163	100.00%	0.073	48.50%
LnIr	0.079	44.20%	0.079	48.10%	0.126	83.50%
LnLg	0.115	64.40%	0.057	34.90%	0.053	35.50%
LnGr	0.093	52.30%	0.093	56.70%	0.042	28.00%
Ln l_{iT-1}	0.178	100.00%	0.114	69.50%	0.124	82.60%
Relative Error	0.001		0.001		0.001	
Sum squared error	0.006		0.007		0.006	

Table 1 refers to the relative importance of the variables that affect the effectiveness of economic value added and its relative weights according to the outputs of the network training process. The variables with normalized importance greater than 50% for CIB are: economic conditions, one-year lagged economic value added, learning risk, liquidity risk, and growth risk. The variables For ALEX are: liquidity risk, credit risk, economic conditions, market risk, customer defection, and growth risk. The variables For UNBE are:one-year lagged economic value added, internal risk, economic conditions, customer defection, and poor bank's portfolio of clients.

The above mentioned statistical analysis shows the following implications:

- Economic conditions have the greatest impact on EVA, as it represents a common variable in the three banks. This conclusion is meaningful as a consequence of the international financial crisis which took place in 2008 and reflected on different countries around the world, as well as, the political turbulences in Egypt that hasaffected the economic environment since 2011 up till now.
- Customer risk has a great effect on EVA in both of UNBE (customer defection, poor bank's portfolio of clients) &ALEX bank (customer defection). This result appears as a significant indicator to the importance of including intellectual capital (represented in customeras risky asset component) in the BRBS matrix. This conclusion makes this research to go beyond the boundaries of Basel requirements which addresses the financial risk only.

Concerning the second hypothesis, data analysis is shown in Table 2:

Table 2. Statistical parameters of significance generated of TQ by MLP in three banks

Bank	CIB		ALEX		UNBE	
IV	Importance	Normalized Importance	Importance	Normalized Importance	Importance	Normalized Importance
LnCd	0.006	2.20%	0.087	41.30%	0.043	27.70%
LnCp	0.024	8.70%	0.033	15.60%	0.068	43.30%
LnCA	0.024	8.70%	0.056	26.50%	0.074	47.40%
$LnEVA_{iT-1}$	0.026	9.70%	0.085	40.00%	0.118	75.60%
LnMr	0.272	100.00%	0.089	41.90%	0.12	76.70%
LnCr	0.111	40.70%	0.096	45.30%	0.072	46.30%
LnLQ	0.233	85.70%	0.212	100.00%	0.156	100.00%
LnIr	0.043	15.70%	0.065	30.70%	0.091	58.30%
LnLg	0.026	9.40%	0.072	34.20%	0.009	5.60%

LnGr	0.081	29.80%	0.093	43.70%	0.117	74.70%
Ln λ_{iT-1}	0.155	57.00%	0.113	53.20%	0.133	84.90%
Relative Error	0.019		0.007		0.007	
Sum squared error	0.033		0.001		0.001	

Table 2 refers to the relative importance of the variables that affect the effectiveness of Tobin's Q and its relative weights according to the outputs of the neural network. The variables with normalized importance greater than 50% for CIB are: market risk, liquidity risk, and economic conditions. The variables For ALEX are: liquidity risk and economic conditions. The variables For UNBE are: liquidity risk, economic conditions, market risk, :one-year lagged Tobin's Q, growth risk and internal risk.

The above mentioned statistical analysis shows the following implications:

- Almost all the variables which affect on the three banks are identical approximately, which refers to the need to pay for these variables a particular importance to be reflected on the Tobin's Q positively.
- Liquidity risk and the economic conditions share the greatest impact on Tobin's Q, as they represent common variables in the three banks. This conclusion is meaningful in severe economic conditions. In the meantime, market risk comes in the second rank as they are shown in two banks.

Concerning the third Hypothesis, data analysis is shown in Table 3:

Table 3. The statistical parameters of significance generated of MS by MLP in three banks

Bank	**CIB**		**ALEX**		**UNBE**	
IV	Importance	Normalized Importance	Importance	Normalized Importance	Importance	Normalized Importance
LnCd	0.029	16.10%	0.066	38.10%	0.027	17.90%
LnCp	0.053	29.50%	0.038	22.20%	0.058	38.20%
LnCA	0.048	26.60%	0.03	17.40%	0.128	84.60%
$LnEVA_{iT-1}$	0.041	22.60%	0.172	100.00%	0.032	21.10%
LnMr	0.18	100.00%	0.063	36.50%	0.135	89.20%
LnCr	0.048	26.80%	0.073	42.10%	0.098	65.00%
LnLQ	0.152	84.60%	0.13	75.40%	0.075	49.70%
LnIr	0.116	64.40%	0.099	57.70%	0.151	100.00%
LnLg	0.073	40.80%	0.027	15.90%	0.092	60.80%
LnGr	0.151	83.90%	0.156	90.70%	0.1	65.90%
Ln λ_{iT-1}	0.111	61.90%	0.145	84.20%	0.105	69.40%
Relative Error	0.001		0.001		. 01	
Sum squared error	0.006		0.006		0.001	

Table 3 refers to the relative importance of the variables that affect the effectiveness of Market Share and its relative weights according to the outputs of the neural network. The variables with normalized importance greater than 50% for CIB are: market risk, liquidity risk, Growth risk, internal risk and economic conditions. The variables For ALEX are: one-year lagged market share, growth risk, economic conditions, liquidity risk and internal risk. The variables For UNBE are: internal risk, market risk, customer defection, economic conditions, growth risk, learning risk and credit risk.

The above mentioned statistical analysis shows the following implications:

- It is worth to mention that the effect of customer as risky assets component did not appear except in UNBE bank through its sub- variable customer defection. This particularly may be explained due to the reason that UNBE is the smallest one in both of size and market share, which make it more sensitive compared to CIB& ALEX. Furthermore, CIB doesn't concentrate on market share but on more profitable segments, while ALEX bank has a wide customer base because of being one of the public banks before it has been acquired by Intesa San Paolo group.
- Liquidity riskis shown in two banks; this result gives the implication that liquidity problems can affect the market share of the bank.

- Internal risk plays a crucial role in the market share of the bank, as internal risk refers to the failure of operating and control system, which in turn have negative impact on the clientele base of the bank.
- Economic conditions represents an important factor in determining the market share of the bank , as the greater the bank suffer from the adverse economic condition, the greater its market share declines.

8. Conclusion & Recommendations

The Central premise of this article is that the effectiveness of implementing of banking risk balanced scorecard has a critical role in enhancing bank value, so the objective of our study was to explore the effectiveness of BRBS on three market based measures as proxy for firm value.

Our approach provides initial evidence on the value relevance of BRBS in banking industries.

We have developed a conceptual framework for measuring the impact of Banking risk balanced scorecard which come from several areas that rely on both of objectivity & subjectivity phenomena, financial, marketing and management theories and areas through and beyond Basel requirements. However it is challenging to link and integrate these several levels of philosophical understanding into a common framework (Acharyya, 2008).

Our approach is different from much existing research related to enterprise risk management because it:

1) Focuses on the banking universe where the risks are multi-dimensional through and beyond Basel requirements.
2) Focuses mostly on quantitative measures for both of stakeholders (shareholder value & intellectual capital) through EVA & Tobin's Q measures while covering competitive advantage through market share.
3) Takes into consideration tow conditions of efficient frontier which maximize expected return and minimize risk for varying levels of expected return (Sharp et al., 1995) where value cannot be created without sustainable risk taking (Acharyya, 2008).

We have found that banking risk Balance score card has a positive effect on both the economic value added & Tobin's Q, hence the results support the notion that BRBS has an essential role to maximize shareholders value and intellectual capital, in the meantime findings assumed that banks successful BRBS practice demonstrates their superior market share, hence it has had a significant impact on a competitive advantage.

On the whole, the results show that BRBS enhances the effectiveness of Bank value.

9. Future Research & Limitations

To our knowledge, our study is the first one in this direction specially to document the value relevance of BRBS but there are several avenues and a lot of efforts for further research as well as limitations that should be discussed ,hence replicated studies should be done in other different environments in addition to verify the findings and to lead to accumulate knowledge, in the meantime the model did not include all the variables which included in the matrix of BRBS due to the absence and the difficulty of obtaining the requireddata to run the model and here comes the importance of applying the model in different countries that can provide missing data.

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Return and Volatility Linkages among G-7 and Selected Emerging Markets

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Abstract

In this research, using twelve year daily data on sixteen market indicies, we examine the return and volatility linkages among developed and selected emerging stock markets. All markets exhibit excess kurtosis and ARCH effect in addition to non-normality. Our results show the existence of non-normality, excess kurtosis and excess volatility (ARCH effect) in all markets. There is also a positive pair-wise correlation among these markets. Interesting observation is that the daily volatility of Indonesia, among all markets including G-7 markets, is observed to be the smallest and there is negative correlation between Hong Kong and China Markets during the sample period. We find that these markets are highly linked except for Italy. Further to our analysis, we observe that except for China, all these markets also exhibit leverage effects. We also observe the asymmetry in volatility in all markets, except for China. Volatility transmission among equity markets in the same continent have the most influence for the stock markets in that area, except for UK market that has links to the USA stock markets. Results also indicate portfolio mix for investors of any country is different from another country.

Keywords: volatility, GARCH, stochastic volatility, leverage effect, ARCH effect

1. Introduction

The interrelation among financial markets through information transmission and spillover effect has been the center of attention among academicians and practitioners since 1980s. As the internet era evolves since early 1990s, research in this field has evolved significantly as international markets have become more integrated, information generated in one country affect financial markets of other countries almost instantaneously as the world economy has become a virtual one economy. At first, the vast majority of the literature examines the return linkages. Later on, literature emerges towards understanding the volatility linkage as it is clearer to the academicians and practitioners that the prominence of the second moment is too important to ignore especially in portfolio decisions. Research on return and volatility linkages have been conducted considering combination of developed markets, developed and emerging markets, among selected emerging markets, and among all markets. Empirical research in the current literature finds the unidirectional linkages as well as bidirectional spillover between different international stock markets (e.g., Li, 2007; Choudhry, 2004). A large number of studies study volatility spillovers among the mature markets (e.g., Karolyi, 1995; Francis et al., 2006; Yang & Doong, 2004; Bhuyan et al., 2013). There also exists many volatility spillover studies on emerging markets in Asia and Latin America (e.g., Hashmi & Tai, 2007; Gebka & Serwa, 2007; Yang & Chang, 2008; Morales, 2008; Tai, 2007), Eastern Europe (e.g., Fedorova & Vaihekoski, 2009; Buttner & Hayo, 2008), and volatility spillovers from developed markets to emerging markets, (e.g., Syllignakis & Kouretas, 2006; Wang & Moore, 2009; Li & Majerowska, 2008; Engle, Gallo, & Velucchi, 2009; Beirne et al., 2008; Li & Majerowska, 2008 among others).

There are few prominent emerging markets that are getting attention from international investors for seeking positive alpha in their investments. These markets are Brazil, Argentina, China, India, Indonesia, Korea, Hong Kong, Taiwan, and Mexico. These countries are attractive to international investors as they experience high growth and offer superior returns to investors. These countries are frequently quoted by Wall Street pundits as key sources of investments for international diversification. The Main objective of this research is to investigate spillover effect

among G-7 and these prominent countries to further contribute to this literature as it does not exist in the existing literature. Using twelve years of daily, we contribute to the literature by testing whether spillover is unidirectional from developed markets to these emerging markets or bidirectional. Our findings bring further to the literature the extent of relations among these markets, where, findings of the research should provide some insights in regards to global portfolio allocations and choices. We contend that as much as it is important to learn the transmission speed and spillover effect, it is also important to learn how information transmission can have impact on active asset allocation in optimal risk choice and hedging. The selected emerging markets that are poised for growth in the future as the developed markets have already matured, understanding the linkages of these markets should provide additional venue for potential investors in asset allocation that can enhance their investments beyond developed markets. From an econometric perspective, we use VAR (Vector Autoregression) and GARCH (Generalized AutoRegressive Conditional Heteroskedasticity) family to conduct our research. The use of GARCH family should help eliminate the typical problem with conventional econometric time series models.

The rest of the paper is structured as follows: Section 2 briefly reviews current literature. Section 3 discusses the data and methodology followed in examining stock markets' returns and volatility dynamics. Section 4 analyzes evidences on returns and volatility linkages. It also discusses some implications of our findings in global portfolio diversification. Finally, Section 5 offers the conclusion of this research.

2. Literature Review

There is a vast research on returns and volatility linkages among countries around the world. Many different models and methodologies such as cross correlations, VAR models, cointegrations models, GARCH family, multivariate GARCH family, Regime switching models, and stochastic volatility models appear in the literature to investigate the extent of linkages. Engle et al. (1990a), Hamao et al. (1990), Koutmos and Booth (1995) or Booth et al. (1997), among others extend international monetary markets to international stock markets. It becomes apparent in the literature that some markets are more interdependent in volatility than in returns. Hong (2001) examines the presence of Granger causalities between U.S. dollar and Deutsche mark and Japanese Yen. He finds simultaneous interaction between the mean of two exchange rates. On the other hand, he finds simultaneous and one-way interactions in the variance. King and Wadhwani (1990) and Hong (2001) develop tests that are based on residual cross-correlation function to study the spillover effect. Van Dijk, Osborn, and Sensier (2005) continue their analysis to further account for the existence of structural breaks in volatility. Diebold and Yilmaz (2009) apply VAR model to in their research to calculate the level of spillovers. Engle, Gallo, and Velucchi (2009) examine daily volatility transmission to capture the dynamic relationships among volatilities in different markets. Finally, Wongswan (2006) observes the international return and volatility transmission from United States and Japan to Korea and Thailand. Engle and Ng (1988), Hamao, Masulis, and Ng (1990), Engle, Ito, and Lin (1990), King, Sentana, and Wadhwani (1994), Lin, Engle, and Ito (1994), Karolyi (1995), and Wongswan (2006) apply multivariate GARCH techniques to study the volatility spillovers among international markets and find the existence across international stock and foreign exchange currency markets. To further investigate on the spillover issue, Cheung and Ng (1996), Hong (2001), Pantelidis and Pittis (2004), Sensier and van Dijk (2004), and van Dijk, Osborne and Sensier (2005) apply simple tests of correlation in volatility based on the lead-lag of squared GARCH-standardized residuals. Gourieroux and Jasiak (2007) test spillover in volatility by approximating conditional log-Laplace transforms of compound AR processes. Diebold and Yilmaz (2008, 2009), on the other hand, examine volatility transmission using VAR on range-based volatility. Corradi, Distasso, and Fernandez (2009) examine the degree of transmission in volatility among world stock markets deriving several tests for conditional independence on daily volatility techniques. Their findings suggest that volatility transmission is stronger from China to Japan and US not the vice-versa. Beirne et al. (2008) investigate volatility transmission from developed markets to Emerging markets and test for their changes during crisis periods. Similar studies also jointly investigate transmission of volatility of Emerging markets to developed markets (Dungey et al., 2006, 2007; Kaminsky & Reinhart, 2003). Beirne et al. (2008) and Spagnolo (2009) look at the transmission mechanism during financial turbulence in developed countries, and review the conditional correlations of returns and find unidirectional volatility effects from developed markets to many emerging markets. Engle et al. (2009) in their research observe that volatility responds differently in quiet and turbulent periods except for East Asian countries. They also observe "build-up" in volatility transmission in case of major episode of the Asian crisis. As it is apparent from existing literature the interest and importance of transmission of return and volatilities among markets, this research extends the literature by investing the linkages among G-7 and prominent countries to bring more insights into the literature.

3. Data and Methodology

The main objective of this research is to investigate spillover effect among G-7 and these prominent countries to

further contribute to this literature as it does not exist in the existing literature. We consider closing-to-closing data on stock market indices like Allen and McDonald (1995). In order to avoid stationary problem, we take natural logarithm of the raw data and continuously compounded return series are computed from market indices series as follows:

$$x_t = \left(\ln P_t - \ln P_{t-1}\right) \times 100 \tag{1}$$

Where x_t is current returns, P_t is the closing stock price index at time t, and P_{t-1} is the previous day closing stock market index. Our dataset comprises of daily closing indices (P_{it}) for the seventeen stock markets for the period December 30, 1995 to February 28, 2007. The beginning data is set based on the availability of data for all countries. The following indices are used for the respective stock markets: Merval, IBOVESPA, TSX Composite, IPC index, SSE Composite Index, Heng Seng Index, BSE Index, Jakarta Index, Seoul Composite, TSEC Index, DAX, Nikkei 225, CAC 40, MIBTEL, FTSE 100 and S&P 500. To understand the returns and volatility linkages, the Vector Auto Regressive has been considered for examining return and volatility linkages. The VAR model is expressed as follows:

$$X_t = C + \sum_{s=1}^{m} A_s X_{t-s} + \varepsilon_t \tag{2}$$

Where X_t is a 16 x 1 vector of return series for all markets, C is the constant, A_s are respectively, 16 x 1 and 16x 1 6 coefficient matrices, m is the number of lag length and e_t is the 16 xl stochastic error vector which is uncorrelated with all the past X_s. The block erogeneity test is applied to isolate the set of exogenous variables that have influence on endogenous variables. WE restrict all the lags of particular variables (X_ts) to zero and then test for the significance. This joint test is analogous to Granger causality. It is also applied to identify the most independent and dependent variables in returns and volatility linkages. We capture the sign, magnitude and persistence of responses of one market to another stock market. If the process used in this research is stochastic noise, the estimated VAR can be used in a moving average representation whose coefficients are forecast error impulse responses. The moving average representation takes the following form:

$$X_t = C + \sum_{s=0}^{k} B_s \varepsilon_{t-s} \tag{3}$$

Where, X_t denotes a linear combination of current and past one step ahead forecast error or innovation. The coefficient, B_s , is the response of one stock market returns to a one standard error shock of any of the markets "s" periods ago. The e_t's are serially uncorrelated although may be contemporaneously correlated. In this research, we use the Cholesky decomposition estimation criterion. We also use Variance decomposition to determine if a market is either dependent or independent. This can be guessed from the extent to which own-innovation can explain variations in first and second moments of the stocks market series.

To test for the volatility transmission among the markets, we first test the volatility of each market using the GARCH, EGARCH and GJR GARCH models. Conditional variance series are then generated using one of the most appropriate listed models that serve as a proxy for volatility for each markets and then is analyzed using the VAR together with impulse response and variance decomposition to examine the transmission among the selected markets. Like Takaendesa et al. (2006), this study also employs the following mean equation:

$$y_t = \mu + \varepsilon_t \tag{4}$$

Where y_t return for each markets and μ is a constant. If autocorrelation is observed, lagged values of the dependent variable would be added until serial correlation is eliminated. The equation is also tested for ARCH effect before proceeding to estimating volatility models. GARCH-M model of Engle et al. (1987) offers a very useful way of modeling risk and return. GARCH-M model is modeled here by extending the above mean equation as follows:

$$y_t = \mu + \delta h_{t-1} + \varepsilon_t, \ \varepsilon_t \approx N\left(0, \sigma_t^{\,2}\right) \tag{5}$$

Where y_t denotes mean returns, h_{t-1} is a lagged conditional variance term and ε_t is the residual term. A conditional variance equation is derived and estimated. The δ in the equation is defined as risk premium. If it is positive and statistically significant, then increased risk leads to a rise in mean return. To test for the ARCH effect in the data we implement Lagrange Multiplier test. The GARCH model (Bolerslev, 1985), that applies MLE process is chosen in our research as it allows the conditional variance to be dependent on own lags. The conditional variance equation in GARCH (1,1) takes the following form:

$$h_t = \omega + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1},\ \alpha + \beta < 1 \tag{6}$$

Where h_t represents conditional variance, ω is the constant, α is the coefficient of lagged squared residuals, ε_{t-1}^2 is the lagged squared residual from mean equation and β is the coefficient for the lagged GARCH component. Here, $a + \beta < 1$ is necessary for stationary of the GARCH model. We extend our analysis to capture the asymmetric effect. For this purpose, we apply EGARCH (Nelson, 1991) that is specified with the following conditional variance equation:

$$\log(h_t) = \omega + \beta\log(h_{t-1}) + \gamma\left(\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}}\right) + \alpha\left[\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}} - \sqrt{2/\pi}}\right] \tag{7}$$

Here, $\delta + \beta < 1$, $\gamma \neq 0$ if there is asymmetry in impact and $\gamma < 0$ if there is leverage effect in the return series. If $\gamma \neq 0$ and significant, negative shocks imply a higher next period conditional variance than positive shocks of the same magnitude (i.e. asymmetric impacts). A leverage effect, which is a special case of asymmetric impacts, would exist if $\gamma < 0$. Finally, the GJR GARCH (proposed by Zakoian, 1990; Glosten et al., 1993) is also explored as this model also captures asymmetry with variation in specifications from EGARCH. This model is also a re-specification of the GARCH (1, 1) model with an added term representing asymmetry as follows:

$$h_t^2 = \alpha_0 + \alpha_1\varepsilon_t^2 + \beta h^2{}_{t-i} + \gamma\varepsilon^2{}_{t-i}I_{t-1}, \tag{8}$$

where $I_{t-1} = 1$ if $\varepsilon_{t-1} < 0$ or =0 if otherwise. Here, I represents asymmetry component and γ is the asymmetry coefficient. The presence of leverage effects is observed when the asymmetry coefficient is significantly positive (i.e. $\gamma > 0$). The intuition behind this is that good news ($\varepsilon_t > 0$) and bad news ($\varepsilon_t < 0$) have different impacts on conditional variance. The impact of good news is only α_1 and that of bad news is $\alpha_1 + \gamma$. Like Shikwambana (2007), we also analyze the trend of volatility overtime by regressing each of the conditional variance series against a constant and a time variable as follows:

$$\text{ht} = \beta_1 + \beta_2 T \text{ ft} \tag{9}$$

Here, h_t is conditional variance at time t for each market and T is the time in days. If β_1 is significantly positive, it implies that volatility increases over time. A significantly negative β_1 would implies that volatility should decrease over time.

4. The Results

Table 1. Descriptive statistics for return series

	Argentina	Brazil	Canada	Mexico	USA	China	HongKong	India	Indonesia	Japan	Korea	Taiwan	France	Germany	Italy	England
Mean	0.000616	0.0005	7.20E-0	0.0006	-7.79E-0	0.0001	6.89E-05	0.00055	0.000711	-0.0001	0.00031	-1.61E-0	-0.00018	-4.81E-0	-0.00024	-5.76E-0
Median	0.001143	0.0013	0.00044	0.0012	0.00060	0.0000	0.000214	0.00128	0.001242	0.0001	0.00136	0.00034	0.00018	0.00075	0.00023	0.00043
Maximum	0.161165	0.1367	0.09370	0.1044	0.10957	0.0940	0.134068	0.15990	0.076234	0.1323	0.11284	0.06524	0.10594	0.10797	0.10370	0.09384
Minimum	-0.129516	-0.1209	-0.09788	-0.0726	-0.09469	-0.0925	-0.135820	-0.11809	-0.109539	-0.1211	-0.12804	-0.09936	-0.09471	-0.07433	-0.08603	-0.09264
Std. Dev.	0.022407	0.0199	0.01269	0.0145	0.01388	0.0169	0.016678	0.01729	0.015355	0.0163	0.01772	0.01615	0.01576	0.01673	0.01314	0.01339
Skewness	-0.072102	-0.0875	-0.78124	0.0450	-0.10934	-0.1099	0.045350	-0.15733	-0.691249	-0.2712	-0.49610	-0.23377	0.04296	0.06400	-0.16691	-0.11511
Kurtosis	7.884198	6.7848	12.9870	7.3581	11.1230	7.1661	11.24070	9.56354	8.963763	9.2968	7.55999	5.38581	8.26164	7.33735	9.73863	9.43676
Jarque-Bera	2403.536	1445.1	10286.3	1912.8	6647.20	1752.1	6837.013	4346.69	3772.762	4021.1	2192.31	595.012	2787.68	1895.45	4582.41	4176.15
Probability	0.000000	0.0000	0.00000	0.0000	0.00000	0.0000	0.000000	0.00000	0.000000	0.0000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Sum	1.488238	1.3774	0.17387	1.5742	-0.18828	0.3254	0.166350	1.33491	1.718016	-0.4257	0.76955	-0.03890	-0.45556	-0.11616	-0.57916	-0.13908
Sum Sq.Dev.	1.212549	0.9616	0.38936	0.5119	0.46585	0.6947	0.671736	0.72192	0.569389	0.6444	0.75888	0.63027	0.60007	0.67613	0.41750	0.43309
Observations	2416	2416	2416	2416	2416	2416	2416	2416	2416	2416	2416	2416	2416	2416	2416	2416

Table 1 provides descriptive statistics for return series of countries under consideration. The statistics show similar characteristics. For instance, there is non-normality in the form of fat tails. We observe some noticeable differences, especially between developed and emerging stock markets. First, returns are larger in emerging markets compared to those of developed markets. It is interesting to observe that the emerging markets exhibit the largest unconditional average daily return of 0.000181% with Indonesia being the highest with 0.000711% during the sample period. Of the developed stock markets Canada has the largest unconditional average return of 0.0000689%

and the lowest for the US of about -0.0000779% . Interesting to observe is also the smallest standard deviation for Indonesia which is well below some of the developed stock markets (Japan and Germany). All the markets show distributions with positive excess kurtosis and evidence of fat tails. A distribution with a kurtosis value of more than 3 is described as leptokurtic relative to normal which implies returns tend to contain extreme values. Finally, the Jarque-Bera (JB) statistic tests indicate that return series are non-normal for all return series which is also evident from the fatter tails of the kurtosis and negative and positive skewness.

Table 2 shows the pair wise correlation matrix among the return series. We find evidence of contemporaneous correlation among these markets during the sample period. Correlation dynamic is diverse indicating that there is no common trend or factor driving these markets in the same direction. This is supported for the possibility of international diversification in portfolio of asset allocations. The most interesting point is the correlation between Hong Kong and China's stock markets, because the number shows that both stock markets are negatively correlated. This information shows the benefit for investors who have interest in these two Chinese stock markets, can safely diversify their investment in both of them.

Table 2. Correlation matrix for return series

	Argentina	Brazil	Canada	Mexico	USA	China	HongKong	India	Indonesia	Japan	Korea	Taiwan	France	Germany	Italy	England
Argentina																
Brazil	0.08812															
Canada	0.03223	0.03626														
Mexico	0.00228	-0.0110	0.07846													
USA	-0.02366	-0.0022	-0.03958	0.06396												
China	-0.0075	0.02884	-0.0175	0.02868	0.05297											
HongKong	-0.01318	0.04793	0.03837	0.01149	0.07163	-0.0039										
India	0.02823	0.00831	-7.94E-	0.02714	-0.00388	0.07252	0.057081									
Indonesia	0.01942	-0.0436	0.04416	0.01513	0.06807	0.05302	0.038795	0.0431								
Japan	0.03484	0.02754	-0.03379	0.03659	-0.01561	0.00749	-0.060109	0.02591	0.09888							
Korea	-0.02219	0.01094	0.01172	0.00423	0.06724	0.02352	0.062126	0.02555	0.07833	-0.01941						
Taiwan	0.09398	0.09892	-0.00067	0.00908	-0.02165	0.00348	-0.019288	0.08671	0.02030	-0.01429	-0.01101					
France	-0.03137	-0.0325	0.02627	-0.0022	0.03560	0.04229	0.0157	-0.0086	-0.02032	0.07631	-0.01855	-0.0204				
Germany	-0.03327	-0.0063	0.03570	0.01854	0.02165	0.02843	-0.009867	0.01004	0.02671	0.05959	-0.00049	0.02149	0.23989			
Italy	-0.03881	-0.0184	0.04727	-0.0093	0.01497	0.00456	0.005996	0.02216	-0.00153	0.01167	0.02181	0.01792	-0.01934	-0.0305		
England	-0.04842	0.0109	0.0213	-0.0106	0.2049	-0.0126	0.099629	0.02601	0.012123	0.013186	0.080050	-0.0061	0.069623	0.033492	-0.12787	

When one look at the matrix, it is also observed that investors from one country can benefit from a mix of stocks of some countries that are different from investors of another country. For example, investors from Canada can benefit greatly by choosing USA, China, India, Japan, and Taiwan as portfolio holdings, whereas, investors from England can greatly benefit by investing in Argentina, Mexico, China, Taiwan, and Italy. Similarly, investors from USA can benefit by investing in Argentina, Brazil, Canada, India, Japan and Taiwan. So the country mixes are different for investors of different countries. Taiwan, interestingly, turns out to be a country of choice for most developed countries but not for the investors of developing countries. We conduct ADF and KPSS test with appropriate lag length of 30. Using SIC and the maximum lag length 30 it is expected that due to their information efficiency, the stock markets should react to new shocks or information within 30 days among countries from the origin of the information. The KPSS is estimated using the Bartlett Kernel estimation method and results of both tests are reported in the Table 3 and 4. Results from both the ADF and the KPSS show that, given the significance level of 1%, all the index series are non-stationary at level. However, all series becomes stationary at differenced once matching the results exist in the current literature as it is the case exist in the current literature.

Table 3. Unit root and stationarity test results (with intercept and trend)

SERIES	ADF		KPSS	
	Level	1st Difference	Level	1st Difference
Argentina	-1.731047	-46.97907	0.536800	0.097710
Brazil	-1.946775	-48.26284	0.444586	0.110090
Canada	-1.257814	-37.90337	0.557728	0.135056

Mexico	-1.577919	-35.49295	0.449272	0.131751
USA	-1.163480	-39.71579	0.574480	0.116217
China	-1.141275	-48.91090	0.485821	0.175725
Hong Kong	-1.474470	-50.60648	0.415993	0.121590
India	-1.835795	-35.29211	0.423481	0.143145
Indonesia	-1.887340	-43.12922	0.364662	0.126199
Japan	-1.133199	-51.01151	0.646266	0.145854
Korea	-1.926636	-48.30874	0.376282	0.083901
Taiwan	-1.045872	-46.76580	0.270087	0.092227
France	-0.847148	-24.32654	0.623244	0.140097
Germany	-0.729269	-51.11089	0.605014	0.137494
Italy	-1.646353	-22.61183	0.686728	0.169190
England	-1.252127	-23.73216	0.570642	0.105585

Note. The MacKinnon (1996) (i.e. for ADF test) 1% critical value = -3.961629 and the KPSS (1992) 1% critical value = 0.216, thus denotes the rejection of the hypothesis of a unit root/non-stationarity for both tests. The lag order for the series for the ADF was determined by the Schwarz information criterion and the spectral estimation method used for KPSS is Bartlett Kernel.

Table 4. Unit root and stationarity test for return series

Series	ADF at Level	KPSS at Level
Argentina	-46.96362*	n/a
Brazil	-48.23189*	n/a
Canada	-37.89748*	n/a
Mexico	-35.40573*	n/a
USA	-39.71512*	n/a
China	-48.91186*	n/a
Hong Kong	-50.60271*	n/a
India	-35.24046*	n/a
Indonesia	-43.04509*	n/a
Japan	-51.01980*	n/a
Korea	-48.30641*	n/a
Taiwan	-46.75839*	n/a
France	-24.30593*	n/a
Germany	-51.10413*	n/a
Italy	-22.59227*	n/a
England	-23.71138*	n/a

Note. The MacKinnon (1996) (i.e. for ADF test) 1 % critical value = -3.961629 and the KPSS (1992) 1% critical value = 0.216, thus * denotes the rejection of the hypothesis of a unit root/non-stationarity for both tests. The lag order for the series was determined by the Schwarz information criterion and the spectral estimation method is Bartlett Kernel for ADF and KPSS, respectively.

4.1 Return Linkage among Equity Markets

Using a VAR model, we test if the return series among the world equity markets are linked. We proceed with return series for our VAR analysis using a lag order of 1-10. Various methods are analyzed in choosing appropriate lags. We conduct our tests based on each of the four criteria shown in Table 5. Although results are very similar, we decide to follow the AIC in choosing lag to present our analysis consistent with existing literature. We present only the result of immediate lag that are significant in Table 6 in order to reduce the size of the paper. It is evident from the table that except for Italy, for all developed countries, own immediate lags have influence in return series and that is not the case for developing countries where lags further behind show significance. In case of Italy, lag 4 seems to be significant in own return influence. Argentina's one lag return has significant influence on Brazil and Taiwan at 5% level of significance, Brazil's lagged return has influence on Korea, Mexico has influence on Canada, Hong Kong influences France, and Japan influences Indonesia as an evidence of linkage. One of the implications of these return linkages for a trader/investor is to avoid including countries where one country has influence on another country and pool countries accordingly in portfolio selection which may help improve portfolio returns with justified risks.

Table 5. Lag length selection criteria

Criteria	Lag Length
LR	30
AIC	10
SC	0
HQ	1

Table 6. VAR results for return linkages

	ARG	BRA	CAN	MEX	USA	CHN	HKG	IDA	IDO	JAP	KOR	TWN	FRA	GER	ITA	BRI
ARG(-1)		0.0575**										0.0508**				
BRA(-1)											0.07063*					
CAN(-1)			-0.1114*		0.19423*											0.0749**
MEX(-1)			0.1378*	0.06**												0.050***
USA(-1)					-0.2058*											0.10859*
CHN(-1)									0.054**							
HKG(-1)							-0.09*						0.0577**			0.06471*
IDA(-1)			0.0480**					0.057***	0.0723*							
IDO(-1)									0.0991*	0.0687**						
JAP(-1)								0.074**	0.0932*							
KOR(-1)											-0.06***					
TWN(-4)												-0.07**				
FRA(-1)													-0.1260*			-0.054**
GER(-1)														-0.10078*		
ITA(-4)															0.0972*	
BRI(-1)					0.0612***		0.08**				-0.077***					-0.1570*

Note. *Significance at 1%, ** significance at 5% level, ***significance at 10% level.

4.2 Volatility Linkages among Equity Markets

In this section we present the results of volatility linkages among countries. We first generate volatility/conditional variance series of each market using univariate volatility model. We then analyze the volatility series using a VAR framework together with impulse response and variance decomposition. We test for the hypothesis that more risk implies more returns by including the GARCH-in mean component in each of the volatility models. The mean equation is estimated for each market and is then tested for ARCH effect to check whether volatility has been captured. Table 7 shows the DW statistics from the mean equations and ARCH LM F-statistics. Our findings indicate that there is no significant evidence of autocorrelation for the mean equations of each of the stock markets and all the markets show significant evidence of ARCH effect, implying that the mean equation does not adequately capture volatility. Once mean equations are determined, we determine the appropriate GARCH model and at the same time test for the hypothesis that high risk is associated with more returns. The univariate GARCH (1, 1), EGARCH (1, 1, 1) and GJR GARCH (1, 1, 1) models are estimated with a GARCH-M component to test the hypothesis that investors in a volatile market earn a premium. Our estimations are reported in Table 8. As observed, in case of Germany, we estimate the models with a residual component of order 2 i.e. GARCH (2, 1), EGARCH (2, 1, 1) and GJR GARCH (2, 1, 1) as the standard models could not adequately capture the volatility. The coefficient δ is the *Arch-in mean* coefficient and it measures the relationship between volatility and returns. For all the stock markets and in all models, this coefficient is statistically significant at 1% (except for China). This means that for all the stock markets, except for the China in some cases, there is significant risk premium in returns as expected. In GARCH (1, 1), EGARCH (1, 1, 1) and GJR GARCH (1, 1, 1) models, the coefficient ω represents the intercept, the coefficients $\alpha 1$ and β are the residual squared and variance squared coefficients, and $\alpha 2$ is the second residual squared coefficient. All three coefficients are significant at 1% for

all three models. For all stock markets, the summation of the residual squared coefficient ($\alpha 1$) and the variance squared coefficient, β are very high (i.e. close to 1 or over) which means that volatility is persistent i.e. does not fade fast. Leverage/asymmetric coefficient γ, that tests the asymmetry hypothesis for volatility in the stock markets turns out to be significantly negative at 1% This indicates that bad news leads to less volatility than positive news of the same magnitude i.e. volatility is asymmetric and there is evidence of leverage effects in all the sixteen stock markets. The result from EGARCH model also finds the coefficient positive and significant for all the stock markets. To identify the most appropriate model, our selection criterion is based on summation of the residual and GARCH coefficients. For any GARCH model to be stationary, we must observe that $\alpha 1 + \beta < 1$. To capture ARCH effect is also considered in our model selection. We observe that in case of EGARCH model, $\alpha 1 + \beta > 1$ for all the stock markets and hence we drop the EGARCH model. However for the GJR GARCH, $\alpha 1 + \beta$ is also bigger than 1. Since the results show that volatility is asymmetric and leverage effects are present in all the stock markets, the standard GARCH better captures volatility in all stock markets and we now use this model to generate our conditional variance/volatility series for each of the stock markets.

Table 7. Autocorrelation test for the mean equation

STOCK MARKET	DW STATISTIC	ARCHLM
Argentina	2.102156	239.0545*
Brazil	2.098276	62.48754*
Canada	2.067353	280.3364*
Mexico	2.060807	50.02819*
USA	2.124900	103.7865*
China	2.016317	36.1468*
Hong Kong	2.192510	309.9013*
India	2.048753	81.54596*
Indonesia	2.076445	83.79729*
Japan	2.177597	133.1380*
Korea	2.048784	52.18535*
Taiwan	2.046328	47.22141*
France	2.066836	68.59643*
Germany	2.091393	80.50881*
Italy	2.085377	102.5436*
England	2.123219	146.9659*

Note. * implies significance at 1 % Level, **significance at 5% level and ***significance at 10% level.

To formally investigate the long-term behavior of volatility, the conditional variance series are regressed on time. The results for the estimation are reported in Table 9 in below. Table 9 shows that volatility in five stock markets (Argentina, Korea, Taiwan, France and the Germany) is increasing although not significantly in case of France. On the other hand, it is decreasing over time for the rest of the equity markets. Overall, volatility in all the stock markets is relatively stable overtime that implies these world stock markets have been relatively stable since 1995. This could be attributed to the fact that investors are becoming more confident in investing in equity markets and are not very responsive to crisis. This explanation is also confirmed by the fact that most of the markets under study, except China and Japan, do not respond very much to the Asian and Latin American crises. The volatility series for the various markets are examined for correlation using the pair-wise correlation matrix in multivariate framework and results are reported in Table 10.

Table 8. GARCH models for volatility analys

GARCH(1,1)

Parameter	Argentina	Brazil	Canada	Mexico	USA	China	HK	India	Indonesia	Japan	Korea	Taiwan	France	Germany	Italy	England
δ	-3.9295*	-10.696*	-8.5793*	-12.539*	-7.4243*	-4.728**	-6.2482*	-8.5487*	-16.045*	-8.5059*	-10.379*	-8.4942*	-9.0345*	-8.7838*	-12.759*	-9.7182*
ω	9.12E-06*	9.32E-06*	1.14E-06*	3.42E-06*	1.01E-06*	5.28E-06*	1.62E-06*	6.02E-06*	1.44E-05*	2.93E-06*	3.31E-06*	1.76E-06*	1.75E-06*	2.24E-06*	1.31E-06*	1.32E-06*
α1	0.113397*	0.082363*	0.102406*	0.09996*	0.08719*	0.08527*	0.07529*	0.16987*	0.15802*	0.09522*	0.08919*	0.06664*	0.08952*	0.10306*	0.10926*	0.11568*
β	0.869610*	0.892646*	0.894345*	0.88597*	0.90809*	0.89837*	0.91913*	0.82198*	0.78215*	0.89505*	0.90355*	0.92805*	0.90444*	0.89034*	0.88585*	0.87949*
α2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
α1+α2+β	0.983007	0.975009	0.996751	0.985937	0.995278	0.983643	0.99442	0.991855	0.940175	0.990269	0.992743	0.994684	0.993963	0.993398	0.995104	0.995179
γ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F-LM	1.877582	2.99117	1.408842	0.672353	5.549868	1.711190	2.827905	1.342150	3.252742	2.379162	1.928281	3.465396	6.393991	8.007481	0.120303	5.713819
SIC	-5.03010	-5.1328	-6.36896	-5.82886	-6.20185	-5.47704	-5.73748	-5.56637	-5.68094	-5.64367	-5.43778	-5.61285	-5.84699	-5.74846	-6.24914	-6.25226
AIC	-5.07564	-5.1784	-6.41449	-5.87439	-6.24738	-5.52257	-5.78304	-5.61190	-5.72647	-5.68918	-5.48328	-5.65838	-5.89252	-5.79399	-6.29467	-6.29779

GJR GARCH

Parameter	Argentina	Brazil	Canada	Mexico	USA	China	HK	India	Indonesia	Japan	Korea	Taiwan	France	Germany	Italy	England
δ	-2.5297**	-7.0096*	-5.2567*	-7.5375*	-3.6368*	-3.833**	-4.268**	-6.1477*	-13.387*	-5.4948*	-6.8106*	-5.5737*	-4.8463*	-5.4227*	-6.2398*	-5.3638*
ω	7.77E-06*	6.12E-06*	4.16E-07*	2.17E-06*	4.25E-07*	6.62E-06*	1.41E-06*	4.69E-06*	1.08E-05*	1.30E-06*	1.7E-6*	9.26E-07*	6.15E-07*	1.15E-06*	2.8E-7*	8.82E-07*
α1	0.17677*	0.156678*	0.148015*	0.15431*	0.13627*	0.16799*	0.11543*	0.24944*	0.22442*	0.15075*	0.1603*	0.11554*	0.13992*	0.17904*	0.1567*	0.18234*
β	0.87582*	0.91023*	0.92762*	0.91679*	0.94553*	0.87752*	0.92905*	0.84598*	0.81795*	0.91914*	0.9246*	0.94623*	0.94474*	0.92262*	0.9355*	0.91906*
α2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
α1+α2+β	1.052599	1.066915	1.075638	1.071106	1.081807	1.04551	1.044489	1.09543	1.042373	1.0699	1.08486	1.061781	1.084668	1.101671	1.09213	1.101415
γ	-0.12193*	-0.14926*	-0.13*	-0.1451*	-0.1514*	-0.1223*	-0.0943*	-0.1799*	-0.1563*	-0.1318*	-0.1533*	-0.1160*	-0.1572*	-0.1859*	-0.1575*	-0.1907*
F-LM	1.703888	2.402017	0.989394	0.314166	4.804885	1.618336	2.436685	1.071762	2.795527	2.025306	1.64211	2.832440	4.201942	7.000572	3.93634	4.618173
SIC	-5.040464	-5.15211	-6.38836	-5.85319	-6.23496	-5.4838	-5.74988	-5.58006	-5.69066	-5.65895	-5.46574	-5.63836	-5.88003	-5.78427	-6.29480	-6.28640
AIC	-5.088393	-5.20004	-6.43626	-5.90109	-6.28289	-5.53178	-5.79788	-5.62797	-5.73859	-5.70688	-5.51367	-5.68629	-5.92796	-5.83217	-6.34272	-6.33433

EGARCH

Parameter	Argentina	Brazil	Canada	Mexico	USA	China	HK	India	Indonesia	Japan	Korea	Taiwan	France	Germany	Italy	England
δ	-2.6263**	-11.041*	-9.1452*	-12.235*	-7.0764*	-2.92244	-5.9733*	-7.3966*	-14.1738*	-9.4034*	-8.9875*	-6.164*	-8.0329*	-8.1339*	-9.0519*	-9.6499*
ω	-0.3550*	-0.42075*	-0.25694*	-0.38241*	-0.21329*	-0.43129*	-0.22736*	-0.45071*	-0.84680*	-0.31642*	-0.34845*	-0.20003*	-0.22602*	-0.26219*	-0.22443*	-0.30887*
α1	0.22876*	0.17183*	0.17211*	0.18903*	0.1103*	0.20417*	0.14136*	0.27430*	0.30704*	0.16830*	0.1866*	0.13008*	0.11539*	0.12739*	0.15227*	0.14799*
β	0.97702*	0.96451*	0.98641*	0.97275*	0.98585*	0.96625*	0.9862*	0.97158*	0.92848*	0.97831*	0.97530*	0.98806*	0.98429*	0.98127*	0.98804*	0.97884*
α2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
α1+α2+β	1.205781	1.136324	1.158512	1.161771	1.096153	1.170414	1.127598	1.245887	1.235529	1.146612	1.161908	1.11815	1.09969	1.108668	1.140322	1.126841
γ	0.07669*	0.10568*	0.08776*	0.09449*	0.13606*	0.07507*	0.07150*	0.07457*	0.06886*	0.08542*	0.11006*	0.07667*	0.13642*	0.14395*	0.10864*	0.14832*
F-LM	0.933211	5.206292	3.286540	3.192479	7.829020	2.099898	4.930390	3.560254	7.154167	4.769311	4.614421	4.094531	7.542368	9.769449	3.145299	8.842191
SIC	-5.046320	-5.16251	-6.39015	-5.85722	-6.24752	-5.49107	-5.75329	-5.58777	-5.69941	-5.66838	-5.47446	-5.63153	-5.89081	-5.80334	-6.30266	-6.29306
AIC	-5.096645	-5.21283	-6.44048	-5.90754	-6.29784	-5.54140	-5.80361	-5.63809	-5.749745	-5.71871	-5.52479	-5.68186	-5.94119	-5.85366	-6.35298	-6.34339

Table 9. Volatility over time for all markets

Stock market	B1	P-value	B2	P-value
ARG	0.012506	0.0000	2.47E-06	0.0000
BRA	0.014890	0.0000	-1.91E-07	0.6282
CAN	0.010905	0.0000	-2.15E-06	0.0000
MEX	0.011621	0.0000	-1.04E-06	0.0005
USA	0.010200	0.0000	-7.80E-07	0.0098
CHN	0.016699	0.0000	-4.30E-06	0.0000
HKG	0.014566	0.0000	-2.75E-06	0.0000
IDA	0.014905	0.0000	-2.29E-06	0.0000
IDO	0.012035	0.0000	-1.00E-06	0.0016
JAP	0.012457	0.0000	-7.13E-07	0.0336
SKR	0.009649	0.0000	2.40E-06	0.0000
TWN	0.009070	0.0000	2.05E-06	0.0000
FRA	0.010405	0.0000	4.29E-07	0.1955
GER	0.009392	0.0000	1.87E-06	0.0000
ITA	0.009521	0.0000	-5.79E-07	0.0418
ENG	0.009881	0.0000	-6.25E-07	0.0288

Table 10. Correlation matrix on volatility

	VOLARG	VOLBRA	VOLCAN	VOLMEX	VOLUSA	VOLCHN	VOLKHG	VOLIDA	VOLIDO	VOLJAP	VOLKOR	VOLTWN	VOLFRA	VOLGER	VOLITA	VOLBRI
VOLARG																
VOLBRA	0.1753															
VOLCAN	0.1191	0.1819														
VOLMEX	0.1260	0.1771	0.2189													
VOLUSA	0.1716	0.1793	0.3341	0.1988												
VOLCHN	0.0151	0.0972	0.1416	0.0707	0.0955											
VOLHKG	0.1247	0.2233	0.2842	0.1981	0.3074	0.1292										
VOLIDA	0.0986	0.1257	0.1640	0.1565	0.1051	0.1260	0.1720									
VOLIDO	0.0842	0.1352	0.1250	0.0876	0.1539	0.0860	0.1409	0.1522								
VOLJAP	0.1904	0.2016	0.1615	0.1623	0.2226	0.0663	0.1643	0.2034	0.1928							
VOLKOR	0.0940	0.1428	0.1688	0.1370	0.2037	0.0154	0.1735	0.1022	0.0913	0.1120						
VOLTWN	0.1547	0.1501	0.1300	0.1509	0.1514	0.0112	0.1211	0.1207	0.0742	0.1181	0.1571					
VOLFRA	0.1202	0.1500	0.2408	0.1229	0.3346	0.0487	0.1844	0.0611	0.1189	0.1538	0.1207	0.1549				
VOLGER	0.1145	0.1341	0.2056	0.1074	0.2558	0.0285	0.1454	0.0592	0.0683	0.1683	0.1590	0.1365	0.4554			
VOLITA	0.0003	0.0104	0.0109	-0.0142	0.0571	-0.0355	0.0159	-0.0122	0.0110	0.0190	0.0270	0.0526	0.0473	0.0763		
VOLBRI	0.1328	0.1723	0.2601	0.2008	0.3301	0.0973	0.2814	0.0924	0.1070	0.1422	0.2337	0.1259	0.2787	0.2471	0.0371	

It is evident that, as in the case of returns, volatility for the stock markets is positively correlated. However, correlation in volatility seems to be more than that of returns. The US equity market volatility is highly correlated with the Canada, Hong Kong, Germany and Britain. Generally, volatility in the US is highly correlated with other markets, implying possibly that the US dominates volatility influence. This implies that potential gains from portfolio diversification are limited among these countries that are highly correlated. Additionally, it raises questions regarding the transmission of harmful contagion effects across the markets.

5. Conclusion

Return and volatility linkages among seven developed and nine prominent emerging stock markets are examined in this research taking twelve years of daily data. The results in descriptive statistics are in line with the properties of financial data, notably non-normality, excess kurtosis and excess volatility (ARCH effect). We also find positive, although low, pair wise correlation between the stock markets. Return linkages among the stock markets are examined using VAR. Our results indicate that world markets show significant returns linkages with the US followed by China. Next, volatility linkages are also analyzed. We find evidence of leverage effects and asymmetry in volatility in all markets, with an exception for the China. The evidence of risk premium in all stock markets is evident. Finally, we examine the volatility transmission among equity markets, and significant volatility interactions are observed. From our results, we also observe that stock markets in the same continent have the most

influence in that area, except for UK market, which has links to the US stock market. An interesting extension of this research would be to experiment portfolio analysis based on the correlations among developed and emerging markets to see which combination provides positive alpha and better diversification. It would also be an interesting future research if we can find optimal portfolio allocation among these countries and compare the performance with large and small cap assets mixes of own country. This result should further validate that whether international diversification is superior to domestic investments only.

In terms of policy implications, given the volatility result, portfolio diversification between high/low volatile stocks should become an essential focus for most investors, particularly for emerging equity markets. This is quite crucial where volatilities of stocks returns are driven by changes in stocks' trading trend and volume that normally follow the flow of the new information and how such information are reflected and incorporated towards stock prices. Further, investors should consider other factors that affect their investment decision together with the risk (volatility) factor. Of such factors are the skewness and kurtosis of the stock's returns, stock's book to market value, the applied dividend's policy, dividend yields, interest rates, firm's earning and firm's size. For policy makers, markets with high volatility of stock returns may cause financial unsteadiness where capital normally seeks for more secure investment destinations. This is particularly true given the intra-integration between financial markets worldwide where less barriers to entry exist.

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Credit Access in the Northern Mountainous Region of Vietnam: Do Ethnic Minorities Matter?

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Abstract

By using the Bayesian Approach to address the problem of model uncertainty and a binary logit regression, this paper examines the credit accessibility of ethnic minority households compared to Kinh households in one of the poorest regions of Vietnam–the Northern Mountainous Region. Analyses show that minorities have more disadvantages compared to the Kinh majority in terms of household endowments. Ethnic minorities are still much more limited to accessing overall rural credit, commercial credit and informal credit compared to the Kinh majority population. Although ethnic minorities are more likely to access preferential credit, they receive a smaller amount of loans in comparison to the Kinh households irrespective of loan sources. This study builds on previous research that shows that the lack of access to affordable credit can make it very difficult for the ethnic minorities to expand agricultural production and their household's livelihoods. Unless constraints with credit access are addressed, ethnic minorities might not benefit from the sustainable development of the country. Therefore, an improvement in access to credit and other resources needs more concern by national poverty reduction policies targeting ethnic minorities.

Keywords: Bayesian Model Average (BMA), credit access, ethnic minorities, northern mountainous region of Vietnam, rural households

1. Introduction

Sustainable growth of the country cannot be achieved without investing in all people across countries, regions and national communities (World Bank, 2009). The cultural communities of Vietnam are diverse, officially comprising 54 ethnic groups. In 2011, Vietnam's population was around 87.84 million people of which ethnic minorities accounted for about 14.5 percent (GSO, 2011). The rest of 85.5 percent were Kinh majority populations. 75% of Vietnam's minorities live in two regions including the Northern Mountains and the Central Highlands and most of these minorities remain as rural residents. More than half the districts in the Northern Mountains have 10 ethnic minority groups or more represented (World Bank, 2009). Vietnam has achieved significant success in poverty reduction. Poverty headcount rate (Note 1) has reduced from nearly 60% of the population in 1993 to 11.7 % in 2011 (Baulch, 2010). Despite the overall impressive achievements, ethnic minorities have experienced lower rates of poverty reduction than the general population (See Figure 1). Ethnic minorities accounted for only 14.5 % of the total population, but they make up 50% of the poor.

In Vietnam, the poverty rate is substantially higher in the Northern Mountains and Central Highlands. In contrast, better-off households are concentrated in the Red River Delta and the Southwest Region (World Bank, 2012). Although the higher overall rate of poverty is present in the Northern Mountains, Swinkels and Turk (2006) revealed that geography alone does not explain why ethnic minorities are poorer than the Kinh. In fact, Kinh populations who also live in impoverished regions are not poorer than they are elsewhere. In addition, Kinh people in the same region have achieved higher rates of poverty reduction in comparison to their ethnic minority neighbors. One of the explanatory reasons could be attributed to their different access to financial resources.

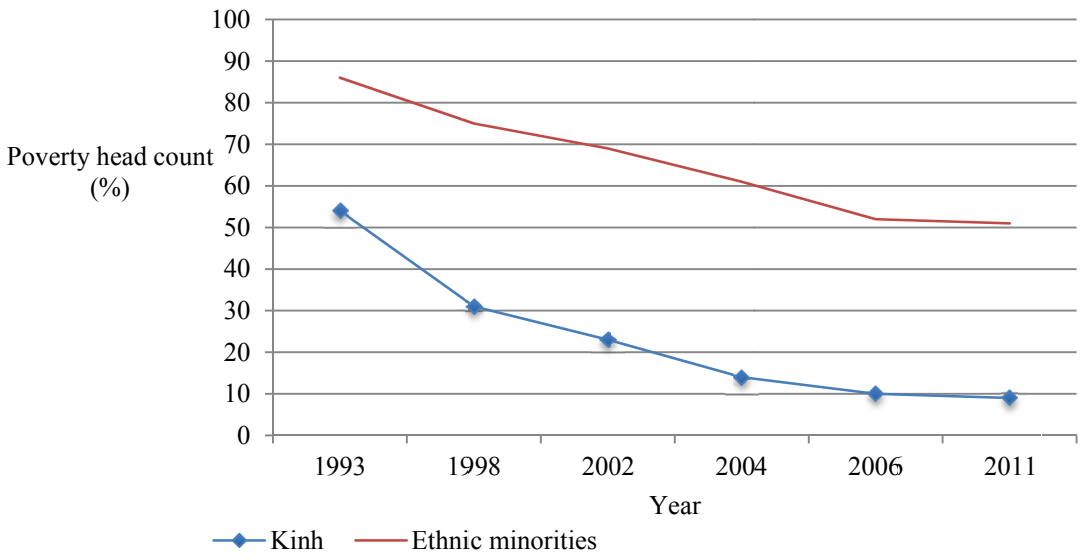

Figure 1. Poverty headcount (%) for the Kinh majority versus ethnic minorities in Vietnam

Source: World Bank (2012).

It is believed that credit is a crucial tool to help the poor access loans, which are very important for agriculture production in disadvantaged rural areas where savings are difficult to accumulate (Guirkinger, 2008). Especially, for poor households, having sources of reliable, convenient and reasonably-priced financial tools would improve their situation (Collins et al., 2009). Hence, access to credit and other financial services has long been acknowledged as an important part of poverty reduction policies. This study aims to provide an analysis of how different household endowments explain different credit accessibility between ethnic minorities and the Kinh majority in the Northern Mountains of Vietnam. Obviously, the understanding of underlying causes is useful to improve credit access by ethnic minorities in the region.

2. Methods and Materials

2.1 Data Source and Research Area

Data used in this study is taken from the Vietnam Access Resources Household Survey (VBRHS) carried out in 2012. The total 3700 surveyed households are from 437 communes, 130 districts in 12 provinces of the country. The survey was conducted by the Institute for Policy and Strategy for rural development (ISPARD), the Central Institute for Economic Management (CIEM), the Institute for Labour Science and Social Affairs (ILSSA) under the technical support from Department of Economics at the University of Copenhagen. The financial support for the survey is from the Organization of the Danish International Development Assistance (DANIDA). Based on the objectives, this study only uses the data of 1338 households extracted from four provinces namely Lai Cai, Phu Tho, Lai Chau and Dien Bien. All those provinces are located in the Northern Mountainous Region of Vietnam.

2.2 Methodology

2.2.1 Bayesian Model Average (BMA) Analysis

George Box, a great statistician, said "All models are wrong, but some are useful". However, the selection of useful models is a particular challenge for academic researchers, especially those who specialize in the field of rural credit. This is also the most important statistical problem today in regression models (Breiman, 2001). Conventional econometric approaches such as stepwise (forward selection and backward elimination) tend to ignore the uncertainty in model selection. This might lead to unreliability in the magnitude of coefficients, standard errors and misleading interpretation of results. This paper is based on the approach of Bayesian Model Average (BMA) which is appropriate to deal with the uncertainty of model selection and make the inferences less risky than previous approaches (Hoeting et al., 1999; Raftery, 1995).

BMA is a technique of multivariate variable selection. Assume that we have a potential number of models (m) for the data D which is specified by each unknown vector of parameter $\theta = (\theta_1, \theta_2, \ldots, \theta_m)$. A prior probability

density p(θ) represents the uncertainty about θ. The probability of observing the data D given true parameter θ is defined by the likelihood p(D|θ). This is also the probability that model is specified.

BMA needs prior information to impose weights for each model. Mathematically, the probability of obtaining θ_m given model m is specified as pr(θ_m|M_m), m=1, …, M). In case of absenting priori information, models have same weights. Suppose that we are interested in comparing two models M_m and M_l with two parameters θ_m and θ_l respectively. Based on Bayes' theorem, the posterior probability that M1 is the correct model is:

$$Pr(M_m\,|D) \propto Pr(M_m) * \Pr(D|M_m) \tag{1}$$

Then the ratio of their posterior probabilities measured by the posterior odds presents the extent to which the data support M_m over M_l. Mathematically, the ratio can be presented:

$$\frac{Pr(M_m\,|D)}{Pr(M_l\,|D)} = \frac{\Pr(M_m)}{\Pr(M_l)} \cdot \frac{\Pr(D|M_m)}{\Pr(D|M_l)} \tag{2}$$

The equation can be also written as:

$$Posterior\ odds\ =\ Bayes\ factor\ \times\ Prior\ odds \tag{3}$$

Of which: Prior odds: is often equal to 1 illustrating the absence of a prior preference for either M_m or M_l. Bayes factor is the ratio of the integrated likelihoods for M_m against M_l.

The Bayes factor represented by the BIC approximation (Bayesian Information Criterion) will be used as criteria for selecting appropriate models. BMA selects a set of variables such that BIC value is lowest.

For linear regression with normal errors, BIC can be written as:

$$\text{BIC} = n\log(RSS_p) + p\log n \tag{4}$$

Where RSS_p is residual sum squared, p is the number of independent variables excluding the intercept and n is number of observations.

The approach of Bayesian Model Average is also applied for the logistic regression or probit model. The key idea of Bayesian analysis in such models is the use of Gibbs sampling to simulate data of latent variables. Then those latent variables are introduced into the problem to obtain better parameters (Albert & Chib, 1993). The purpose of Gibbs sampling is to compute posterior distribution of parameters and the approximate the value of latent variable. In the maximum likelihood estimation and Bayesian methods, the logit and probit models give very similar results (Tektas & Gunay, 2008). The most important advantage of using BMA is that the choice of explanatory variables is more appropriate and estimated parameters are more accurate compared to conventional approaches. And this is particularly important for interpreting and generalizing results.

2.2.2 A binary Logit Regression

After selecting appropriate variables, a binary logit regression is used to analyze the credit accessibility by rural households. The dependent (binary) variable receives a value of one for all households with access to credit and a value of zero otherwise. A mixture of continuous and categorical variables reflecting the socio-economic conditions of households may explain this dependent binary variable. In the binary logit regression model, the predicted probabilities for the dependent variable will never be less than (or equal to) zero, or greater than (or equal to) one, regardless of the values of the independent variables. The linear logistic model has the form as follows:

$$logit\ (P) \equiv \log\left(\frac{P}{1-P}\right) = \alpha + \beta X \tag{5}$$

For binary response models, the response, Y, of a household can take on one of two possible values, denoted for convenience by 0 and 1.

X is a vector of explanatory variables which captures the household characteristics. X includes both control variables and the variable of the most interest.

P = Pr(Y = 1/ X) is the probability of accessing credit given X.

α is the intercept parameter and β is the vector of slope parameters.

Because Y is binary dependent variable, so the application of the Ordinary Least Square (OLS) method leads to some problems. Specifically, the errors are heteroscedastic and are a function of the parameter vector β; the predicted values can take values outside the interval of between 0 and 1 (Tektas & Gunay, 2008). Therefore, using Maximum Likelihood Estimation (MLE) for the logit model is more appropriate in this case (Bun, 2002).

In this study, analyses are conducted for four models including the overall rural credit, preferential credit of

VBSP, commercial credit of VBARD and the informal credit model. In the first one, all overall credit-users and credit non-users are put into analysis. In the other models, only households with access to a particular source of credit are added into analysis. The separations of those models separations allow us to examine determinants of accessing to different credit sources.

2.2.3 The Choice of Explanatory Variables

The selection of explanatory variables is based on the theories, data availability and potential significance for policy interventions. Those variables are important to explain credit accessibility by households and to evaluate the creditworthiness of households by lenders.

Theoretically, there could be many variables influencing credit accessibility of rural households. Suppose that credit access is a function of possible explanatory variables.

Credit access = f(ethnic minorities, risk, social capital, age, education, family size, nonfarm income, extension, membership of local associations, distance to market, asset, land fragmentation).

In order to reliably infer the causal relationship between the ethnicity and credit access, other independent variables (control variables) are also included in the credit access model. The description and hypotheses of how each variable influences credit access are reported in Table 1.

Table 1. Description and assumptions of selected explanatory variables

Variables	Type	Description	Expected sign
Help	Continuous	The number of people known who could be asked for help (persons)	+
Relation	Binary	Households have members, relatives or friends holding office or other trusted position in the communes (1=Yes)	+
Risk	Binary	Household suffered risks over the previous 12 months (1= Yes)	-
Risk losses	Continuous	Economic losses caused by agricultural and health risks (VND 1000)	-
Age	Continuous	General education of household heads (years in school)	+/-
Family size	Continuous	Total members of the household (persons)	+/-
Nonfarm	Continuous	Share of non-farm income in total household income (%)	
Extension	Binary	Households have access to extension services (1=Yes)	+
Visits	Continuous	Number of household visits to agricultural extension in the last 12 months and vice versa (number)	+
Savings	Continuous	Total value of savings (VND 1000)	-
Union	Binary	Membership of women's unions (1=Yes)	+
Asset	Continuous	Total value of household asset (VND 1000)	+
Plot	Continuous	The number of land plots household own (number)	+/-

Source: Based on prior expectations.

A brief description and assumptions of control variables and variables of interest are presented as follow:

2.2.3.1 The Variables of the Most Interest

Ethnicity is the variable of the most interest. This binary variable captures the difference between the ethnic minorities and the Kinh ethnic majority. It receives a value of one for ethnic minority households and is zero otherwise. Ethnic minorities include Tay, Nung, Dao, H'Mong and some other ethnic minority groups.

2.2.3.2 Control Variables

Social: In this study, two variables are used as proxies for social capital of households. The first continuous one (Help) indicates the number of people known who could be asked for help. Burt (2000) indicated that social capital refers to friends, colleagues, and more general contacts through which households receive opportunities to use other forms of capital. The theory of social capital can be applicable to the rural credit market. Dufhues et al. (2011) also argued that social capital of households also explains their credit repayment performance and therefore relates to creditworthiness of households. The second one, Relation, which is a binary variable

receiving a value of 1 for cases in which households have members, relatives or friends holding office or other trusted positions in the communes. It is expected that households with better relationships to local authorities might have better access to credit (Behr et al., 2011).

Risk: This binary variable receives a value of one for households, which suffer from unexpected risks, and otherwise zero.

Risk losses: It is assumed that economic losses caused by agricultural and health risks can push rural households into further poverty or indebtedness. Farm households, especially the poor ones are the most vulnerable in Vietnam (GSO, 2012b). Therefore, access to financial services such as credit and insurance is very important for farmers because of two such services might help farmers to cope with risks and improve their agricultural production efficiency (Skees & Barnett, 2006).

Age: Age of the household head might represent the social reputation and attitude to debt. Moreover, age is likely to correlate with income or consumption over time. Income generated by household heads and their family increases to a peak as their career develops then declines when they get older (Zeller & Sharma, 2002).

Education (years in school): A household head with a higher level of education is believed to be a better manager regarding farm household decisions, performing better risk management and higher income generation. This variable also reveals the social reputation in rural society because societies highly appreciate people who have a higher educational level. Moreover, education level also represents the potential to work in off-farm activities. From the point of view of lenders, they are likely to believe that more educated households are more creditworthy than less educated ones (Khalid, 2003; Okurut, 2006).

Family size: This variable can represent the labor potential of the farm household as well as the dependency ratio. On the one hand, a larger household size might indicate a greater number of laborers, which is a potential for the household's future income and repayment ability. On the other hand, a larger household size might increase the dependency ratio (measured by taking the number of people outside the working age range divided by the number of people aged within the range (16-60 years). Consequently, households with a higher number of dependents are considered to be less able to improve their living standard and hence, less creditworthy (Bao, Duong, & Izumida, 2002).

Nonfarm: The share of non-farm activities in total yearly income refers to that portion of farm household income obtained off the farm, including nonfarm wages and salaries, pensions, and interest income earned by farm families. Stampini and Davis (2009) concluded that households engaging in off-farm labor activities spend significantly more on seeds, services, hired labor and livestock inputs. Encouraging access to off-farm activities may serve as a substitute for access to credit.

Extension: This variable reflects the access and the numbers of household visits to the agricultural extension stations in the last 12 months and vice versa. Agricultural extension services are assumed to help farmers manage and use resources more effectively. At the same time, maintaining relationships with agricultural extension stations might improve the household's social capital to improve access to other services such as credit (Mahajan & Vasumathi, 2010).

Savings: This variable reflects the total value of savings, which might represent collateral security and household ownership as physical capital. In addition, it is a good indicator of the repayment capability of a household. Savings are essential for the extremely poor who strongly rely on their own savings and depend on informal credit to prevent food shortages and starvation (Wright et al., 1997).

Union: Membership of women's unions might improve household social networks. Women's participation in credit programs is helpful into improving women's empowerment, women's mobility and their social interactions at the community level (Pitt et al., 2006). Hence, these households may better access credit programs.

Distance: The distance of the household to the commune center is used to capture the transaction costs to obtain credits as well as the market access conditions of households. It is expected that a greater distance increases transaction costs in accessing credit and the market. In return, higher transaction costs are expected to have a negative impact on loan repayment. (Khoi et al., 2013) and Stanton (2002) argued that infrastructure has a link to transaction costs of obtaining loans. In this aspect, better infrastructure could enhance profitable business activities that cover loan costs.

Asset: This variable reveals the total value of household assets, which might represent the relative wealth level of households. Access to credit is determined by relative wealth status of households rather than collateral ownership (Takahashi et al., 2010).

Plot: This variable indicates the number of land plots households own. It is assumed that land fragmentation might discourage the use of other necessary inputs such as fertilizer, pesticides, agricultural extension, irrigation services, and so on. Zeller and Sharma (2002) showed that household demand for credit depends on availability of agricultural production inputs rather than farm size.

3. Results

3.1 Credit Sources Categorized by Ethnicity Groups

In the Northern Mountainous Region of Vietnam, rural households borrow from two main credit sources namely from the formal and informal sectors. The formal sector is composed of the two state-owned banks including Vietnam Bank for Social Policy (VBSP), Vietnam Bank for Agriculture and Rural Development (VBARD) and People's Credit Funds (PCFs). The informal credit sector comprises all lenders such as private lenders (shopkeepers, moneylenders, or any lender without a family relationship or friendship with the borrower) and household friends and relatives. Table 2 presents the distribution of selected households in terms of credit access and ethnic groups.

Table 2**.** Distribution of households in terms of credit sources and ethnicity

Credit sources	Kinh		Ethnic minorities		All sample	
	Frequency	%	Frequency	%	Frequency	%
Non-accessed	260	65.16	638	67.94	898	67.12
Accessed	139	34.84	301	32.06	440	32.88
Only Vietnam Bank for Social Policy (VBSP)	37	9.27	207	22.04	244	18.24
Only Vietnam Bank for Agriculture and Rural Development (VBARD)	40	10.03	27	2.88	67	5.01
Only People's Credit Funds (PCF)	3	0.75	2	0.21	5	0.37
Only UNION	9	2.26	7	0.75	16	1.20
Only informal	42	10.53	50	5.32	92	6.88
VBSP & informal	7	1.75	5	0.53	12	0.90
VBARD & VBSP	0	0.00	3	0.32	3	0.22
VBARD & PCF	1	0.25	0	0.00	1	0.07
Total	399	100	939	100	1338	100

Note. UNION represents Farmer's/Veteran's/Women's Union.

Source: own calculation.

The Vietnam Bank for Agriculture and Rural Development (VBARD), the biggest state owned commercial bank, was established in 1990. It has provided commercial credit for agricultural and rural areas, which account for more than 50% of its total outstanding loan volume (GSO, 2012a). The major form of government intervention in rural credit markets in Vietnam is the extension preferential loans of Vietnam Bank for Social Policy (VBSP) to low-income agricultural households. Preferential credit can be received via the bank. Borrowers pay only part of the commercial interest rate, whereas the remainder is paid by the government. There is hence, a subsidy of the interest rate. Since 2003, preferential credit has been handed out by the Vietnam Bank for Social Policy. The bank has provided 11 programs of lending to low income households. These credit programs comprise loans for the poor households, extremely disadvantaged ethnic minority households, programs for business and production households living in extremely disadvantaged areas and communes, etc. In the country, after the collapse of rural credit cooperatives in the late 1980s, a network of People's Credit Funds (PCFs) was established. The key objective of PCFs is to build the confidence of rural people in the formal credit system, to reform and strengthen the country's rural banking system. PCFs are commune-based entities, jointly owned, operated and managed by their members to provide savings and credit services. PCFs are operating based on the economic principle of cost covering. However, PCFs have been established in regions with better socio-economic development. The targeted customers of PCFs are farms, small and medium enterprises rather than poor farm households. Therefore, the network plays a limited role in proving credit to the rural poor and poverty reduction (Putzeys, 2002).

Although rural credit has been increased in recent years, there is still a large proportion (nearly 70%) of households without credit access. A majority of rural households have access to formal credit sources, while a

minority of them has access to informal credit. This situation reflects the dominant role of formal credit in providing credit to rural households in the region. Moreover, households with access to preferential credit by VBSP occupy the largest proportion, followed by informal credit and VBARD. Households with access to credit of the People's Credit Fund merely represent more than 1% of total households. So, the formal credit market is mainly provided by the two lenders consisting of VBSP and VBARD.

Regarding the ethnicity aspect, the Kinh appear to obtain credit from the Bank for Agriculture and Rural Development (VBARD) and informal credit while minorities tend to take mostly subsidized loans from the Vietnam Bank for Social Policy (See Figure 2). Several policies, which intend to reduce poverty among ethnic minorities have been implemented in recent years namely the Government Decree No.78/2002/ND-CP and Decision 32/2007/QD-TTg. Due to the expansion of preferential lending policies, minorities appear to have better access to this source.

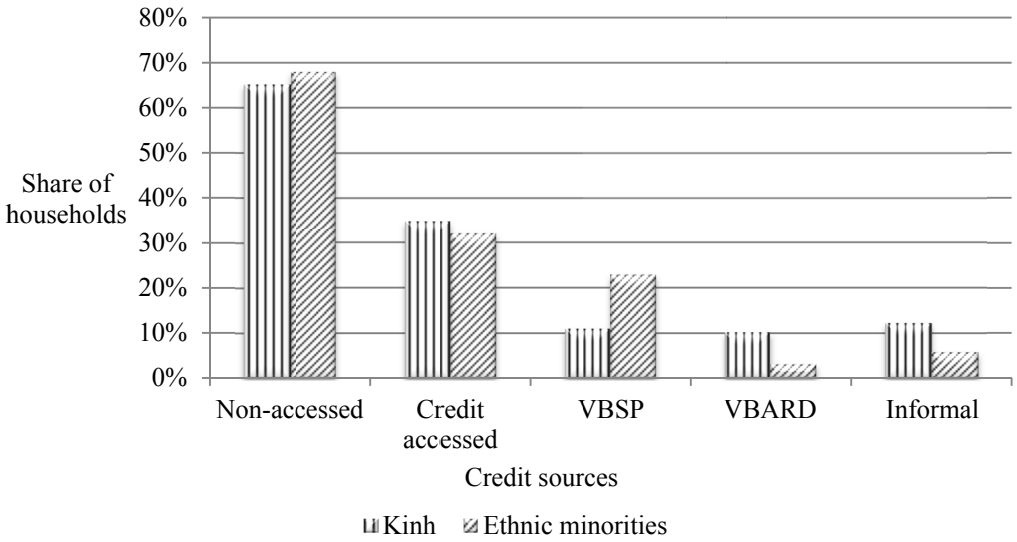

Figure 2. Sources of loans by ethnic groups

Source: own graph.

3.2 Endowment Differences between Two Ethnicity Groups

3.2.1 Difference in Household Income

Figure 3 illustrated by the box plot presents the means and standard deviations of total household income between ethnic minorities and Kinh majority. The average income of the Kinh is much higher when compared to ethnic minorities and the difference is statistically significant at 1% level (Note 2). The explanatory factors for this situation might include variations in the quality and quantity of household resources allocated for economic activities. It might also be due to unequal access to financial assets such as credit.

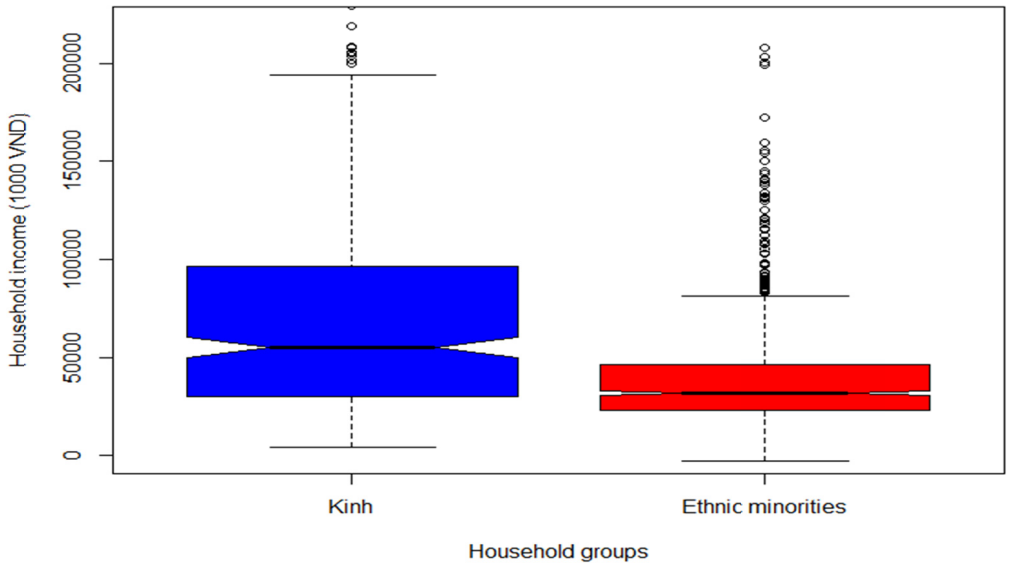

Figure 3. Income difference between Kinh and ethnic minorities

Source: own graph.

3.2.2 Difference in Other Household Endowments

The differences in household endowments between the two household groups can explain the disadvantages of ethnic minorities compared to the Kinh people. Table 3 presents the t-statistics and Pearson Chi squared tests (Note 3) for the differences in means of selected variables between two ethnic groups subcategorized by credit access. Accordingly, minorities have more disadvantages compared to the Kinh majority on most of indicators. Specifically, the Kinh people tend to have a higher value of assets and savings compared to minorities. Land, which tends to be much more fragmented in the case of minorities, might discourage ethnic minorities from agricultural investment and productivity improvement. One constraint in socio-economic transactions of ethnic minorities is that they live further away from the market center. Higher transaction costs could be a disadvantage to access information, adopt new ideas and expand social networks. Extension is important for minorities in rice terrace cultivation which is different from the cultivation of the rice fields in the lowlands. The table further shows that there is no difference in share of households with access to extension services, but the number of visits to extension services is significantly higher in the case of the Kinh majority. In addition, minorities tend to have a larger family size, creating the likelihood of having more family dependents. The share of risk affected households and the amount of risk losses are significantly higher in the case of ethnic minorities who are much more vulnerable to risks. Cultural constraints could be a reason for lower participation of ethnic minority females in local women's unions. This might limit women's benefits from accessing social networks in minority communities.

Table 3. Differences in means of selected variables

Variables	No credit		Credit access		All sample	
	Kinh majority	Ethnic minorities	Kinh majority	Ethnic minorities	Kinh majority	Ethnic minorities
Help	3.85***	2.97	4.19	3.67	3.97***	3.19
Relation	.28	.26	.41**	.29	.32**	.27
Risk	.47***	.77	.68***	.82	.54***	.78
Loss	2317***	4777	4185	5021	2968***	4855
Age	54.02***	46.50	49.78***	43.83	52.54***	45.64
Education	8.49***	9.25	9.16	8.68	8.72*	9.07
Family size	3.45***	5.50	3.87***	5.51	3.60***	5.50

Nonfarm	.13***	.03	.17***	.05	.14***	.03
Extension	.49	.50	.57	.58	.52	.53
Visits	1.80***	1.10	1.63	1.51	1.74***	1.23
Savings	27789***	5111	7894*	4135	20858***	4798
Union	.11***	.03	.11***	.03	.11***	.03
Asset	19574***	11522	26719***	11631	22063***	11557
Plot	8.39***	11.64	9.32***	11.85	8.71***	11.71
Distance	1.47***	4.96	1.69***	4.25	1.55***	4.73

Note. Absolute value of standard deviation in parentheses; ** significant at 5%; *** significant at 1%.

Source: own calculation.

3.3 Ethnic Minorities and Credit Accessibility

Table 4 presents the explanatory variables selected by the approach of Bayesian Model Average (BMA), and the Probit regression. LR chi-square statistics are equal to 73.33, 59.29, 56.02 and 27.46 for pooled, VBSP, VBARD and informal credit model respectively. These results lead to reject the null hypotheses that all parameters in three models are equal to zero. In other words, all models are appropriate at the confidence level of 99%. The Probit models predicted 68.16, 80.64, 94.62 and 92.45 % of all households correctly. These results indicate that the goodness of fit is satisfied.

As expected, control variables also influence credit access by rural households. Those variables are important because they not only explain the determinants of credit access but serves for adjusting the coefficient of Ethnicity variable- the variable of the most interest. The social capital related variable reflected by the number of helpers is positively associated with credit accessibility by households. This result agrees with the finding of Story and Carpiano (2015), which indicated that a better connection with helpers facilitates household social capital and credit access.

The coefficient of Nonfarm is positive and significant for the overall credit and formal commercial credit model. Households with a higher proportion of off-farm income might need better skills to run other business activities. In addition, these households might have laborers, who work for governmental organizations or companies, which require higher levels of qualification. Non-farm income is also useful for households to smooth consumption in the case of crop losses or other unexpected risks. As expected, households with a higher share of non-farm income have better access to credit, especially non-preferential credit sources. This finding favors the statement of Simtowe et al. (2006), which showed that households with a higher share of nonfarm income are more likely to access technologies, be less vulnerable to risks and achieve creditworthiness.

Table 4**.** Logistic estimation of credit accessibility

Explanatory variables	Overall credit	VBSP	VBARD	Informal
Intercept	-.36	-1.61***	-2.73***	-2.63***
Control variables				
Help	.04***	.05***		.04**
Risk	.60***	.53***		.76***
Age	-.02***	-.02***		
Nonfarm	.83**		1.93***	
Extension	.09***		.17***	
Savings	-.0000161***	-.000012**	-.0000103*	
Variable of interest				
Ethnicity	-.37**	.58***	-1.00***	-.97***
Number of observations	1338	1338	1338	1338
LR chi2(7)	73.33	59.29	56.02	27.46
Prob > chi2	0.0000	0.0000	0.0000	0.0000
Correctly classified (%)	68.16	80.64	94.62	92.45

Note. ** Significant at 5%; *** significant at 1%.

Source: own calculation.

Households with access to agricultural extension services are likely to access credit. This conclusion is confirmed by the overall and formal commercial credit models. Agricultural extension services are expected to not only improve knowledge, agricultural production skills but also provide households with necessary information about credit sources and credit institutions. In addition, those households are more likely to also be members of local mass organizations such as farmer's unions, which often play an intermediate role in loan disbursement. This argument agrees with the findings of Buadi et al. (2013) and Okten and Osili (2004), which report that access to extension services is significant to help famers manage and use resources more effectively as well as provide information about credit programs to potential borrowers.

The coefficient of Savings is negative and significant at the 5 % level for all credit models except informal credit. Results indicate that households with higher amounts of savings are less likely to take loans. The reason could be attributed by the fact that savings are substitutable for loans to meet household demands of investment. This result is in line with the finding of Dong et al. (2012), which reported that savings can also serve as a self-insurance tool and a financial substitution source for credit.

Risk has a positive coefficient indicating that risk affected households are more likely to access credit. This coefficient is particularly significant for all credit models except the VBARD model. The poor are not only more affected by personal risks but also by weather conditions and fluctuation of market prices. Risks might reduce land productivity, crop yield and household income. Perhaps, one possible way of poorer households to respond to risks is to take loans.

In term of Age of household heads, lenders tend to provide loans to younger clients who might represent a potential for improving agricultural production within this economic age range and can be members of the credit institutions for a longer time.

The variable of the most interest is Ethnicity, which has statistically significant coefficients in all credit models. Ethnic minority households are more likely to access preferential credit by VBSP but less likely to access overall rural credit, especially commercial credit from VBARD and informal sources. These results are quite consistent with the mission of VBSP to provide credit to the poor, especially ethnic minorities. In realities, a majority of borrowers of preferential credit are ethnic minorities, who are poorer than the Kinh majority in the same region. The fact that the poorer households benefit less from accessing credit is also found in Thailand, a neighboring country with Vietnam. Coleman (2006) evaluated the impact of two microfinance programs in Northeast Thailand. His paper highlighted the positive impact of accessing credit but only for non-poor borrowers.

3.4 Ethnic minorities and credit amounts

Improving access to loans by ethnic minorities also means increasing their amounts of credit as much as possible. Loan providers normally restrict the maximum amount of loans they are willing to grant because they are concerned very much about the ability of borrowers to repay. Figure 4 illustrated by an error bar graph presents the means and standard deviations of credit amount in each accessed households categorized by ethnicity. The graph also provides the visualization of mean comparison in loan amounts between groups.

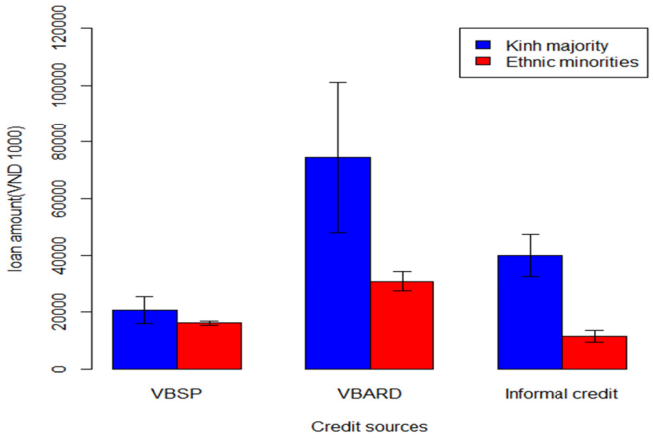

Figure 4. Distribution of loan amounts categorized by ethnicity groups

Source: own graph.

It is observed that distribution of loan amount is quite different among groups. Minorities significantly obtain smaller loans compared to the Kinh for all credit sources (Note 4). This could be explained by the fact that preferential loans for minorities come mostly from VBSP, which has a credit limit policy (around 30 million VND or less). Smaller amounts of loans might target poorer households. The deeper outreach of preferential credit is remarkably due to the policy of subsidized interest rates. In contrast, credit of VBARD is mainly offered to the wealthier households who qualify for higher amounts. Loans from VBARD often have higher interest rates and need collateral requirements such as land use certificates. In addition, loan amounts tend to vary significantly in case of the Kinh accessed households. This could be explained by the fact that the loan amount of the Kinh households may be adjusted in the case of VBARD because borrowers and lenders are more flexible to negotiate their credit contracts. Smaller loans from preferential credit might be insufficient for ethnic minority households to expand production and improve livelihood. This argument is supported by the findings of Coleman (1999) and Bauchet and Morduch (2013), which have a common implication that small loans have no significant impacts on farm profits. van Rooyen et al. (2012) also showed that small loans have higher probability of harming the poorest households in Sub-Saharan Africa and credit intervention by itself seems to have no significant impact.

4. Conclusion and Discussion

This paper has attempted to provide an understanding of the difference in household endowments and credit access between ethnic minorities and the Kinh majority in the Northern Mountains of Vietnam. Although the government has paid great attention to the development of minorities, a number of disadvantages including limited access to extension and credit still remain. Specifically, this study shows that ethnic minorities are less likely to access overall rural credit, credit of VBARD and informal credit. Although minorities have better access to preferential credit, they still receive smaller amounts of loans compared to the Kinh majority regardless of credit sources. The shortage of credit might make it very difficult for ethnic minorities to expand their production and diversify their likelihoods. Subsidized loans from the Bank for Social Policy are important, but the credit amounts from this source are limited. If the ethnic minorities are still limited in their access to credit while the lack of capital is one of the main reasons in explaining their poverty situations, then the economic growth might not benefit all people throughout the country.

Therefore, to improve the credit access by ethnic minorities, a policy with comprehensive socio-economic dimensions should be also considered. The average size of formal loans could be raised for ethnic minorities. However, the provision of credit to ethnic minorities needs to consider the purposes of credit use, the seasonality of farming activities as well as their cash flow of income and expenditure. The development of risk-coping capacities such as agricultural insurance and health care insurance could not only help ease the credit access constraints but also enhance the welfare impact of credit. Ethnic minorities in the research areas face various types of risks, especially from natural conditions. However, farm households have little risk prevention measures as none of them are covered by any type of agricultural insurance. In addition, ethnic minorities also need non-financial services such as business skills, market access, agricultural extension services and infrastructure improvement.

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Notes

Note 1. The national poverty line based on Decision 09/2011/QD-TTg of Vietnamese Government for the period 2011-2015 is VND 400, 000 monthly capita income.

Note 2. T-statistic is computed to test the difference in average income: t-test= 9.26 and p-value =0.0000;

Note 3. T-statistics are computed for continuous variables and Peason chi2 is applied for discrete variables to test the difference in means of selected variables between ethnic minorities and Kinh majority.

Note 4. T-statistics are employed to test the differences in means of loan amounts received by ethnic minority households and Kinh majority households: t-test= 3.11, 1.99, 2.29 and 3.68 for the overall credit, preferential credit of VBSP, commercial credit of VBARD and informal sources respectively.

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Macroeconomic Stress, Equity Market Liquidity Spirals and Markov Regime Switching

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Abstract

This paper makes an attempt to identify the periods of high illiquidity spiral and loss spiral fitting into Markov switching regimes model with Constant Transition Probability and Time-Varying Transition Probability models in US equity market. We identified two different states of the illiquidity spiral and loss spiral in the data associated with the said variables under the CPT and TVTP. However the time-varying transition probabilities for illiquidity spiral and loss spiral have changed significantly during the period under analysis and the explanatory variables are very informative in dating the evolution of the state of the illiquidity spiral and loss spiral over a period of 27 years starting with 1983. Hence TVTP model is preferred over the CTP model in identifying the illiquidity spiral and loss spiral regime switching. In particular, the probability of remaining in the high illiquidity spiral and high loss spiral regimes increases with a decrease in S&P 500 return.

Keywords: Markov regime switching model, constant transition probability, time-varying transition probabilities, liquidity spiral

1. Introduction

Liquidity plays an important role in the well-functioning of the economic system. It is more closely intertwined with the financial markets of the economy (Fuerst, 1992; Brunnermeier, 2008; Naes, Skjeltorp, & Odegaard, 2011). Market liquidity is a function of the information flow (Glosten & Milgrom, 1985; Klibanoff, Lamont, & Wizman, 1998), trading rules (Amihud & Mendelson, 1988), and sentiments of market participants (Baker & Stein, 2004; Chen, Hong, & Stein, 2002). Sudden dry out of the liquidity from the system disrupts business and economic activities in the economy. Brunnermeier and Pedersen's (2009) observe that during 2008 financial crisis liquidity suddenly dried up due to evolvement of liquidity spiral. Some literature suggests that market liquidity dryness occurs due to various triggers such as asset price bubbles (Brunnermeir, 2010), credit bubbles (Kiyotaki & Moore, 1997) and liquidity spirals (Brunnermeier & Pedersen, 2009). Further, Brunnermeier and Oehmke (2012) study points out a severe mismatch between funding structure and potential investment venues dried out liquidity from the market during 2008 financial crisis. Jain, Mishra and McInish (2013) also empirically examine and affirm the existence of liquidity spirals during the financial crisis periods in US market.

Whether the existence of such liquidity spiral phenomenon was only limited to 2008 financial crisis, remains an open question for empirical investigation? This phenomenon might be associated with the other periods of financial crisis as well. Against this backdrop, this study uses the spiral measures proposed in Jain, Mishra and McInish (2013) and examine its applicability to identify illiquidity spiral and loss spiral dynamics across different crisis periods from 1983 to 2010 for S&P 500 constituent stocks using Markov-Switching Regime Models (MSRM).

This study contributes to the existing stock of finance literature in three ways. Firstly, we model the dynamic behavior of spiral measure namely illiquidity spiral and loss spiral and their state dependencies perhaps for first time to the best of our knowledge. Secondly, we also examine whether liquidity spiral measure actually captures the variation in the liquidity states together. Thirdly, the correspondence of illiquidity spiral with the loss spiral during the market stress period extends the scope to empirically examine the dynamic co-movement behavior of these two components of liquidity spiral phenomenon. Nonetheless empirical findings of this study extend support partly towards the proposed theoretical liquidity spiral phenomenon by Brunnermeier and Pedersen's (2009).

The rest of the paper is structured as follows. Section 2 provides review of literature on liquidity and liquidity spirals. Section 3 presents materials and methods. Section 4 outlines the econometric methodology that models the periods of illiquidity and loss across the study period. Section 5 delineates the preliminary and empirical findings of the study. Conclusion and limitations are discussed in section 6.

2. Literature Review

2.1 Liquidity and Liquidity Measure

There is no such unique definition of 'liquidity'. Being multidimensional in nature, it is neither observed nor measured directly (Amihud, 2002). Measurement without definition is, however, difficult if not impossible. Researchers have used different proxies to measure different dimensions of asset liquidity. According to Larry Harris, liquidity has four major dimensions namely, immediacy, width, depth, and resiliency. Immediacy shows how quickly a given size of asset can be arranged, width or market breadth refers to cost involved in trading asset, depth refers to size of asset at a given trading cost and last dimension resiliency indicates how quickly prices revert back to fundamental level. In empirical research, measures the liquidity under a few broad categories (i) volume based measures, which are captured by transaction cost (Stoll, 1978) and market frictions (Stoll, 2000), (ii) price based measure that reflects the resiliency of assets, which is commonly captured by price volatility and market efficiency coefficients (Hasbrouck & Schwartz 1988), and (iii) market impact which indicates the differential impact of liquidity on price (Cvitanić & Malamud, 2011; Ren & Zhong, 2012).

Thus, the finance literature identifies a wide array of proxies for the liquidity measurement, some of them are bid-ask spread, effective spread, trade volume, Amihud illiquidity measure, Roll's estimate, Gibbs sample estimates, Lesmond, Ogden, and Trzcinka (LOT) estimate (1999), and Stambaugh Gamma price impact estimator. However, the usage of such liquidity proxy normally differs based on frequency of data, and richness of data. Despite its importance, problems in measuring and monitoring liquidity risk persist. There are no consensus of using single efficient liquidity measure which captures all the dimensions (Goyenko, Holden, & Trzcinka, 2009; Corwin & Schultz, 2012).

2.2 Liquidity Spiral Phenomenon and its Measures

Brunnermeier and Pedersen's (2009) theoretical study triggered another debate on the characteristics of liquidity during the severe crisis periods. It is observed that liquidity dynamics and price movement behave in different way and document a reinforcing relationship between illiquidity and price movement. They named such liquidity dynamics as "liquidity spirals". In a study of 2007-2009 crisis period, Hameed, Kang, and Viswanathan (2010) also find the dynamic relationship between sudden liquidity-dry up and the severity of crisis. The liquidity and crisis association becomes more prominent when liquidity is tied up with the funding availability. Rösch and Kaserer (2013) also document the spiral effect between the financial sector's funding liquidity and an asset's market liquidity. This effect is more prominent during the marker downturn periods. As under the uncertain and panic situations the asset funding becomes difficult and in result an increase in liquidity commonality which then leads to market-wide liquidity dry-ups. In order to define the liquidity spiral phenomenon, Jain, Mishra and McInish (2013) proposed measure to capture liquidity spiral phenomenon. The proposed measure includes two proxies called illiquidity spiral and loss spiral. The illiquidity spiral quantifies the intensity of illiquidity whereas loss spiral measure scales the severity of loss due to decline in the stock prices.

3. Materials and Methods

3.1 Data Sources

The study is based on the secondary data which is obtained majorly from the Center for Research in Security Prices (CRSP) database, provided by The University of Chicago where sample stocks related data are restricted to S&P 500 composite index and the daily stock data from January 1983 to December 2010. The each stock specific data obtained from CRSP are daily stock prices, daily high and low price, bid-ask prices, trading volume data, market capitalization, standard industrial classification, ticker symbol and permanent company code.

3.2 Variables description

3.2.1 Liquidity Spiral Measure

Liquidity spiral is a new phenomenon documented around 2008 financial crisis and not much studied in depth in the finance literature. However, Jain, Mishra, and McInish (2013) study that examines the existence of liquidity spirals in equity market as predicted by Brunnermeier and Pedersen's (2009). Our work follows the liquidity spiral construction methodology of Jain, Mishra, and McInish (2013) and in brief such construction methodology is presented below:

3.2.2 Illiquidity Spiral

The construction of the illiquidity spiral measure is based on two conditions i.e. assigning direction to 'day wise state of the liquidity' and aggregation of the state of the liquidity for two weeks for each stock. In assigning values for the state of the liquidity, following conditions are resorted to: (i) if today's stock spread is simultaneously greater than the previous day's stock spread and benchmark spread , the liquidity is deteriorating for the stock which is captured by assigning '+1' value, (ii) if today's stock spread is simultaneously lesser than the previous day's stock spread and benchmark spread, the liquidity is improving for the stock which is captured by assigning '-1' value and (iii) violation of any of the aforesaid condition, a value '0' is assigned, which indicates the unchanged state of the stock's liquidity. This expression captures the depth of the illiquidity spiral in terms its duration for each individual stock. For example, a value +10 for illiquidity spiral ($S_{spiral10}$) on a given day shows a high level of illiquidity for a stock.

3.2.3 Loss Spiral

The loss spiral measure assumes that higher is the value of loss spiral, higher is deterioration in the price level. The loss spiral measure is based on two conditions i.e. assigning direction to 'day wise state of the stock price' and aggregation of the state of the price changes for two weeks for each stock. In assigning values for the state of the loss, following conditions are resorted to: (i) if today's stock price is simultaneously lesser than the previous day's stock price and benchmark price, this indicate deterioration in the stock price which is captured by assigning '+1' value (ii) if today's stock price is simultaneously greater than the previous day's stock price and benchmark stock price. The price of a stock is improving which is captured by assigning '-1' value and (iii) violation of any of the aforesaid conditions, a value '0' is assigned, which indicates the unchanged state of the stock's price. This measure captures the behavior of the price series over the previous 10 consecutive days. For example a value -10 for loss spiral ($P_{spiral10}$) indicate improvement in stock prices which is a case of a booming market.

3.2.4 Term Spread

It is measured as difference between 10 years Govt. bond rate and 91 days Treasury Bill Rate and market return is measured as S&P500 index return. Various studies (see Hameed, Kang, & Viswanathan, 2010) has shown that market wide illiquidity get reflected as increase in Term spread and decrease in market return.

3.2.5 Market Return

It is computed S&P 500 composite index return.

3.2.6 TED Spread

It is computed as difference between LIBOR and 91 days Treasury Bill Rate. This variable captures short term market liquidity (Note 1).

4. Econometric Methodology

The applications Markov Switching Regime Model (MSRM) proposed by Hamilton (1989) are prominently found in business cycle change detection (see Lam, 1990; Goodwin ,1993; Diebold, Lee, & Weinbach, 1994; Filardo, 1994; Ghysels, 1994; Kim & Yoo, 1995; Filardo & Gordon, 1998; Kim & Nelson, 1998), periodically collapsing bubbles (Hall et al., 1999), interest rate change detection, exchange rate change detection (Hamilton, 1989), real estate speculative bubble detection (Paskelian, Hassan, & Huff, 2011), detecting volatility regimes (Hamilton, 1996; Hamilton & Lin, 1996), bull and bear market detection (Maheu & McCurdy, 2000), equity trading rules (Alexander & Dimitriu, 2005b, 2005e), credit spread (Alexander & Kaeck, 2008) and transmission of liquidity shock (Frank, Hermosillo, & Hesse, 2008). However to the best of our knowledge, the application of MSRM is not found in the liquidity spiral literature. Thus, in this paper we apply MSRM to estimate and identify the dynamic patterns of illiquidity spiral and loss spiral across time periods.

We use two different variants of the MSRM i.e. Constant Transition Probability Model (CTP) and Time-Varying Transition Probability Model (TVTP). We compare the estimated results under CTP and TVTP model. The CTP estimation include an intercept and the three lags of the dependent variable and a random variable with two states, where regression coefficients and the variance of the error terms are all assumed to be state-dependent as per the Markov switching model. Thus, there are only two possible states, only three explanatory variable and that the error process is normally distributed and homoscedastic in each state. The Markov switching model may be written as:

$$Y_t = \alpha_{s_t} + \beta_{s_t} X_t + \varepsilon_{s_t}, \varepsilon_{s_t} \sim N(0, \sigma_{s_t}^2) \quad (1)$$

where latent state variable $s_t \in (1,2)$ that means s_t takes value 1, if state 1 governs at time 't' and s_t takes value 2 if state 2 governs at time 't'.

$$\sigma_{s_t}^2 = \sigma_1^2 + \sigma_2^2 s_t, \sigma_1^2 \rangle 0 \quad (2)$$

The state variable is assumed to follow a first-order Markov chain (eq. 2) where the *transition probabilities* for the two states are assumed to be constant. Denoting by p_{ij} the probability of switching from state i to state j, the matrix of transition probabilities can be written as:

$$p_{ij} = \begin{pmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{pmatrix} = \begin{pmatrix} p_{11} & 1-p_{22} \\ 1-p_{11} & p_{22} \end{pmatrix} \quad (3)$$

where unconditional probability in regime 1 is stated by p = $\frac{p_{21}}{p_{12}+p_{21}}$. The complete set of model parameters can be summarized from the above model in a vector, θ = (1, 2, 1, 2, σ1, σ2, p11, p22).

The model is estimated using maximum likelihood, where errors are assumed to be normally distributed in each state. The log likelihood function for the purpose is denoted by $\varphi(x, \mu, \sigma^2)$ the normal density function with expectation μ and standard deviation σ:

$$\varphi(x;\mu,\sigma^2) = \frac{1}{\sqrt{2\pi}\sigma} \exp\left[-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2\right] \quad (4)$$

It is very often argued that constant transition probabilities are too restrictive to explain the behavior of financial or economic variables under the examination as they are not allowed to affect transitional probabilities. As explained by Filardo (1994) and Diebold et al. (1999), the Markov switching model with time-varying transition probability (TVTP) has the advantage over the fixed transition probabilities (CTP) in terms of flexibility. It can recognize systematic changes in the transition probabilities before and after turnings points, capture more complex temporal persistence and allow expected duration to vary across time. In this context, economic fundamentals and policy shocks can influence the regime transition probabilities.

To estimate Markov switching model with TVTP, we have followed Diebold et al. (1999). In the process we endogenized probabilities of changes of regime by incorporating economic variables as their determinants. Then, equation (3) becomes:

$$p_{ij} = \begin{pmatrix} p_{11}(Z_{t-1}) & p_{12}(Z_{t-1}) \\ p_{21}(Z_{t-1}) & p_{22}(Z_{t-1}) \end{pmatrix} = \begin{pmatrix} p_{11}(Z_{t-1}) & 1-p_{22}(Z_{t-1}) \\ 1-p_{11}(Z_{t-1}) & p_{22}(Z_{t-1}) \end{pmatrix} \quad (5)$$

where, $Z_{t-1} = (1, Z_{1t-1}, Z_{2t-1}, Z_{3t-1}, \ldots, Z_{kt-1},)$ is a set of information variables.

The transition probabilities are modelled as a logistic functional form such as (6):

State (1), *Time* (*t*), *State* (2).

$$\begin{matrix} State(1) \\ Time(t-1) \\ State(2) \end{matrix} \begin{bmatrix} p_t^{11} & p_t^{12} = 1 - p_t^{11} \\ P(s_t = 1 \mid s_{t-1} = 1, Z_{t-1}; \beta_0) & P(s_t = 1 \mid s_{t-1} = 1, Z_{t-1}; \beta_0) \\ \frac{\exp(Z'_{t-1}\beta_0)}{1+\exp(Z'_{t-1}\beta_0)} & \frac{\exp(Z'_{t-1}\beta_0)}{1+\exp(Z'_{t-1}\beta_0)} \\ p_t^{21} = 1 - p_t^{22} & p_t^{22} \\ P(s_t = 2 \mid s_{t-1} = 1, Z_{t-1}; \beta_1) & P(s_t = 3 \mid s_{t-1} = 2, Z_{t-1}; \beta_1) \\ \frac{\exp(Z'_{t-1}\beta_0)}{1+\exp(Z'_{t-1}\beta_0)} & \frac{\exp(Z'_{t-1}\beta_0)}{1+\exp(Z'_{t-1}\beta_0)} \end{bmatrix} \quad (6)$$

To estimate this regime switching model, we must specify the complete data likelihood function. Following Diebold et al. (1999), let y_t be the sample path of a time series conditional upon as follows:

$$(y_t \mid s_t = i, \alpha_i)^{iid} \sim N(\mu, \sigma_i^2) \quad (7)$$

Where $\alpha_i = (\mu, \sigma_i^2)$ and i=0, 1.

Thus the conditional density function of y_t is specified as:

$$f(y_t \mid s_t = i, \alpha_i) = \frac{1}{\sqrt{2\pi}\sigma_i} \exp\left[-\frac{1}{2}\left(\frac{y_t - \mu_i}{\sigma_i} \right)^2 \right] \quad (8)$$

where i=0, 1.

Following Diebold et al. (1999), the MSRM TVTP parameters includes the mean and variances of each state (μ, σ_i^2) ∀i=1, 2 the transition probabilities (p_t^{11}, p_t^{22}), their determinants (β) and the initial conditions (ρ) are jointly estimated with Maximum Likelihood methods.

Thus, contextualizing equation (1) the illiquidity (Y_t) depends on X_t, its own lags (Y_{t-i}) and σ_t a random variable with iid that follows a normal distribution with zero mean and $\sigma_{s_t}^2$ state-dependent variance in equations (1) and (2). $\alpha_{s_t}, \beta_{s_t}$ in equation (1) determines the behavior of the switching from one state to other under CTP. Equation (3), we specify that the switching of regimes follows a first-order Markov chain, where probabilities are noted by p_{11} and p_{22}, where p_{11} is the probability of remaining in state 1 at *t,* given that the economy is in regime 1 at *t-1*, and p_{22} is the probability of staying in regime 2 at *t,* given that the economy is in state 2 at *t-1*; *1-* p_{11} and *1-* p_{22} are the transition probabilities for switching from one regime to the other under CTP. The maximum log likelihood function is specified in equation (4), which is deployed in estimating the MSRM with CTP. In equation (5) we specify the MSRM with TVTP. Equation (6) is the mathematical representation of the transitional probabilities under MSRM with TVTP. Equation (7) and (8) represent the complete data likelihood function and conditional density function under MSRM with TVTP respectively.

5. Findings

5.1 Preliminary Findings

The summary statistics for major variables used in the study including two spiral measures for full panel period consisting 476 common stocks that are included in the S&P 500 index for the study period is presented in Table 1. Total number of filtered stock sample contains 1,704,907 observations for stock prices. The minimum value of stock price is $0.35, average value is $44.81 while maximum value is $996.74.

We computed relative quoted spread (spread), mid-quote, illiquidity spiral and loss spiral as defined in previous sections. In data sample, the mean value of ask and bid price for stocks is $44.91 and $44.7 respectively. Ask and bid price series also show a high kurtosis which indicate variability in the sample. The average high and low trade price is $44.81 and $44.01 respectively. The trade volume shows a high variability in sample. The average value of trade volume is 3,554,600 and minimum value is 100. The volume series shows a very high kurtosis 2839.54 and skewness 40.67. Our sample contains constituent of S&P 500 index where there is remarkable variation in stock's market capitalization. Data descriptive also points this variation where minimum market capitalization of a firm is $16.2 millions and maximum is $6.14billions. The computed spread value varies from minimum of 0.002 % points to maximum of 196.04%. The spread variable is highly asymmetric in nature with kurtosis value 2476.53. Our main interest variables-loss and illiquidity spirals, value moves in the range of -10 to +10. The average value of illiquidity and loss spiral is -1.08 and -0.58 respectively. However, the skewness and kurtosis value are also not very high for our main interest variables.

Table 1. Descriptive statistics on full sample

Variables	Mean	Std.	Skew.	Kurt.	Min.	Max.	Median
Trade Price ($)	44.81	40.97	9.3103	138.55	0.35	996.74	38.29
Spread (%)	0.59	0.94	16.252	2476.53	0.002	196.04	0.18
Ask Price ($)	44.91	41.02	9.3145	138.60	0.35	996.77	38.40
Bid Price ($)	44.70	40.91	9.306	138.53	0.34	994.54	38.19
Volume(in '000)	3554.60	14699.30	40.666	2839.54	0.10	1897900	1078
Market Cap. ('000) ($)	18,041,158	38,247,995	5.5241	41.12	16,219	614,687,978	6,726,331
Mid Quote ($)	44.80	40.97	9.3096	138.54	0.35	995.66	38.30
Illiquidity Spiral	-1.08	3.15	0.273	-0.64	-10	9	-1
Loss Spiral	-0.58	4.70	0.1857	-1.4	-10	10	-1

Note. Total number of observation during the sample period for each variable is 1,704,907.

We provide a plot of estimated variation in illiquidity spiral and loss spiral Figure 1. The series are graphed over the time period 1983 to 2010. It is revealed that the variation in illiquidity and Loss spirals have gone up across the macroeconomic crises periods. The average spread has also gone high during the same period which indicates that the market has become very illiquid in market downturn periods. Further the variation in illiquidity spiral fluctuates more wildly than does loss spiral and both series generally share the same pattern at least around the recessionary periods. For example, the spirals measures magnitude spiking up around the economic crisis of 1987, 2002 and 2008 and it is either spiking down or stabilizing during the rest of the study period (Figure 1).

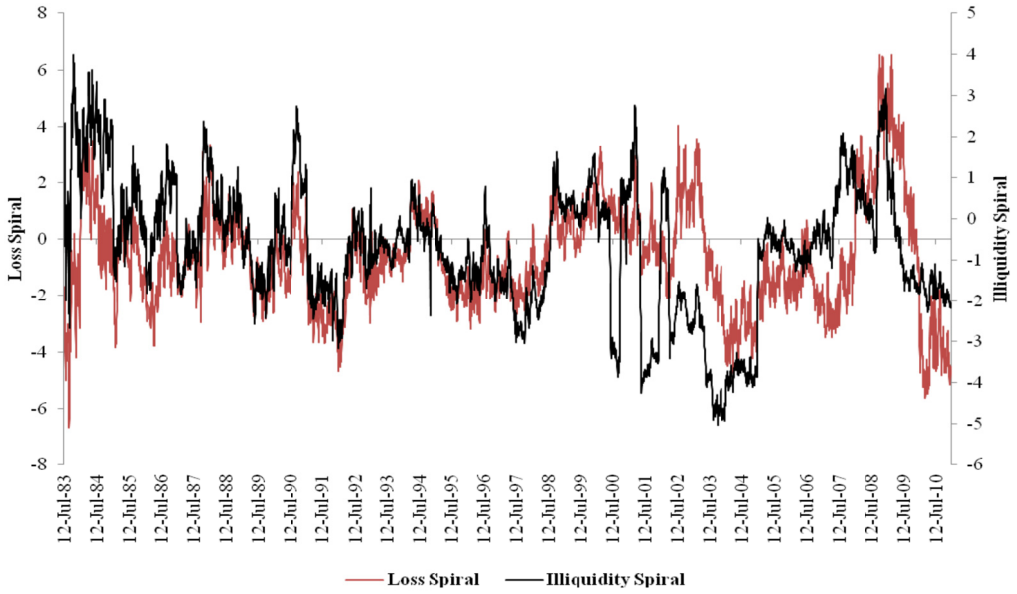


Figure 1. Average daily variation in loss spiral and illiquidity spiral

5.2 Empirical Findings

In this study, we model liquidity spiral measures i.e. illiquidity spiral and loss spiral, independently with the MSRM CTP followed by the MSRM with TVTP. In the MSRM TVTP we examine the switching of regimes by incorporating broad market based financial variables (i.e. term spread and market return) as the determinants of illiquidity spiral and loss spiral. The term spread is used here as a proxy for market liquidity risk as the risk of the market increases at the time of market down turn and decreases at the time of market up turn. The availability of funds may not be even available to a solvent agent at the former market scenario, but it is of limited relevance during times of tranquility or market up turn, where financial intermediaries in many a times does not examine the credit worthiness of the agent and extend the credit. Secondly, the equity market return is used as a proxy for market state, where market return is sensibly low and negative at the time of downturn as compared to a reverse scenario of market up turn. The estimated results from MSRM CTP and TVTP for both the interest variables are presented sequentially.

5.2.1 Illiquidity Spiral and Loss Spiral under CPT

In the first step, we considered explanatory variables (X_t) to be confirmed by an intercept (α_{st}), first three lags of the dependent variable (Y_{t-1}, Y_{t-2}, Y_{t-3}) and the random variable ε_{st} (equation 1).We have built MSRM CTP both for Illiquidity spiral and loss spiral. Hence, our dependent variable for the first model is considered as Illiquidity spiral and for the second is loss spiral. The estimation of the CPT for both illiquidity spiral and loss spiral revealed that none of the autoregressive coefficients found to be statistically significant. Thus, we seek to explore if regime dependence is relevant only to constant and variance and covariance matrix. Against this backdrop, we proceed to estimate the Markov Regime Switching CPT including intercept only both for illiquidity spiral and loss spiral.

The results from estimating first order MRSM CTP have several interesting findings which are reported in Table 2. The maximum likelihood estimates of the parameters in the selected models are found to be statistically

significant for both the models at least at the 5% level of significance. The estimated parameters and the LR statistics for illiquidity spiral and loss spiral are observed to be 9884.92 and 11068.92 respectively, which suggest the rejection of the null hypotheses of no regime switching against alternative of regime switching for both the variables. Thus, the estimated results support the assumption that the two different states occurred in the data α_{st} for state 1 and state 2 are statistically different in both the models. In particular, the estimated results suggest that an average increase in illiquidity spiral and decrease in loss spiral of 0.273 and -2.074 unit in bear market regime (intense illiquidity and loss state) and decrease illiquidity spiral (increase in liquidity) of -2.188 unit and increase loss spiral of 0.798 unit in bull market regime(intense liquidity and profit spiral state) respectively. Further the relatively large posterior standard deviation, which is inferred from the variance of the parameter of the state of the illiquidity and loss spiral both reflect that there are a few observations in that state.

While examining the transition probability matrix (TMP) and the expected durations of the both the states it is affirmed that there is considerable state dependence in the transition probabilities with a relatively higher probability of remaining in the origin regime for illiquidity spiral and alternate regime for loss spiral switching regressions. The closer examination of the constant transition probabilities affirm on the one hand that the probability of staying in liquidity spiral state (p11) at time (t), given that the market is in the same state at time (t-1) is 0.9935. On the other hand, the probability of staying in illiquidity spiral states (p22) in time (t), given that the market is in the same state at time (t-1) is found to be 0.9996. Similarly examining the probabilities of remaining in the loss spiral state and non-loss spiral state are affirmed to be very high with a tune of 0.9909 and 0.9912 respectively. The transition probabilities results are observed to be very large and statistically significant at 1% in both the states for illiquidity spiral (p11 = 0.9935 and p22 = 0.9964) which suggest that both states (illiquid and liquid spiral) are highly persistent. It is also further evident for the loss spiral that the state transition probabilities are found to be very large and statistically significant 1%, (p11 = 0.9909 and p22 = 0.9912) which suggests that both the states (loss spiral and non-loss spiral) are highly persistent (Table 2). These high probabilities either in liquidity or illiquidity spiral state and either in loss spiral or non-loss spiral state correspond that it is likely to be in such regimes. Thus the analysis here suggests that the periods can be easily identified under two states both for illiquidity spiral and loss spiral in the US equity market under the study period.

Table 2. Maximum likelihood parameter estimates and standard errors of the first order two state Markov regime switching CPT model for illiquidity and loss spiral

Parameters	Illiquidity Spiral			Loss Spiral		
	Coefficients	SE	Z statistic	Coefficients	SE	Z statistic
αst in state 1	-2.188**	0.0223	98.09	0.798**	0.0321	26.623
αst in state 2	0.273**	0.0172	15.85	-2.074**	0.0246	-83.07
αst in state 1 (σ_1)	0.0339*	0.0121	2.81	0.275**	0.0124	22.26
αst in state 2 (σ_2)	-0.027**	0.0097	-2.78	0.027*	0.0131	2.02
TMP (P11)	5.027**	0.2378	21.03	4.685**	0.1902	24.71
TMP (P21)	-5.401**	0.2393	-22.57	-4.719**	0.1933	-24.52
Parameters			State Dep. Value			State Dep. Value
CTP P11			0.9935			0.9909
CTP P12			0.0065			0.0092
CTP P21			0.0045			0.0088
CTP P22			0.9964			0.9912
Duration	State 1		153.873	Duration	State 1	109.2884
Duration	State 2		222.692	Duration	State 2	113.109
AIC			2.861	AIC		3.2
BIC			2.868	BIC		3.21
Log Likelihood			-9884.92	Log Likelihood		-11068.9
Convergence	Iterations		21	Convergence	Iterations	6

Note. TMP stands for Transaction Matrix parameter, CTP Constant Transition Probability.

**Indicates at 1% level of significance, * indicates at 5% level of significance.

Further an attempt has been made hereunder to conduct the horizontal switching and the duration analysis for the illiquidity spiral and loss spiral in US equity market. It is observed that the probability of switching from a liquid

spiral state to illiquid spiral state (P_{12}) is almost 0.0065 and the probability of changing from illiquidity spiral state to liquidity spiral state (P_{21}) is close to 0.0045. The corresponding expected durations to be in illiquidity spiral and liquidity spiral regimes are approximately 222.692 and 153.873 periods respectively. While the probability of switching from the loss spiral state to non-loss state (P_{12}) is almost 0.0092 and the probability of changing from non-loss spiral state to loss spiral state (P_{21}) is close to 0.0088. The corresponding expected duration to be in loss spiral state regime and non-loss spiral regimes are approximately 109.3 and 113.2 respectively (Table 2). However, it is evident that the illiquidity spiral duration is relatively observed to be longer than that of the liquidity spiral duration and the loss spiral duration is shorter than the non-loss spiral duration in the US equity market during our sample study period. Thus it is affirmed that the change from illiquidity and non-loss spiral state to liquidity and loss spiral state is more likely than change from liquidity and loss spiral state to illiquidity and non-loss spiral state in the US equity market.

It can be inferred from the above analysis that relatively illiquidity spiral state is longer than that of the loss spiral state, which corresponds that there might have some stretch of periods either in the state 1 or state 2 where illiquidity spiral and loss spiral don't move together in the US equity market. This non occurrence of simultaneous illiquidity spiral and loss spiral in certain cases of the both the states would be partially examined graphically in filtered and smoothened regime probabilities obtained from both the illiquidity and loss spiral Markov Regime Switching CTP models.

5.2.2 Illiquid Spiral and Loss Spiral under TVTP

We estimate the Markov Regime Switching TVTP both for illiquidity spiral and loss spiral, where we allowed a set of broad financial market variables to explain the evolution of such probabilities. The initial set of proxies used as explanatory variables Markov Regime switching TVTP frameworks selected are broad equity market return (S&P 500 index return), Term spread and TED Spread. With this information we established different models to select the one that presents the smooth transition probabilities consistent with the state of upturn and down turn of the US equity market history since 1983.

Table 3. Maximum likelihood parameter estimates and standard errors of the first order two states Markov regime switching *TVTP* model for illiquidity spiral and loss spiral

Parameters	Illiquidity Spiral			Loss Spiral		
	Estimates	SE	Z statistic	Estimates	SE	Z statistic
αst in state 1	0.268**	0.0175	15.36	1.129**	0.0281	40.23
αst in state 2	-2.195**	0.0220	-100.17	-1.812**	0.0217	-83.53
αst in state 1 (σ_1)	0.948**	0.0170	55.76	1.731**	0.0270	64.11
αst in state 2 (σ_2)	1.026**	0.0370	27.73	1.048**	0.0250	41.57
TMP (P11)	5.463**	0.2561	21.26	4.618**	0.2060	22.44
P11-S&P_{500}RET	-0.229	0.2340	-0.98	-0.145	0.1276	-1.13
TMP (P21)	-5.080**	0.2462	-20.62	-5.391**	0.2660	-20.27
P21-S& P_{500}RET	-0.331*	0.1683	-1.97	-0.904**	0.1923	-4.70
Parameters			State Dep. Values			State Dep. Values
TVTPP11			0.9960			0.990
TVTPP12			0.0044			0.009
TVTP P21			0.0068			0.009
TVTP P22			0.9933			0.991
Duration	State 1		218.58	Duration	State 1	109.78
Duration	State 2		149.75	Duration	State 2	78.22
AIC			2.862675			3.216792
BIC			2.69603			3.22372
Log Likelihood			-9886.40			-11068.93
Convergence	Iterations		23			15

Note. TMP stands for Transaction Matrix parameter, TVTP: Time Varying Transition Probability.

**Indicates at 1% level of significance, * indicates at 5% level of significance.

Table 3 presents the results of the final selected model, which includes only S&P 500 return as explanatory variable in the TVTP model both for Illiquidity spiral and loss spiral. As expected, the external shocks have

significantly affected the evolution of both illiquidity spiral and loss spiral in the US equity market. The model was selected based on the gradients and on a likelihood test that compares the Hamilton model, with CTP, with the model of TVTP.

The estimated results of the TVTP model indicate that the US equity market experiences two different states both in the context of illiquidity spiral and loss spiral. The magnitudes of the illiquidity spiral and loss spiral states significantly differ from the liquidity spiral state and non loss state. The illiquidity spiral and loss spiral states are identified with a positive mean value of 0.268 and 1.129 and the liquidity spiral and non loss spiral states are identified with a negative mean value of -2.196 and -1.812 respectively. However on the one hand TVTP and CTP models remained equally efficient in estimating the coefficients for illiquidity spiral under two different regimes and on the other hand TVTP model better discriminates compare to the CTP in segmenting the loss spiral under two different regimes.

Further the coefficients of the S&P 500 return in the TVTP model both for illiquidity spiral and loss spiral differ from zero with opposite (statistically significant) signs under the two different states. As to the transition matrix parameters, we find that increases in the illiquidity are associated with higher probabilities of being in the illiquidity spiral regime, lowering the transition probability out of regime 1 and increasing the transition probability from regime 2 into regime 1. Similarly, the transition matrix parameters, we see that increases in the loss are associated with higher probabilities of being in the loss spiral regime, lowering the transition probability out of regime 1 and increasing the transition probability from regime 2 into regime 1 (Table 3).

While examining the transition probability matrix and the expected durations of the TVTP model it is affirmed that there is considerable state dependence in the transition probabilities with a relatively higher probability of remaining in the origin regime both for illiquidity and liquidity spiral state and loss and non loss spiral states. The corresponding expected duration of illiquidity and liquidity regimes are approximately 218.58 and 149.75 periods and expected duration of loss and non loss regimes are approximately 109.78 and 78.22 periods respectively (Table 3).

Finally based on the discriminating power of the model in segmenting the states and likelihood test carried out in the line with Diebold et al. (1999), and the result supported the MSRM TVTP model over the CTP model both for illiquidity spiral and loss spiral identification. Thus the illiquid and liquid spiral states and loss and non-loss spiral states are identified in the line of the filtered transition and smoothen transition results obtained from the MSRM under TVTP.

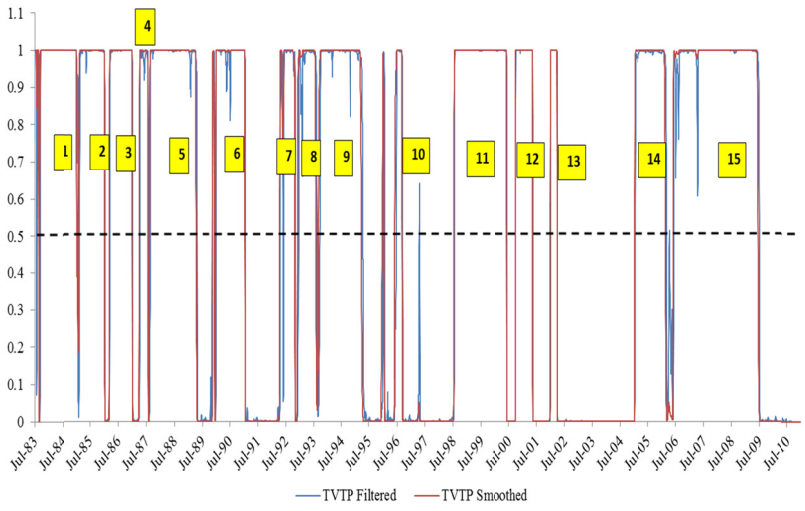
5.3 Regime Identification for Illiquidity and Loss Spiral

The identification of the regimes under TVTP both for illiquidity spiral and loss spiral are based on standard deviations, which is obtained from the variance and covariance matrix. The dating of the two regimes both for Illiquidity spiral are schematically presented in Figure 2 and Figure 3 respectively, which plot simultaneously the filtered transition and smoothing (posterior) probabilities of state = 2 are summarized in Table 3. We combine both the filtered and smoothing transition probabilities to determine the illiquidity and liquidity spiral states and loss and non loss spiral states in the US equity market. In addition to that we have taken 0.5 as the cut off value for State =1 or 2. That is, the periods with the filtered and smoothing probabilities of State = 2 greater (less) than 0.5 are more likely to be in the state of high illiquidity spiral and high loss spiral periods respectively. According to this approach, since 1983 the US equity market has been experiencing 15 number of illiquidity spiral periods and 11 number of loss spiral periods. However in general, we observed a few number of occasions, where illiquidity spiral and loss spirals are observed to be persistent in the US equity market during the sample study period. A detailed analysis is resorted hereunder to relate with the events of the switching of illiquidity and loss spiral regimes in US equity market corresponding to our study period.

The high illiquidity and the loss spiral spikes during 1987 corresponds to the periods around the Black Monday of October 1987 when stock market around the world crashed, when a few short lived jumps that forced the US equity market to be in high volatile regime. The illiquidity and loss spiral regimes of 1991 can be attributed to the periods in which US engaged in Gulf war especially with the Iraq that culminated in high volatility regimes in the US equity market. Higher jumps in illiquidity spiral and loss spirals during 1997 corresponds to the Asian Financial crisis that led to massive deterioration of wealth in the East Asian economies real estate space, along with the onset of capital controls in Malaysia and blemish advice and numerous conditionality of the IMF to such economies ultimately buckled the confidence of the investors across the world. As a result of such crisis equity market across the world including US went on rampage in the fronts of equity prices and market volatility. The dot com bubble burst could have been responsible for shifting the regimes of illiquidity and loss spiral state around the turn up of the 21st century. Further the 9/11 attack of World Trade Center coupled with the recession

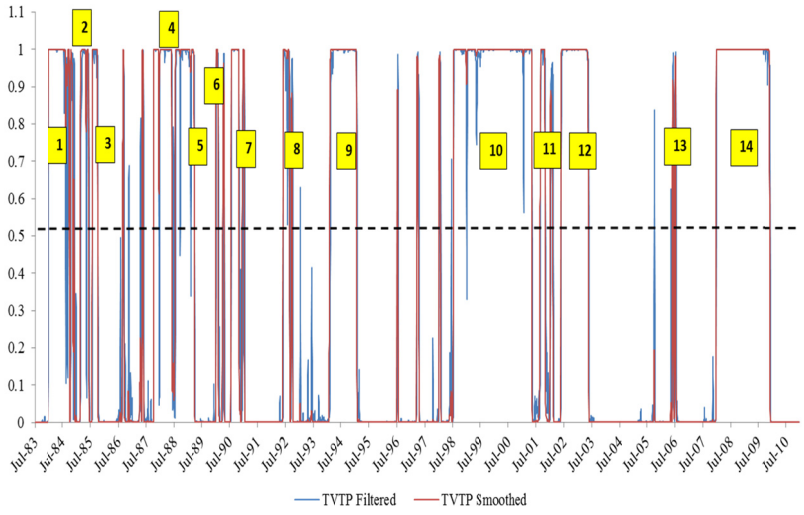
in US economy elongated the illiquidity and loss spiral jumps in the US equity market towards the end of the year 2001 and entire 2002. The staggering inflation and high energy prices in the US economy around 2005 further created uncertainty in the economy as a result of which equity market experienced regime shift in illiquidity spiral for a period of 13 months and loss spiral approximately for a very short period of about a month. Specifically the US equity market experienced a prolonged period of illiquidity spiral for almost a period of two years and loss spiral for a period of almost a year due to the onset of the 2008 global financial crisis that originated in US and suddenly contaminated the financial, monetary and asset markets across the world.

However, examining the identified periods more closely it is affirmed that illiquidity spiral and loss spiral grew rapidly across the macroeconomic stress periods. The level of average illiquidity spiral and loss spiral were spiking high during NBER identified recessionary periods of 1987, 2000 and 2008 whereas the average illiquidity spiral before and after the recession for the respective periods the level of illiquidity spiral and loss spiral were observed to be very low. This explains why the Markov switching model classifies all the average level of illiquidity spiral values into two different states when the full sample is considered. Nevertheless, from Figure 2 and 3 of the smoothing probabilities curve we can see that illiquidity spiral and loss spirals are still experiencing some ups and downs across the periods. However the average levels of illiquidity spiral and loss spiral values are relatively experiencing higher levels of ups during major US recessionary periods and down around the periods of tranquility or market up turn. It is very interesting to note that the period around the global financial crisis (2008) the US equity market has experienced the longest period of illiquidity and loss spiral. Thus it is affirmed that there is simultaneity between illiquidity and loss spiral occurrences in the US equity market at least during the market down turn. That means on an average a period of high illiquidity spiral goes in hand in hand with the period of high loss spiral at least during recessionary period.



Period	Start	End
1	9/7/1983	10/18/1984
2	2/28/1985	1/14/1986
3	3/31/1986	1/2/1987
4	4/28/1987	5/26/1987
5	7/2/1987	1/27/1989
6	1/16/1990	12/26/1990
7	5/11/1992	10/1/1992
8	12/30/1992	8/2/1992
9	10/1/1993	3/21/1995
10	7/3/1996	9/11/1996
11	7/28/1998	4/27/1999
12	10/16/2000	4/21/2001
13	1/10/2002	4/5/2002
14	1/20/2005	2/16/2006
15	6/20/2006	6/16/2009

Figure 2. Illiquidity spiral Identifications under Markov regime switching time varying transition probability (TVTP) with S&P 500 return with start and end period details



Period	Start	End
1	1/16/1984	8/7/1984
2	3/15/1985	6/5/1985
3	8/14/1985	10/9/1985
4	10/19/1987	6/30/1988
5	8/15/1988	3/29/1989
6	1/17/1990	2/7/1990
7	8/6/1990	11/9/1990
8	6/12/1992	9/3/1992
9	2/14/1994	2/7/1995
10	6/21/1998	5/18/2001
11	9/7/2001	11/6/2001
12	6/5/2002	5/22/2003
13	6/13/2006	6/28/2006
14	1/8/2008	12/10/2009

Figure 3. Illiquidity spiral Identifications under Markov regime switching time varying transition probability (TVTP) with S&P 500 Return with start and end period details

6. Conclusion

It is concluded that the Markov switching regime model with CTP and TVTP delineates clearly the two states of illiquidity spiral and loss spiral in US equity market under the study period. Further illiquidity spiral state is relatively longer than that of the loss spiral state, which perhaps indicate that illiquidity spiral and loss spiral don't move together always in the US equity market. While examining the transition probability matrix and the expected durations of the both the states it is affirmed that there is considerable state dependence in the transition probabilities with a relatively higher probability of remaining in the origin regime for illiquidity spiral and alternate regime for loss spiral obtained from the CTP switching regressions. The closer examination of the constant transition probabilities and time varying transitional probability affirm that the periods can be easily identified under two states both for illiquidity spiral and loss spiral in the US equity market under the study period. While selecting the suitable model for identification of illiquidity and loss spiral regime switching TVTP model is preferred over the CTP model due to its better predictability that emerged out of the likelihood test. Thus the identification of illiquid and liquid spiral states and loss and non loss spiral states is carried out in the line with the filtered transition and smoothen transition results obtained from the Markov Regime Switching TVTP Model. In nutshell, we have identified 15 stretches of illiquidity spiral and 14 stretches of loss spiral in the US equity market from 1983 to 2010. However, it is also observed that the illiquidity and loss spiral do not always corresponds to each other but they occur simultaneously during the extreme market conditions. Such joint occurrence is termed as liquidity spiral which is observed to be a rare phenomenon in the US equity market. Thus the findings of our study support the study of Jain, Mishra and McInish (2013) and identified the periods of high liquidity particularly during the macroeconomic stress periods.

The study reports several implications on the need to monitor the liquidity spiral occurrences and take up the appropriate policy measures. Under the intense liquidity spiral conditions, the role of financial systems like banks- becomes more crucial as the market dried up due to high illiquidity. The timely channelization of fund to the market could subsidies the intensity and prolong period of liquidity spirals phenomena. Our proposed measure provides an instrumental tool which can be used to gauge and identify the trigger of the severe illiquidity. The paper contributes to the literature by modeling and identifying the periods of illiquidity spiral and loss spiral in the equity market with focus on US. The study also supports the existing literature that small size firms are more vulnerable to spiral intensities than the large size firms. Further it is concluded that the occurrence of spiral phenomenon are rare in nature and it appears during the extreme market down turn periods. Future research in this direction could focus impact of political uncertainty, drastic change in regulatory norms (relating to forex policies, monetary policy, fiscal policy, trade policy and public debt policy), government austerity measures, inflation persistence, major world events, natural calamity, terrorist attack and waging wars might have a linkage with the liquidity spiral phenomenon. Further the study on liquidity spiral contagion across the economies would no doubt a fortified field for future research.

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Note

Note 1. For details, see Bouson, Stahel and Stulz (2010).

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Do Ownership Structure Characteristics Affect Italian Private Companies' Propensity to Engage in the Practices of "Earnings Minimization" and "Earnings Change Minimization"?

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Abstract

The study aims to verify whether and how ownership structure (with specific reference to ownership concentration and identity) affects Italian private (unlisted) companies' propensity to engage in practices of "earnings minimization" and "earnings change minimization". Companies that engage in these practices have been identified following the "earnings frequency distribution" approach suggested by Burgstahler and Dichev (1997). The influence of ownership structure, together with that of a set of control variables mainly aiming to control for tax, financial, and size incentives, is tested by logit analysis models. Ownership concentration does not have a statistically significant influence. Conversely, institutional, state, and foreign ownership has a statistically significant influence. In the first and third cases, the influence is negative, in the second case the influence is positive. The study extends the current knowledge on the relationship between aspects of corporate governance and earnings management practices in private companies, especially SMEs. It also expands what is known about the earnings management practices undertaken by companies in countries, like Italy, in which a code law system is in force and accounting and tax systems are closely aligned.

Keywords: earnings management, earnings minimization, earnings change minimization, ownership structure, ownership concentration, ownership identity, private companies, Italy

1. Introduction

Our study explores the relationship between ownership structure and earnings management. In particular, it aims to verify whether and how ownership structure (with specific reference to ownership concentration and identity) affects Italian private (unlisted) companies' propensity to engage in practices of "earnings minimization" (EM) and "earnings change minimization" (ECM).

We observe EM practices when companies with negative earnings manage them upward to overcome the threshold of zero and, at the same time, companies with positive earnings manage them downward to bring them close to zero (e.g. Coppens & Peek, 2005; Marques, Rodrigues, & Craig, 2011; Poli, 2013a, 2013b). We observe ECM practices , instead, when companies manage earnings to avoid large earnings changes or, in other words, to smooth earnings (e.g. Coppens & Peek, 2005; Poli, 2013a). EM and ECM fall under the category of earnings management practices aiming to meet or beat certain earnings targets (e.g. Burgstahler & Dichev, 1997; Degeorge, Patel, & Zeckhauser, 1999). They have great relevance and are widely popular in countries such as Italy (e.g. Gavana, Guggiola, & Marenzi, 2013; Lamb, Nobes, & Roberts, 1998; Poli, 2015), where accounting and tax rules are closely aligned. In these countries, in fact, tax incentives stimulate companies to manage their earnings (e.g. Baralexis, 2004; Coppens & Peek, 2005; Eilifsen, Knivsfla, & Saettem, 1999; Goncharov, & Zimmer-mann, 2006; Guenther, 1994; Hermann & Inoue, 1996; Marques et al., 2011; Othman & Zeghal, 2006; Poli, 2013b). On the one hand, they stimulate companies to avoid losses in order to decrease the probability of tax audits. On the other hand, they stimulate companies to minimize earnings in order to minimize tax payments. As a result, companies are likely to report slightly positive earnings and to smooth the changes in earnings.

Poli (2013a, 2013b) has found that these practices have great relevance and are widely popular among Italian private companies. However, whether and how ownership structure affects Italian (and non-Italian) private companies' propensity to engage in them has not yet been sufficiently explored in the literature.

In addition to filling this knowledge gap, our study contributes to expanding the existing literature in two main ways. First, it enriches the knowledge on the relationship between aspects of corporate governance and earnings management practices in private companies, especially small- and medium-sized ones. Although this relationship has been extensively explored in the literature, the focus has largely been on different earnings management practices than those we consider in our study and it has also been on public (listed) companies (e.g. Akileng, 2014). Second, our study enriches the knowledge on earnings management practices undertaken by companies in countries, like Italy, where a code law system is in force and accounting and tax systems are closely aligned, that have been relatively less explored in the literature.

From a methodological standpoint, we identify the companies that practice EM and ECM following the "earnings frequency distribution" approach suggested by Burgstahler and Dichev (1997) and we test our research hypotheses on the influence of ownership structure on the propensity of companies to practice them through logit analysis models.

Our study proceeds as follows. Section two reviews the literature and develops the research hypotheses. Section three describes the research design and the sample selection. Section four shows and discusses the empirical findings. Section five summarizes the findings and highlights the main contributions to the literature, the limitations of the study, and possible further research opportunities.

2. Literature Review and Research Hypotheses

To reiterate what was stated above, several previous studies have explored the relationship between aspects of corporate governance and earnings management practices (e.g. Akileng, 2014), but most of them have focused on earnings management practices different from those that we consider in our study and on listed companies. Instead, the relationship between aspects of corporate governance and the EM and ECM practices undertaken by private companies has not yet been sufficiently explored in the literature. On the one hand, this gives importance to our study. On the other hand, this makes it difficult to find direct points of reference in the literature for the formulation of our research hypotheses. We are aware of this discrepancy but, in order to formulate our research hypotheses, we refer to this literature even though it is not directly comparable to our study which delves into very specific EM and ECM earnings management practices.

2.1 Ownership Concentration and Earnings Management

Previous studies have widely investigated the relationship between ownership concentration and earnings management. They have generally shown that this relationship exists. However, they have shown that ownership concentration can affect earnings management in two alternative ways. The first hypothesis (the "alignment effect"), inspired by the agency theory, suggests that owners with significant amounts of shares have a greater interest in their investments and a greater ability to monitor managers' behavior and decisions. This decreases their incentive to expropriate companies for their personal benefit and to minimize earnings management practices in order to secure companies and their own future. Thus, ownership concentration appears to be a very effective internal governance mechanism that hinders managers' opportunistic behavior and decisions. As a result, ownership concentration and companies' earnings management activity is inversely related (e.g. Abdoli, 2011; Alves, 2012; Persons, 2006; Ramsay & Blair, 1993; Roodposhti & Chashmi, 2011). Conversely, the second hypothesis (the "entrenchment effect") suggests that owners with significant amounts of shares have incentives to exploit their dominant position to the detriment of minority shareholders (e.g. Bebchuk, 1994; Liu & Lu, 2007; Stiglitz, 1985). As a result, ownership concentration and companies' earnings management activity is directly related (e.g. Choi, Jeon, & Park, 2004; Claessens, Djankov, & Lang, 2000; Fan & Wong, 2002; Kim & Yoon, 2008; Wang, 2006).

All of the studies just mentioned refer to public companies. Private companies display different characteristics from public companies. Most private companies (here, we are specifically interested in Italian ones) have an ownership structure that is generally very concentrated and composed of a few owners. Consequently, private companies are less likely than public companies to be affected by agency problems between owners and managers and problems between majority and minority shareholders (e.g. Ball & Shivakumar, 2005; Garrod, Kosi, & Valentincic, 2008). Economic incentives for owners and managers are generally closely aligned, because they are often the same persons. Any change in the value of the companies is directly reflected in the wealth of the owners. The absence of agency problems between owners and managers and problems between majority and minority shareholders leads us to hypothesize that, in the context of private companies and especially smaller ones, the types of relationship between ownership concentration and earnings management found in the context of public companies described above may not exist.

This leads us to hypothesize the absence of an association between ownership concentration and Italian private

companies' propensity to practice EM and ECM. Therefore, we test the research hypothesis that follows:

H_1: *Ownership concentration is not related to companies' propensity to engage in EM and ECM practices.*

2.2 Institutional Ownership and Earnings Management

Previous studies have widely investigated the relationship between institutional ownership and earnings management. They have come to two possible, but antithetical, interpretations: the "efficient monitoring hypothesis", that has had more evidence, and the "passive hands-off hypothesis". The first hypothesis suggests that institutional ownership ensures a better monitoring of managers' activities and reduces their ability to opportunistically manage earnings. As a result, institutional ownership and companies' earnings management activity is inversely related (e.g. Almazan, Hartzell, & Starks, 2005; Bange & De Bondt, 1998; Bushee, 1998; Chung, Firth, & Kim, 2002; Cornett, Marcus, & Tehranian, 2008; Ebrahim, 2007; Koh, 2003). Conversely, the second hypothesis suggests that institutional ownership may not limit managers' earnings management activity and may increase their incentives to engage in earnings management. As a result, institutional ownership and companies' earnings management activity is directly related (e.g. Claessens & Fan 2002; Duggal & Millar, 1999; Porter, 1992; Pound, 1988; Sundaramurthy, Rhoades, & Rechner, 2005).

This leads us to hypothesize the existence of an association between institutional ownership and Italian private companies' propensity to practice EM and ECM, but not to have expectations about the sign of the association. Therefore, we test the research hypothesis that follows:

H_2: *Institutional ownership is related to companies' propensity to engage in EM and ECM practices.*

2.3 State Ownership and Earnings Management

The earnings management practices undertaken by the companies owned by states, governmental agencies, governmental departments, and local authorities (hereinafter simply referred to as "state") have only been investigated to a limited degree in the literature. In addition, the majority of previous studies have investigated Chinese listed companies (Aharony, Lee, & Wong, 2000; Chen & Yuan, 2004; Ding, Zhang, & Zhang, 2007; Liu & Lu, 2007; Wang & Yung, 2011). Ding et al. (2007) and Wang and Yung (2011) have found that state-owned companies manage earnings less than privately-owned companies. Conversely, Aharony et al. (2000), Chen and Yuan (2004) and Liu and Lu (2007) have found that state-owned companies manage earnings more than privately-owned ones do. Recently, Capalbo, Frino, Mollica, and Palumbo (2014) have investigated Italian private companies, finding that state-owned companies manage earnings less than privately-owned ones do. Thus, all previous studies have shown that state ownership and earnings management practices are associated, but the sign of this association is divergent.

This leads us to hypothesize the existence of an association between state ownership and Italian private companies' propensity to practice EM and ECM, but not to have expectations about the sign of the association. Therefore, we test the research hypothesis that follows:

H_3: *State ownership is related to companies' propensity to engage in EM and ECM practices.*

2.4 Foreign Ownership and Earnings Management

Beuselinck, Blanco, and Garcia Lara (2013) have investigated whether and how foreign ownership impacts on earnings quality of companies domiciled in weak institutional quality countries (Greece, Italy, Spain, and Portugal) and whether and how such an impact varies according to the country where the foreign investor is domiciled. They have found that increases in foreign ownership, when the foreign investor is domiciled in strong institutional quality countries, positively affect the earnings quality of companies domiciled in weak institutional quality countries.

This leads us to hypothesize the existence of a negative association between foreign ownership and the Italian private companies' propensity to practice EM and ECM. Therefore, we test the research hypothesis that follows:

H_4: *Foreign ownership is negatively related to companies' propensity to engage in EM and ECM practices.*

3. Research Design and Sample Selection

To test our research hypotheses, we use logit analysis models. They are appropriate when dependent variables have one of only two possible values representing the presence or absence of the attribute of interest (in our case, the presence or absence of EM and ECM) (e.g. Freedman, 2009).

3.1 Dependent Variables–Measures of Earnings Management

The dependent variables correspond to the presence or absence of EM and ECM. We identify the companies that practice EM and ECM following the "earnings frequency distribution" approach suggested by Burgstahler and

Dichev (1997). Although it is not free from criticism in the literature (e.g. Beaver, McNichols & Nelson, 2007; Dechow, Richardson, & Tuna, 2003; Durtschi & Easton, 2005, 2009; Holland, 2004; Lahr, 2014; McNichols, 2003), it has been widely used to detect the presence of earnings management practices (e.g. Baber & Kang, 2002; Beatty, Ke, & Petroni, 2002; Brown & Caylor, 2004; Burgstahler & Dichev, 1997; Collins, Pincus, & Xie, 1999; Coppens & Peek, 2005; Daske, Gebhardt, & McLeay, 2006; Degeorge, Patel, & Zeckhauser, 1999; Easton, 1999; Gore, Pope, & Singh, 2007; Hamdi & Zarai, 2012; Hayn, 1995; Holland & Ramsay, 2003; Jacob & Jorgensen, 2007; Kerstein & Rai, 2007; Marques et al., 2011; Moreira, 2006; Phillips, Pincus, Rego, & Wan, 2004; Poli, 2013a, 2013b; Revsine, Collins, Johnson, & Mittelstaedt, 2009). According to this approach, we assume that a company practices EM if the reported earnings of a fiscal year, scaled to total assets of the previous fiscal year, assumes a value between 0 and 0.005 (0 is included, 0.005 is excluded) and that a company practices ECM if the reported earnings change of a fiscal year (determined as the difference between the reported earnings of a fiscal year and the reported earnings of the previous fiscal year), scaled to total assets of the second previous fiscal year, assumes a value between -0.0025 and 0.0025 (-0.0025 is included, 0.0025 is excluded). The choice of the interval amplitudes has been primarily made to facilitate the comparison of our findings with those of previous studies.

For each earnings management practices, we use a specific dependent variable. Specifically, we use EM1 and EM2, respectively.

3.2 Independent Variables

The independent variables correspond to the ownership structure characteristics whose influence on companies' propensity to practice earnings management we are interested in observing. They derive from the four hypotheses above. They are defined as follows.

CONCENTRATION is the independent variable we use to test the influence of ownership concentration. As in previous studies (e.g. Demsetz & Lehn, 1985; Prowse, 1992; Claessens & Djankcov, 1999; Ding et al., 2007), it is defined as the proportion of shares held by the majority shareholder.

INSTITUTIONAL is the independent variable we use to test the influence of institutional ownership. It is defined as the proportion of shares held by institutional shareholders. For institutional shareholders we intend banks, insurance companies, mutual and pension funds and private equity firms.

STATE is the independent variable we use to test the influence of state ownership. It is defined as the proportion of shares held by state shareholders. For state shareholders we intend states, governmental agencies, governmental departments or local authorities.

FOREIGN*Strong* and FOREIGN*Others* are the independent variables we use to test the influence of foreign ownership. They are defined as the proportion of shares held by foreign shareholders domiciled in either strong or non-strong institutional quality countries, respectively. According to Beuselinck et al. (2013), the strong institutional quality countries are: Australia, Austria, Belgium, Canada, Denmark, Germany, Ireland, Luxembourg, the Netherlands, Norway, Sweden, Switzerland, the United Kingdom, and the United States of America.

All the independent variables are defined in terms of controlling rights and direct ownership.

3.3 Control Variables

The control variables aim to control for the influence of the factors (tax, financial and size incentives, time and sectors) that previous studies have found to be able to affect companies' propensity to engage in EM and ECM practices.

Previous studies have controlled for tax incentives (e.g. Marques et al., 2011; Poli, 2013b). They have found that EM practices are observable among the companies that have a higher actual tax rate (ATR) and not among companies that have a lower ATR (e.g. Marques et al., 2011; Poli, 2013b). According to them, to control for tax incentives, we use the ATR variable. It is a dummy variable that holds a value of 1 if the ATR of the company is higher than the median of the overall distribution, of 0 otherwise. ATR is defined as follows:

$$ATR_{it} = \frac{IBT_{it} - NI_{it}}{\left|IBT_{it}\right|} \quad (1)$$

where: ATR_{it} is the actual tax rate of company i referring to fiscal year t; IBT_{it} is the income before taxes of company i referring to fiscal year t; NI_{it} is the net income of company i referring to fiscal year t.

Consistent with previous studies (e.g. Marques et al., 2011; Poli, 2013b), we expect that ATR positively

influences companies' propensity to practice EM and ECM.

Previous studies (e.g. Baralexis, 2004; Moreira, 2006; Poli, 2013b) have controlled for bank indebtedness. However, their findings are mixed. On the one hand, Moreira (2006), exploring the impact of the level of bank indebtedness on Portuguese private companies' earnings management practices, found that companies with a higher level of bank indebtedness have a higher propensity to manage earnings upward to avoid losses and a lower propensity to manage earnings downward to minimize tax payments than companies with a lower level of bank indebtedness. On the other hand, Baralexis (2004) and Poli (2013b) found that the level of bank indebtedness does not constrain private companies' propensity to manage earnings downward to minimize tax payments in the Greek and Italian contexts, respectively. As in previous studies (e.g. Moreira, 2006; Poli, 2013b), to control for the bank indebtedness influence, we use the BANK variable. It is defined as follows:

$$BANK_{it} = \frac{BANKLOANS_{it}}{TA_{it}} \quad (2)$$

where: $BANK_{it}$ is the level of bank indebtedness of company i referring to fiscal year t; $BANKLOANS_{it}$ is the bank loans of company i referring to fiscal year t; TA_{it} is the total assets of company i referring to fiscal year t.

Consistent with Poli (2013b), we expect that BANK positively influences companies' propensity to practice EM and ECM.

Previous studies have generally controlled for size. To do so, we use the variables SIZE*Large* and SIZE*Medium*. The first is a dummy variable that holds a value of 1 if the observation corresponds to a large company, of 0 otherwise. The second is a dummy variable that holds a value of 1 if the observation corresponds to a medium-sized company, of 0 otherwise.

Our definition of large and medium-sized companies is inspired by that provided by the European Commission's Recommendation 2003/361/CE. We consider a company to be large if it meets the following criteria:

- number of employees > 250 and,
- balance sheet total > €43 million or turnover > €50 million.

We consider a company to be medium-sized if it meets the following criteria:

- number of employees between 50 and 250 and,
- balance sheet total between €10 and 43 million or turnover between €10 and 50 million.

The findings of previous studies on the influence of size are mixed. Generally, the influence is negative, in the sense that the bigger the company, the smaller the probability that it engages in earnings management practices. However, Poli (2013b), in his investigation of Italian private companies' propensity to practice earnings management, found that the influence is positive; moreover, the size of the companies was measured by the natural logarithm of total assets. This leads us to hypothesize the existence of an association between company size and the companies' propensity to practice EM and ECM, but not to have expectations about the sign of the association.

Previous studies have generally also controlled for time and sector. The variables we use to this end are YEAR and SECTOR, respectively. The first is a dummy variable that holds a value of 1 if the observation refers to 2013, of 0 otherwise (our investigation refers to 2012 and 2013). The second, that is used to control for industry fixed effects, is a set of dummy variables based on the two-digit NACE 2 rev. codes. The base case is the set of sectors that have less than twenty observations.

3.4 Testing Methodology

The logit analysis models we use to test our research hypotheses are the following:

$$EM1_{it} \text{ or } EM2_{it} = \beta_0 + \beta_1 CONCENTRATION_{it} + \beta_2 INSTITUTIONAL_{it} + \beta_3 STATE_{it} + \beta_4 FOREIGNStrong_{it} + \beta_5 FOREIGNOthers_{it} + \beta_6 ATR_{it} + \beta_7 BANK_{it} + \beta_8 SIZE_{it} + \beta_9 YEAR_{it} + \beta_{10} SECTOR_{it} \quad (3)$$

The variables are analytically described in Table 1.

Table 1. Definitions of the variables

Variables	Definitions
EM1$_{it}$	Dummy variable that holds a value of 1 if the reported earnings of fiscal year t, scaled to total assets of fiscal year t-1, of company i assumes a value between 0 and 0.005 (0 is included, 0.005 is excluded), of 0 otherwise.
EM2$_{it}$	Dummy variable that holds a value of 1 if the reported earnings change (determined as the difference between the reported earnings of fiscal year t and the reported earnings of fiscal year t-1) of fiscal year t, scaled to total assets of fiscal year t-2, of company i assumes a value between -0.0025 and 0.0025 (-0.0025 is included, 0.0025 is excluded), of 0 otherwise.
CONCENTRATION$_{it}$	Proportion of shares held by the majority shareholder in company i in fiscal year t.
INSTITUTIONAL$_{it}$	Proportion of shares held by institutional shareholders in company i in fiscal year t.
STATE$_{it}$	Proportion of shares held by state shareholders in company i in fiscal year t.
FOREIGN*Strong*$_{it}$	Proportion of shares held by foreign shareholders domiciled in strong institutional quality countries in company i in fiscal year t. The strong institutional quality countries are: Australia, Austria, Belgium, Canada, Denmark, Germany, Ireland, Luxembourg, the Netherlands, Norway, Sweden, Switzerland, the United Kingdom, and the United States of America.
FOREIGN*Others*$_{it}$	Proportion of shares held by foreign shareholders domiciled in non-strong institutional quality countries in company i in fiscal year t. The non-strong institutional quality countries are those countries that are not included among the strong institutional quality countries.
ATR$_{it}$	Dummy variable that holds a value of 1 if the actual tax rate of company i in fiscal year t is higher than the median of the overall distribution, of 0 otherwise. ATR is defined as follows: $$ATR_{it} = \frac{IBT_{it} - NI_{it}}{\left|IBT_{it}\right|}$$ where: ATR$_{it}$ is the actual tax rate of company i referring to fiscal year t; IBT$_{it}$ is the income before taxes of company i referring to fiscal year t; NI$_{it}$ is the net income of company i referring to fiscal year t.
BANK$_{it}$	Incidence of bank debt to total assets of company i in fiscal year t. It is defined as follows: $$BANK_{it} = \frac{BANKLOANS_{it}}{TA_{it}}$$ where: BANK$_{it}$ is the level of bank indebtedness of company i referring to fiscal year t; BANKLOANS$_{it}$ is the bank loans of company i referring to fiscal year t; TA$_{it}$ is the total assets of company i referring to fiscal year t.
SIZE*Large*$_{it}$	Dummy variable that holds a value of 1 if the observation refers to a large-sized company, of 0 otherwise. The company is considered large if it meets the following criteria: - number of employees > 250 and - balance sheet total > €43 million or turnover > €50 million.
SIZE*Medium*$_{it}$	Dummy variable that holds a value of 1 if the observation refers to a medium-sized company, of 0 otherwise. The company is considered medium-sized if it meets the following criteria: - number of employees between 50 and 250 and - balance sheet total between €10 and 43 million or turnover between €10 and 50 million.
YEAR$_{it}$	Dummy variable that holds a value of 1 if the observation i refers to 2013, of 0 otherwise.
SECTOR$_{it}$	Set of dummy variables based on the two-digit NACE 2 rev. codes (the base case is the set of sectors that have less than twenty observations).

The logit analysis models we use do not include variables to verify the influence of possible interaction effects of the explanatory variables.

For validation of our research hypotheses, we are interested in the sign and statistical significance of the ß coefficients. The positive (or negative) sign means that the corresponding independent or control variable positively (or negatively) influences companies' propensity to engage in EM and ECM. Table 2 summarizes our expectations on the signs of the independent and control variables.

Table 2. Expectations on the signs of the independent and control variables

Variables	**Expected signs**
$CONCENTRATION_{it}$	/
$INSTITUTIONAL_{it}$	+/–
$STATE_{it}$	+/–
$FOREIGN\mathit{Strong}_{it}$	–
$FOREIGN\mathit{Others}_{it}$	/
ATR_{it}	+
$BANK_{it}$	+
$SIZE\mathit{Large}_{it}$	+/–
$SIZE\mathit{Medium}_{it}$	+/–
$YEAR_{it}$	**?**
$SECTOR_{it}$	**?**

Note. + = we expect a positive sign. – = we expect a negative sign. +/– = we expect an association but we do not expect a specific sign. / = we expect no association. ? = we do not have an expectation.

3.5 Sample Selection and Data

The sample of Italian private companies we used to test our research hypotheses was extracted (on 13rd January 2015) from the "Analisi Informatizzata Delle Aziende" (AIDA) database supplied by Bureau van Dijk. The AIDA database provides financial statement data for a vast set of private and public Italian companies operating in sectors other than the financial one.

Table 3. Main descriptive statistics referring to the variables

Variables	**Obs.**	**1st quartile**	**2nd quartile**	**3rd quartile**	**Mean**	**Standard deviation**
EARNINGS	27 448	0.0003	0.0078	0.0330	0.0177	0.0703
EARNINGS CHANGE	27 448	-0.0124	-0.0002	0.0108	-0.0013	0.0776
CONCENTRATION	27 448	0.4000	0.5000	0.8392	0.5920	0.2601
INSTITUTIONAL:						
with	728	0.2884	0.7000	1.000	0.6296	0.3559
without	26 720					
STATE:						
with	808	0.7991	1.000	1.000	0.8645	0.2417
without	26 640					
FOREIGN*Strong*:						
with	720	0.2827	0.5000	1.0000	0.6133	0.3687
without	26 728					
FOREIGN*Others*:						
with	46	0.0141	0.1186	0.4000	0.2288	0.2238
without	27 402					
ATR	27 448	0.3223	0.4232	0.6694	-0.7128	4.0645
BANK	27 448	0.0424	0.2030	0.3557	0.2192	0.1827
SIZE:						
small	11 935					
medium	14 768					
large	745					

We selected the sample of companies on the basis of the criteria that follow: limited liability companies; active companies; unlisted companies; companies that prepare their (non-consolidated) financial statements in ordinary form according to the Italian legislation and generally accepted accounting standard in the period 2010-2013; companies that are not micro-enterprises according to the quantitative size limits established by the European Union (according to the European Union, a micro-enterprise is that which meets the following criteria: fewer than 10 employees and a balance sheet total below €2 million or a turnover below €2 million); companies that have a positive total shareholder equity in the period 2010-2013; companies for which complete information on

the ownership structure is available; companies that are not controlled by an industrial company, i.e., an industrial company that owns more than 50% of the shares (in order to exclude companies belonging to industrial groups). In the database, the number of companies that meet the above selection criteria amounts to 14,147.

The database only provides data relating to the date of consultation (it does not provide historical information). Because Italian companies generally have an ownership structure that tends to be stable over time, we assumed that the ownership structure of companies at the date of consultation had remained stable during the period 2012-2013. Based on this assumption, we developed the investigation referring to a period of two years (2012-2013). In doing so, the initial sample of companies included 28,294 firm-year observations. From that, we subtracted the observations for which data was either incomplete or invalid. The sample of companies, therefore, consists of 13,724 companies, corresponding to 27,448 firm-year observations. Table 3 shows the main descriptive statistics referring to them. It illustrates some of the features that distinguish private Italian companies: high ownership concentration, high level of actual tax rate, high level of bank debt, widespread small-to-medium size.

Figure 1 shows the frequency distribution of earnings (defined as the reported earnings of fiscal year t scaled to total assets of fiscal year t-1). It is characterized by a peak of observations in the first positive interval [0-0.005) (+1), a marked discontinuity and a convex shape both to the left and to the right of this interval. The frequency distribution of earnings, therefore, displays the typical characteristics of earnings management practices aiming to minimize earnings (e.g. Coppens & Peek, 2005; Marques et al., 2011; Poli, 2013a, 2013b). The verification of the statistical significance of the two discontinuities, using the test statistics suggested by Burgstahler and Dichev (1997) and Garrod, Pirkovic, and Valentincic (2006), for which the data is not shown, has revealed that they are statistically significant at a level of 1%. Figure 1 shows that the EM practices are widely popular among Italian private companies, confirming the findings of previous studies (Poli, 2013a, 2013b).

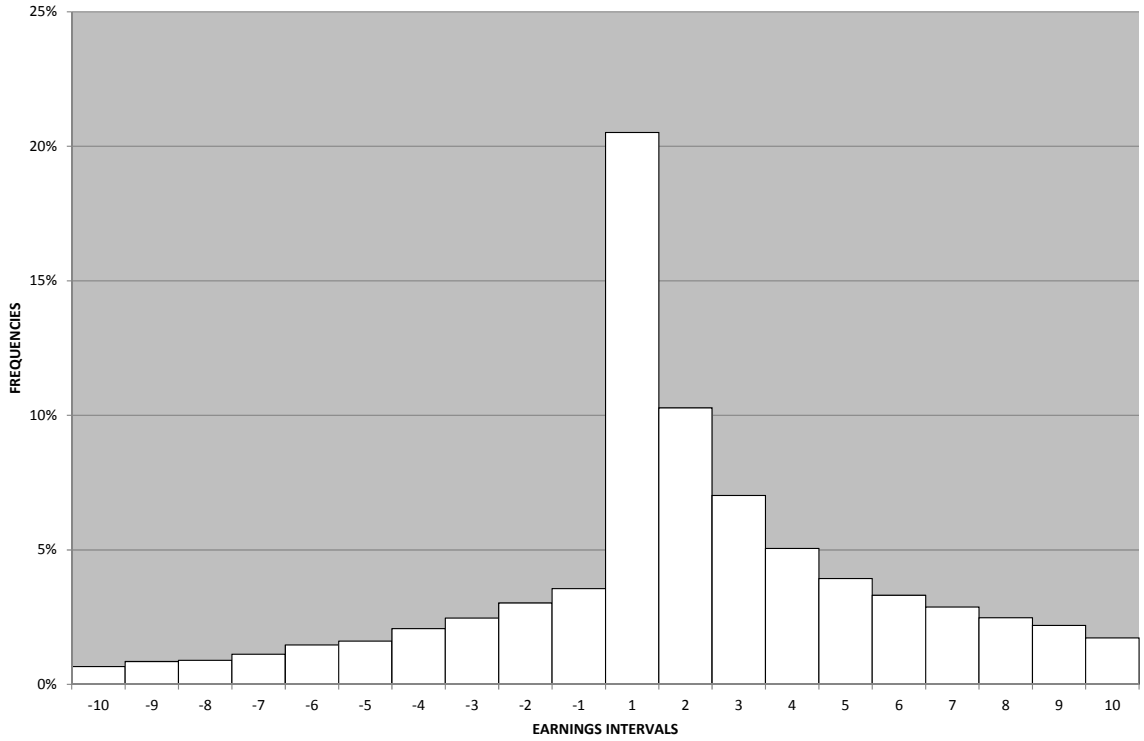

Figure 1. Earnings frequency distribution

Note. The abscissa axis shows earnings intervals. The ordinate axis shows frequencies (the percentage of the observations falling in each earnings interval). The interval amplitude is 0.005. So, interval "1" is the first positive interval to the right of zero (0; 0.005), interval "2" is the second positive interval to the right of zero (0.005; 0.01), and so on. Conversely, interval "-1" is the first negative interval to the left of zero (-0.005; 0), the interval "-2" is the second negative interval to the left of zero (-0.01; -0.005), and so on. The intervals include the lower limit and exclude the upper limit. The figure is truncated, showing only the first ten intervals of positive (from 1 to 10) and negative (from -1 to -10) earnings. The figure shows 21,171 observations, corresponding to 77% of the overall sample (27,448 observations).

Figure 2 shows the frequency distribution of earnings changes (defined as the difference between the reported earnings of fiscal year t and the reported earnings of fiscal year t-1, scaled to total assets of fiscal year t-2). It is characterized by peaks of observations in correspondence to the first negative interval (-0.00250-0) (-1) and the first positive interval (0-0.0025) (+1), a marked discontinuity and a convex shape both to the left of the first negative interval and to the right of the first positive interval. The frequency distribution of earnings changes, therefore, displays the typical characteristics of earnings management practices aiming to minimize earnings changes (e.g. Coppens & Peek, 2005; Poli, 2013b). The verification of the statistical significance of the two discontinuities, using the test statistics suggested by Burgstahler and Dichev (1997) and Garrod et al. (2006), for which the data is not shown, has revealed that they are statistically significant at a level of 1%. Figure 2 shows that EM practices are widely popular among Italian private companies, confirming the findings of previous studies (Poli, 2013a).

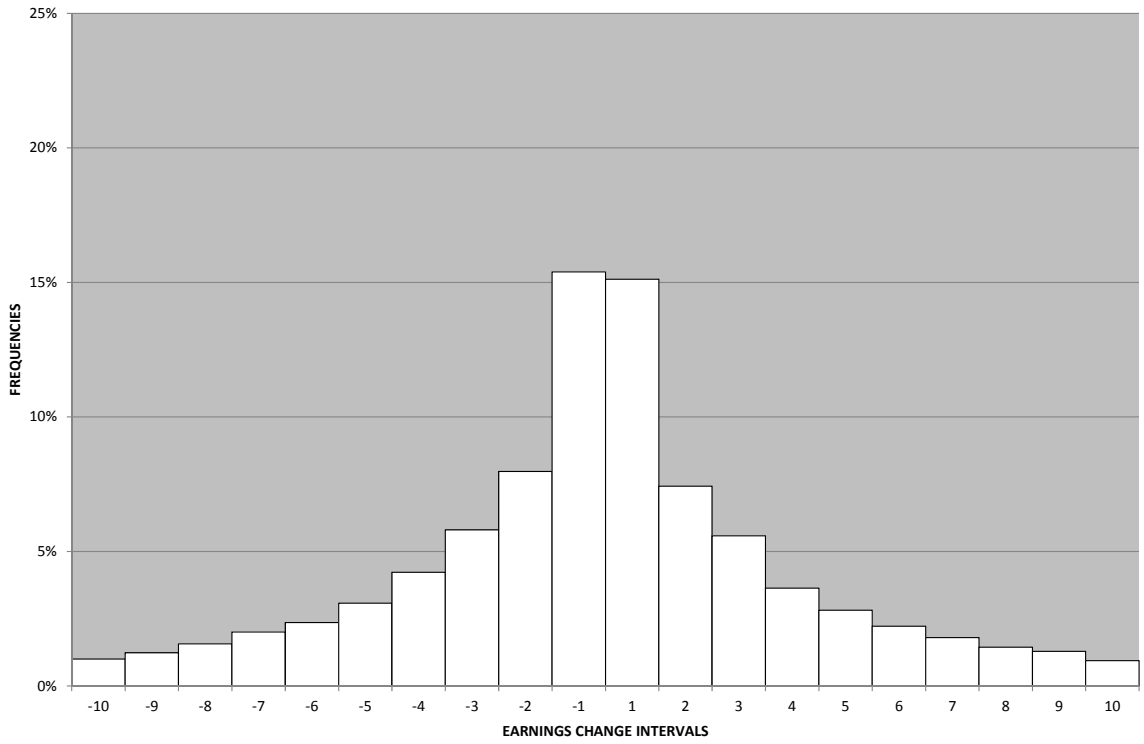

Figure 2. Earnings change frequency distribution

Note. The abscissa axis shows earnings intervals. The ordinate axis shows frequencies (the percentage of the observations falling in each earnings interval). The interval amplitude is 0.0025. So, interval "1" is the first positive interval to the right of zero (0; 0.0025), interval "2" is the second positive interval to the right of zero (0.0025; 0.005), and so on. Conversely, interval "-1" is the first negative interval to the left of zero (-0.0025; 0), interval "-2" is the second negative interval to the left of zero (-0.005; -0.0025), and so on. The intervals include the lower limit and exclude the upper limit. The figure is truncated, showing only the first ten intervals of positive (from 1 to 10) and negative (from -1 to -10) earnings changes. The figure shows 23,859 observations, corresponding to 87% of the overall sample (27,448 observations).

4. Findings and Discussion

Table 4 shows the results of the logit analysis models we use to test our research hypotheses.

Table 4. Results of the logit analysis models

Variables	Coefficients (Standard error)	
	EM1	EM2
CONSTANT	-4.05537***	-2.96057***
	(0.16401)	(0.16493)
CONCENTRATION	0.11019	-0.00531
	(0.06820)	(0.06380)
INSTITUTIONAL	-0.37965**	-0.40573**
	(0.18271)	(0.16773)
STATE	1.31791***	1.05256***
	(0.11262)	(0.10327)
FOREIGN*Strong*	-0.48226**	-0.24502
	(0.19627)	(0.16661)
FOREIGN*Others*	0.12130	-0.35794
	(1.29886)	(1.26063)
ATR	2.95602***	1.25205***
	(0.05426)	(0.03532)
BANK	1.61498***	0.95582***
	(0.09759)	(0.09038)
SIZE*Large*	-0.33013***	0.20726**
	(0.12011)	(0.10137)
SIZE*Medium*	-0.11143***	0.06090*
	(0.03525)	(0.03342)
YEAR	0.04276	0.05095
	(0.03391)	(0.03342)
SECTOR	INCLUDED	INCLUDED
Adjusted R^2	23.20%	7.09%
Likelihood-ratio test	6,604.74(0.00000)	2,042.23(0.00000)
Percentage of correctly predicted results	79.80%	80.90%

Note. ***, **, and * indicate significance at 1%, 5% and 10%, respectively.

Ownership concentration does not have a statistically significant influence with regard to both practices of earnings management. As a result, our first research hypothesis is confirmed. As stated above, the fact that the level of concentration is generally high in the context of Italian private companies and the fact that for these we can rule out the existence of agency problems between owners and managers and problems between majority and minority shareholders could be a satisfactory explanation of the findings we have obtained. Our findings lead us to believe that neither the "alignment effect" hypothesis nor the "entrenchment effect" hypothesis can explain the relationship between ownership concentration and EM and ECM practices in the context of Italian private companies.

Institutional ownership has a negative and statistically significant influence with reference to both practices of earnings management. This means that the presence of institutional investors adversely affects the propensity of companies to practice EM and ECM (in particular, the higher the proportion of shares directly held by institutional shareholders, the lower the probability that the company practices EM and ECM). As a result, our second research hypothesis is confirmed. The "efficient monitoring hypothesis" could be the best explanation of our findings (e.g. Almazan et al., 2005; Bange & De Bondt, 1998; Bushee, 1998; Chung et al., 2002; Cornett et al., 2008; Ebrahim, 2007; Koh, 2003).

State ownership has a positive and statistically significant influence with regards to both practices of earnings management. This means that the presence of state investors positively influences the propensity of companies to practice EM and ECM (in particular, the higher the proportion of shares directly held by state shareholders, the higher the probability that the company practices EM and ECM). As a result, our third research hypothesis is confirmed. However, our findings contrasts with those of Capalbo et al. (2014). They found that, in Italy, state-owned companies manage earnings less frequently than privately-owned companies. We believe that our findings could be explained by the lower efficiency that generally characterizes Italian state-owned companies

and by the desire to avoid too negative or too positive levels of earnings arousing criticism from public opinion or the higher levels of government.

Foreign ownership has a negative and statistically significant influence with reference to both practices of earnings management if foreign investors are domiciled in strong institutional quality countries. Otherwise, the relationship is not statistically significant. This means that the presence of foreign investors domiciled in strong institutional quality countries adversely affects the propensity of companies to practice EM and ECM (in particular, the higher the proportion of shares directly held by this kind of foreign shareholders, the lower the probability that the company practices EM and ECM). As a result, our fourth research hypothesis is confirmed. Our findings are consistent with those of Beuselinck et al. (2013).

Both ATR and BANK have a positive and statistically significant influence with reference to both practices of earnings management. This means that the level of ATR and BANK positively influences the propensity of companies to practice EM and ECM (in particular, the higher the level of ATR and BANK, the higher the probability that the company practices EM and ECM). Our findings are consistent with our expectations and the findings of previous studies (e.g. Poli, 2013b). In countries like Italy, characterized by a close alignment between accounting and tax rules, tax incentives greatly impact on private companies' earnings management practices (e.g. Coppens & Peek, 2005; Goncharov & Zimmermann, 2006; Marques et al., 2011; Poli, 2013b). With regard to the findings referring to financial incentives, Poli (2013b) has posited that it could depend on the fact that Italian banks do not attribute great importance to the financial information provided by Italian private companies' financial statements. In fact, Italian banks generally require (informal) information in addition to what is reported in financial statements in order to grant loans to Italian companies.

With regard to size, the results differ according to the practice of earnings management. With reference to EM practices, both the SIZE*Large* and SIZE*Medium* coefficients are negative and statistically significant, showing that an inverse relationship exists between the size of companies and their EM practices (in essence, the greater the size, the lower the probability that the company practices EM). Conversely, with reference to ECM practices, both the SIZE*Large* and SIZE*Medium* coefficients are positive and statistically significant, showing that a direct relationship exists between the size of companies and their ECM practices (in essence, the greater the size, the higher the probability that the company practices ECM). Our findings referring to the relationship between company size and EM practices contrasts with those obtained by Poli (2013b). However, as specified above, in Poli (2013b), the size of the company was measured by the natural logarithm of total assets.

With reference to the control for time, the coefficient of the corresponding control variable is not statistically significant in both models. Thus, the year does not affect the companies' propensity to practice EM and ECM.

With reference to the control for sector, both of the logit analysis models include 60 dummy variables. The base case is represented by all the sectors that have less than twenty observations. In the first model, only 11 sectors showed a statistically significant relationship. In the second model, instead, 33 sectors showed a statistically significant relationship. Therefore, the sector has only a little importance in the first model and a relatively greater importance in the second model.

The last three rows of Table 4 show the indicators for estimating the goodness of fit of the logit analysis models. They appear acceptable. The logit analysis models are not affected by multicollinearity problems.

5. Conclusion

Our study has explored whether and how ownership concentration and identity affect Italian private companies' propensity to engage in EM and ECM. The logit analysis models we have used have shown that ownership concentration is not associated with both types of earnings management practices and that, conversely, the presence of institutional, state and foreign (if foreign investors are domiciled in strong institutional quality countries) shareholders are associated with both of them. In the first and third cases (institutional and foreign ownership), the relationship is negative (the higher the proportion of shares held by institutional or foreign shareholders, the lower the propensity for companies to practice EM or ECM). In the second case (state ownership), the relationship is positive (the higher the proportion of shares held by state shareholders, the higher the propensity for companies to practice EM or ECM).

In showing this, our study extends the current knowledge on the relationship between aspects of corporate governance and earnings management practices in private companies, especially SMEs, and on earnings management practices undertaken by companies in countries, like Italy, in which a code law system is in force and in which accounting and tax systems are closely aligned. Both issues are under-explored in the literature. Moreover, despite previous studies having shown that EM and ECM practices are widely popular among Italian

private companies (e.g. Poli, 2013a, 2013b), whether and how such practices are influenced by ownership structure characteristics have not yet been investigated. Our study, therefore, fills this knowledge gap.

The main limitation of our study refers to the method we have used to detect companies that practice EM and ECM (e.g. Dechow, Ge, & Schrand, 2010). In fact, it is difficult to distinguish companies that report slightly positive earnings and slight earnings changes because of chance circumstances (or as a result of credible alternative explanations including non-accounting issues) from those that report them as a result of earnings management practices. Thus, caution should be used in interpreting our findings.

This study notwithstanding, the earnings management practices of Italian private companies are still insufficiently investigated. Therefore, further studies are required to gain a full understanding of the earnings management practices of Italian private companies.

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The Impact of the IAS/IFRS Adoption on the Predictive Quality of Discretionary Accruals: A Comparison between the French and the British Context

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Abstract

The purpose of this article is to study and compare the impact of the adoption of the international standards IAS/IFRS and the legal regime of a country on the pertinence of the discretionary accruals in terms of its quality of the prediction of future operating cash flows in two contexts: The French and United-Kingdom. The findings of our study prove that the adoption of these norms has clearly improved the predictive quality of discretionary accruals in the British context. In France, such effect has been demonstrated as significant and positive for both periods. The study of the impact of the IFRS norms on the predictive quality of discretionary accruals on the two European countries of our study shows that in the British context, the association between the discretionary accruals and the future operating cash flows is more important for the companies using the international norms than in those applying the British ones. In the French context, no significant association between the discretionary accruals and the IFRS has been verified. Next, our study has spread to see the impact of the legal regime on the predictive power of discretionary accruals before and after the adoption of the IAS/IFRS norms. The findings prove that the fullness of the association between the future operating cash flows and the discretionary accruals is stronger for the enterprises which are under the British context than those under the French one.

Keywords: discretionary accruals, relevance, IAS/IFRS, legal system, future operating cash-flows, French and British context

1. Introduction

Politics and capital market generalization all over the world has made the integration of principles and practices of financial divulge unavoidable (Ball, 2006; Burns, 2000).It is with an increase internationalization of both economic exchanges and business universality that the financial information, which is prepared with reference to the national accounting systems, could no more satisfy the needs of users whose decisions are more and more international (Zeghal & Mhedhbi, 2012). Being conscious of this harmonizing necessity, the efforts of normalizing are accentuated to achieve this objective and it is the year 1973 which noticed the creation of the private organism I.A.S.C (*International Accounting Standard Committee*). The main objectives of this organism are the following : to establish internationally acceptable accounting standards, to promote their use, and to work in order to harmonize the accounting laws and the presentation of the financial states at the international level. Since (2001), the I.A.S.B has modified its structure and its label to become *The International Accounting Standard Board* (I.A.S.B). During this reform, it has been decided that the norms and their interpretations would be henceforth relative not only to the process of accounting normalization but also to the financial news in general.

The tendency of accounting globalization has been on the one hand, accelerated by the voluntary accessory with IFRS (Note 1) norms; and on the other, reinforced by some other events which occurred in numerous countries during the late 1980's. Indeed, in November 1995, The European Committee (EC) emphasized that "*The necessity for the European Union to react without delay so that those who prepare and those who use the account would have the securities that the companies, willing to place their capitals in the American market and*

on the other world markets, would not have to go outside the accounting framework of the Union." In 2000, The International Organization of Security Commission (I.O.S.C) recommended the I.A.S.C principles to those who intervene on the capital markets. In 2001, many capital markets all over the world to name: London, Frankfurt, Zurich, Luxemburg, Bangkok, Hong Kong, Amsterdam, and Rome, which accepted the financial states of the foreign firms quoted, have to be prepared according to the IFRS without any reconciliation. The European Commission and the Australian legislation announced that the IFRS would have to be adopted since 2005.

The compulsory adoption of these norms by the European Union countries and the formal commitment by the FASB and The I.A.S.B to converge the US GAAP to the international standards have clearly contributed to their wide acceptance by many countries all over the world (Ding et al., 2007). However, many researchers claim that the effects of this adoption may differ from one country to another (Flower, 1997; Zeff, 1998). In fact, as pointed out by (Ball, 2001; Hope, 2003; Hope et al., 2006), the accounting principles are present in mosaic in the frame of a complex institutional context and non in isolation. The modification of one piece of it would not be the best solution if the other institutional factors remain stable. On the same footing, Ball (2001) gives arguments that the mere modification of an accounting principle, without making the corresponding improvement at the level of law making and the development of capital markets, will lead nowhere as far as the financial disclosure of quality is concerned.

According to Soderstrom and Sun (2007), the conversion to IFRS seems to affect the financial disclosure but it is only one of the determining accounting quality factors. Other factors as the political and legal system of a country and the incitation of financial disclosure remain always determinant. The financial statements, which are considered as the most interesting means of communication between the enterprise and the investors, contribute generally to achieve an informational equilibrium between these two last and the decision-takers. In order to elaborate these files of synthesis, the managers are invited to make some estimations and judgments based on the interpretation of transactions and to choose through the practices and the accounting methods to adopt. Nevertheless, Peluci-Grecco et al. (2014), suggested in this case, that managers could make use of the flexibility of the accounting principles to maximize their wealth at the expense of the investors.

The manipulation of earnings constitutes one illustration of these opportunistic behaviors (Jones, 1991; Dechow et al., 1995; Kang & Sivaramakrishnan, 1995; Teoch et al., 1998; Dechow & Dichev, 2002; Kothari et al., 2005; Ball & Shivakumar, 2008; Ghosh & Olsen, 2009) this can happen when managers manipulate the accounting findings in order to reach or overcome those anticipated by financial analyzers Badertsher et al. (2012).

In practice, there are many mechanisms that can limit this doing such as: the accounting legislations, independent audit and the good practice of enterprises which are governing (Peluci-Grecco et al., 2014). The accounting laws, essentially those made by lawful organism of capital markets, could be a means to restrict the findings manipulations. The main objective of these laws is to guarantee comparison, transparency and the good quality of the news linked not only to the financial situation but also to the firm performance. Consequently, the more efficient the law, the less the manipulation (by the managers) is possible and thus a higher accounting quality data is produced. Therefore, every modification of a quality accounting law has as a consequence on the improvement of the accounting information quality and as a result the shrinking of the manipulation (by managers). Moreover, the outspread of the decision-takers opportunistic manipulations seem to be more significant in a high asymmetric context. Furthermore, the opportunistic manipulation of findings may increase uncertainty towards future cash flow, which will create on its turn, asymmetric information in the capital markets.

In this article, we suggest to examine the impact of the IAS/IFRS norms on the discretionary accruals pertinence to forcast the future operating cash flows in the British and the French context. Indeed, as suggested by Subramanyam (1996) and Krishnan (2003), on the contrary of other accounting earnings components, the discretionary accruals are more subjective and reflect a high level of managerial judgments. They allow managers to communicate their favorite and private data; and consequently, to improve the earnings capacity that reflect the economic value of the firm. Based on the findings of many researches which prove that there is a positive link between every element which has an important effect on the quality of the accounting data and the informative content of discretionary accruals. We suppose that the accounting norms of high quality increase the credibility of discretionary accruals in minimizing the opportunistic part and therefore, improve their informative content for the prediction of cash flow of future exploitation. It is in this framework that Ball (2001) noted that norms "of good" quality should protect the users of the transmitted accounting information in restricting the managers opportunistic accounting choices towards results managements.

The IAS/IFRS standards are generally considered more rigorous and detailed than the domestic accounting

standards which they replace. They allow participants, in the capital markets, to better estimate the quality of the findings (Cormier et al., 2011). Furthermore ,it is commonly argued that the adoption of the IAS/IFRS will lead to the reduction of the informative asymmetry between the investors and the firms through the increase of the disclosure and the improvement of the communicated accounting information (Gul et al., 2003; Ghosh & Olsen, 2009). France, being a civil law country whose accounting principles are largely influenced by the system of imposing, has chosen, as all the other members of the European Union, to adjust with the IAS/IFRS norms since the year 2005.

In our study, we examine the problem of the informative content of discretionary accruals for the future operating cash flows by reference to the IAS/IFRS standards. We choose to tackle this issue by comparing the British context ,which is emerging from an Anglo-Saxon model with the French context, issuing from an Euro -continental one.

To the best of our knowledge, this study is the first to investigate how IAS/IFRS affect the value relevance of discretionary accruals in terms of its ability to predict future operating cash-flows, for comparison between the French and the UK contexts.

The remainder of this article is organized as follows: section 2 presents the theoretical background and the development of research propositions. The method is described in section 3. Results are interpreted in section 4. Finally, section 5 provides a conclusion and discussion of potential implications.

2. Literature Review and Hypothesis

The importance given to the accruals concept, as a pertinent component of the accounting earnings, has been reinforced by the identification of the discretionary dimension of the accruals themselves. Subramanyan (1996) divide the findings into: first, cash flow of exploitation, second, non discretionary accruals and third, discretionary accruals. This author demonstrates that the discretionary accruals are related to the findings and to the cash flow of future exploitation. These results confirm the informative value of the discretionary accruals. In fact, as suggested by Krishnan (2009), as t opposed to the other elements of the findings, the discretionary accruals are more subjective and reflect a high degree of managerial judgments. These allow the decision-makers to communicate both their favored and private information and consequently to improve the result capacity to reflect the economic value of the enterprise. Nevertheless, the decision-takers may overuse the allowed flexibility given by the accounting principles, which are generally accepted and carry out aggressive divulges of accruals that may alter the informative content of the published results.

There are three approaches which have been identified in the accounting literature dealing with the choices of the discretionary accountings and each of which has some implications for the prediction of future operating cash-flows of the enterprise.

The first is of an *"informative perspective*" one. This approach stipulates that the discretionary accounting choices are accomplished in order to reveal the private information of the decision-takers concerning the study of future trends of the enterprise. Thus, offering some accruals elements which are the best for predicting future cash flow for the enterprise. Such perspective is widely illustrated by the accounting literature (Holthausen & Leftwich, 1983; Watts & Zimmerman, 1990; Subramanyam, 1996; Demski, 1998; Degeorge et al., 1999; Arya et al., 2003; Kanagaretnam et al., 2004; Altamuro et al., 2005; Louis & Robinson, 2005; Badertsher et al., 2012), who consider that according to this point of view. the managers make use of the elasticity that exists in the accounting principles generally admitted to ameliorate the pertinence and the feasibility of the published accounting information; and consequently increases the predictive usefulness and faithful representation.

The second approach is *"opportunistic"*. It considers that managers make some discretionary accounting choices in order to conceal the truth surrounding the economic performance to improve their wealth at the expense of the investors (Jensen, 2005; Teoh et al.,1998; Dechow & Skinner, 2000; Beneish, 2001; Nelson et al.,2002; Hribar & Jenkins,2004, Revsine et al., 2005; Badertsher, 2011). Badertsher, Collins & Lys (2012) consider that this approach is an "opportunistic perspective" which look for operating the possibility that decision-takers experienced the accounting discretion in order to, reach or go beyond the reference results as the ones forecasted by financial analyzers. In this case, Badertsheret al. (2012) consider that both the pertinence and feasibility and consequently the usefulness of prediction and the faithful representation become of secondary considerations because that these accrual choices are made for opportunistic reasons. These authors added that the accounting choices motivated by opportunistic reasons are intended to reduce the predicative power of the results and of its components for future cash flow because of the intervention of the decision-takers in the accounting process, is in this case classified as opportunistic, whose objective is to induce or to incite a bias or a noise in the published data.

The third explanation is of the discretionary accounting choices of decision-takers are *contractual*. According to Badertsher et al. (2012), the contractual explanations of the accounting choices are in most cases classified into two: the opportunistic contractual hypothesis and the efficient contractual hypothesis. As far as the first hypothesis is considered, the manipulation of the accounting results is of an opportunistic trend (Healy et al., 1987; Guidry et al., 1999; Holthausen et al., 1995; Dufond & Jiambalvo, 1994; Sweeny, 1994). For the second hypothesis, which is classified as efficient contractual perspective of the discretionary accounting choices, implies that bosses on the one hand, make their choices essentially to minimize the contractual cost trough different contractual parties of the firm; on the other to, to maximize the value of the enterprise. However, as suggested by Watts and Zimmmerman (1990), it would be difficult to separate the opportunistic accounting choices (posterior) from the efficient accounting choices. In fact, the first one could represent a level of the second ones and the decision-takers are conscious in order to protect the prices. On this bases Badertsher et al. (2012) consider that classifying part of the efficient discretionary accounting choices as opportunistic, may diminish the predicative power of discretionary accruals for future cash-flows. They explain that the managerial intervention in the accounting process, generally, add to the published information some noise and/or some bias, which can on its turn have negative implication on the predicative capacity of the discretionary accruals.

These divergence as to motivations, (informational, opportunistic or contractual) for the discretionary accounting choice and their divergent implications for the relation between the accounting results and their components (cash flows, discretionary accruals, non discretionary accruals) and the cash flows of future exploitation represent the motivations of our first hypothesis. In fact, as proved by Zimmmerman (1996), the current level of discretionary accruals is associated with the future profitability of the firm. Moreover, based on the informational perspective of discretionary accruals, Badertsher et al. (2012) showed that the discretionary choices of motivated managers, by informational objectives, are useful for the prediction of cash flow of future exploitation. This is how we formulate our first hypothesis which is the following:

H1: The discretionary accruals have a predictive power for the future operating cash flows.

Although the effect of choices between accounting methods for certain level of principle is examined by the positive accounting research (Watts & Zimmerman, 1990), little attention was given to the effects of the difference at the level of accounting principles at the international level. Furthermore, as advanced by Choi (1991), the research on the empirical consequences of differences at the level of rules for accounting gauge across countries remains a prudent question.

In this part of our study, we will try to describe the essential characteristic of the performance model of prediction in two countries having different characteristic in terms of law making concerning the financial disclosure and the capital markets. Most studies that we have investigated during the review of the literature, and those which have particularly, examined the relation between the institutional accounting factors and the characteristic of the earnings and cash flow predictions, are based essentially on the prediction made by the financial analysts (Basu et al., 1998; Hope, 2004; Hope & Kang, 2005).

Hope (2004) advanced that the variations at the level of the environment of the financial disclosure may have multiple effects on the financial file users. Consulting the literature review allowed us to make census of four institutional dimensions through which researchers tried to test the impact of international accounting differences on the predictive power of accounting news to label: the outspread of accrual registration, (Basu et al., 1998; Hope, 2004), the degree of choice through accounting methods (Basu et al., 1998; Hope, 2004); the use of the notion of the right price (Basu et al., 1998; Hope, 2004); and the power of the put onto practice of the accounting principles (Basu et al., 1998; Hope, 2004).

On the basis of the behavioral assertion according to which the precision decreases with the complexity of the task, Ashbaugh and Pincus (2001) argued from a debate on the use of IAS vis-à-vis domestic principles, that the presence of an important number of accounting methods increase the complexity of the work assigned to analysts. It is in this framework, that Elliott and Philbrick (1990) demonstrate that the variation in the accounting methods can attack the precision of the prediction operated by the financial analysts. From these findings, Hope (2004) suggested that the move from one situation, where the choice through the accounting methods is lower than another one where many methods were offered to account for a given transaction, could make the prediction of results by analysts less precise. Furthermore, He added that it would be difficult for analysts to correct the differences at the level of accounting methods in time and space across the enterprises and consequently the increase of the uncertainty can make the prediction less precise than when only one method is used. Indeed, the findings in his study allow confirming such suggestions. In fact, He demonstrates that the choice through accounting methods is negatively linked with the precision of the prediction.

These findings and these suggestions are contradictories, which were proved by Basu et al. (1998). These authors affirm that the impact of the choice through the accounting methods on the errors of prediction of earnings by the financial analysts depend on several factors. They explained that according to an efficient contractual perspective, the choice between the accounting methods is a means which gives permission to firms to transmit real and pertinent news about their present and future performance. Moreover, they advanced that if the accounting methods are known in advance, the precision of the prediction will be the same throughout all the companies that are using different methods. However, if the choice between the methods is limited, those which are permissible will be optimal for some and non for others. Consequently, the analysts' prediction errors will be in average higher than when there is no restriction in the choice. Basu et al. (1998) advance that one of the arguments contrary to the restriction in the choice of the accounting methods is to facilitate the comparison of the financial state in time (consistency) and in space (uniformity). The principle is that it will be a little bit difficult for analysts to correct the differences at the level of the accounting methods throughout the companies and through time. Therefore, the prediction becomes less precise than when only one method is allowed.

Another argument linked to the opportunist behavior of managers which is presented in opposition to this choice. Indeed, according to Basu et al. (1998), these managers choose between the methods which may maximize their wealth at the expense of other shareholders interests' and the shrinking of such a choice could shorten such a possibility. However, facing this argument, and based on the results demonstrated by Kim and Schroeder (1990), who signal that analysts seem to take into consideration the outline of the users interests' in order to foretell the accounting earnings, Basu et al. (1998) affirmed that the restriction in the choice of the accounting methods is not necessary to improve the prediction capacity of those who intervene in the market provided that, the choice of the methods had to disclose in advance.

The put into application of the accounting principles is another topic that attracted the attention of many researchers in the field of accounting. In fact, Hope (2003a) affirmed that the overspread with which the principles are applied and the operated violations are as important as the principles themselves. In the same direction, Kothari (2000) advance that the quality of financial news, is dependent on both the quality of accounting principles and on the making of law imposed by the put into vigor of these principles. Nevertheless, even though, academics and practitioners agree on the importance of the application of the accounting principles as a determining element of the disclosure on news quality, little attention has been paid to the study of the impact of this dimension at the international level. Hope (2003, 2004) explains that such weakness is due to the complexity linked to the measure of this factor across the countries.

During the last decade, an important number of organizations have been implicated in the improvement and harmonization of the application of the accounting principles all over the world. Their efforts have been considered as an essential element in the infrastructure of the financial disclosure. Few of these organizations could be mentioned, for example: *The I.A.S.B*; *the I.O.S.C*; *the W.F.E. the World Bank*; the I.M.F; *the S.E.C*; *the I.F.A*; *the U.E.* These organizations have expressed a view linked to the lack of a global mechanism for the application of these accounting principles in general and of the international accounting principle (I.A.P) in particular. With regard to this, we can mention as an example the opinion expressed by (I.C.AE.W, 2000) according to which "*A mechanism of applying the accounting principles is found necessary to support the application of international accounting principles. One of the major risks which may face the reputation principles of the I.A.S.C is the bias that can touch the interpretation of these international principles by national agencies of the accounting law".*

According to Hope (2004), the power of applying the accounting principles is multidimensional and has many forms in numerous countries. For instance, the SEC is considered as the main organism which controls the application of the accounting principles in the U.S.A; in other countries, it is the financial market which insures such application. Foster, (1986) advances that in most countries, it is the financial market and the making of law of the government which divide the responsibility elaboration, supervision, and the application of exigencies in terms of law making.

On the basis of these suggestions, Hope (2003, 2004) affirms that the power of applying the accounting principles constitutes a capacity for the managers to adhere to the accounting principles prescribed, and consequently, represents a security against the instances of deceit of the financial divulge. He adds that the existence of a powerful law for the application of a principle would normally present insurance in favor of the consistency of the adopted methods throughout time. Thus, decrease as a matter of fact, the complexity of the prediction. Ball (2001) considers that reducing the possibility of fraud, increases the credibility of financial reports and as a result, decrease the uncertainty concerning the accounting methods adopted, which lead to facilitating the prediction task.

Subramanayam (1996) divides the accounting earnigs into three elements: operating cash flows, the non discretionary accruals and the discretionary accruals. He demonstrates that the three components are not only strongly appreciated by the capital market, but also linked to the future profitability of the company. Because of their nature, the discretionary accruals allow the managers to commit some opportunistic behavior in the intention of maximizing their personal profit at the expense of those of the firm. Other ulterior studies demonstrate that the predictive ability of the accruals to forecast the future profitability is attributed to the discretionary component (Xie, 2001; Chan et al., 2001). Subramanayam (1996) and Krishnan (2003) examine the eventual existence of a link between the quality of the audit and the valorization of discretionary accruals for the capital market and their impact on future profitability. They demonstrate that the association between discretionary accruals and the stock return is stronger for the audited firms by the Big six. Furthermore, they show that the managers use the discretionary accruals in order to communicate the private news concerning the future profitability. Moreover, they proved that the audited discretionary accruals by the Big six auditors have a superior predictive value to those audited by the non Big six cabinet. These authors interpreted that a high quality audit can reduce the aggressive and opportunistic manipulations of discretionary accruals.

Nevertheless, the harmonizing effort to reduce the disparity between the practices of financial disclosure and the adoption of international standards by many countries all over the world, exhorted numerous reactions in the international accounting environment, and different points of views have been expressed. In fact, the common European framework is marked by the presence of two big classes of the accounting models: Anglo -Saxon and the Euro- continental each of which has different characteristics in terms of the financial market and the orientation of the financial information.

The IFRS standards are characterized by their orientation towards the capital market and the excessive use of the concept “the fair value”. In France, The European Union decision has faced many opponent reactions. According to Raffournier (2007), although the decision adopted by the IFRS could be applied to all the European Union countries, they do not seem to induce such opponents as in France. He said that the negative reactions are attributed to the deep change of the accounting philosophy that implies the adoption of the IFRS, and that it represents a true cultural cut and requires new competence on the part of accounting practitioners.

As far as the Anglo-Saxon orientation countries are concerned, whose adoption does not seem to incite the same critics. Indeed, the IFRS as advanced by Capron and Chiapello (2005), are the representatives of the Anglo-Saxon conception. According to these standards, the accounting information has to favor the financial and economic analysis which was central in the training program of the Anglo-Saxon countries; but it was not of the same importance given to the Euro-continental ones. In this sense, Raffournier (2007) develops that in waiting for the training program to progress the French accounts are in somehow handicapped compared to their homologue Anglo-Saxons, whose education, through time, has widely used the financial and economic analysis.

Examining the new quality linked to the discretionary accruals in an environment using the IAS/IFRS has become a topic which interests many recent researches. The impact of the IAS/IFRS standards at the level of the manipulation of the accounting results using the discretionary accruals has made the object of an important number of empirical verification and the results of these studies are various.

Ding et al. (2007) considered that the differences translated in terms of “absence” and of “divergence” between the domestic standards of a country and the international norms may have important implications on the disclosure quality. They demonstrated that a high score in terms “of absence” may create an important margin for the earnings manipulation and consequently, the firms which are in countries characterized by a non-sophisticated-accounting legislation have the tendency to achieve an advantage of accounting discretion linked to the manipulation of earnings. In the contrary, for the sign of “divergence” no significant link has been detected with the result manipulation.

Aussenegg et al. (2009) examined the impact of the adoption of the IAS/IFRS standards at the level of the accounting results manipulation in fifteens countries of the European Union. In this study, the IAS/IFRS standards have been integrated in the models as a mute variable. Tests have proved that the result manipulations seems to be lower in two regions of central Europe (German law countries: Austria, Germany, and, Switzerland- and three French law countries: Belgium, France and Netherland). Nevertheless, in the United Kingdom, Ireland and Northern European countries, which are characterized by a low level of results manipulations, no difference has been detected between the IFRS and domestic GAAP.

Christensen et al. (2008) studied that the impact of the IAS/IFRS standards on the earnings manipulation in the German context based on two categories of the firms. The first, those which adopt the voluntary standard, and the second, those which apply the obligatory way. They demonstrated that the second ones require less

advantages of the IAS/IFRS standards. These opinions which prove that the positive impact of the voluntary adoption on the pertinence of the accounting news are divided by the studies of Soderstrom and Sun (2007) and Leuz and Wysoki (2008). Contrary to these opinions, Hung and Subramanyam (2007) didn't observe any positive association between the voluntary adoption of the IAS/IFRS standards and the pertinence of the accounting news in the German context. These same conclusions were deduced by Eccer and Healey (2003), who compared the accounting news published with reference to the Chinese standards.

As a reaction to these results, Christensen et al. (2009) suggested that the companies, which adopted the IFRS voluntary, prove a better improvement in the liquidity of their shares and the capital cost. In fact, the obligatory assortment of the IFRS norms does not constitute a sufficient condition to the improvement of the financial disclosure; but rather other institutional and legislative factors prevail. In addition, as mentioned by Ball et al. (2003) it would be a little bit naïf to say that the application of an identical level of an accounting principle will lead to the same level of financial disclosure. The economic environment of a country remains always significant. In order to justify these interpretations, many studies are reinforced to examine and explain the effect of the adoption of the IAS/IFRS standards in many contexts.

Li (2010) studied the impact of the transition towards IFRS standards in eighteen countries. They demonstrated that the reduction of the capital cost was only observed in the countries characterized by a strong legal enforcement. Daske et al. (2008), Bruggerman et al. (2009), and Li (2010) suggested that such a reduction in the informative asymmetric system between the decision –makers and investors result from the following. First, the high quality of the financial divulges. Second, an interesting follows up by a big number of financial analyzers. Third, a rigorous control of the application of international norms by auditors and directors. In the same frame, Horton and Serafeim (2007) demonstrate that in the British context, the enterprises, which publish results according to the IFRS inferior to the one determined by the British principles, are penalized by the financial market.

Always with reference to the British context, Christensen et al. (2009) demonstrate that the transition toward the international standard do not produce only to itself information about the future cash flow. This is because the capital market is highly developed regulated, dominated by the public financing system and that the British accounting principles quality is comparable to that of the IAS/IFRS standards. Nevertheless, they foretell that from the fact that the accounting news can affect the distribution of wealth between creditors and investors. The finding of the study proved that the reaction in the return of the shares to the reconciliation to IAS /IFRS and that it was detected in a more significant way near to enterprise having a high cost capital. According to Iatridis (2010), despite that the adoption of the IAS/IFRS norms has increased the level of the news available to investors in the British context; it has on the other side, created not only a higher uncertainty linked to the prediction of the accounting results by financial analyzers, but also some volatility at the level of the British result status due to the excessive use of the notion of the right value.

In the French context, Cormier et al. (2009) demonstrate that the first adoption of the IAS/IFRS by the French enterprises was perceived as of a sign of improvement in their financial status. Moreover, in a comparative study dealing with France, the United Kingdom, and Austria, Jean Jean and Stolowly (2008), demonstrate that the application of the IAS/IFRS standards did not have as an impact on the diminishing of the manipulation of results which on the contrary increased for France. These authors conclude that the application of a uniform level of accounting principles does not constitute a sufficient condition to create a common financial language. The incitation of decision –takers and the institutional factors remain always determinant characteristics of the financial divulge.

Based on a sample of composed of ninety six observations of French enterprise making part of the CAC40, Boumediane et al. (2014) examine the impact of the adoption of the IAS/IFRS standards on the manipulation of earnings. In this analysis, the authors choose two periods: one *before* adoption (2003-2004) and another one *after* adoption (2006-2007). The findings prove that the manipulation exists before and after the acceptance. However, the adoption of the international standards helped reducing this manipulation. Two explanations were presented in these findings. First, they considered that the transition to international standards represent a difficult stage which requires placing a new system of news, training of staffs, an understanding of the privilege and inconvenience of this passage. Consequently, there is some distrust and prudence on the part of the decision-takers while applying these new accounting politics. Also, based on the anterior literature, (Nafti et al., 2013; Kothari et al., 2003; Mariam & Jacque, 2007; Bartov, 2004; Aboody et al., 1999) these authors suggested that after the application of the IAS/IFRS norms, the managers are less incited to manipulate the earnings up because the put into place of the fair value notion will have as a consequence the immediate increase of the findings.

On the basis of the findings of the studies synthesized above, the second hypothesis that comes is the following:

H2: The international standards IAS/IFRS affect differently the predictive ability of the discretionary accruals in France and the UK.

According to our observation of the studies linked to the debate on the effects of the IAS/IFRS, the empirical evidences such as mentioned above are mixed. Bogstrand and Larson (2012) suggested that the econometric considerations could be a possible explanation. In fact, the selective criteria of the sample and/ or the methodological choice such as the omission of some variables, the lack of robustness, and/ or the deflation problems through the firms of the sample could be a source of bias. Furthermore, the accounting literature linked to this part of research considers that it is rather the legal environment quality and institutional factors that govern the industries, the countries and regions, constitute the most persuasive explanation. Soderstrom, and Sun (2007) and Leuz and Wyoski (2008) consider that the institutional factors as the legislative accounting system and the protection degree of investors, are the extremely important elements in the making of the manner with which the companies and investors react to the financial disclosure. In reality, as explained by anterior researchers (Ball, Kothari, & Robin, 2000; Leuz, Nanda, & Wysocki, 2003), it is the national organism power of the accounting legislation which direct the interaction between investors and firms and will affect consequently the nature and the manner with which the companies communicate accounting in their financial reports. The argument presented by Bogstrand and Larson (2012) to these interpretations is that in some industries, some countries and some regions, the investors 'rights and other shareholders are found injured by the dealing of the managers whose choices are affected by their personal incitation non in conformity with the accounting legislative requirements which minimize therefore the accounting quality and the put into question the pertinence and the feasibility of financial reports.

The above interpretations allow us to represent initiations on the effects which the international norms could have on the quality of financial disclosure in general and on the pertinence of the accounting information in particular. Certainly, as developed in the anterior accounting research (La Porta et al., 2002; Genther & Young, 2000; Haw et al., 2004; Leuz & Wyosocki, 2008). A weak Institutional environment looks for the efficacy of the accounting principles. Consequently, the reduction of the accounting quality through financial reports, and to be prudent in the studies interested by the impact of the IAS/IFRS norms on the accounting information pertinence. These dissertations lead us to the development of the 3rd hypothesis:

H3: The country's legal regime affects the predictive ability of discretionary accruals.

3. Research Methodology

3.1 The Sample of the Study

Our sample is composed of firms quoted on the *SBF 120* between 1990 and 2008 for the French firms. For the British companies, are those quoted on the *FTSE 500* between 1998-2008.

The firms of our sample are part of all activities sectors, except the financial sector because of the particularities that it represents for both the legislative and specifities in terms of accounting treatment sides. Our French and British sample are classified in eight sectors of activities: agriculture, forests, fishing, mines sectors, manufactory, transport sector, communication electricity and gas, wholesale commerce, retail commerce sector, service sector.

The Table 1 presents British firms for the period before adoption, the number of enterprises is of 103 and 102 for the period after adoption. In fact, in terms of the data available, six enterprises of this first sample have been excluded and other five added during the period after adoption.

Table 2 presents the classification of French companies; they are among 62 current period before adoption. This number is 68 for the period after adoption that the first sample, one company was rejected given the unavailability of the information, and seven others have been added.

Table 1. Classification of British firms by activity sectors

Sample for the period before adoption of IAS/IFRS			
Sector of activity	**Number of companies**	**Number of observations Companies -years**	**Frequency within the sample in %**
Sector Agriculture, forestry, and fisheries	6	36	5,8
Sector Mining	6	33	5,8
Sector Construction	12	66	11,7
Sector Manufactures	16	108	15,5

Sector Transportation and communication	32	194	31,1
Sector Wholesale	2	13	2
Sector Retail	6	34	5,8
Sector services	23	132	22,3
Total	**103**	**616**	**100**
Sample for the period after adoption of IAS/IFRS			
Sector Agriculture, forestry, and fisheries	6	29	5,88
Sector Mining	6	30	5,88
Sector Construction	12	57	11,764
Sector Manufactures	17	80	16,666
Sector Transportation and communication	33	159	32,35
Sector Wholesale	2	10	1,96
Sector Retail	6	30	5,88
Sector services	20	89	19,61
Total	**102**	**484**	**100**

Table 2. Classification of French firms by activity sectors

Sample for the period before adoption of IAS/IFRS			
Sector of activity	**Number of companies**	**Number of observations Companies -years**	**Frequency within the sample in %**
Sector Mining	3	14	4,84
Sector Construction	4	24	6,45
Sector Manufactures	15	89	24,2
Sector Transportation and communication	22	127	35,48
Sector Wholesale	2	12	3,23
Sector Retail	4	24	6,45
Sector services	12	70	19,35
Total	**62**	**360**	**100**
Echantillon de la période après adoption des normes IAS/IFRS			
Sector Mining	4	18	5,8
Sector Construction	6	28	8,8
Sector Manufactures	18	83	26,47
Sector Transportation and communication	21	91	30,88
Sector Wholesale	2	8	2,9
Sector Retail	4	20	5,8
Sector services	13	63	19,12
Total	**68**	**311**	**100**

3.2 Definition of Variables

The accounting information is collected directly from the financial statements composed of the balance sheets, income statements and notes to the financial statements.

3.2.1 Operating Cash-Flow

In our research, it's operating cash-flows that are retained. According to paragraph 18 of the IAS7 norm, there are two methods to realize the exploitations activities: the direct method and the indirect one. In the first one, the information is supplied on the main categories of the ins and outs the raw bottom; whereas in the second, the liquidity resulting from the exploitation activities are obtained in adjusting the net benefice (or the net loss) of the operation not having a monetary character. Both using the direct and indirect methods are authorized for the presentation of cash flow of exploitation. In our study, this variable is directly extracted from the cash-flows statement.

3.2.2 Discretionary Accruals

Healy (1985) considers that the published earnings have two components: one constituted of charges and of products opening the path to ins and outs of treasury flow. The other, constitutes charges and products calculated and displaced (the accruals). The last component pick up that the application of the commitment accounting

principle. It is composed of two variables: one non-discretionary and another one discretionary. The second component is disposed to the manager discretion from the fact that it is on the one side topic of flexibility in the application of accounting principles; and on the other side, to the professional judgment exercise. McNichols and Wilson (1988) emphasis that it is the discretionary accruals which constitute the base for the manipulation of earnings. Many models were suggested to determine the discretionary accruals (Jones, 1991; Subramanyam, 1996). Nevertheless, in order to estimate the discretionary accruals, it is convenient firstly to calculate the total accruals. Dechow, Sloan, and Sweeny (1995) supply evidence that the modified model of Jones has the highest power to detect the accounting result manipulation than the other competitive models. This model is formulated as follow:

$$TA_{i,t}/A_{i,\,t-1} = \alpha_1(1/A_{i,t-1}) + \alpha_2\alpha_2(\Delta REV_{i,t} - \Delta REC_{i,t}/A_{i,t-1}) + \alpha_3(PPEN_{i,t}/A_{i,t-1}) + \varepsilon_{i,t}$$

With:

$TA_{i,t}$: total accruals in period t for firm I;

$\Delta REV_{i,t}$: change in turnover between t and t-1 for firm I;

$\Delta CRE_{i,t}$: change in receivables from clients between t and t-1 for firm I;

$PPEN_{i,t}$: net value of property, plant, and equipment scaled by lagged total assets of firm i in year t;

$A_{i,t-1}$: Total Assets at end of period t-1 for firm i.

$\varepsilon_{i,t}$: Error term

The discretionary accruals are determined by the difference between the total accruals *(TA)* and the non-discretionary accruals (NDA). Thus, the *TA* is determined by the difference between the result before extraordinary elements and the cash-flows of exploitation.

TA = Net result before extraordinary elements – Operating cash-flows.

The non discretionary accruals (NDA) are determined by the predicted values for the model described above and the discretionary accruals (DA) corresponding to the terms of mistakes of the same model.

3.3 Models of the Study

In order to test the predictive quality of the discretionary accruals to forecast future operating cash-flows, the model formulated in this way is the following:

$$CF_{\,i,\,t} = \beta_0 + \beta_1\ CFO_{i,\,t-1} + \beta_2\ AD_{i,t-1} + \beta_3\ AND_{\,i,t-1} + \varepsilon_{i,t}$$ **(Model 1)**

CFO: Operating cash-flows;

AD: Discretionary accruals;

AND: Non Discretionary accruals.

In order to concretize the adoption impact of the international standards on the predictive ability of the accounting information and essentially on the predicative quality of discretionary accruals, we were based on the same steps to study the impact of accounting normalization nature on the predicative power of accounting information. The objective of this part is binary: it consists to study first the impact of the adoption of the IAS/IFRS in each case of the both countries of the European Union, GB and France and consequently if the impact of this adoption varies through both countries.

In this frame, based on the work of Subramanyam (1996) and Krishnan (2003) we have constructed a model which allows examining the influence of the adoption of international norms on the foresight of future profitability of the enterprise. Our model allows comparing the international referential to the accounting referential of the two countries. This model is presented as follow:

$$CFO_{i,t+1} = \beta_0 + \beta_1 CFO_{i,t} + \beta_2 AD_{i,t} + \beta_3 AND_{i,t} + \beta_4\ IFRS_{i,t} + \beta_5 AD_{i,t} * IFRS_{i,t} + \varepsilon_{i,t}$$ **(Model 2)**

IFRS: 1 if the enterprises use the international accounting standards.
0 if the enterprises use the British and French accounting standards.

The third model tests the impact of the country's legal regime on the predictive quality of the discretionary accruals after the adoption of the IAS/IFRS norms in Great Britain and France. This is formulated as:

$$CFO_{i,t+1} = \beta_0 + \beta_1 CFO_{i,t} + \beta_2 AD_{i,t} + \beta_3 AND_{i,t} + \beta_4\ UK_{i,t} + \beta_5 AD_{i,t} * UK_{i,t} + \varepsilon_{i,t}$$ **(Model 3)**

UK: 1 if the enterprises are part of the British context.
0 if the enterprises are part of the French context.

4. The Study Findings

4.1 Descriptive Statistics

The descriptive statistics presented in Table 3 reveals that the average of operating cash-flows is positive for both countries. Nevertheless, this average is negative for the French context the period before IAS/IFRS standards adoption. For the variation of operating cash-flows, it is more important in UK than in France. For the DA, the descriptive statistics shows that the average is negative for both countries during the period before adoption. Such average has become positive for both countries during the period after adoption. The variation of discretionary accruals is neatly more important in the UK than in France for the period before and after adoption. As far as the non-discretionary accruals are concerned, their average is negative during the period before adoption, whereas it is positive for the period after adoption. The variation of this variable is more important in UK than in France.

Table 3. Descriptive statistics earnings components

		The French		
Panel A	**Min**	**Max**	**Mean**	**Std dev**
		French GAAP		
CFO	-0.3424163	135.2928	4.264964	19.0325
AND	-113.0523	253.5435	-0.0881839	11.38718
DA	-85.09541	32.17323	-1.99397	16.38423
		IFRS		
CFO	-0.4983214	0.9644668	0.0916449	0.1094059
AND	-0.0265848	0.20772	0.0004427	0.0120252
DA	-0.0021571	0.0145848	0.000103	0.0012227
		The UK		
Panel B	**Min**	**Max**	**Mean**	**Std dev**
		UK GAAP		
CFO	-3.515625	246.3086	2.407817	20.60231
NDA	-431.8692	253.5435	-0.1874707	32.82959
DA	-10.26931	2.640912	-4.102846	56.63279
		IFRS		
CFO	-851.9886	167.2443	-2.143785	41.8004
NDA	-18.40417	16.44198	0.0699435	1.206878
DA	-16.44448	18.39792	0.000103	1.201339

Note. ***CFO:*** Operating cash-flows; ***AND:*** Non discretionary accruals ***; DA:*** Discretionary accruals.

From Table 4, the correlations of Pearson show that for the period before adoption the IAS/IFRS norms, the non-discretionary accruals components are significantly and negatively correlated with the cash-flow of exploitation for both European countries. Nevertheless, for Spearman's correlations, it is significant and negative between the cash-flow of exploitation and the non-discretionary accruals for both countries. On the contrary, it is significant and negative between the discretionary accruals and the cash-flow of exploitation for France and non-significant for the U.K. For the period after adoption, the Pearson's correlation between discretionary and non-discretionary and the cash-flow of exploitation do not show significance in both cases. Whereas, they prove significant and negative correlations between the non-discretionary accruals and the operating cash-flows in the two context. As for the discretionary accruals, their correlation with the operating cash-flows is negative and significant for France but non-significant for the UK.

Table 4. The correlations of pearson (spearman) above (below) du diagonal

	Before IFRS		
	CFO	**AND**	**AD**
CFO			
UK	1	-0,489**	-0,600**
FR	1	-0,769**	-0,466**
AND			
UK	-0,123**	1	0.406**
FR	-0,218**	1	0,083
AD			
UK	-0,073	-0,614**	1
FR	-0,104**	-0,750**	1
	After IFRS		
	CFO	**AND**	**AD**
CFO			
UK	1	-0,029	0,033
FR	1	-0,019	-0,093
AND			
UK	-0,210**	1	-0,699**
FR	-0,200**	1	0,387**
AD			
UK	-0,042	-0,690**	1
FR	-0,116*	-0,324**	1

Note. **CFO:** Operating cash-flows; **AND:** Non discretionary accruals**; DA:** Discretionary accruals; *** significant at the level of 1%, ** significant at the level of 5%, * significant at the level of 10%.

4.2 Multi-varied findings Analysis

4.2.1 Discretionary Accrual Predicative Quality Analysis before the Adoption of the IAS/IFRS Standards

Table 5. Synthesis of statistics related to regression of future operating cash flows on past operating cash-flows and the component discretionary and non discretionary accruals

$CF_{i,t} = \beta_0 + \beta_1 CFO_{i,t-1} + \beta_2 AD_{i,t-1} + \beta_3 AND_{i,t-1} + \varepsilon_{i,t}$ *(Modèle 1)*				
Variable	***Grande Bretagne***		***France***	
	Coef	***P-value***	***Coef***	***P-value***
Constant	-1,044	(0,003)***	5,779	(0,000)***
CFO_{t-1}	0,5068	(0,000)***	0,2339	(0,018)**
AD_{t-1}	-0,532	(0,000)***	1,216	(0,000)***
AND_{t-1}	0,192	(0,000)***	0,158	(0,120)
	Tests de validité du modèle			
Hausman test				
Chi2	404,75		152,96	
Prob>ch2	(0,0000)***		(0,0000)***	
test Breusch-Pagen				
Chi2	1,16		9,35	
Prob>ch2	(0,2808)		(0,0022)***	
Fisher test				
F	2618,81		8,86	
Prob > F	(0,0000)***		(0,0000)***	
N observations	516		295	
R^2***overall***	83,65%		17,59%	

Note. **CFO**: Operating cash-flows; **AD:** discretionary accruals**; AND:** non discretionary accruals; *** significant at the level of 1%, ** significant at the level of 5%, * significant at the level of 10%.

It is Hausman's specification test which served to decide about the use of model fix effect or aleatory model. This test proves that the fix effect model is better adapted for the date in both contexts for the period before adoption of IAS norms. The synthesis results in the table 5 exposes that the discretionary accrual impact on the prediction of future cash-flow of exploitation is significantly negative for the U. K whereas, it is positive for France. As far as the non-discretionary accruals, the estimations prove the positive significant impact for the British context, but no impact has been found for France. The same remark is indeed for the cash-flow of exploitation. The Fisher's test linked to the global validity of the model announces that the last is globally significant for both countries. In addition, the R^2 presents the most important value in the British context.

The obtained findings above are found in conformity with that was interpreted by Subramanayam (1996) and Krishnan (2003). Both of them justified that the three components of the accounting results, the treasury flow the discretionary accruals and the non-discretionary accruals, are associated with the future profitability of the firm. Badertsher et al. (2012) demonstrated that the predictive capacity of the discretionary for the future operating cash-flows depends on the reason for which the managers make their discretionary choices. Such a choice could be made either by the opportunistic intentions, informational or contractual. In order to achieve this study, the authors compared the predictive power of the data in relation to those published. These authors demonstrated that the companies classified as making accrual choices for opportunistic reasons, are retired information which represent the predicative power the most interesting for the future cash-flows than the really published data. Moreover, they remarked that in this case, the published data are not significantly associated with the future cash-flows. However, for the firms classified as opting for the choice of non-opportunistic discretionary choices, the results are consistent with the informational hypothesis than the initially published accruals which have a predicative capacity more interesting for the future cash-flow of exploitation than the retired data. Also, discretionary accrual component is significantly associated to the future cash-flow whereas; no accruals component is significantly associated to future cash-flows. This synthesized information at the level of the discretionary accrual component reflects the discretionary accounting choices of managers. Indeed, managerial dispose discretion margin for the verification of charges. This discretion could be used by managers to the private information or for manipulating in an opportunistic way the earnings.

Badertsher et al. (2012) suggest that the informational motivation of discretionary choices could be set up with regard to the limits of accounting principles generally admitted or outside these limits. Being classified as of second-hand choices, the considered choices by the normative and/or by auditors as not allowed by the accounting principles generally admitted and once fourth detected leading to retirements. However, we find the accounting principles generally admitted, offering to the takers some degree of flexibility, interpretation and of judgment essentially when facing a problem of specific accounting technical choices, to the divulgation procedures or of estimation. These principles and the degree of flexibility put at the disposition of decision-takers, vary though the accounting normalization of the country. The study of the impact of the accounting normalization nature on the capacity of discretionary accruals to foresee the future cash-flow of exploitation is analyzed at the level of the following section.

4.2.2 The Discretionary Accrual Predictive Quality Analysis after the IAS/IFRS Norms Standards Adoption

The findings linked to the estimation of the discretionary and non-discretionary component power in the two contexts after the IAS norms adoption are summarized in Table 6. The Hausman's test shows that the fix effect model, which is the most adapted to the data of both countries. As for the British context, the estimation shows that both discretionary and non-discretionary components of accruals, positively and significantly affect the future cash-flow of exploitation at the level of 1%; The model is globally significant at the level of 1% and the R^2 is of a highly value (93.6%). In the French context, the model is globally significant and all explicative variables prove a significant positive predicative capacity at the level of 1%.

To synthesize, we can interpret that the alignment between the predicative power of the components of accounting results after the adoption of IFRS norms has been some dimensions and not for others. Such alignment has been left for the discretionary and non-discretionary accrual power whereas the divergences are identified at the level cash-flow of exploitation. Therefore, we can say that although we are located in two countries proceeding to the application of the same accounting principles for the preparation of the financial information, the output of the financial divulgation do not seem to produce the same predicative power for the future cash-flows. These results come to confirm the explanation presented in the internal accounting lit, which indicate that the accounting principle do not allow the only to determine the quality of financial divulgation. (Ball, Robin, & Wu, 2003; Leuz, Nanda, & Wysocki, 2003; Leuz & Wysocki, 2008) and that there are other forces which influence such an output as the accounting legislation and its application/put into practice.

Table 6. Synthesis of statistics related to regression of future operating cash flows on past operating cash-flows and the component discretionary and non discretionary accruals

	$CF_{i,t} = \beta_0 + \beta_1 CF_{i,t-1} + \beta_2 AD_{i,t-1} + \beta_3 AND_{i,t-1} + \varepsilon_{i,t}$ (Model 1)			
Variable	*Grande Bretagne*		*France*	
	Coef	*P-value*	*Coef*	*P-value*
Constant	421,0186	(0,353)	-0,013	(0,592)
CFO $_{t-1}$	0,125	(0,317)	1,201	(0,000)***
AD $_{t-1}$	242,8021	(0,000)***	14,443	(0,002)***
AND $_{t-1}$	236,0505	(0,000)***	0,5604	(0,000)***
Hausman test				
Chi2	51,64		94,14	
Prob>ch2	(0,0000)***		(0,0000)***	
Breusch-Pagen test				
Chi2	3,81		0,13	
Prob>ch2	(0,0982)*		(0,7204)	
Fisher test				
F	124 631,72		659,49	
Prob > F	(0,0000)***		(0,000)***	
N observations	380		238	
R^2overall	93,67%		14,68%	
RMSE	930,996		0, 96	

Note. **CFO**: Operating cash-flows; **AD:** discretionary accruals**; AND:** non discretionary accruals; *** significant at the level of 1%, ** significant at the level of 5%, * significant at the level of 10%.

Holthausen (2009) suggest that many factors allow modelizing the financial disclosure quality and that the accounting principle represent only one of these factors. He adds that the impact of these principles is power felt compared to that of other determinants and as the managers incitation's, the auditor quality, the legislation and its application, the structure of the propriety. In this sense, Mahoney (2009) conclude that the legislation of the financial market and its put into practice, may lead to important divergence at the result level of the financial disclosure.

Coffee (2007) has already interpreted that it is not enough to understand the law, on the contrary the understanding of the manner with which they are put into vigor would be of determining results for the discreet of economic and financial divulge.

All these expositions have important implications for the interpretation of the effect of the IFRS standards adoption on the financial divulge all over the world. In fact, the adoption of these norms worldwide was produced quickly under the hypothesis that it will be an advantage in producing a uniform level of principles for the final divulge and consequently make the comparison between the enterprises across the countries easier and more transparent. However, we remark from the results of our study that this objective was not completely achieved and that the main differences are at the level of the accounting information quality, in terms of its predicative capacity in France and in the UK after the adoption of IFRS standards.

These results may be explained from what have been presented in the international literature concerning the adoption of IFRS and its impact. Indeed, in both countries of our study, in spite of speaking of the application of the same accounting principle level, the differences at the environment level of the financial divulge is still there. This was explication of a common level of accounting principle across the countries does not seem to at a similar quality at the financial disclosure level only if other powers which govern the financial state quality become similar across the countries. Ball (2006) for him he considered that it would be naïf to believe in uniform accounting norms producing inevitably uniform financial states in the measure that the accounting choices are dictated by political and economic considerations essentially local ones. He is rather in favor of maintaining some competitiveness between the norms.

In our study, both European countries selected to test the impact of the IFRS adoption on the predictive power of the accounting information belong to two different classes. The first to the class of Anglo- Saxon countries (UK) and the second to the Euro- continental (France). The IFRS norms are base on the principles of the common law, according to which the legal rules come from the legal prudence, and consequently it is the same orientation of

the British context.

The same for France, we have to remind that it is a country of strong tradition and the adoption of the IFRS norms constitute an important move at the level of objectives of the financial disclosure. Ayoub and Hooper (2008) have synthesized the differences between the IFRS norms and the French norms in three big points. The first is linked to the notion of fair value which is unknown to the French accountants who base their work on the historic cost. The second is that France has always favored Inland Revenue on the financial communication; whereas, the new referential, favors the real economic value of the enterprise, and the production of a faithful image in order to satisfy the informative needs of investors. The third point is linked to the structure even of the IFRS that do not have according to Ayoub and Hooper (2008) equivalent in France. Indeed, these norms let a wide place for interpretation whereas, the French accountant are used to follow a very precise instructions of the General Accounting Plan.

Raffournier (2007) suggested that the decision of the European Union to make The IFRS compulsory for the enterprises quoted to solicit many negative reactions in the academic and economic environment. He attributed this hostility to the deep change of accounting philosophy which imply the adoption of the IFRS and to the difficulties for some actors of the process of accounting normalization to accept to be dispossessed of their prerogative in the material. He explain that in general, the introduction of the IFRS norms that represent the Anglo-Saxon conception of accounting, in most of Euro-continental countries mark a true cultural revolution by the accounting philosophy move that it represents. Such an interpretation may explain the result of our study, for which we did not identify the net variation at the level of the predicative power of the accounting information before and after the adoption of the IFRS norms in the British context. In the contrary, in the French context, we notice an important upside down at the level of this power before and after. It is essentially at the level of accruals and their components that we remarked this variation.

Such a suggestion has already been practically approved by Ayoub and Hooper (2008), who with their interviews semi directive with chartered accounts, auditors, and academics in France, they looked for identifying the cultural reasons that pushed French people to have negative attitudes vis-à-vis the IFRS. They showed that variables as the language, the religion, the social organization or more politics could bring elements of supplementary response to resist international norms.

Colasse (2006) has already declared that “more than the technical problems that their put into practice was able to do, the international standards, and it is their main stake, are bringers of a governing way in stage with a capitalism of financial market”. Chiapello (2005) has gone further by writing that “the international standards tend to put forward the enterprise as being before all merchandise whose financial markets do business, and not as an institution producing and selling goods”.

Raffournier (2007) added to all these explanations that the IFRS norms lay down so major difficulties in practice to be used in the French context. Indeed, in France and according to Garnier’s (1947) formula, accounting is “algebra of the right”; in other words, accounting has to reflect the juridical relations between the enterprise and the thirds. This is not the case for the IFRS where the accounting information must privilege the economic analyses. Therefore, the IFRS application in France presents a true cultural break, what‘s more is that it requires new competences on the part of practitioners of accounting. In reality, in France the economic teaching, in particular the financial analysis had not been absent in the programs but they did not have a central place. The application of the IFRS requires on the other hand, that accountants have a deep financial education, which is not the case for the Anglo-Saxon accounts whose training has ever made a larger place for the financial and economic analysis.

To study the impact the international norms adoption on the predicative quality of the accounting information in the two European countries, more precisely, on the quality of discretionary accruals, consists the object of our next part.

4.2.3 Impact of the IAS/IFRS International Norms on the Predicative Quality of the Discretionary Accruals

The synthesized findings in Table 7 shows the three components of the accounting result that are associated significantly at the level of 1% with the future cash-flows. This link is positive for the cash-flows and the anterior non discretionary accruals whereas it is negative for the past discretionary accruals. The coefficient β_5 measures the association with the discretionary accruals and the future cash-flows of the companies using international norms compared to those using the British standards. This coefficient is positive, which imply that the association between the discretionary accruals and the future cash-flows is more important for the enterprise using the international norms than the other ones. These results confirm our hypothesis that the international norms allow improving the quality of the accounting information, essentially those of the discretionary accruals

in the British context.

Table 7. Synthesis of statistics related to regression of future operating cash flows on past operating cash-flows, discretionary accruals, non discretionary accruals, and discretionary accruals related to the nature of accounting standards: British standards against international standards

$$CF_{i,t+1} = \beta_0 + \beta_1 CFO_{i,t} + \beta_2 AD_{i,t} + \beta_3 AND_{i,t} + \beta_4 IFRS_{i,t} + \beta_5 AD_{i,t} * IFRS_{i,t} + \varepsilon_{i,t} \text{ (Model 3)}$$

Variable	*Coefficient*	*t-student*	*P-value*
Constant	-1,051	1,75	(0,017)**
$CFO_{i,t}$	0,564	23,80	(0,000)***
$AD_{i,t}$	0,562	22,16	(0,002)***
$AND_{i,t}$	0,048	22,46	(0,000)***
$IFRS_{i,t}$	0,840	1,26	(0,208)
$AD*IFRS_{i,t}$	0,498	17,29	(0,000)***
N		893	
F		592,95 (0,0000) ***	
R^2		76,97%	
$Adj\text{-}R^2$		76,84%	
RMSE		9,7221	

Note. **CFO**: Operating cash-flows; **AD:** discretionary accruals**; AND:** non discretionary accruals; *** significant at the level of 1%, ** significant at the level of 5%, * significant at the level of 10%.

Table 8. Synthesis of statistics related to regression of future operating cash flows on past operating cash-flows, discretionary accruals, non discretionary accruals, and discretionary accruals related to the nature of accounting standards: French standards against international standards

$$CF_{i,t+1} = \beta_0 + \beta_1 CFO_{i,t} + \beta_2 AD_{i,t} + \beta_3 AND_{i,t} + \beta_4 IFRS_{i,t} + \beta_5 AD_{i,t} * IFRS_{i,t} + \varepsilon_{i,t} \text{ (Model 3)}$$

Variable	*Coefficient*	*t-student*	*P-value*
Constant	0,883	1,83	(0,017)**
$CFO_{i,t}$	1,174	25,87	(0,000)***
$AD_{i,t}$	0,636	3,66	(0,002)***
$AND_{i,t}$	0,418	5,84	(0,000)***
$IFRS_{i,t}$	-0,899	-1,35	(0,177)
$AD_{i,t} *IFRS_{i,t}$	-0,572	-0,10	(0,918)
N		535	
F		354,78 (0,0000) ***	
R^2		77,703%	
$Adj\text{-}R^2$		76,81%	
RMSE		6,9794	

Note. **CFO**: Operating cash-flows; **AD:** discretionary accruals**; AND:** non discretionary accruals; *** significant at the level of 1%, ** significant at the level of 5%, * significant at the level of 10%.

Consulting Table 8 proves that the French context and the three components of the accounting results are related to the cash-flows of future exploitation along the study period from 1999 until 2008. All the coefficients are β_1, β_2 and β_3 are significantly positive at the level of 1%. The coefficient B5 measure the supplementary association between the discretionary accruals and the cash-flows of future exploitations for the firms using the international norms compared to those using the French ones. The sum of β_2 and β_4 represents the link between the discretionary accruals and the future for the enterprise using the international standards during the period (2004-2008). As far as the impact of the international norms on the predicative quality of the discretionary accruals, the results show a B5 non significant. This does not imply that the French standards and the

international ones are identical. And supply accounting information of similar quality. But rather, because of the nature of the French accounting environment, the application of the accounting standards essentially oriented to the satisfaction of investors needs', characterized by an enormous flexibility may not achieve the wished objectives.

The second hypothesis of our analytical study of the adoption of the same level of accounting principles, the IFRS by the two European countries in the alignment of the predictive power of the component of the accounting results. The results are able to reveal that the level of alignment wished essentially in the dimensions that grasp the accounting principles, that is to say the discretionary accruals, is not achieved. These results confirm what has been developed in the international accounting literature, that the accounting principle is not the only determinant of the quality of financial divulges and that other powers influence such output as the accounting legislation and their application.

Also, this difference at the level of the detected result in both countries, members of the European Union after the adoption of the IFRS norms, could be explained by the fact that for France, the accounting legislation belongs to the state ;whereas for the U.K, it belongs to professionals. Thus, we notice that for the U.K, the adoption of the IFRS does not constitute a real upside down because it translates only the replacing of professionals by others who share the same philosophy. In the contrary, for France the introduction of these standards represents a modification of accounting philosophy of this country, and leads to many difficulties of application. It is in this sense that Christensen et al. (2009) explained that the U.K which is a country characterized by a very developed and ruled financial market; and the fact that the disclosure with reference to the UK GAAP is comparable to those prepared according to IFRS. It does not seem that the accounting results prepared by the transition of the UK GAAP towards the IFRS offer unique information about cash –flows. Nevertheless, because the accounting information is served to satisfy investors' needs, the technical variation at the level of earnings calculation may influence the wealth distribution between shareholders and creditors. Consequently, the institutional factors as the high level of rules of the financial market may affect substantially the differences of the evaluation by the financial market of the divulged information.

These interpretations are found reinforced by our findings during the estimation of the impact of the international norms on the predicative quality of discretionary accruals. Indeed, the results prove that the international norms react positively on the predicative capacity of discretionary accruals in the British context. However, no impact has been detected in the French context. This allows us to confirm previous developments that for the international norms to achieve the wished objectives, they must be applied in adaptation with the environment factors of the country.

4.2.4 The Legal System and Its Impact on the Predicative Quality of the Discretionary Accruals before Adoption of IAS/ IFRS Norms

Table 9 represents the estimated results linked to the impact of legal system on the predicative quality of the discretionary accruals during the period before adoption of the IAS/IFRS norms. They allow demonstrating that the different components of the results are related significantly to the level of 1% with cash flow of future exploitation. This result is coherent with those of Subramanyam (1996) and Krishnan (2003). This link is positive for the cash flow of exploitation and the non discretionary accruals passed whereas it is negative for the discretionary accruals. As far as the norms used, the coefficient β_4 is negative at the level of 1% which imply that our model is sensitive to the nature of the legal regime of the country. In other words, the application of the British accounting standards affects negatively the prediction of cash flow of future exploitation. The coefficient β_5 measures the link between the discretionary accruals and the cash flow of exploitation of enterprises using the British norms compared to those using the French norms. This coefficient *(20,428; P- value=0,000)* is associated significantly and positively to the legal system which affects the predicative quality of discretionary accruals. The positive sign implies that the fullness of the link of the association between the cash flow of future exploitation and the discretionary accruals is higher for the enterprises using the French norms compared to those using the British norms.

This result leads us to say that compared to the French, the British norms are more able to limit the opportunistic practices of managers. Indeed, although, the British norms are characterized by an important degree of flexibility, one norm suggests many options and the characteristics of its financial environment limit the opportunistic behavior of the decision-takers.

For the period after adoption, the estimations show that the British legal regime affects significantly and positively the prediction of future operating cash-flows which proves that the two countries the apply the same level of accounting principles, the nature of the political system remains a determining element of the quality of

the accounting information. The coefficient β_5 *(10,121; P-Value=0,000)* show that the fullness of the link between the cash flow of future exploitation and the discretionary accruals is more important for the enterprise using the UK standards compared to those using the French ones.

Table 9. Synthesis of statistics related to regression of future operating cash flows on past operating cash-flows, discretionary accruals, non discretionary accruals, and discretionary accruals related to the nature of accounting standards: UK standards against French standards before IFRS

$CFO_{i,t+1} = \beta_0 + \beta_1 CFO_{i,t} + \beta_2 AD_{i,t} + \beta_3 AND_{i,t} + \beta_4 UK_{i,t} + \beta_5 AD_{i,t} * UK_{i,t} + \varepsilon_{i,t}$ *(Model 3)*			
(global sample: French and UK combined effect of legal system)			
Panel A			
	Avant adoption des normes IAS/IFRS		
Variable	***Coefficient***	***t-student***	***P-value***
Constante	1,602447	2,12	(0,035)**
$CFO_{i,t}$	0,6917	27,10	(0,000)***
$AD_{i,t}$	21,327719	3,36	(0,000)***
$AND_{i,t}$	0,4064	6,47	(0,000)***
$UK_{i,t}$	-3,563	-4,98	(0,000)***
$AD_{i,t}*UK_{i,t}$	20,42856	3,22	(0,000)***
N	***802***		
Wald test	1309,36		
	Prob >chi2 = (0,0000) ***		
R^2 Overall	62,19%		
Panel B			
	Après adoption des normes IAS/IFRS		
Variable	***Coefficient***	***t-student***	***P-value***
Constante	0,0784099	0,1	0,923
$CF_{i,t}$	0,1954571	5,46	(0,000)***
$AD_{i,t}$	0,9455241	81,35	(0,000)***
$AND_{i,t}$	0,3584546	22,01	(0,000)***
$UK_{i,t}$	4,740196	4,57	(0,000)***
$AD_{i,t}*UK_{i,t}$	10,12095	18,21	(0,000)***
N	***619***		
Wald test	***101694,77***		
	Prob >chi2 = (0,000) ***		
R^2 overall	***99,44%***		
RMSE	***12,536***		

Note. **CFO**: Operating cash-flows; **AD:** discretionary accruals**; AND:** non discretionary accruals; *** significant at the level of 1%, ** significant at the level of 5%, * significant at the level of 10%.

5. Conclusion

The adoption of the IAS/IFRS by many countries and their impact on the quality of financial disclosure has solicited numerous reactions in the academic and professional field of accounting. (Flower, 1997; Zeff, 1998; Ball, 2001; Hope, 2003; Hope et al., 2006; Meulen et al., 2007; Ding et al., 2007; Soderstrom & Sun, 2007; Barth et al., 2008; Clacher, Ricqebourg, & Hodgson, 2013).

The purpose of this article is to study the impact of the adoption of the IAS/ IFRS norms on the pertinence of discretionary accruals in terms of their capacity to forecast the future operating cash-flows of future exploitation in two European countries of two different classes. The first, the UK being included under the Anglo-Saxon class which is characterized by a very developed financial market and financial information designed essentially to satisfy the investors' needs. The second, France which is belonging to a Euro-continental group characterized by a narrow link between Inland Revenue, accounting and accounting information supplied to satisfy the government needs.

Based on a sample composed of quoted companies in *SBF 120* for the French context and *FTSE 500* for the British ones. The findings of our study show that the application of the IAS/IFRS allows improving the

predictive quality of discretionary accruals in the British context. Indeed, the negative impact during the before -adoption-period, we have detected a significant and positive impact along the after- adoption-period. In the French context, the predictive quality of discretionary accruals for future cash-flows is more important for the firms using the international norms than in those applying the British ones. In the French context, no impact has been proved for the IAS/IFRS on the predictive quality of the discretionary accruals. This does not imply that the French and the international norms are similar and supply a similar quality accounting information. But rather, because of the nature of the French accounting norms which are essentially designed to the satisfaction of the investors needs and characterized by high flexibility may not lead to achieve the desired objectives. These results confirm what was developed in the international accounting literature, that the accounting principles do not represent the only determinant of the quality of financial divulge and that other forces influence such output as the accounting laws, and the put into application. Similarly, this difference detected at the level of results in both states members of the European Union after the adoption of the IFRS norms, could be explained by the fact that for France, the making of accounting laws belongs to the government whereas in the UK, the adoption of the IFRS norms does not constitute a fundamental upside down because it is simply translated by replacing the professionals by others who share the same philosophy. In the contrary, for France, the introduction of the IFRS represents a modification of the accounting philosophy of the country and represents many difficulties of applications.

The findings of our study prove that the legal regime of countries affects the predictive quality of discretionary accruals. According to the domestic principles (period before adoption), the discretionary accruals are better evaluated in the U.K. than in France. The same results have been deduced for the period after adoption.

In our point of view, this study, contributes to spread the anterior literature linked to the quality of the information carried by the discretionary accruals. Our bringing could be summarized in three points of views. First, we have estimated the pertinence of the discretionary accruals in terms of their capacity to forecast future operating cash-flows with a comparative study between two countries presenting different characteristics in legislation of financial market. Second, we have studied the effect of adoption of the IAS/IFRS norms. Third, we have tested the impact of the legal regime of a country on the predicative quality of discretionary accruals for both periods: *before* and *after adoption*. To our knowledge, this study is the first to tackle the way with which the IFRS affect the pertinence of the discretionary accruals in two contexts characterized by different legal systems.

In spite of our study bringing, it seems that our results should be interpret with caution. Indeed, to study the predictive power of the discretionary accruals on a sample of heterogeneous enterprises may be a source of bias. Some recent methodological refining and a better consideration of contextual variables, would be pertinent to test the predicative power of the accounting information.

Even though in our study we tried to supply a rich theoretical and empirical work, many ways of future researches remain contemplative to predict the future cash flow. Moreover, spreading the analysis to other countries will allow to better estimate the country effect and the differences between domestic principles and the IFRS on the pertinence of the discretionary accruals.

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Note

Note 1. Switzerland, Germany and Austria are the European countries where there is the highest proportion of companies applying IFRS early. Indeed, since 1998 the application of these standards has been authorized in Germany and Austria. As regards Switzerland, Dumontier and Raffourrnier (1998) showed that in a sample of 133 firms, 52 of them using IFRS.

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Internal Deficit–External Deficit Nexus in Africa: 1960-2012

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Abstract

In this article, we have tested the causality correlation linking the internal deficit with the external deficit for a group of 15 African economies. Specifically, using causality analysis, we have tested the four possible causation linkages: (1) internal deficit causes external deficit, (2) there is bidirectional causality linking the two variables, (3) the two deficits are not causally related and (4) external deficits cause internal deficits. Using linear panel causality, this paper shows with heterogeneous Granger causality analysis that in five African countries, Côte d'Ivoire, Gambia, Morocco, Democratic Republic of Congo and Tunisia, external deficit Granger caused internal deficit. Two countries, Nigeria and Egypt, postulate causality from internal deficit to external deficit. While one country, South Africa, reveal a bidirectional causal link between internal deficit and external deficit. Monetary policies focused on the efficiency, as well as the exchange rate, will help to re-build, harmonize and control the budget policy in African countries.

Keywords: internal deficit, external deficit, public debt, twin deficits, ricardian equivalence, causality analysis

1. Introduction

Nexus internal deficit and external deficit is one of the most important macroeconomic troubles for all economic policy makers and advisors of the developed and developing world. Internal deficit problems appear because of excessive public expenditure over governmental revenue. External deficit problems occur because of excessive imports of goods and services over exportations. The relationship between internal and foreign deficits has been the focus of considerable attention in development macroeconomics (Agenor & Montiel, 2008). We will examine below some of the theoretical and empirical issues that arise in the African context. The twin deficits assumption, also called the twofold deficit supposition or twin deficits irregularity, is a hypothesis from macroeconomics that contends that there is a robust association among a national economy's present description balance and its government financial plan balance. The double deficits theory traces back at least to the International Monetary Fund economist Polak's (1957) when he analyses the effects of specified monetary changes on income or on the balance of expenditures. The perseverance of large twin deficits in developed and developing countries for an extended period is due to increasing in public debt (domestic and foreign).

In fact and in the economic history, the self-styled double deficits assumption arose throughout the "Reagan fiscal experiment" in the 1980s, obvious time of robust appreciation of the dollar with atypical modification scramble in present balance deficits. The accessible literature related on double deficits hypothesis is largely paying attention on the interrelationships and/or the commoving relation in a bivariate construction linking internal balances and external deficits (or present description balances). In Europe, Germany and Sweden faced comparable troubles emerged in the early part of the 1990s where the increase in the country's government financial plan deficit was accompanied by authentic appreciation of their national currencies which unfavorably influence the present financial records situation (Ibrahim & Kumah, 1996). This is not an exemption for African countries as most have also experienced difficulties with their existing account balances in near the beginning of 1980s.

According to the Ricardian standpoint (Ricardo, 1888), deficits financed by either debt or taxes are economically equivalent. In fact, for a known spending channel, replacement of debt for taxation has no consequence on total demand or in interest rates. Deficits could be financed through debt financing, taxes and printing money. Except

taxes which are a leakage, both printing of money and debt financing are injections into the economy and could be inflationary if they are not properly and effectively managed. An internal deficit can be financed either by drawing down resources or incurring new liabilities of national and/or external. While use of resources is constrained by the stock and attractiveness of the assets, government, then, normally resort to internal borrowing (form the central bank, banking system, or private sector) and/or external borrowing (two-side or multilateral). Then again, any government borrowing entails a cost, in spite of its nature. External borrowing often appears more attractive for the government, because of less significant crowding out effects on private asset, and reduced risks of inflationary pressure. But, an increasing external debt tends to deteriorate the financial system. Additionally, when foreign debt is contracted on commercial terms, a higher external interest rate leads to an increase in debt service expenditures that may lead to a debt crisis.

With regards to the soundness of the Feldstein-Horioka theorem, households either face precise investment controls and/or basically require a favorite for external capital, both of which are uncertain in a world of extremely mobile investment. Balance due is created by the act of borrowing. Debt is considered as the resource or money use in an organization which is not contributed by its owner and does not in any other way belong to them. It is an accountability represented by a financial mechanism or other formal equivalent. In modern law, debt has no precise fixed meaning and may be regarded essentially as that which one person legally owes to another or an obligation that is enforceable by legal action to make payment of money. When government borrows, the money owing is a public debt. Public debts are either internal or external, incurred by the public sector through borrowing in the domestic and international markets so as to finance national investment.

Debts are categorized into two: productive debt and flat heaviness debt. When a loan is obtained to enable the state or nation to purchase some sort of assets, the debt is said to be productive for example, money borrowed for acquiring factories, electricity, and refineries. However, debt undertaken to finance wars and expenses on current expenditures are dead heaviness debts. When a country obtains a credit in a foreign country, it means that the country can import from abroad goods and services to the value of the loan without at the same time having to export anything for substitute. When capital and interest have to be repaid, the same country will have to get the burden of exporting goods and service without receiving any imports in exchange. Internal loans do not have the type of burden exchange of goods and services. These two categories of debt, however, require that the borrowers' future savings must cover the interest and main payment (debt servicing).

The objective of this article is to empirically analyze the causality association linking internal deficit and external deficit in some 15 African countries over the period 1960 and 2012. Four different questions can be addressed: Is internal deficit causes external deficit? Is there bidirectional causality between the two deficits? Are the double deficits not causally linked? And is external deficit causes internal deficit? This causal relationship has become an interesting research area for academics, policy makers and advisors in the past decades. The studies about this phenomenon are principally centered based on two most important economic theories: the Keynesian approach associated with the Mundell-Fleming framework and the Ricardian equivalence hypothesis. Data from Word Development Indicators (WDI) database, Penn World Table, and Historical Public Debt Database 2012 of International Monetary Fund are used. Descriptive statistics and econometric methods are utilized to analyze the causal relations between internal and external deficits. The content of the rest of the article is as followed: Section 2 analyzes the theoretical construction of the twin deficits hypothesis and reviews the empirical literature. Section 3 presents the methodology. The empirical results are presented and discussed in section 4 and section 5 concludes.

2. Twin Deficits: Theoretical Framework and Empirical Literature

From the eminent Keynesian macroeconomic framework resulting from the national revenue identity we get the following equations:

$$Y = C + I + G + (X - M) \tag{1}$$

and

$$S + (T - G) = I + (X - M) \tag{2}$$

Where, Y is the national revenue. C is the private consumption. I is the private investment. G is the government expenditures on goods and services. X is the amount of exports of goods and services. M is the amount of imports of goods and services. $(X - M)$ is the net exports or the trade balance or the external deficit. S is the national savings or the private sector savings. T is the government tax revenues.

After substitution, equation (2) becomes:

$$(X - M) = (S - I) + (T - G) \tag{3}$$

The equation (3) shows that the net exports are simply equal to the private saving-investment gap plus the budget balance. Equation (3) can be rewritten as follows:

$$ED = ID + SI \tag{4}$$

Where, *ED* is the external deficit or exports balance. *ID* is the internal deficit and *SI* is the gap between private savings and private investments. The equation (4) shows the quasi-simultaneity of the external (trade) deficit and the internal (budget) deficit. The external deficit is the sum of two gaps: the internal deficit and the saving and investment balance. When assuming a constant saving - investment balance, a growing in internal deficit will directly amplify the external deficit.

From Nikiforos, Carvalho and Schoder (2013), we can now integrate the discussion of the trajectory of the governmental or public debt and internal deficit with some basic accounting identities that link the accumulation of debt with the deficit, the growth and interest rate and inflation. By defining each time *t*, the public debt is equal to the debt of the previous period plus the public deficit of the current period. Formally we can write the dynamic equation as follows:

$$PD_t = PD_{t-1} + ID_t \tag{5}$$

Where, *PD* stands for public debt and *ID* for the public or internal deficit. The subscript denotes the period each variable refers to. Stated differently, equation (5) can be rewritten as follows:

$$\Delta PD_t = PD_t - PD_{t-1} = ID_t \tag{6}$$

Where, Δ is the difference operator. In the traditional neo-classical model, public debt varies as a function of momentary increases in government expenditures (Barro, 1979).

Previously literature based on the twin deficits has mostly centered the debates on problems found on two main theoretical models. In spite of this, these are not the only potential results between the internal and external deficits. Actually, four probable causation linkages can be investigated linking the internal deficit and the external deficit: (1) internal deficit causes external balance, (2) there is bidirectional causality among the two variables, (3) the two gaps are not causally linked and (4) external deficits cause internal deficits. The first relationship is the traditional Keynesian intention (Keynes, 1936) often linked with the Mundell-Fleming representation (Mundell, 1963; Fleming, 1962). It argues that there exists a positive association between the double deficits. The causality is from the internal balance to the external deficit. In the context of this model, a rising in internal deficit causes an increase in national interest rate above the foreign rate, with capital inflows and appreciation of the national currency as effects. These effects, in turn, result in an increase in external (present account) balance.

A related literature shows that studies such as Hutchison and Pigott (1984), Zietz and Pemberton (1990), Bachman (1992), Vamvoukas (1999), Piersanti (2000), and Leachman and Francis (2002) without a doubt establish that internal deficit provokes an increase in foreign accounts deficits. In spite of this, analysis from Baharumshah and Lau (2007) indicate a uni-directional causal model from internal deficit to external deficit in Thailand. For illustration, the budget deficit does positively affect the current account deficit. Acaravci and Ozturk (2008) and Hakro (2009) have confirmed a comparable result for Turkey, and Pakistan, correspondingly.

Bidirectional causality exists between external and internal deficits. Despite the fact that internal deficits possibly will cause external deficits, the existence of significant view may source causality linking the two variables to run in mutual directions. In this situation, it is not adequate to reduce the internal balance in order to reduce external deficits. It is essential as well to harmonize budget-cut policies with a coherent box focusing on policies for export promotion, productivity improvement and exchange rate, among others. The empirical literature related to the bidirectional (or the double way) causality between internal deficit and external balance analyses the existence of significant feedback which cause causality between the two variables to run in both directions (Darrat, 1988; Normandin, 1999; Hatemi & Shukur, 2002; Kouassi, Mbodja, & Kymn, 2004; Lau & Baharumshah, 2004). Lau and Baharumshah (2006) who analyze nine Asian countries in the panel setting, Jayaraman and Choong (2007) for statistics in Fiji while Arize and Malindretos (2008) for the majority of the African countries established that both internal deficit and external deficit depends on each other.

In difference, proponents of the Ricardian equivalence assumption put forward the absence of any association linking the external deficit and the internal balance. The Ricardian equivalence proposition states that deficits and taxations are equivalent in their effect on consumption (Barro, 1974). This analysis points out that, while a tax cut (hence a deficit) has the consequence of reducing public revenues and public savings and enlarging the internal balance. It increases private saving by an amount equal to the expected increase in the tax burden in future years. That is, savings will respond positively to the changes in budget deficits, leaving the trade deficit

unaltered. Similarly, if government runs a deficit by borrowing, the economic agents expect that government will move up upcoming taxations to finance the budget deficit and so they increase their savings to meet the future tariff burden. In sum, alterations in the composition of public financing (for example, debt versus taxations) have no impact on real interest rate, total demand, private spending, the exchange rate or present account balance. In other words, the nonappearance of any Granger causality association among the double deficits would corroborate Ricardian equivalence hypothesis. The empirical analysis of Enders and Lee (1990), Evans and Hasan (1994), and Kaufmann, Scharler and Winckler (2002) assume that there is no relationship between the two deficits and hence is supportive of Ricardian equivalence hypothesis. The internal and external deficits are not really twins (Feldstein, 1992). However, Blanchard (1985) has abandoned the Ricardian argument by viewing that utility maximizing tax-payers would behave differently under a finite horizon as opposed to an infinite horizon as assumed by Ricardo. Blanchard (1985) suggests a positive correlation between sustained budget deficits and a country's external debt.

After all, the opposite causation from external to budget deficits can happen if excessive trade deficits push an financial system into a depression and consequently conduct to a financial or solvency crisis in which a large introduction of public funds may be required to re-establish the struggling financial sector or to minimize the gravity of a recession (Kim & Donggeum, 2006). The large inflow of investment or debt accumulations affects the budgetary stance of a country and finally conducts to internal deficit. Investigations from Islam (1998), Anoruo and Ramchander (1998), Khalid and Guan (1999), Kim and Kim (2006) support the unidirectional of the link from external to internal deficits. Marinheiro's (2008) analysis has abandoned the double deficits hypothesis in maintaining of the transpose causality from external to internal deficits using the data from Egypt. According to them, this will appear if the government of a country utilizes their budget (fiscal) stances to affect the external balance. This representation of external adjustment might be especially relevant for developing countries (Khalid & Guan, 1999).

Other authors such as Edwards (2001) and, Obstefeld and Rogoff (2004) have dealed with the double deficits debate from the point of view of macroeconomic stability of the economy. They have underlined that the negative implications of a mixture of adverse factors (for example double deficits, elevated interest rates and swap rate depreciation) would amplify the weakness of an economy and that the fiscal instruments are central for sensible macroeconomic policy for transition and developing economies. Consequently, the double deficits should be avoided.

In the Table 1 below, a summary of some relevant empirical analysis related on the Ricardian equivalence, the twin deficits (internal deficit-ID, external deficit-ED) hypotheses, the related developing countries and the causality results in time of series of studies is presented.

Table 1. A meta-analysis studies on Ricardian equivalence and/or twin deficits hypotheses without developed countries

Author(s) and years	Developing countries concerned	Time period	Causality in time series studies
Akbostanci and Tunç (2002)	Turkey	1987-2001	Not valid
Anoruo and Ramchander (1998)	India, Indonesia, Korea, Malaysia, Philippines	1957-1993	ED → ID
Baharumshah and Lau (2009)	Indonesia, Japan, Malaysia, Singapore, South Korea, Philippines, Thailand	1980-2006	ID → ED
Drakos (2001)	Greece	1981-1996	ED → ID
Egwaikhide (1999)	Nigeria	1973-1993	ID → ED
Hakro (2009)	Pakistan	1948-2005	ID → ED
Hashemzadeh and Wilson (2006)	Egypt, Iran, Jordan, Kuwait, Morocco, Oman, Syria, Turkey, Yemen	1982-2003	ID ↔ ED
Islam (1998)	Brazil	1973-1991	ID ↔ ED
Khalid (1996)	21 developing countries	1960-1988	ID ↔ ED
Kim and Kim (2006)	South Korea	1970-2003	ED → ID
Lau and Tang (2009)	Cambodia	1996-2006	ID → ED
Marashdeh and Saleh (2006)	Lebanon	1970-2004	ED → ID
Mukhtar *et al.* (2007)	Pakistan	1975-2005	ID ↔ ED
Nikiforos *et al.* (2013)	Greece	1980-1995	ID → ED
Onafowora and Owoye (2006)	Nigeria	1970-2001	ED → ID

Parikh and Rao (2006)	India	1970-2000	ID → ED
Pattichis (2004)	Lebanon	1982-1997	ID → ED
Ratha (2010)	India	1998-2009	ID → ED
Saleh *et al.* (2005)	Sri Lanka	1970-2003	ID → ED
Vamvoukas (1999)	Greece	1948-1994	ID → ED

Sources: Authors' elaborations.

From the above table, we notice that, the causality outcomes are varied, depending on the developing economy under consideration, the point in time and the period used.

3. Methodology: Model, Variables, Data Sources and Descriptive Statistics

3.1 Model Specification

To analyze the dynamics associations and to give good reason for the fundamental link among among the external deficit and the internal balance, we use the subsequent function:

$$ED_{it} = f(ID_{it}), \text{ ceteris paribus} \quad (7)$$

The function (7) can be presented in an econometric model as follows:

$$ED_{it} = \alpha_0 + \alpha_1 ID_{it} + \alpha_3 X_{it} + \mu_{it} \quad (8)$$

Where, ED_{it} is the external deficit, ID_{it} is the internal deficit captured here with ΔPD_{it} the variation of public debts, α_0 is the constant term, α_1 is the model coefficient, α_3 is the coefficient of the control variables, X_{it} is the control variables, μ_t is the random error term, i is the country index (i = 1, …, 15), and t is time (t = 1960, …, 2012).

3.2 Variable Selections

As measure of internal deficit (*ID*), we use the variation of public debt in percent of gross domestic product-GDP (equation 6). While external deficit (*ED*) is provide by external balance on goods and services (% of GDP). Moreover, in order to separate the effect of the variation in the internal deficit on the variation of the external deficit, we use exchange rate (*ER*) and consumer price index (*CPI*) as control variables.

Internal deficit is the gap between incomes and expenditures for a government over a given period of time. It is often referred to as a public deficit or fiscal deficit. In many cases, countries have administrative subdivisions that also run significant fiscal deficits. The sum of state, local, and federal deficits constitute the internal deficit of these countries. On very rare occasions the concept is applied to the deficit run by private enterprises as well as by public sectors. In such case, the term is considered as the total debt of a country that is held by its own citizens. External balance on goods and services (formerly resource balance) is equal to exports of goods and services minus imports of goods and services (previously nonfactor services). External deficit is considered as a current account deficit. It is a negative net flow of liquid assets to the citizens of a particular country. The external balance includes the trade gap, the net foreign factor revenue and the net foreign aid received. Usually the most important cause of an external deficit is a trade deficit.

The rate at which one currency may be converted into another is called exchange rate. The exchange rate is used when simply converting one currency to another (such as for the purposes of travel to another country), or for engaging in speculation or trading in the foreign exchange market. There are a wide variety of factors which influence the exchange rate, such as interest rate, inflation, and the state of politics and the economy in each country. This term is also called rate of exchange or foreign exchange rate or currency exchange rate. Exchange rate measures of the value of a currency against a weighted average of several foreign currencies.

The consumer price index is a measure of changes in the purchasing-power of a currency and the rate of inflation. The consumer price index expresses the current prices of a basket of goods and services in terms of the prices during the same time in a previous year, to show effect of inflation on purchasing power. It is one of the best known lagging indicators. The consumer price index reflects changes in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals. For the government expenditures, we used final consumption expenditure (formerly total consumption) which is the general government final consumption expenditure (general government consumption).

3.3 Data Sources

The data utilized in this paper cover the period 1960 to 2012 for 15 African countries: Angola, Cameroon, Central Africa Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of Congo, Egypt, Gambia, Ghana,

Morocco, Nigeria, South Africa Republic, Tunisia, and Zambia. External balance on goods and services and Consumer price index are extracted from WDI database. Exchange Rate comes from Penn World Table, version 8.0. Public debt (% of GDP) is provided by Historical Public Debt Database 2012 of International Monetary Fund.

3.4 Descriptive Statistics

Table 2 shows the summary statistics of the selected dependent, independent variables, and the control variables. The variables of the present study are linked to each other and the values of mean and median are in between the range of minimum and maximum values.

Table 2. Summary of descriptive statistics

	External Deficit	Exchange Rate	Consumer Price Index	Internal Deficit
Mean	-0.228918	287.5495	61.95556	-0.714114
Median	-1.900766	9.550745	51.77515	-0.098474
Maximum	52.47367	5046.109	2378.378	120.9910
Minimum	-100.9709	1.67E-12	2.35E-13	-161.4878
Std. Dev.	12.43114	669.5967	123.1100	19.10183
Skewness	-0.221476	5.161885	14.51994	-1.385621
Kurtosis	11.81240	32.35690	256.8663	20.29255
Jarque-Bera	1712.800	21304.97	1436411.	6747.662
Probability	0.000000	0.000000	0.000000	0.000000
Observations	528	528	528	528

Source: Authors' calculations.

The Jarque-Bera test, in statistics, is a goodness-of-fit test of whether sample data have the skewness and kurtosis matching a normal distribution. The result of the statistic analysis and precisely the Jarque Bera test reveals that, for all series of data used in this paper the assumption of the normality of the error term of the distribution is abandoned.

4. Empirical Results

4.1 Results of Panel Unit Test

We start the presentation of the empirical results by exploring the temporal properties of the series. Table 3 presents the empirical results of the panel unit root test on the selected variables.

Table 3. Panel unit root test on variables

	External Deficit	Exchange Rate	Consumer Price Index	Internal Deficit
Null: Unit root (assumes common unit root process)				
Levin, Lin and Chu t*	-6.99378***	3.79217 (-11.5774***)	7.84677 (-1.00397)	-10.3439***
Null: Unit root (assumes individual unit root process)				
Pesaran and Shin W-stat	-6.44337***	4.79363 (-12.5272***)	12.5165 (-2.42101***)	-12.0752***
ADF - Fisher Chi-square	99.6689***	10.0358 (212.363***)	0.68664 (88.5459***)	196.018***
PP - Fisher Chi-square	94.8534***	(7.91049 (303.413***)	0.31894 (107.607***)	326.679***

Note. Number in parentheses indicates the unit root test on variables in first differences. Probabilities for Fisher tests are computed using an asymptotic distribution. All other tests assume asymptotic normality. ***, ** and * respectively indicates significance at 1%, 5% and 10% level.

Source: Authors' calculations.

The Table 3 displays the panel unit root tests of external deficit, internal deficit, exchange rate and consumer

price index series in level and in first differences. Firstly, the null hypothesis assumes common unit root process. After performing Augmented Dickey-Fuller (ADF) test we can see that external deficit and internal deficit are stationary in level I(0) and, exchange rate is stationary in difference I(1). Secondly, the null hypothesis assumes individual unit root process. Three tests also reveal that external deficit and internal deficit are stationary in level I(0) and our control variables, exchange rate and consumer price index are stationary in difference I(1).

4.2 Linear Panel Causality Results

Two types of panel regression methods are considered in this investigation: the pooled ordinary least square (OLS) model and the fixed effects (FE) model. The pooled OLS model assumes no variation of the coefficients and intercept terms while the FE model allows for variation within each country intercept (Hsiao, 2003; Craigwell & Moore, 2008). The statistic tests, based on the two panel regression methods, are given from lags 1 to 3 and F-test is used to test restrictions on the coefficients at the chosen lag lengths which were determined by the Schwartz Bayesian Criterion (SBC), given the relative small sample utilized here.

The homogeneous causality hypothesis (HC) test results seen in Table 4 reveal non-causal relationship between external deficit and internal deficit. To make sure that the representation in Table 4 is well precise, we also run specification including exchange rate and consumer price index as control variables. These results suggest a robuts causal relationship from external deficit to internal deficit, and only one "lag" (OLS - no control) gives a significant causal relationship from internal deficit to external deficit. Nevertheless, about the models without controls variables, we find a strong causal relationship from external deficit to internal deficit, and a similar link from internal deficit to external deficit. Then, using the homogenous and instantaneous non-causality hypothesis (HINC) tests, the regression coefficients across countries are statistically different from zero and the null hypothesis is rejected (Table 4) for certain models.

Table 4. Homogenous and instantaneous non-causality tests (no controls and controls)

		HINC (No control)		HINC (with control)		HC	
	Lags	OLS	FE	OLS	FE	OLS	FE
$ED \rightarrow ID$	1	13.41806***	12.93701***	57.21085***	54.46345***	1.38814	-
	2	13.69234***	12.88241***	74.59394***	71.54537***	1.26778	-
	3	14.02813***	12.72758***	76.56901***	72.80340***	0.58333	-
$ID \rightarrow ED$	1	12.55463***	12.52379***	10.78071*	9.758554	0.54101	-
	2	11.80330***	12.22474***	10.37381	9.128460	0.34034	-
	3	15.29021***	14.16667***	15.87916	14.16630	0.99523	-

Note. ***, ** and * respectively indicates significance at 1%, 5% and 10% level.

Source: Authors' calculations.

A supplementary finding concerns the heterogeneous non-causality hypothesis (HENC) test, which is also used to determine if the θ_{ik} coefficients are different across countries. Then Table 5 shows that five countries, Côte d'Ivoire, Gambia, Morocco, Democratic Republic of Congo and Tunisia, external deficit Granger caused internal deficit, two countries, Nigeria and Egypt, postulate causality from internal deficit to external deficit, and while one country, South Africa, reveal a bidirectional causal link between external deficit and internal deficit. For the other countries in our sample such as Angola, Cameroon, Congo, Ghana, Central Africa Republic, Chad and Zambia the macroeconomic association between internal and external deficit is established. But the macroeconomic relationship is not significant to be used for a robust conclusion.

Table 5. Heterogeneous Granger causality test

Country	$ED \rightarrow ID$	$ID \rightarrow ED$
Angola	0.02954	0.23290
Cameroon	0.11636	0.32758
Congo	1.41985	0.01296
Cote d'Ivoire	6.23517**	0.70908
Egypt	2.33350	4.70058**
Gambia	6.51213**	0.45263

Ghana	0.22483	1.57857
Morocco	5.13655**	0.13571
Nigeria	0.00063	5.76072**
Central Africa Republic	0.0000	0.21733
Demo. Rep. of Congo	7.92307***	1.61025
South Africa Republic	3.80319*	5.53818**
Chad	2.16867	0.02959
Tunisia	9.90735***	0.01620
Zambia	0.80089	0.57923

Note. ***, ** and * respectively indicates significance at 1%, 5% and 10% level.

Source: Authors' calculations.

4.3 Non-Linear Panel Causality Results

Using the non-linear panel causality, the empirical results obtained in the Table 6 suggest a significant non-linear causality solely for one causal variable when the external deficit is the dependent variable.

Table 6. Non-linear causality result: External deficit is the dependent variable

Causal Variables	Lags	Coefficient	t-statistic
ID	1	-0.095458	-2.220139**
ID2	2	0.000293	0.505890
ID3	3	-2.36E-06	-0.834211
δID	1	0.019182	0.488026
δID2	1	0.000345	0.944520
δID3	1	0.000000	0.710538

Note. ***, ** and * respectively indicates significance at 1%, 5% and 10% level. δ is the difference operator.

Source: Authors' calculations.

Table 7 shows the inexistence of the non-linear panel causality from internal deficit to external deficit.

Table 7. Non-linear causality result: Internal deficit is the dependent variable

Causal Variables	Lags	Coefficient	t-statistic
ED	1	-0.074440	-1.094510
EDI2	2	-0.004741	-1.375433
ED3	3	1.13E-05	0.617356
δED	1	-0.060756	-0.450115
δED2	1	0.002095	0.419849
δED3	1	0.0000	0.865626

Note. ***, ** and * respectively indicates significance at 1%, 5% and 10% level. δ is the difference operator.

Source: Authors' calculations.

When using the non-linear panel causality with internal deficit considered as the dependent variable, the empirical results obtained in the Table 7 indicate the absence of a significant non-linear causality.

5. Conclusions and Recommendations

In this paper we have investigated the causality association between internal deficit and external deficit in 15 African countries during the period 1960-2012. Using causality analysis we have empirically tested the four main causation linkages: (1) internal deficit causes external deficit, (2) there is bidirectional causality between the two variables, (3) the two deficits are not causally related and (4) external deficits cause internal deficits. The estimates econometrically support that: external deficits cause internal deficits; internal deficit causes external deficit; and bidirectional causality between internal and external deficits. Our empirical results show that five countries, Côte d'Ivoire, Gambia, Morocco, Democratic Republic of Congo and Tunisia, external deficit Granger

caused internal deficit, two countries, Nigeria and Egypt, postulate causality from internal deficit to external deficit, and while one country, South Africa, reveal a bidirectional causal link between external deficit and internal deficit.

Therefore, appropriate economic policy measures should be used to reduce internal deficits which would play an important role in reducing the external deficits and vice-versa. Important factors such as: improving the terms of trade, coordination of monetary and fiscal policies, sustaining the effort to enhance private saving, and consolidation of the fiscal taxes should be encouraged in order to increase public saving. Others monetary policies focused on the efficiency, as well as the exchange rate, will harmonize the budget cut policy. Finally, the control of national budgetary policies should be re-build.

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The Effect of Capital Competence on the Jordanian Banks Profitability

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Abstract

This study aims at investigating the effect of capital competence on the Jordanian commercial banks' profitably through two measurements: capital competence versus total assets and capital competence versus risk assets. In regard to profitability it has been measured through return on investment (ROA), return on Equity (ROE) and return on share (EPS).

In order to achieve the objectives of the study, a statistical test is conducted through the use of linear regression coefficient and the use of SPSS. The study revealed several results, and is concluded with recommendations, which assures the effect of capital competence on the Jordanian commercial banks profitability in facing risk and enhancing liquidity in order to achieve financial solidity.

Keywords: capital competence, commercial banks, financialconsolidation, profitability.

1. Introduction

Capital competence is increasingly gaining importance day after day, in the midst of accelerating events of money and business, and focusing on having banks to reserve a minimum level of its own resources so as to counter risks, and to organize relationship between capital and deposits on the basis of having liquidity and profitability that go side by side but in a contradicting manner. Because of this condition and because of commercial banks performance started to retrograde, Basel agreement has been founded; to loans and facilities. Furthermore, Basel has other general objectives such as: support financial and banking sectors to strengthen them through modernizing and updating methods, and approaches for risk management. Therefore, capital competence has become the main indicator for banks ability and competency in need decision making for pricing banking services, risk monitoring and enhance commercial banks profitability.

Therefore, commercial banks have been obliged to preserve the minimum level of capital competency to counter risks that banks may be subjected to, and in accordance with determined measures which reflect the capital competency the banks owns, to absorb any losses may face that bank. This will be according to what is known by the ratio of total capital Assets and the reliance extent on equity rights to finance assets. Moreover, there is what is known by equity rights to risk assets ratio when discussing the risk of: loans, securities, and long-term investment that carry high risks which reflects- in one way or another, assets that are difficult to turn into cash without losses.

This reflect liquidity terminology that expresses ready cash or equity liquidity which means, easy and rapid transfer into cash such assets can be ready cash without losses what so ever, and according to ordinary processes of financial issues. (Haddad, 2014, p. 21).

Most recently, numerous authors have started examining banks profitability and the determinants which affect this profitability (Jarrah, Ziadat, & Rimawi, 2010; Ramadan, Kilani, & Kaddumi, 2011) and other, these authors discussed the impact of several factors that influence banks profitability such as: Return on assets, (ROA) return on equity (ROE) and other elements. However, this study discusses banks capital competency or well-capitalized banks on their profitability.

While Jordan is considered to be one of the pioneer countries in applying international standards, therefore, the Jordanian commercial banks sector has experienced quantitative and qualitative growth in recent years which positively reflect on financial crises consequences.

The Jordanian banking sector enjoys a safe liquidity, whereas the cash deposits in these banks reached up to 26 percent of total assets, comparing to 50 percent in 2013 and 49 percent in 2012. At the same time covering of non-active loan allotted (covering percent) went up to reach 78,2 percent by the end of 2013. Therefore, these performance indicators reflected positively on the percent of capital competency; whereas, it is the highest in the middle East and North Africa, which is around 18 percent to 20 percent between the years 2007-2013. These figures are higher than the percent, which the Jordanian central Bank has determined, 12 percent and higher than Basel's 8%.This means that there is a substantial closeness between capital competency percent and primary capital's. This leads to the strengthening of financial stability and assures a greater extent the ability to absorb losses.

This indicates that banks follow the reservation approach in its dealing by not jumping into risk practices. Therefore, the magnitude of banks investment in the Jordanian governments bonds reaches up to 8,903 million dinar with Zero risk constitutes 21% of banks total assets.

While the Jordanian commercial are not far away from surrounding risk, it is expected from these banks to be more careful in applying and strengthening the capital competency percent by which it may achieve several positivity in general and benefits for profitability in particular.

Consequently, authors determined to study the effect of capital competency on the Jordanian commercial banks profitability in order to reveal the ideal applicability and positive consequence on financial performance solidity and profitability.

1.1 Significance and the Objectives of the Study

This study is considered to be important for several reasons: it discusses the population of the Jordanian commercial banks listed in Amman Stock Exchange; in addition, this study is the first study that disuses the effect of capital competency to (total assets) from one aspect and to (risk assets) from the other, on commercial banks profitability measured by three ratios: return on assets (ROA), return on equity (ROE) and return on shares (EPS).

1.2 Objectives of the Study

This study aims at investigating the effect of capital competency on the Jordanian commercial banks listed on Amman Stock Exchange profitability through the achievement of the following objectives:

Investigating the effect extent of capital competency to total assets on Jordanian commercial banks profitability measured by return on assets (ROA).

Investigating the effect extent of capital competency to total assets on Jordanian commercial banks profitability measured by return on equity (ROE).

Investigating the effect extent of capital competency to total assets on Jordanian commercial banks profitability measured by return on shares (EPS).

Investigating the effect of capital competency to total risk assets on Jordanian commercial banks' profitability measured by return on assets (ROA).

Investigating the effect extent of capital competency to total assets on Jordanian commercial banks profitability measured by return on equity (ROE).

Investigating the effect extent of capital competency to total assets on Jordanian commercial banks profitability measured by return on share (EPS).

1.3 The Problem of the Study

This study seeks to reveal the effect of capital competency on Jordanian commercial banks profitability through answering the following question:

What is the effect of capital competency (to total assets on Jordanian commercial banks profitability measured by return on asset (ROA)?

What is the effect extent of capital competency to total assets on Jordanian commercial banks profitability measured by return on equity (ROE)?

What is the effect extent of capital competency to total assets on Jordanian commercial banks profitability measured by return on share (EPS)?

What is effect extent of capital competency (to risk assets) on commercial banks profitability measured by return on assets (ROA)?

What is the effect extent of capital competency (to risk assets) on commercial banks profitability measured by return on equity (ROE)?

What is the effect extent of capital competency (to risk assets) on commercial banks profitability measured by (EPS)?

1.4 Theoretical Framework and Previous Studies

Commercial banks are the backbone of banking system due to the vital role they play in banking arena. As a result, banks are facing several challenges in order to gain customers trust and the solidity of their financial condition in the midst of rapid moving environment. Thus, banks are obligated to adhere to international banking standards, and be obliged to capital competency standard according to Basel committee in general and the central bank's instructions in particular.

Capital competence of a bank or well-capitalized bank is the way the bank finances its assets across several elements of debt, equity or hybrid securities (Taan, 2013). It is a combination of debt and equity that makes the total capital of a bank. From this principle and to achieve the objectives of the study.

Capital competence is worthy for exploring in Jordanian banks for several reasons:

1) Commercial Jordanian banks concentrate its investment activities and practices on local projects and facilities mainly: loans to government and buying American Treasury bills.
2) Capital competency is utilized by local banks in Jordan to be an effective instrument in investing in local large projects so as to generate substantial profits with minimum risk. That is why author has chosen the variables of capital competency to total assets and capital competency to total risk assets.

Capital as being banks' security line and the fortifying its financial position, it is a means to protect depositors through provide guarantees for their rights, and a bank's protective shield to confront and countering potential loss. In addition, capital competence is the indicator that reflects the trust of those who deal with banks and its creditors as well. Consequently, this means risks market and operation. Moreover, the significance of capital competency stems from organizing the relationship between capital in one side, and deposits in other: Also having the bank withholds the minimum level from its own money to counter and control risks for the purpose of pricing banking service, enhance returns which positively reflects on banks' capital competency, and enhancing banks' competitive ability in order to protect their financial position and competitiveness.

Thus, banks should maintain review processes and comprehensive assessment for capital competency, guarantee their obligation towards staying within legal averages of capital, and prevent capital lowering beyond required minimum level to counter losses, through early intervention and taking necessary steps to maintain the required limits by determining total ratios of capital and its components, which is in accordance with banking transparency and precaution monitoring. As results the issue of capital competency has become significant by banks and monitoring apparatuses. Whatever concepts or terminology used in this context, all show agreement over relationship between the capital sources and risk for being as a measurement instrument for capital competency (Mekhlafi, 2004; Barakat, 2009).

Previous studies point out to the necessity for commercial banks to enhance their financial positions through the application of capital competency measurement which represents the required level of financial safety and security (Taib & Shateet, 2011). The ratio of operation casts to total assets and the average of risk assets to total assets and the banking focus degree have relationship with the capital (Abu Fahkrah, 1997).

Thus, commercial banks competency is linked, to a greater degree, with banks productivity and profitability within money and credit policies and within commercial banks financial statements. Moreover, the commercial banks' performance, to a greater degree, relies on the increase in their capitals and to employ such capitals ideally within banking position and cash and reserve's demand. This reflects on the competition and profitability degree, within the belief that banks success, achieve their competition and enhancing their profitability are all affected by bank's size competition degree among bank themselves (Llewellyn, 2005).

Furthermore, previous studies revealed the applicability of capital competency limits, therefore positive results can be achieved at liquidity and profitability size and minimizing risks. Consequently, banks competition is enhanced in a way that guarantees financial solidity and banking safety (Siam, 2012).

The aforementioned reveals the capital competency significance of the Jordanian commercial banks, considering it as an active instrument to face risks, preventing and minimizing risks and enhance banks' competition.

In addition, the positivity's of enhancing capital competency shall increase deposited funds protection and increase trust with depositors and creditors as well. Consequently, a kind of balance between potential risks and

the size of capital is achieved (Saudi, 1999). This assures the necessity to have serious attitude towards banks' capital increase in a way that goes parallel with banking potential risks and the application of capital competency standard. (Abdel Fatah, 2013).

1.5 Determinants of the Jordanian Banks' Profitability

Central bank of Jordan has played significant role in the substantial developments during the past few decades. One of these development, is to transfer banking sector in Jordan from the wealthy families dominance on certain banks: (Arab Banks vs. Shuman family; Ahli Bank vs. Muusher gamily and others), into modern up to date banking systems through competent supervisory and regulatory roles, as well as following the latest global financial practices. As a result, banking sector in Jordan, plays a key role in Jordan by pushing forward growth rates through national savings and using them to finance productive economic sectors. For example, during the period (2003-2010) the work of banks recorded a strong growth reached at end of the first half of 2010 to JD 32.5 billion or 45.9 billion American dollars. (Central Bank Report, 2011) Furthermore; determinants of bank profitability have received much attention from academic researchers:

Authors; Ramadan, Kilani, and Knddumi (2011) conducted a research in this context entitled Determinants of Bank profitability: Evidence from Jordan. So as to investigate the nature of the relationship between the profitability of banks and the characteristics of internal and external factors. They used ROA and ROE as measurements of bank's profitability. Results of the study indicated that, Jordanian banks' characteristics explain a significant part of the variation of bank profitability high Jordanian bank profitability tends to be associated with well- capitalized banks…".

Taani (2013), from different angle adds, capital structure and profitability of banks in Jordan. Banks performance which is measured by net profit, return on capital employed and net interest margin is to be significantly and positively associated with total debt.

Alkhazaleh and Al Msafir (2014) examined bank specific determinants of profitability in Jordan such as: capital structure, bank size and liquidity. Results of their study indicate that the capital structure of the bank, the bank size as well liquidity contribute to banks' profitability.

From Jordan to Malaysia where Jamal, Karim, and Himidi (2014) conducted a study by the title of "Determinants of commercial Banks' return on Asset (Malaysia)". In their study authors attempted to investigate the possible influence of macroeconomics factors on domestic and foreign banks' profitability.

The results of the study indicate that all the external factors namely: inflation, indirect rate of GDP have a positive impact on all commercial banks' return on assets

Lee and Hsieh (2013) focus in their research on the impacts of bank capital on profitability and risks. Authors reached the following results:

1) Banks in low-income countries have a higher capital effect on profitability.
2) Banks in Middle Eastern countries own the highest and positive capital effect on profitability.

Jorrah et al, 2010 found out that the most important internal determinants of the bank's profitability are the loans to total assets ratio, the operating expenditure ratio, the capital structure and other. Finally, profitability of Jordanian's banks does not respond speedily to change in the explanatory variables in the short-run.

Jalman (2013) uses financial ratios in determining factors affect banks profitability in Iraq. Author found that, assets size capital competency, loans, equity and cash flow, have significant impact on banks profitability.

Finally, current study will contribute to literature relevant to determinants effect on bank's profitability in Jordan.

1.6 Hypotheses of the Study

Based upon theoretical framework and previous studies and in accordance with the study's objectives, the following hypotheses are developed and be tested,

Ho1: there is no statistically significant relationship between capital competency to total assets and the profitability of the Jordanian commercial banks (ROA).

Ho2:thereis no statistically significant relationship between capital competency to total assets and the profitability of the Jordanian commercial banks (Return on Equity).

Ho3: there is no statistically significant relationship between capital competency to total assets and the profitability of the Jordanian commercial banks (Return on share).

Ho4: there is no statistically significant relationship between capital competency to total risk assets and the

profitability of the Jordanian commercial banks (ROE).

Ho5: there is no statistically significant relationship between capital competency to total assets and the profitability of the Jordanian commercial banks (to risk total assets).

Ho6: there is no statistically significant relationship between capital competency to total assets and the profitability of the Jordanian commercial banks (To risk assets).

1.7 Population and the Sample of the Study

The study population consists of all commercial banks operating in Jordan, while the sample of the study consists of all banks listed in Amman stock Exchange as shown in Table 1:

Table 1. Study's Participating Banks

No.	Bank	Capital competency	Return on assets %
1	Arab Bank	16	1.41
2	Housing Bank	14	1.48
3	Ahli Bank	10	0.6
4	Mal Bank	17	1.5
5	Bank of Jordan	15	1.75
6	Jordanian Islamic Bank	7,5	1.13
7	Itihad Bank	13	1.17
8	Societe General Bank	17	1.09
9	ABC Bank	14	1.22
10	Arab investment Bank	16	1.39
11	Jordan-Kuwaiti Bank	16	1.86
12	Cairo-Amman Bank	12	1.84
13	Investment Bank	18	1.53
14	Islamic Jordan-Dubai Bank	25	0.28
15	Jordanian Trade Bank	11	0.3

Source: Bank annual statements.

2. Data Collection Methods

In addition to relevant books, research, published studies and journals, it has been relied on analytical approach besides other statistical analyses approaches and banks annual financial statements for the years 2010-2013.

Statistical analysis is used to test study's hypotheses' creditability and accuracy, through Regression equation.

2.1 Regression Equation Formula

When we reviewed linear functions, we described equations of the type, Y = .75X + 3. Then we put in values of X, calculated values of Y, and drew the line on a graph. But what if we don't know the values of the parameters a and b?

In Regression analysis we don't know a and b. We have to calculate a value of a and a value of b from the sample data. We're going to use the data to calculate the slope and the intercept of the regression line.

The current graphic shows the formulas for calculating the slope and the intercept from the data. Our estimated value of Y will be found through the equation Y' = a + b X The yellow box on the left shows the formulas for a and b.

The intercept, a, is equal to the Mean of X minus b times the Mean of Y.

The slope, b, is equal to the correlation coefficient, r, times the standard deviation of Y divided by the standard deviation of X.

Note: we can reverse the predictor variable and the criterion variable. That is reverse X and Y so to predict X from Y instead of Y from X. In this example, that means predict the size of profits (X) from the capital (Y). The pink box in the lower right of the graphic shows the formulas for predicting X from Y.

2.2 Linear Regression

Linear regression attempts to model the relationship between two variables by fitting a linear equation to

observed data. One variable is considered to be an explanatory variable, and the other is considered to be a dependent variable. For example, a modeler might want to relate the weights of individuals to their heights using a linear regression model.

Before attempting to fit a linear model to observed data, a modeler should first determine whether or not there is a relationship between the variables of interest. This does not necessarily imply that one variable causes the other (for example, higher SAT scores do not cause higher college grades), but that there is some significant association between the two variables.

A linear regression line has an equation of the form Y = a + bX, where X is the explanatory variable and Y is the dependent variable. The slope of the line is b, and a is the intercept (the value of y when x = 0). (Source: Google accessed on 15/3/2015).

Author has used these complicated formulas in calculating the relationship with independent and dependent variables of the study.

3. Data Analysis and Hypotheses Testing

To test the hypotheses acceptability linear regression coefficient is used, with the use of SPSS so as to find out the effect extent of capital competency to total assets (X1), and capital competency to risk assets (X2) as independent variables on bank's profitability as dependent variable (Y).

The linear regression equation determines the coefficient value which shows the effect extent of the independent variable on the dependent variable through the equation B, and the value (SIG) and (R) coefficient between variables, in addition to R2 testing to explain change ratio in profitability as a result of change in capital competency.

3.1 Variables of the Study

First: dependent variable:

Represents commercial banks' profitability, which is measured by: Return on assets, return on equity and return on shares, each of these is represented by the dependent variable (Y).

Second: Independent variables:

Capital competency to total of assets (X1).

Capital competency to risk assets (X2).

Testing First Hypothesis.

Ho1: there is no statistically significant relationship between capital competency versus total assets and the Jordanian commercial banks profitability (Return on assets).

ROA	constant	B	R2	SIG
Capital/Assets	1.16	0.351	0.16	0.02

The statistical analysis shows the presence of positive statistically relationship between capital competency (to total assets) and return on assets of commercial banks, whereas, the value of (SIG) is 0.02 which means the acceptance of alternative hypothesis at α=0,05 and the value of R=0,16.

This results proves that capital competency intercepts 16% of change in the average of return on assets.

Second hypothesis testing:

Ho2: there is no statistically significant relationship between capital competency to total assets and the profitability of the Jordanian commercial banks (Return on Equity).

ROE	constant	B	R2	SIG
Capital/Assets	15.1	-0.41	0.19	0.01

The statistical analysis shows the presence of negative statistically significant relationship between capital competency (versus total assets) and bank' return on equity whereas sig=0.01. This means the acceptance of the alternative hypothesis at α=0.05; and R=0.19. This result also shows that capital competency intercepts 19% of change in return on equity.

Third Hypothesis testing:

Ho3: there is no statistically significant relationship between capital competency to total assets and the profitability of the Jordanian commercial banks (Return on share).

EPS	constant	B	R2	SIG
Capital/Assets	0.367	0.97-	0.13	0.08

Statistical analysis shows the presence of negative statistically significant relationship between capital competency (to total assets) and EPS of commercial banks with sig=0.08. This means the acceptance of the alternative hypothesis at α=0.010, R=0.13 thus capital competency intercepts 13% of change in EPS.

Fourth Hypothesis testing:

Ho4: there is no statistically significant relationship between capital competency to total assets and the profitability of the Jordanian commercial banks (return on assets).

ROA	constant	B	R2	SIG
Capital/risk Assets	1.65	0.58	0.07	0.57

Statistical analysis shows that there is no statistically significant relationship between capital competences (to total risk assets).And ROA of commercial banks whereas:

Sig= 0.57at which means the acceptance of the original hypothesis atα=0.05, R=0.13. Consequently, capital competency to total risk assets has no statistically significant which shows the presence of statistically significant effect of capital competency to total assets on ROA.

Fifth Hypothesis testing:

Ho5: there is no statistically significant relationship between capital competency to total assets and the profitability of the Jordanian commercial banks (return on equity).

ROE	constant	B	R2	SIG
Capital/risk Assets	14.42	-0.28	0.133	0.013

Statistical analysis revealed the presence of negative statistically significant relationship between capital competency to total assets and return on equity of Jordanian Banks, whereas sig=0.013. this means to accept the alternative hypothesis at α=0,05, R=0.133 this result shows that capital competency to total risk assets intercepts 13.3% of change in ROE.

Sixth Hypothesis testing:

Ho6: there is no statistically significant relationship between capital competency to total assets and the profitability of the Jordanian commercial banks (EPS).

EPS	constant	B	R2	SIG
Capital/risk Assets	0.253	-0.129	0.03	0.71

Statistical analysis shows that there is no statistically significant relationship between capital competency (to total risk assets) and EPS of banks, where Sig=0.71 this means the original hypothesis acceptance at α= 0.05, R=0.03 this results also shows that capital competency to total risk asset has no statistically significant effect on EPS. In contrast with the third hypothesis which shows negative statistically significant of capital competency to total risk assets on EPS average.

4. Results of the Study

4.1 Current Study Reached the Following Results

There is a positive statistically significant relationship between capital competency (to total assets) and ROA. These results are concurrent with previous studies. In turn, the lack of statistically significant relationship between capital competency (to total risk assets) and banks' ROA, means that there is no accurate capital (to risk assets) measurement.

There is a negative statistically significant relationship between capital competency (to total risk assets) and ROE of banks. In addition to negative statistically significant relationship between capital competency (to total

risk assets) and ROE of Banks. This result indicates a decrease in ROE during the study's period.

There is a negative statistically significant relationship between capital competency (to total risk assets) and EPS, in turn, there is no statistically significant relationship between capital competency (to total risk assets) and banks' EPS.

4.2 Recommendations

Enhancing the Jordanian commercial bank capital competency through the increase in their capitals in order to face risk, and secure financial solidity, even through resorting to bank merging.

Enhancing the balance between expected risks and capitals size because of transparency and banking discipline.

It is necessary to have bankers be aware of the importance of bank's capital competency; clarify its rules and foundations, and the measurement of capital competence.

Conduct further studies using measurement tools and other variables for each of capital competency and profitability. It is possible in these further studies to use capital: deposits return: investment and loan.

Conduct further studies for other periods of time in order to reveal the role of capital competency in banks' profitability, whereas the period of this study occurred right after the banks started recovering from global financial crisis.

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Appendix A. Jordanian commercial banks statement

Banks sector	2010	2011	2012	2013
Total assets	48,477,966,019	50,516,950,642	52,024,825,201	54,912,998,990
Total risk assets	24,621,954,823	25,300,663,917	27,413,853,757	29,263,037,426
Payables total	41,313,985,784	43,156,869,098	44,356,875,789	46,883,048,480
Total shareholders' rights	7,021,599,386	7,207,014,190	7,510,300,753	7,852,486,395
Net profit	476,357,885	589,930,322	635,748,300	766,137,413
EPS	0.22	0.26	0.26	0.32
Return on total assets %	0.98	1.17	1.22	1.40
Return on shareholders' right %	6.63	8.00	8.32	9.68
Debt %	85.22	85.43	85.26	85.38
Capital/assets %	14.78	14.57	14.74	14.62
Capital/risk assets %	29.01	29.09	27.97	27.44

Source: Jordanian commercial banks annual reports.

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Macroeconomic Variables and Value Creation in the Nigerian Quoted Companies

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Abstract

This study uses 1,425 observations, relating to firm level and time series data sets, to examine the effect of macroeconomic variables on the economic value created by the Nigerian quoted companies. The data described macroeconomic variables such as inflation (INF), interest rates (INT), capital expenditure ratio of government (CAR) foreign exchange rates (FRXG), gross domestic product (GDPG) and the developments in the capital (CMKG) and labour market (LBMG) and the economic value added (EVA) by 186 purposively selected quoted companies for the years 2001-2012. To allow for comparison, the companies were categorized into two sub-sectors: manufacturing (715 observations) and services (710 observations). The study uses descriptive and inferential statistical tools such as mean, standard deviation, correlation, pooled ordinary least square (OLS) regression and generalized method of moments (GMM) techniques to analyze data. The study found that EVA followed an autoregressive function after one period and lagged EVA was included in model. Due to the problem of heteroskedasticity, Generalized Method of Moment results were relied upon and significant (positive and negative) impact of CAR ($\beta = -0.0173$, p<0.05), FRXG ($\beta = 0.00857, p < 0.01$), INF ($\beta = -0.00896, p < 0.05$), INT ($\beta = 0.0262, p < 0.1$) and LBMG ($\beta = 0.00158, p < 0.01$) on EVA was found, for all the companies. We concluded that value creation, measured by EVA, is a function of prior year EVA and that inflation rate, interest rate, foreign exchange rate, capital expenditure ratio and the development in labour market were important macroeconomic factors that should be improved upon if quoted companies were to optimally create economic value in Nigeria.

Keywords: value creation, macroeconomic variables, quoted company

1. Introduction

In recent times, the Nigerian economy had been growing and the contributions of the quoted companies cannot be overlooked. The companies have been recording operating results that demonstrated their value creating potentials and abilities to provide incomes (e.g. interests, taxes, dividends and salaries) to various stakeholders, which were reflected in their annual audited reports and accounts over the years 2001-2012.

However, no organizations exist in vacuum (Mullins, 1999); they take inputs from the environment and, through a series of activities, transform them into outputs that command prices in the markets. This means that the performance of the companies must have been influenced by factors that are within and outside their control. Environmental influences such as macroeconomic variables, competitors, infrastructures, government policies, regulations and reforms as well as individual firm characteristics such as assets, age and management structure have implications on the achievement of organizations' goals (Porter, Lawler, & Hackman, 1975; Shirai, 2002; Adenikinju, 2005).

Heavy protection and regulations, which were the outcomes of the Nigeria's industrial policy, have impacted on the competitiveness of the manufacturing sector and economic fortunes, in terms of growth, employment, inflation, private credits and interest rates (Salawu, 2010), which have consequences on the ability of the Nigerian quoted companies to create economic value. Also, the move towards free markets (capital, money, labour, commodity and foreign exchange) since 2000, growth in credits to core private sector, capital expenditure of government, together with monetary policies might have provided ample opportunities to the Nigerian quoted companies to optimally create value.

Moreover, series of consolidation and recapitalization were instituted to widen and deepen the financial system, especially in 2005. The reforms aimed at helping companies, operating in different sectors of the Nigerian economy to play an increasing and predominant role in value creation, employment and income generation, as well as expanding the size of the productive sector, generating tax revenue for the government and facilitating poverty reduction through fiscal transfers (Prasad, Green, & Murinde, 2001). The operating environment of the Nigerian companies had therefore changed over the years 2001-2012, allowing more flexibility on how quoted companies create and distribute economic value.

There have been remarkable growth in the literature on how firm performance is measured and several arguments have been offered on the superiority of economic value added (EVA) over accounting metrics (Stewart, l991; Elubar, 1998; Stern & John, 2001). Besides, a plethora of studies had examined the factors that drive firm value with empirical evidences that they revolved around finance, growth, management and employees, products, assets, operating efficiency (Asogwa, 2009; Oba, 20l1) and several firm-specific characteristics (Booth, 1998; Court & Loch, 1999; Akalu, 2002; Kraai, 2006; Laitinen, 2008).

Though, these studies have broadened our understanding of the issues involved in value creation, most of the factors examined were internal to the companies. What is still not clear and which is equally important in sustainability accounting research agenda of the Nigerian quoted companies is the extent to which macroeconomic variables have been contributing to the economic value added by the companies over the years 2001-2012.

This study considered nine (9) macroeconomic variables such as interest rates, inflation rates, foreign exchange rates, money supply, private sector credits, gross domestic product, capital expenditure of government and the developments in the capital and labour markets to address the following questions: 1) Is there any significant impact of the macroeconomic variables on the economic value created by the Nigerian quoted companies? 2) If there is, do the macroeconomic variables affect the economic value created by companies operating in the manufacturing and service sectors the same way?

There have been links between corporate behaviour and macroeconomic stability of a country and it is our belief that the behaviour exhibited by the Nigerian quoted firms, operating in different economic sectors, in terms of the value created was affected by the changing macroeconomic environment, over the year 2001-2012. Besides, the Nigerian economy had been growing over the years and it is important to understand how the macroeconomic environment had impacted on the value creating abilities of the companies. The major proposition of this study is therefore that value creation (EVA) is a function of nine macroeconomic variables and this relationship was modeled using ordinary least square (OLS) linear regression equation.

2. Conceptual and Literature Review

Many scholars have conceptually addressed the issue of how firms create value (Booth, 1998; Bowman & Ambrosini, 2000; Coff, 2005). In the literature, there is much debate and, arguably, some confusion about the concept of value (Lieberman & Balasubramanian, 2007) and value creation. This is because scholars have often taken an overtly narrow view, equating value creation with returns to the ordinary shareholders (Booth, 1998; Kramer & Pushner, 1997; Bowman & Ambrosini, 2000), which means that the value created by a company belongs only to shareholders, thereby neglecting other stakeholders of the companies. This was caused by the belief held by most managers that the best way to increase firm value is to maximize short- term earnings in a predictable way, on behalf of the shareholders.

Value creation is the difference between inputs value and output value (Booth, 1998). From one period to the other, value is created (or destroyed) when revenue generated from a company's business activities is greater (or lesser) than the cost of purchased inputs or components used to generate outputs. It can also be measured by summing up factors payments such as total labour compensation, depreciation and amortization, rental payments, net income after taxes and all tax payments (Lieberman & Chacar, 1997). The value referred to here is therefore the value created for all the stakeholders of a company and not necessarily shareholder' value, as used in some studies.

According to Lieberman and Balasubramania (2007), value creation means different things to different people. To customers, it means making products or providing services that they find consistently useful. To employees, it entails being treated with respect, being involved in decision making, excellent reward opportunities and continuous training and development. To investors however, value creation involves delivering, consistently, high returns on capital, which generally requires strong revenue growth and attractive profit margins that can be achieved only if a company sustainably delivers value. This therefore implies that a company's goal should be defined in terms of value adding activities rather than the traditional short-term financial performance.

Ordinarily, managers are expected to pursue increased shareholders' wealth, earnings growth and returns on the assets employed. However, successful managers have come to realize that the purpose of a business is to create value for its stakeholders, irrespective of whether the stakeholders have financial claims against the business or not (Lieberman & Balasubramania, 2007). The managers have therefore discovered that the traditional performance measures should not be the primary targets because they are merely rewards for aiming at the real target; that is, adding maximum value to the business.

According to Porter, Lawler and Hackman (1975), there are some environmental influences, which an organization should deal with. They further posited that only organizations whose internal features best match the demands of their environment and whose structure is properly designed to meet the challenges of the changes that occur both within and outside the organization can achieve the best. This had therefore put more responsibilities on managers on how to address the problem of instability in several macroeconomic variables such as increased interest and inflation rates that are externally foisted on companies, in order to achieve objectives such as profit or wealth maximization or any other economic, financial or non-financial goals.

The stability of the macroeconomic environment had been identified as an important factor for sustainable performance of firms and for the overall competitiveness of an economy. In fact, businesses are best conducted in an environment of stability with a minimum level of uncertainty (Adenikinju, 2005). There is therefore no doubt that the interference of government in various markets can bring about distortions in value creating potentials of businesses, their growth rates and sizes and the economy of a country at large.

It is evidenced in the literature that government's efforts at promoting economic development, by controlling macroeconomic variables such as interest rates and securing inexpensive funding for their own activities, have undermined financial development (Shirai, 2002; Salawu, 2010). This is because rigid controls and rules over interest rates, exchange rates, inflation rates and the capital market beyond the equilibrium level that market forces would dictate, have resulted in low direct investments in Nigeria (Salawu, 2010), with consequences on commodity and labour markets. There is therefore the need to determine the extent to which macroeconomic variables influenced the economic value created by quoted companies in Nigeria.

3. Data and Methods

3.1 The Macroeconomic Variables

The macroeconomic variables chosen for this study were drawn from the variables identified in Rose, Wesley and Giroux (1982), McNamara and Duncan (1995), Gunu and Idris (2009), Akinlo (2012), Omojimite (2012) and Odior (2013). The measures of the economic variables was also drawn based on the theories of market and price (developments in the capital, labour, money and foreign exchange markets), monetary economics (inflation, money supply and credits to core private sectors) and theory of public goods (capital expenditure of government) and output factor (gross domestic product). These variables have been theoretically posited and found to have impact on firm performance, however with mixed results.

3.2 Theoretical Model

Generally, economic value added (EVA) is modeled as a function of the macroeconomic variables as follow:

$$EVA_{it} = f(MAC_{it}) \quad (1)$$

where, *EVA* is the economic value created by company *i* at time *t* and *MAC* contains the macroeconomic variables proposed to affect the behaviour of company *i* at time *t*.

We initially considered nine macroeconomic variables, that is interest rates, inflation rates, foreign exchange rates, money supply, private sector credits, nominal gross domestic product, ratio of capital to total expenditure of government, developments in capital and labour markets, over the years 2001-2012. However, the different levels at which the variables were measured and the strong trend in most of them suggested that they cannot be used directly in the model, Hence, percentage change in foreign exchange rates growth (FRXG), money supply growth (MSG), private sector credits growth (PSCG), nominal gross domestic product growth (GDPG), capital market growth (CMKG) and growth rate of employees' remuneration in the labour market (LBMG) and the ratio of capital expenditure to total expenditure of government (CAR) were used while inflation (INF) and interest rates (INT) were used directly. This is consistent with most economic and financial models.

The key endogenous variable was the economic value added (EVA), that is, the wealth created by the companies in each of the years covered by this study, which was measured by the proportion of EVA to net sales. Linear relationship for the equation was adopted because of its simplicity and efficacy in forecasting and because economic value was both created (positive) and depleted (negative) by the companies during the years covered

by this study, which prevented us from using any other kinds of relationship like log-linear approach.

EVA was theoretically modeled as a function of macroeconomic variables (MAC) with the intention that all the nine variables, used to capture the exogenous variable, will be included. However, correlation results (as will be seen later) suggested that two out of the nine macroeconomic variables should not be included in the model, that is, MSG and PSCG. Not only that these variables were highly correlated with each other, they also exhibited high correlation with three other variables, that is, CAR, FRXG and CMKG.

While the correlation analysis identified the exogenous variables for the linear equation model, there was little or no guidance as to the process that generated the EVA series, which may have followed a moving average (MA) or autoregressive (AR) or mixed process. Thus, we explored the time series properties of EVA, using the Box-Jenkins Q-statistics methods. The autocorrelation and partial autocorrelation functions were plotted and the graph indicated that EVA followed an autoregressive function AR(1) after one period because the pike flattens after the first lag. Hence, one period lag of EVA was included as exogenous variable in the model. Equation (1) was therefore re-specified as follows:

$$EVA_{it} = a_0 + \beta_1 INT_{it} + \beta_2 INF_{it} + \beta_3 FRXG_{it} + \beta_4 GDPG_{it} + \beta_5 CAR_{it} + \beta_6 CMKG_{it} + \beta_7 LBMG_{it} + \beta_8 EVA_{it-1} + \eta_{it} \quad (2)$$

where, β_1 are the coefficients of the exogenous variables, ao is the constant and η is the stochastic error term of the model for company i at time t.

3.3 The Sample

This study uses a total of 1,425 observations for firm year and macroeconomic data, covering the period 2001-2012, for analysis. Macroeconomic data were collected from the Statistical Bulletin of the Central Bank of Nigeria, 2012 and the firm year data on EVA were gathered from audited annual financial statements of 186 purposively-selected quoted companies in Nigeria; based on availability of data at the Nigerian Stock Exchange (NSE). The sample size therefore represents more than 70 percent of all the quoted companies in Nigeria. The sample was later divided into two sets of data to allow for different estimations for manufacturing companies (715 observations) and service companies (710 observations). The period 2001-2012 was chosen because it coincided with the periods when the Nigerian economy witnessed increased growth in all markets (commodity, money, labour and capital) which made the operating environment of quoted companies to change, significantly.

3.4 Mode of Analysis

Pooled data was used in this study because data could not be collected for all the companies and the years covered by this study, which resulted into missing data for endogenous variable, EVA. Pooled data also has a potential to remedy near multicollinearity problem (Brooks, 2008) because large data were involved and the degree of freedom increased. Apart from the descriptive statistics, data analysis was carried out in two stages: 1) Correlation matrix that showed pairwise relationships among the exogenous variables i.e. macroeconomic variables. This was to examine any incidence of multicollinearity and to produce a reduced set of macroeconomic factors to be used in regression model. 2) Regressing EVA and the macroeconomic factors using OLS and GMM estimation techniques. Before arriving at the final model, residual diagnostic test was carried out to ensure that the estimates obtained were reliable and consistent.

4. Results and Discussions

4.1 Descriptive Statistics

The descriptive statistics of the variables are as presented in Table 1. Mean value for LBMG was the highest among the exogenous variables; followed by CMKG and PSCG, indicating that the developments in the labour market, capital market and growth rate of the credits to private sector were rapid than others. These results were supported by the variables' standard deviations and ranges. While standard deviation indicated the dispersion of each variable's value to its mean r the volatility in the markets' development and credits growth rate, range showed the differences between the lowest and highest values of the variables, which were much wider than any other variables in this study.

None of the variables were normally distributed as the data in the table provided information that suggested high Jarque-Bera statistics with p-values <0.001, which indicated rejection of null hypothesis of the presence of normality in data series in each case. This is typical of financial data because companies' behaviour can change at any time, which can lead to an unexpected poor or better performance. Also, most of the variables were positively skewed except inflation rate that was negatively skewed.

Table 1. Descriptive analysis results

Statistics	EVA	CAR	CMKG	FRXG	GDPG	INF	INT	MSG	LBMG	PSCG
Mean	0.1865	2740	39.853	3.9345	21.285	12.573	18.214	25.005	66.052	33.572
Median	0.0108	28.510	40.270	2.3700	22.780	12.590	17.590	28.070	10.780	27.380
Maximum	16.5238	43.090	159.61	25.580	46.290	18.890	24.850	54.740	306.58	78.720
Minimum	-0.9010	19710	-28.070	-5.770	2.0500	5.4200	15.140	3.2900	-35.990	9.0200
Std. Dev.	0.1806	6.3471	53.884	8.6866	13.354	3.7003	2.3607	14.723	99.3897	22.058
Skewness	11.2926	0.3781	0.7328	1.4391	0.1511	-0.240	1.3921	0.3780	1.27212	0.9466
Kurtosis	183.379	2.6674	3.1067	4.3656	1.9575	2.6147	5.0443	2.5178	396.317	221.24
Jarque-Bera	1962156	40.514	128.220	602.60	69.939	22.489	708.376	47.730	396.317	221.24
Prob.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Observation	1,425	1,425	1,425	1,425	1,425	1,425	1,425	1,425	1,425	1,425
Cross-section	186	186	186	186	186	186	186	186	186	186

Source: Computations from E-view by the authors, 2014.

4.2 Correlation Analysis Results

The data in Table 2 showed the pairwise degree of association among the exogenous variables, that is, the macroeconomic variables. The results indicated very low magnitudes for most of the variables except for MSG and PSCG, FRXG and MSG, CAR and PSCG and CMKG and LBMG that were highly correlated with each other, in that order. While a large number of negative relationships were recorded, there were also positive relationships among the variables. For example, GDPG was negatively correlated with four variables (CAR, FRXG, MSG and PSCG) and positively correlated with the other four (CMKG, INF, INT and LBMG). However, CMKG positively correlated with five variables (GDPG, INT, LBMG, MSG and PSCG) but negatively correlated with three variables (CAR, FRXG and INF). The results therefore showed how the variables co-moved during the period under study and had implications on the variables that were included in regression model.

Table 2. Correlation results

Variables	CAR	CMKG	FRXG	GDPG	INF	INT	LBMG	MSG	PSCG
CAR	1.000								
CMKG	-01581	1.0000							
FRXG	0.2152	-03772	1.0000						
GDPG	-0.4421	0.1116	-0.3844	1.0000					
INF	0.1113	-0.4186	0.2676	0.1646	1.0000				
INT	-0.0198	0.0194	0.4618	0.4699	0.2955	1.0000			
LBMG	-0.1314	**0.6332**	-0.2836	0.1803	-0.3434	-0.0807	1.0000		
MSG	0.2887	0.1858	**-0.6995**	-0.1475	-0.3057	-0.4869	-0.0751	1.000	
PSCG	**0.6963**	0.1316	-03021	-0.3592	-0.2890	-0.3687	-0.1916	**0.7215**	1.0000

Source: Computations from E-view by the authors, 2014.

4.3 Regression Results

Equation model (2) was estimated using pooled cross-sectional time series data and initially by using OLS pooled estimation technique. Pooled regression is appropriate where a researcher is interested in population regression coefficients, drawn from a population rather than obtaining different individual company's regression coefficient using time series data of each company or common coefficient for all companies at a time using cross-sectional data. By using pooled data, a more efficient estimator β_1 can be obtained (Brooks, 2008).

However, the disturbance term vector η was assumed to be cross-sectionally homoskedastic, that is, has a constant variance and was time-series uncorrelated i.e. autocorrelated. Should these classical regression assumptions violated by the model, the ordinary least square (OLS) estimates for the pooled data will be inefficient. Thus, residual diagnostic tests, such as serial correlation (using Breusch-Pagan-Godfrey methods) and heteroskedasticity (using White, 1990 method) were carried out to examine possible violation of the assumptions concerning the disturbance term.

The series of tests revealed serial correlation with the Breusch-Pagan-Godfrey LM test statistic being insignificant (χ^2 = 0.475, p>0.l) for all companies; significant serial correlation (χ^2 =321.475, p<0.0l) for manufacturing companies and insignificant serial correlation (χ^2 =0.119, p<0.01) for services companies. These results were respectively supported by their F-statistics. The White (1990) test statistic for heterogeneous disturbances (and other possible misspecifications), for all companies (x^2 = 1107.93, p<0.01) suggested that the null hypothesis should be rejected. That is, the disturbance terms for the OLS models were not homoskedastic, as there are some evidences of significant heteroskedasticity. In fact, both the F-statistic (F= 620.001, p<0.01) and Scaled explained SS (χ^2 =83607.23, p<0.0l) supported the results.

Also, for manufacturing companies (χ^2 =36.152, p<0.01) and services companies (χ^2 =554.717, p<0.01), the White (1990) test indicated significant heteroskedasticity in error terms, respectively. The F-statistics (F-stat. =4.700, p<0.01 and F-stat. =314.601, p<0.0l, respectively) and Scaled explained SS statistics (χ^2 =5645.515, p<0.0I and χ^2 =20465.49, p<0.01, respectively) for the two categories of companies also supported the results. The presence of significant serial correlation in the disturbance terms for the manufacturing companies must have contributed to the overall results obtained for all the companies.

To overcome these problems, a different estimation technique that incorporated information about the structures of the disturbance terms and that produced more efficient and reliable estimates for beta coefficient was used. The structural equation model was therefore re-estimated using the generalized method of moments (GMM) with adjustment for heteroskedasticity errors. This technique was selected because of the lagged dependent variable included in model as explanatory variable and because the method has the ability to provide information about the dynamic relationship between the endogenous and exogenous variables (Brooks, 2008).

The results obtained from model estimation using OLS and GMM were reported in three panels in Tables 3 and 4, respectively. The first panel in Table 3 showed results for all companies and the second for manufacturing sector while the third is for services sector (banks, insurance and trading companies). A quick glance at the results in the table revealed that the coefficients were statistically significant at 1, 5 and 10 percent levels and the fit was very tight with adjusted R-squares of 0.4771, 0.9597 and 0.4654 for all companies, manufacturing and service companies, respectively.

However, since the error term is serially correlated, the estimated OLS standard errors were invalid and the estimated coefficients were biased and inconsistent, due to the presence of a lagged dependent variable on the right- hand side. The Durbin-Watson statistics were therefore not appropriate in testing for serial correlation. Statistics of 2.007, 2.009 and 0.575, respectively, supported the outcomes of the Breusch-Pagan-Godfrey‘s LM test for serial correlation because no significant serial correlation was detected for all companies and services companies but significant serial correlation in error terms was detected for manufacturing companies.

The data in Table 4 (1st column) showed significant explanatory power at 1, 5 and 10 percents for most of the variables except CMKG (capital market growth used to measure the developments in capital market) and GDPG that showed insignificant relationship with EVA. In fact, the variables did not make meaningful contribution to the value created by all the companies during the periods, given the size of their coefficients (β=0.00138, p>0.l) and (β=0.00283, p>0.l) for CMKG and GDPG, respectively. In the same vein, CMKG (β =0.000131, p>0.l) and GDPG (β =0.000627, p>0.l) did not have significant impact on the value created by manufacturing companies while GDPG (β =0.00771, p<0.05) had positive and significant impact on the value created by companies in the services sector.

Though, the contribution was very small and less than 1%, this result for the services sector supported the findings of McNamara and Duncan (1995) that increases in the level of economic activities, as measured by GDP, are accompanied by increases in companies’ performance. The result also provided the notion that increases in economic activity flew through to sales and thus positively affected the economic value created by the companies operating in the services sector of the Nigerian economy.

Table 3. Pooled OLS regression results

Dependent variable: EVA

Variables	All Companies	Manufacturing Sector	Services Sector
Constant	01386	0.01698***	0.2262
	(0.68)	(-1.65)	(0.54)
EVA(-l)	0.68388*	5.57E02*	0.6829*
	(35.47)	(5.94)	(24.69)
CAR	l.95E-04	3.19E04**	1.74E-03
	(0.07)	(-2.07)	(0.29)
CMKG	1.34E-04	-8.43E-07	7.70E-05
	(0.28)	(-0.03)	(0.08)
FRXG	3.04E-03	2.10E-04	5.68E-04
	(0.73)	(0.90)	(0.07)
GDPG	3.55E-03	-6.07E-05	5.88E-03
	(1.24)	(-0.40)	(1.05)
INF	12E02**	1.85E-04	0.0207**
	(-2.29)	(-0.75)	(-2.04)
INT	-5.91E-03	1.38E-03	-6.16E-03
	(-0.38)	(1.71)	(-0.20)
LBMG	l.05E03*	1.15E05*	9.05E04**
	(4.80)	(88.99)	(2.05)
Adjusted R-square	0.48	0.96	0.47
Schwarz Criterion	1.74	-4.87	2.45
F-Statistics	163.23	2121.24	78.04
Durbin-Watson	2.007	0.58	2.009
Cross section	186	84	102
No. of observation	1425	715	710

Source: Computations from E-view by the authors, 2014.

Note. the figures in parentheses indicate t-statistics. *, ** and indicate significance at 1%, 5% and 10% levels, respectively.

The contribution of one year lag EVA was positive (β =0.7927, p<0.0l), its impact on current year EVA was also statistically significant and high, which means that the value created in the immediate past year by the companies had noticeable impact on the subsequent year's value being created. The same situation applied to the results obtained for manufacturing (β =0.5044, p<0.0l) and services (β =0.7340, p<0.0l) companies. The manner in which economic value is appropriated might have contributed to this result. Perhaps, the value distributed to critical stakeholders of the companies, like employees, favoured the creation of greater value.

The data in the table further provided evidence that inflation positively and significantly affected the manufacturing companies (β =0.00155, p<0.05) but negatively affected the companies in the services sector (β =-0.00917, p<0.l), though not significant. The negative results for CAR (β =-0.0173, p<0.05), CMKG (β =-0.00138, p>0.l) and INF (β =-0.00896, p<0.05) were inconsistent with the apriori expectation that these macroeconomic variables will have significant positive effects on the wealth created by the companies, as depicted in the structural equation model specified in this study.

While the developments in the capital market (CMKG) since 2001 to 2012 did not have any significant effect on the wealth created by the Nigerian quoted companies (manufacturing and services), the developments in the foreign exchange market (β =0.00857, p<0.0l) and labour market (β =0.00158, p<0.0l) however had positive, high and significant effect. It is usually expected that interest rates (INT) will have significant negative effect on firm performance through their impact on cost of factors of production, which means that the higher the interest rates, the lower the firm performance.

However, since EVA is the difference between input value and output value, it was *apriori* expected that interest rates' effect on EVA will be positive. The data in the table provided information that was not inconsistent with the expectation because the variable had positive and significant impact (β =0.0112, p<0.0l) on the wealth created by the manufacturing companies and positive but statistically insignificant effect on the wealth created by services companies (β =0.00703, p>0.l), even at 10% level.

Table 4. GMM regression results

Dependent variable: EVA

Variables	All Companies	Manufacturing Sector	Services Sector
EVA(-l)	0.7927*	0.5044*	0.7340*
	(7.19)	(4.53)	(6.35)
CAR	-1.73E-02**	-8.30E-03*	1.50E-04
	(-2.49)	(-4.23)	(0.03)
CMKG	-1.38E-03	1.31E-04	1.05E-03
	(-1.30)	(0.99)	(0.87)
FRXG	8.57E-03*	7.94E-03*	1.18E-02**
	(2.64)	(3.55)	(1.89)
GDPG	2.83E-03	6.27E-04	7.71E-03**
	(1.63)	(-1.03)	(1.94)
INF	-8.96E-03**	1.55E-03**	-9.17E-03
	(-2.18)	(-2.20)	(-1.03)
INT	2.62E-02***	1.12E-02*	7.03E-03
	(1.84)	(2.74)	(-0.40)
LBMG	1.58E-03*	1.25E-03*	5.54E-04**
	(4.76)	(21.79)	(2.10)
Adjusted R-square	0.43	0.47	0.45
J-Statistics	5.73	3.51	2.93
P-values (J-stat.)	0.057	0.0608	0.087
Instrument Rank	10	9	9
Durbin-Watson	2.15	2.54	2.11
Cross section	186	84	102
No. of observation	1,425	715	710

Source. Computations from E-view by the authors, 2014.

Note. Figures in parentheses indicate t-statistics. *, ** and *** indicate level of significance at 1%, 5% and 10%, respectively.

The adjusted R-squares for the GMM models indicated that the variables accounted for 43, 47 and 45 percents, respectively of the overall variations in the wealth created by all, manufacturing and services companies. Also, J-statistics showed that the variables included in the models were good. This was confirmed by the instrument rank of 10, 9 and 9 for the three models, respectively. To ascertain that the final models were reliable and consistent, orthogonality test was carried out for all the instrumental variables and the results obtained (not reported) indicated that the null hypothesis should be rejected.

5. Summary and Conclusion

The purpose of this study was to examine the impact of macroeconomic variables on the wealth created by the Nigerian quoted companies over the years 2001-2012. We used secondary data that described dependent variable, that is, EVA and nine macroeconomic variables as the independent variables and the data were analyzed using descriptive and inferential statistical tools such as mean, standard deviation, correlation and OLS and GMM regression techniques.

The study found rapid growth in the developments in labour market, in terms of employees' compensation, over the years 2001-2012 more than the other macroeconomic variables included in this study. Time series properties of the endogenous variable, that is, EVA were explored using Box-Jenkins Q-statistics and the results showed that the variable followed an autoregressive function AR(1) after one period hence, one-year lagged EVA was included in the model estimated.

Significant serial correlation in data series was also detected for manufacturing companies but insignificant serial correlation detected in the data series collected from service companies using Breusch-Pagan-Godfrey LM and White tests. The estimates obtained from OLS regression method using pooled data were then considered biased, inconsistent and unreliable hence, the use of GMM estimation technique.

The results obtained from GMM technique showed significant and positive contributions of one year lag EVA on current year EVA for the companies operating in manufacturing and services sectors. The lead lag model suggested that a forecast of the value creation potentials of the Nigerian quoted companies can be made based on

the model presented in this study. We also found significant impact (positive and negative) of capital expenditure ratio, foreign exchange rates growth, inflation rates, interest rates and the developments in labour market on the value created by the Nigerian quoted companies. This showed that improvements in these macroeconomic variables can account for higher value being created by the companies.

Whereas, foreign exchange rates growth, gross domestic product growth and the developments in labour market had positive impact on the value created by the companies, capital expenditure ratio and inflation rates growth had significant negative impact. Also, capital expenditure ratio had significant negative effect on the economic value created by manufacturing companies. Though, the magnitude was very low, inflation rates had significant positive impact on the value created by the manufacturing companies and its effect on the value created by service companies was insignificant. In addition, residual statistics such as the adjusted R-square, J-statistics and orthogonality tests results indicated that the variables included in this study were good, fit, reliable and consistent.

Based on the major findings of this study, we concluded that value creation, measured by EVA, is a function of prior year EVA and that macroeconomic variables such as inflation rates, interest rates, foreign exchange rates growth, capital expenditure ratio and the developments in the labour market are important macroeconomic factors to be improved upon if quoted companies are to optimally create economic value in Nigeria.

Different policy implications can emerge from this study. Firstly, the companies should develop policies aimed at promoting the identification and exploitation of value adding economic activities in terms of innovation and research and development (production and marketing) activities to improve performance since prior year EVA had significant and positive impact on current year EVA. Secondly, the significant impact of the development in the foreign exchange market on EVA indicated that the development in the Nigerian economy during these periods necessitated investment opportunities that required the use of foreign currencies by the companies, which consequently brought about increased economic value being created. Hence, government should design and tailor regulatory policies towards enhancing its efficiency and increasing the positive effects of foreign exchange market on the value creating potentials of the companies.

Thirdly, free markets (money, labour and foreign exchange) should be encouraged and policy measures capable of removing barriers to their operations such that their efficiency can be enhanced should be developed by the government. Any instability in inflation, interest rates and foreign exchange rates should also be promptly addressed. Government interference should however be guided by sound economic principles and appropriate consideration to the different demands of each sector of the Nigerian economy. Finally, the discrepancies in the magnitudes and signs of the impact of most of the macroeconomic variables on the value created by manufacturing and services companies (most importantly gross domestic product, interest rates, inflation rates and capital expenditure ratio) signified the fact that government policies affected different sectors differently. Hence, future policies should take this into consideration both at the planning and implementation stages.

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Bank Capital Ratio, Prudential Regulation and Liquidity Risk Taking: Behavior of Tunisian Banks in a Simultaneous Approach

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Abstract

We analyze in this article the simultaneous incidence which connects the variations of the ratio of capital and the level of the risk-taking of liquidity, under the regulatory pressure regarding bank liquidity and solvency. To reach this goal, we used a model with two simultaneous equations developed by Aggarwal and Jacques (1998) and inspired from the contribution of Dietsch and Tillov (2014), in datum of panel during period 1990-2012 by using the technique of estimation of 3SLS on ten Tunisian universal banks. Our results show that the institutional conditions show a negative association with the change of the level of solvency of these establishments. Every variation of the level of the risk of liquidity implies no adjustment of the level of the ratio of the capital. This behavior leads to predict the existence of a certain carelessness towards this risk supported by the intervention of the Central Bank of Tunisia to insure a balance of finance at the level of the short-term operations of the interbank availability. On the other hand, our results testify of the importance of the pillows of liquidity to keep a minimum level of liquidity which is going to serve to protect these establishments, lenders or borrowers on the interbank market, counter possible shocks at the level of their availability. Besides, the results show the existence of a certain instability at the level of the banking behavior in an environment regulated regarding risk of liquidity.

Keywords: bank prudential regulation, liquidity risk, solvency risk, capital buffer, simultaneous approach

1. Introduction

The objective of this article is to encircle the simultaneous incidence which binds the variations of the ratio of capital and the level of the risk-taking of liquidity, under the statutory pressure regarding liquidity and regarding solvency on the Tunisian banks. To reach this goal, we used a model in two simultaneous equations developed by Shrieves and Dahl (1992), Son Lai et al. (2012), and inspired of the contribution of Dietsch and Tillov (2014), using a panel over a period going from 1990 till 2012 by the technique of 3SLS. In the literature, Goodhart (2008) indicated that the liquidity and the solvency are both inseparable pillars in the banking profession, often impossible to distinguish them one of the other one. Indeed, a not liquid bank can quickly become insolvent and conversely. Particularly, in times of crisis, the variations of the liquidity are immediately translated by modifications of the structure of the stockholders' equity of credit institutions. However, Pagès (2001), considered that the shocks of liquidity can be transformed into shocks of solvency and quite changes at the levels of the stockholders' equity of banks can reduce, even block their access to the financing if they are perceived as a threat for their level of solvency.

The results show that the institutional conditions show a negative association with the change of the level of solvency of these establishments. Every variation of the level of the risk of liquidity implies no adjustment of the level of the ratio of the capital. This behavior leads to predict the existence of a certain carelessness negligence towards this risk supported by the intervention of the Central Bank of Tunisia to insure a balance of finance at the level of the short-term operations of the interbank availability. On the other hand, many empirical works testify of the importance of the pillows of liquidity to keep a minimum level of liquidity which is going to serve to protect these establishments, lenders or borrowers on the interbank market, counter possible shocks in Level of their availability. Besides, other contributions show the existence of a certain instability at the level of the banking behavior in an environment regulated regarding risk of liquidity.

The present paper is organized as follows: in the first section, we are going to present the main part of the reserved variables, to formulate the underlying hypotheses and to develop the econometric specification of the reserved model. Two tests of preliminary specifications will also be the object of this section. In the second section, we expose the statistical description of the data, the matrix of correlation of the various variables as well as the signs expected from the parameters of the model. Before our conclusion, we analyze, in the third section, the results of the estimation of the model.

2. Variables, Hypotheses and Econometric Specification

2.1 Definition of Proxies and the Main Hypotheses

LIQRISK: Measures the risk of liquidity of the bank. Introduced under endogenous shape in the equation (5.2) by a first variation between two exercises (t) and (t-1) noted (Δ LIQRISK). It is about a ratio which indicates the part of the availability collected in the short term which can be honored in case of banking problem from the liquid assets. A high value of this ratio reveals a healthy management of the risk of liquidity and thus a lesser vulnerability at the risks of liquidity. According to Descamps and Soichot (2002), Darmon (1998), the risk of liquidity is essentially connected to three elements: a) the intrinsic risk of balance sheet which materializes by the notion of transformation, b) the attitude of the economic agents towards the establishment which reflects the reliable notion and c) the institutional context in which the establishment evolves in particular the general liquidity of the market. These authors noted that one of the banking specificities lies in the transformation of short resources in more distant term. According to the prudent approach, the criterion of liquidity most frequently measured in the national banking regulations by the cash ratio is defined by the relationship between current assets and current liabilities. In our study and seen the absence of precise information on these confidential sizes, we are going to choose a simpler approach by reporting the competitions to the economy in the deposits of the clientele.

$$LIQRISK = Domestic\ Loans\ /\ Deposits$$

Rochet (2008) considered that in the light of the recent events, a banking regulations basing only on a device of adequacy of stockholders' equity seem insufficient. The turbulences on the money market revealed that certain banks had preserved very few liquid assets to deal with a lack of the level of very short-term liquidity. The Agreement of Basel II adjusts exactly the device of adequacy of stockholders' equity compared with the risk generally, but, it does not evoke the question of the constitution of reserves to cover needs for liquidity. Indeed a good solvency is translated by a level of ratio of comfortable capital, this is synonymic of a level of liquidity or comfortable availability, when the customers pay off their credits, a level of liquidity will will been guaranteed and available at the level of the bank and, consequently, we attend a reduction in its risk of liquidity. By referring to these arguments we can move forward the following hypothesis: hypothesis (H1) - the relation between the variation of the level of the ratio of capital and the level of the risk of liquidity shows a negative association.

REGL: it is an exogenous variable among the explanatory variables in the equation (5.2) of our econometric model, corresponding to the incidence of the level of risk of liquidity on the change of the level of the ratio of capital under statutory conditions by means of the variables of composite controls. According to the texts of laws and to the circulars which govern the profession of credit institutions in Tunisia, the banking regulations regarding liquidity rest essentially on articles 13, 14 and 15 of circular no 91-24 of 17.12.1991 replaced by the circular to banks no 93-08 of 30.07.1993, then by the circular to banks no 99-04 of 19.03.1999 and finally, by the circular no 2001-04 of 16.02.2001. Indeed these articles stipulate that "banks have to respect permanently a cash ratio which cannot be lower 100% calculated by the relationship between the current assets and the current liabilities" and that "banks have to send to the BCT a monthly statement of the cash ratio for the deadline not exceeding 25 days as from the expiration of the month considered". In fact when Heid et al. (2005), Van Roy (2005), Cannata and Quagliariello (2006) and Matejasák and Tepl ý (2009) and more recently Milné and Jokipii (2010) and Lin et al. (2013), handled the statutory pressure regarding solvency, they used the regulations in force, that is the international solvency ratio equal to 8 %. In our case and to express the regulations regarding liquidity, logically we chose the standard of liquidity, that is the 100 % ratio. This variable can take two possible values, is [Min REGL + LIQRISKi] - LIQRISK i, t, is zero.

Flaunet (2010), Deloitte (2010) and Cecchetti (2010) found that the reaction of banks regarding liquidity under the statutory conditions shows a positive trend and sometimes negative. As for Trichet (2010), Tahiry (2010) and Weber (2010), by ruling on the effect of the banking regulations (Directives of the BIS) on the behavior regarding risk-taking of liquidity and defect, during crisis situations, they ended in results debated on behalf of the banking firms. Min REGL it is the required minimum regarding liquidity in Tunisia 100% equal, it is the ratio of current assets on current liabilities. We note (LIQRISK) the standard deviation of the cash ratio of the

noted bank (LIQRISK). For a bank (i) and towards the end of one year (t) the variable statutory pressure regarding liquidity (REGL) is defined in the following way:

$$REGL_{i,t} = [Min_{REGL} + \sigma (LIQRISK_i)] - LIQRISK_{i,t} \text{ if } LIQRISK_{i,t} \leq Min_{REGL} + \sigma (LIQRISK)$$

$$REGL_{i,t} = 0 \text{ if } LIQRISK_{i,t} > Min_{REGL} + \sigma(LIQRISK)$$

Previous contributions underlined the fundamental role of the banking legal and regulatory environment in the management of the risk of liquidity in spite of their rarity. The second hypothesis translates the incidence of the institutional component (REGL) there (t-1) on the behavior of taking risk of liquidity of the bank (ΔLIQRISK) one year later (t). The second hypothesis can be built in the following way: hypothesis 2 (H2) - The statutory pressure presents an unforeseen effect on the behavior of the Tunisian banks regarding risk-taking of liquidity.

(REGX ΔLIQRISK): it is an interactive variable, introduced to detect the incidence of the statutory conditions regarding solvency on the speed of adjustment of the ratio of capital together with the variation of the level of the liquidity risk. This variable was used in the works of Hassen and Hussain (2006). Indeed, the statutory pressure regarding solvency (REG) was defined by Van Roy (2005), Matejasák and Teplý (2009) and Saadaoui (2010). We call back that the variable regulatory pressure (REG) is defined as follows:

$$REG_{i,t} = [Min_{REG} + \sigma CAR_i] - CAR_{i,t} \text{ if } CAR_{i,t} \leq Min_{REG} + \sigma CAR_i$$

$$REG_{i,t} = 0 \text{ if } CAR_{i,t} > Min_{REG} + \sigma CAR_i$$

(BUFFER X LIQRISK): it is a term of interaction defined as the product of the variable reflecting the reserve of stockholders' equity and that of the level of risk of liquidity. It is the variable which was included in the equations explaining the variations of the behavior of the risk-taking of liquidity. We examine if banks, when they have low stocks buffers of stockholders' equity, adjust the latter and the risks more quickly compared with the opposite situation. According to Tirole (2010), the weight of risk associated with liquid assets means that banks can increase their reserves of stockholders' equity by the liquidation of assets. Consequently, the banks who hold more liquid assets have generally a low level of pillow of stockholders' equity and also can be inclined to increase their levels of risk.

According to Dietsch and Tillov (2014), to put in reserve of the capital allows a bank to absorb the possible losses. The amount of the capital which a bank has to hold, compared with its assets, should be sufficient to cover the unexpected losses and remain solvent and especially to have some liquid in times of crisis. The more the capital put in reserve will be raised, the less is the incentive in the risk-taking and particularly that of the liquidity. Normally, banks can accumulate stockholders' equity buffers by preserving their profits and undistributed profits, what means the reduction of the discretionary distributions of the results. These activities include the reduction of the payments of dividends, shares buyback and payments of bonuses to the staffs. This variable was introduced by Bouri and BenHmida (2011), which supposed a negative association with the behavior of the risk-taking of liquidity. We present the fourth hypothesis in the following way: hypothesis 4 (H4) - the interactive or composite variable (BUFFER X LIQRISK) is negatively bound with the level of the liquidity risk of the bank.

2.2 Econometric Specification of the Model

To explain the link between the level of solvency and the incentive to the taking of the risk of liquidity in a simultaneous way, as for Bouri and Ben Hmida (2011), a model with double equation will be specified. The objective is to estimate this model and to take into account the simultaneity between its variables. To do it, our analysis is made through a model of partial adjustment developed initially by Shrieves and Dahl (1992) and Jacques and Nigro (1997). We are going to follow their initiatives by basing us on the first-rate differentiation to eliminate the serial correlations due to the effect of the endogénéité of specific variables as indicate it Arellano and Bond (1991). The first works on this subject quantified the particular simultaneity between the level of the ratio of capital and that of the risk. By analogy, and by way of meticulous empirical investigation, we are going to emphasize the risk of liquidity. This choice is based on the contribution of Godlewski (2005).

Indeed, further to statutory requirements on the capital, every increase of the ratio of capital is translated by an improvement of the level of solvency which can improve the level of banking liquidity. Rime (2001) considered that the process of discretionary adjustment is fundamental to maintain the level of the constant capital. In our analysis, we included the risk of liquidity as a particular component of the level of the global risk of the bank. This inclusion emanates from the relation which exists between the level of the risk of liquidity and the level of the risk of solvency which is profoundly discussed in the previous literature, in particular the contributions of Merton (1974), Kim and Sundaresan (1993), Shimko and Van Deventer (1993), Longstaff and Schwartz (1995) Leland (1998), Jarrow and Turnbull (1997) and Duffee (1999). Our model can have the following form:

$$\Delta CAR_{i,t} = \psi\ (CAR^* - CAR_{t-1}) \quad (1)$$

$$\Delta LIQRISK_{i,t} = \theta\ (LIQRISK^* - LIQRISK_{t-1}) \quad (2)$$

ΔCAR* and ΔLIQRISK *, two endogenous variables, represents respectively target measures of the level of ratio of capital and the level of the risk of liquidity. The bank (i) wishes to reach these target levels for every period (t) as indicates it Peltzman (1970), Marcus (1983), Wall and Peterson (1987) during exposure of a model of partial adjustment to model the behavior of risk-taking generally and the level of the capital for banking institutions. By analogy, in this frame of analysis, the variations of the capital and the risk of liquidity are relatively proportional in the difference between one target value and the value in the previous period (t-1). We note by (Xt) and (Yt) all the exogenous factors which can determine both reserved endogenous variables respectively. The terms (Ψ) and (θ) represent the discretionary speeds of adjustment of both ratios towards their targets, these coefficients ventilate between zero and the unit. We obtain the following basic specifications:

$$\Delta CAR_{i,t} = \psi\ (CAR^* - CAR_{t-1}) + Xt \quad (3)$$

$$\Delta LIQRISK_{i,t} = \theta\ (LIQRISK^* - LIQRISK_{t-1}) + Yt \quad (4)$$

We can write our model under the shape of both simultaneous equations (5.1 and 5.2) according to the following system:

$$\Delta CAR_{i,t} = \psi_0 + \psi_1 ROA_{i,t} + \psi_2 SIZE_{i,t} + \psi_3 SPREAD_{i,t} + \psi_4 \Delta LIQRISK_{i,t} + \psi_5 CAR_{(i,t-1)} + \psi_6 BUFFER_{i,t} + \psi_7\ (REG_{(i,t-1)}\ X \Delta LIQRISK_{(i,t-1)}) + \psi_8\ (REG_{i,t}\ X \Delta CAR_{i,t}) + \phi_{i,t} \quad (5.1)$$

$$\Delta LIQRISK_{i,t} = \theta_0 + \theta_1 SIZE_{i,t} + \theta_2 LLOSS_{i,t} + \theta_3 SPREAD_{i,t} + \theta_4 \Delta CAR_{i,t} + \theta_5 LIQRISK_{(i,t-1)} + \theta_6 REGL_{(i,t-1)} + \theta_7\ (BUFFER_{(i,t-1)}\ X \Delta CAR_{(i,t-1)}) + \theta_8\ (BUFFER_{i,t}\ X\ LIQRISK_{i,t}) + \Gamma_{i,t} \quad (5.2)$$

Knowing that $\psi_{i\ (i=1....8)}$ and $\theta_{k\ (k=1.....8),}$ are the parameters of the model relative to the various reserved variables and (ψ_0) and (θ_0) represent the respective constants in both simultaneous equations (5.1 and 5.2). With ($\phi_{i,t}$) and ($\Gamma_{i,t}$) who indicate respectively the residues of the relative equations at the level of the ratio of capital (ΔCAR) and the level of the risk of liquidity for every bank (i) and year (t).

2.3 Exploratory Tests of Specification and Method of Estimation

All the estimators of simultaneous equations try to manage the fact that the hazards of the structural equations are correlated to any endogenous variable appearing in the equation. This correlation returns the not convergent estimators MCO. We saw that 3SLS solves this problem the by replacing the defective regressors by instruments. The technique of estimation considered the most suitable and the most strong is the one. Three Stage Last Square, chosen to realize our estimation.

2.3.1 Tests of Durbin-Wu-Haussman and Davidson and Mckinnon

With the aim of detecting the presence of the problem of endogénéité between the variables of the model and the terms of residues in both equations, the test of Fisher joined by residues seems the most appropriate. At first, we are going to make the regression of each of the endogenous variables on all the suspected exogenous variables. Then, we resume these residues and we introduce them at the level of the basic specification (5). This test comes true in double stage such as explained by Durbin-Wu-Haussman and of Davidson and Mckinnon (1993). Indeed, we are going to test the endogénéité of the variable (ΔCARi,t) and afterward that of the variable (ΔLIQRISKi,t) according to the respective terms of errors ϕi,t and Γi,t. The main part of the results of the test of endogénéité made on our model is included in the following Table 1:

Table 1. Endogeneity tests results (1st and 2nd equation)

Endogenous Variable: $\Delta CAR_{i,t}$	**T-Student**	**(P-value)**	**Endogenous Variable:** $\Delta LIQRISK_{i,t}$	**T-Student**	**(P-value)**
Residue : $\phi_{i,t}$	-	0.000	Residue: $\boldsymbol{\Gamma_{i,t}}$	-	0.000
Intercept: ψ_0	-	0.000	Intercept : $\boldsymbol{\theta_0}$	-	0.000
N	*230*		*N*	*230*	
Fischer F (5,220)*	*47.62****		*Fischer F (7,220)**	*23.54****	
$\boldsymbol{R^2}$	*31.35*		R^2	*12.78*	

Note. *** Ficher significative at 1%: F(q, n-k-1), N : Number of observation, R^2: (global significativity).

According to the results found further to the regression of (ΔCARi,t) in the equation (5.1) on the various exogenous variables (ROAi,t, SIZEi,t, SPREADi,t, ΔLIQRISKi,t, CAR(i,t-1), REGL(i,t-1), LLOSSi,t, ΔCARi,t, BUFFERi,t, (REG(i,t-1) x ΔLIQRISK(i,t-1)), (REGi,t x ΔCARi,t), LIQRISK(i,t-1), (BUFFER(i,t-1) x ΔCAR (i,t-1))), and (BUFFER i,t x LIQRISKi,t) besides the constant (ψ0) on residues (ϕi,t), we notice a statistics of Fisher F (5,220) of the order of (47.62) significant in a threshold of probability upper to 1 % and which is more than critical value on the table of Fisher. We can conclude that the term of residue concerning the level of ratio of capital is not significant: there is thus absence of problem of endogénéité. In the same table (1), the results reveal that the regression of the variable (ΔLIQRISKi, t) on all the exogenous variables and on constant (θ_0) compared with the term of error ($\Gamma_{i,t}$) in the equation (5.2), show a statistics of Fisher F (7,220) equal to 23.54 significant in an interval of 99 % confidence. For a number of observation equal to 230 and over all the period from 1990 to 2012, this value is superior to that criticize on the table of Fisher. Also, we can conclude that the relative residue the variation of the level of the risk-taking of liquidity is not significant, consequently there is absence of problem of endogénéité in the reserved specification.

2.3.2 Conditions of Model Identification

Usually made beforehand in the estimation, the check of the conditions of identifiability of the model is necessary as indicated by Bourbonnais (2004). For our specification, we are going to examine these conditions of order are determined equation by equation in the following way: the number of the exogenous variables of the model, (g ‘) the number of the endogenous variables appearing in an equation and (k ‘) is (g) the number of the endogenous variables of the model, (k) the number of the exogenous variables appearing in an equation. So the conditions of identification of the model amount through the following three situations:

1st situation: if g - 1 > g-g ‘ + k - k ‘, then the equation is under identified;

2nd situation: if g - 1 = g - g ‘ + k - k ‘, then the equation is just identified;

3rd situation:if g - 1 g - g ‘ + k - k ‘, then the equation is under identified.

Our model in two simultaneous equations (5.1 and 5.2), contains two endogenous variables (ΔCAR)) and (Δ LIQRISK), thus (g) equal in (2). Besides the constant, we have fifteen exogenous variables: (ROA, SIZE, SPREAD, ΔLIQRISK,CAR, REGL, LLOSS, ΔCAR, BUFFER, (REGxΔLIQRISK), (REGxΔCAR), LIQRISK, (BUFFERxΔCAR), et (BUFFERx LIQRISK)), thus (k) equal to (15). In the first equation (5.1) the number of endogenous variables and (g ‘) is equal in (1) and the number of exogenous variables amounts to eight (k ‘ equal to 8). This enumeration, applicable time on the equation (5.2), gives the same results. We can verify:

Equation (5.1)	$[\mathbf{2-1}] = \mathbf{1} < [(\mathbf{2-1}) + (\mathbf{15-8})] = \mathbf{8}$
Equation (5.2)	$[2-1] = \mathbf{1} < [(2-1) + (15-8)] = \mathbf{8}$

In the light of these results, we can say that both equations (5.1 and 5.2) are on identified, what shows that our model, too, is on identified. We can conclude that it is possible to estimate the model (IV.5) by the technique of the Triple Lesser Squares (3SLS). After the verification of the absence of the problem of endogénéité for both endogenous variables (Δ CAR) and (ΔLIQRISK) as well as the conditions of identification of both equations, it is important to make an estimation of the model retained over the period going of 1990 to 2012. Compared with the results found in the matrix of correlation where all the coefficients are lower than (0.7), we judge that the "VIF" test between the various variables is not necessary. We notice the absence of the problem of mulicollinearity between the reserved variables.

3. Description of the Data and the Descriptive Statistics

In this section, we shall present our data through a statistical description, the matrix of correlation between variables as well as their signs hoped in the model estimated by the software (Stata 11.) over a period of 23 years for ten universal Tunisian banks.

3.1. Sources (Springs) and Description of the Data

To build our database, we began by collecting financial statements of the Tunisian banks, worth knowing balance sheets, states of results, cash flow statements, commitments except balance sheets and notes in financial statements. Our sample is established by ten universal commercial banks during period from 1990 till 2012. The sources of these documents are the reports of the APBEFT, the BCT, Fitch-rating and Maxula Bourse, as well as the other statistics identified with the BAD. Reports on the statutory supervision in Tunisia and other banking statistics available on web sites appropriate to every establishment were the object of the source of our data. Several variables made the object of a calculation either by ratios or by calculations of variation between two exercises (t) and (t-1) or still the product of two variables in the form of composite variables (interactive). The

list of the reserved banking institutions as well as the information on some significant ratios on June 30th, 2013 are exposed in the Table 2.

Table 2. Informations about bank sample

Banks	Social nomination	Informations at 30/06/2013			
		RISK	**CRRISK**	**LIQRISK**	**CAR**
ATTIJARI	Attijari Bank	7,372	22,74 %	105.20%	9,24%
AB	Amen Bank	16,666	23,70%	106.70%	13,15%
ATB	Arab Tunisian Bank	20,412	27,41%	107.30%	14,39%
BIAT	Banque Internationale Arabe de Tunisie	20,412	26,71%	105.90%	11,92%
BH	Banque de l'Habitat	18,898	19,11%	133.50%	10,23%
BNA	Banque Nationale Agricole	17,677	23,11%	118.40%	11,41%
BT	Banque de Tunisie	21,320	53,37%	123.50%	21.84%
STB	Société Tunisienne de Banque	16,666	18,67%	116.30%	9.02%
UBCI	Union Bancaire pour le Commerce et l'Industrie	12,309	21,45%	106.50%	10.51%
UIB	Union Internationale des Banques	18,898	19,60%	113.50%	9.27%

Source: by auteurs. CAR: capital ratio, RISK: global Risk index (IR=[E(ROA) + CAR] / σ(ROA)) with E(ROA) and σ(ROA) respectively mean and variance of return on assets ,CRRISK: credit risk ratio (Provisions NPL /Total credit), LIQRISK: liquidity risk ratio (domestic loans/ deposits).

3.2 Descriptive Statistics

Table 3. Statistical properties of the variables

Variables	(N)	Mean	S. Devi.	Min.	Max.
ΔCAR	230	0.00351	0.01747	-0.097418	0.070737
ΔLIQRISK	230	0.163008	0.141872	-0.71	0.70713
CAR(1)	230	0.08256	0.03097	-0.01098	0.17482
LIQRISK (1)	230	0.76883	0.133258	-0.69009	1.71307
BUFFER	230	-0.016011	0.030021	-0.094818	0.090985
REGL(1)	230	0.214738	0.239997	0	0.78155
REG x ΔLIQRISK (1)	230	-0.00176	0.344682	-0.421821	0.109696
REG x ΔCAR	230	0.000970	0.000906	-0.001293	0.002901
BUFFER x ΔCAR (1)	230	-0.000162	0.000926	-0.008864	0.002069
BUFFER x LIQRISK	230	-0.000734	0.007650	-0.497924	0.463119

Source: calculation made by the software Stata 11. N: number of observations over the period of analysis (on 1990-2012). Min: minimal value observed. Max: maximal Value observed. The sample includes 10 Tunisian universal banks., (1): variable calculated there (t-1), Δ: mean the variation of the variable between (t) and (t-1).

The statistical description of the data obtained in the picture(board) (3) shows that the variation of the level of the risk of liquidity of ten reserved banks posts(shows) an average of 16.30 % with a standard deviation equal in (14.18 %). This endogenous variable ventilates between a minimal and maximal value respectively of the order of (71 %) and (70 %). The levels of liquidity to these banks differ from one year to the next: it is the nature of the banking profession which explains this variation of the level of liquidity which seems to be very volatile over the period of 23 years. As for the variable relative to the statutory pressure (REGL), we register(record) an average value for 230 observations of the order of 21.47 % with a standard deviation about 24 %. As defined higher, this variable is superior zero, its shows values between 0 and 78.15 % for ten banks of our panel. The Table 4. According to, present the various levels of correlation between the endogenous and exogenous variables of our model (5). It is about the matrix of correlation realized by the software STATA 11.

3.3 The Matrix of Correlation

Table 4.

Variables	ΔCAR	ΔLIQRISK	ROA	SIZE	SPREAD	CAR(1)	BUFFER
ΔCAR	1						
ΔLIQRISK	0.2902	1					
ROA	0.3585	-0.0798	1				
SIZE	-0.2433	-0.0167	-0.0590	1			
SPREAD	-0.0525	-0.0410	-0.0277	-0.0577	1		
CAR(1)	-0.4596	-0.1167	0.1366	0.2339	0.0020	1	
BUFFER	-0.2355	-0.1127	-0.4533	0.1765	0.0612	-0.6393	1
REG **x** ΔLIQRISK (1)	0.0252	0.2777	-0.04559	-0.0544	-0.0138	-0.0588	0.0523
REG **x** ΔCAR	0.1634	-0.2912	-0.0930	0.2898	0.0876	-0.0856	0.6927
LLOSS	0.2344	0.0650	0.0400	-0.6270	0.0080	0.2344	-0.1947
LIQRISK (1)	-0.0398	0.1254	-0.0405	0.0217	-0.0328	0.0850	-0.0134
REGL(1)	0.1116	0.2018	0.1524	-0.3341	-0.0088	-0.2646	-0.0935
BUFFER x ΔCAR (1)	-0.0248	-0.0532	-0.0474	0.0144	0.0076	-0.0577	0.0887
BUFFER x LIQRISK	-0.2858	-0.6018	0.0917	0.0699	0.0004	0.0915	0.1576

Table 4. Continued

Variables	REG **x** ΔLIQRISK (1)	REG **x** ΔCAR	LLOSS	LIQRISK (1)	REG(1)	BUFFER x ΔCAR (1)	BUFFER X LIQRISK
ΔCAR							
ΔLIQRISK							
ROA							
SIZE							
SPREAD							
CAR(1)							
BUFFER							
REG **x** ΔLIQRISK (1)	1						
REG **x** ΔCAR	-0.2326	1					
LLOSS	0.0463	-0.2378	1				
LIQRISK (1)	0.5636	-0.2074	-0.0164	1			
REGL(1)	-0.1382	0.7006	0.5209	-0.1746	1		
BUFFER x ΔCAR (1)	-0.0962	0.0887	-0.0370	-0.2926	0.0223	1	
BUFFER x LIQRISK	-0.2956	0.2944	-0.1424	-0.1351	-0.1830	0.0320	1

Source: calculation made with Stata 11. Values of the coefficients of correlation and their signs for every establishment (i) and year (t), Over all the period from 1990 till 2012. REGL: the variable of the statutory pressure in terms of liquidity. BUFFER: the capital in reserve "buffer" of stockholders' equity ΔLIQRISK: the variation of the level of the risk of liquidity ΔCAR, represents the variation of the level of the insolvency risk. REG x ΔLIQRISK, REG x ΔCAR, BUFFER x ΔCAR, BUFFER x LIQRISK are composites proxies in the model (IV.5).

According to the matrix of correlation between the various variables held in our specification, we can indicate that the coefficient of correlation between (ΔCAR) and that of the level of the liquidity risk is positive at (0.2902). The hypothesis (H1) relative to these two variables plans a negative association, it is to say that the parameters (ψ4 and θ4) will be supposed with negative signs in our model (5).The composite variable ((REG) x (ΔLIQRISK)) shows a positive coefficient of correlation equal to (0.2777) compared with (ΔCAR) and the interactive component (BUFFER x LIQRISK) is negatively associated with the variation of the risk of liquidity (ΔLIQRISK) with a coefficient of correlation of the order of (-0.6018). Indeed, the parameter (ψ7) is expected with a positive association whereas the parameter (θ8) has a negative sign. The statutory pressure regarding liquidity (REGL) posts(shows) a positive correlation with the level of risk of liquidity, we register a coefficient of correlation about (0.2018). In consideration of the controversy in the literature handling the link between these two components, and according to the hypothesis (H2), the parameter (θ6) can be either positive, or negative, thus the effect of this variable seems unforeseen.

3.4 Presentation of the Signs Expected from the Parameters

Table 5. Signs expected of model parameters

Variables	Parameters	Expected signs (IV.5)	
		Endogenous Variable (IV.5.1): $\Delta CAR_{i,t}$	**Endogenous Variable (IV.5.2): $\Delta LIQRISK_{i,t}$**
$\Delta CAR_{i,t}$	θ_4		-
$\Delta LIQRISK_{i,t}$	ψ_4	-	
$ROA_{i,t}$	ψ_1	+	
$SIZE_{i,t}$	ψ_2 et θ_1	-	-
$SPREAD_{i,t}$	ψ_3 et θ_3	+	-
$CAR_{(i,t-1)}$	ψ_5	-	
$BUFFER_{i,t}$	ψ_6	-	
$REG_{(i,t-1)}$ x $\Delta LIQRISK_{(i,t-1)}$	ψ_7	+	
$REG_{i,t}$x $\Delta CAR_{i,t}$	ψ_8	+	
$LLOSS_{i,t}$	θ_2		+
$LIQRISK_{(i,t-1)}$	θ_5		-
$REGL_{(i,t-1)}$	θ_6		*N/A*
$BUFFER_{(i,t-1)}$ x $\Delta CAR_{(i,t-1)}$	θ_7		-
$BUFFER_{i,t}$ x $LIQRISK_{i,t}$	θ_8		-

Note. N/A means that the sign expected from the parameter of this variable can be positive or negative. The indications (i) and (t) represent respectively bank and exercise ψi 1,2…8 et θj 1,2….8: the parameters of the model allocated to every variable are. REGL: the variable of the statutory pressure in terms of liquidity. BUFFER: the capital buffers or pillow of stockholders' equity ΔLIQRISK: the variation of the level of the liquidity risk? ΔCAR, represents the variation of the level of insolvency risk. REGx ΔLIQRISK, REG x ΔCAR, BUFFER x ΔCAR, BUFFER x LIQRISK are the composite variables.

The signs were waited the various parameters of the model (5), are fixed so as to express our advanced hypotheses farther. These signs were also anticipated by Bouri and Ben Hmida (2011). Other similar works planned different signs to those mentioned in the table (5). The prediction of these incidences differs from a contribution to an other one according to the justified theoretical hypotheses and to the general context of these works. In the following section, we are going to present the results of the estimation of our model obtained in our panel over the period going of 1990 to 2012. Our approach concerning the interpretation of these results will put a particular accent on the incidence of the variation of the ratio of capital on the behavior of the risk-taking of liquidity of these banks under the specific statutory pressure.

4. Results of the Estimation

Table 6. Results of model (5) estimation (3SLS)

Period estimation:	1990-2012	
Endogenous variables	**ΔCAR**	**ΔLIQRISK**
Exogenous Variables		
ROA	0.195915	
	(3.21)***	
SIZE	0.004954	0.004459
	(3.96)***	(0.41)
SPREAD	0.000303	-0.003404
	(0.76)	(1.07)
$CAR_{(i,t-1)}$	-0.59959	
	(20.74)***	
$LIQRISK_{(i,t-1)}$		0.023717
		(0.65)
$REGL_{(i,t-1)}$		0.065365
		(2.91)***
LLOSS		-0.28115
		(2.67)***

BUFFER	-0.597183	
	(16.11)***	
ΔLIQRISK	-0.00511	
	(0.90)	
Δ CAR		0.49479
		(1.58)
$REG_{(i,t-1)}$ x $\Delta LIQRISK_{(i,t-1)}$	-0.01004	
	(0.58)	
$REG_{i,t}$x $\Delta CAR_{i,t}$	-0.2278	
	(5.54)***	
$BUFFER_{(i,t-1)}$x $\Delta CAR_{(i,t-1)}$		-3.85966
		(0.76)
$BUFFER_{i,t}$x $LIQRISK_{i,t}$		-6.7137
		(3.85)***
Intercept	0.00500	0.017481
	(0.54)	(0.18)
N	*230*	*230*
R^2	*75.76%*	*77.45%*
χ^2	*721.53***	*789.10****

Note. Estimation made with the software Stata 11par the technique of 3SLS, *: significativité in 10 %, **: significativité in 5 %, ***: significativité in 1 %, N: number of observation. The statistics of Student in brackets. R ²: coefficient of global significativité of the model X²: statistics of chi -Deux.

4.1 Relation between the Variation of the Level of Capital and the Variation of Liquidity Risk

The reaction of ten banks regarding adjustment of the solvency ratio compared with their behavior of risk-taking of liquidity seems statistically not significant. Indeed, the results(profits) of the estimation obtained in the table (6) show that the coefficients (θ4) and (ψ4) respectively in the equations (5.1 and 5.2), show values of the order of ((-0.00511 and 0.49479) and which are statistically not significant with respective t-Student about ((0.90 and 1.58). Our first hypothesis specifies that the relation enters the variation of the level of the ratio of capital (ΔCAR) and the level of the risk of liquidity (ΔLIQRISK) shows a negative association. The theory " of absorption of the risks " bases on the classic role of the banking firms regarding transformation(processing) and regarding absorption of the risks. Allen and Mange (2004), among the partisans of this theory, moved forward the argument which considers that a high level of liquidity exposes banks to considerable risks, in particular massive withdrawal of funds by the depositors. The more the capital is raised as well as the level of risk is decreased, thus the most capitalized banks are more inclined to create liquid assets. Few works were interested in the interaction between the level of the ratio of capital of banks and their behavior of risk-taking of liquidity.

Berger and Bouwman (2009) showed that the theoretical literature rests on two ways to explain the reaction of the level of the liquidity risk of a bank according to its ratio of capital. Indeed, a first way, supported by Bhattacharya and Thakor (1993) and Repullo (2004), is due to the fact that stockholders' equity absorbs the unexpected losses of the banking firm, which is likely to strengthen its capacity to create more liquidity and consequently more incentive in the risk-taking. The second sends back to the works of Diamond and Rajan (2001) and Bervas (2008), which considered that the fragility of the balance sheet of banking institutions establishes a condition of their activity of creation of liquidity and thus their behavior of risk-taking of liquidity.The current situation of the banking liquidity is summarized according to central Bank of Tunisia (BCT) in the following way: the Bank noticed the progress registered at the level of funds injected in the banking system, carrying the global volume of refinancing in more than 5 billion dinars in 2013 against 962 million dinars on average of 2010. The BCT tried to support the reasons at the origin of the increase of the needs for banks in liquidity which is a logical result in the economic and financial evolutions which knew the country since January, 2011. Besides, among the factors which affected the banking liquidity, the first one holds the evolution of bills and active money held by the households to insure their running costs but also for motives of precaution. The latter passed from 5,8 billion dinars in 2010 to more than 7,6 billions at present, what engendered an additional withdrawal about 1,8 billion dinars with the banking counters. This evolution is partially natural, in the sense where it follows an increase of household incomes and where it was amplified by the uncertainty and the concern which accompanied the transition. According to the BCT, the second factor which had impacted negatively on the banking liquidity is in particular the important reduction in the assets of foreign exchange reserve which passed of 13 billion dinars at the end of 2010 in approximately 11,4 billion

dinars at present, that is a 1,6 billion dinar reduction in the banking liquidity.

The third factor which contributed to the contraction of the banking liquidity is the slowing down observed in the execution of the state budget, as soon as the public spending can supply liquid assets to the banking system if the political and economic conditions improve. This will lead to the improvement of the performances of the outside sector, to the return of the confidence to all the economic agents and to the positive evolution of the situation of liquidity in the banking sector. This lack of liquidity did not reach the level of the crises in the Tunisian banking sector which is widely supported by the authorities and particularly by the lender in the last resort (the BCT). All the banks of our sample respect practically the current prudent standard and the level of solvency of banks seems not to affect liquidity significantly. (H1) is thus accepted.

4.2 Impact of Regulations Conditions on the Behavior of Liquidity Risk-Taking

According to the results(profits) found further to the estimation of the model (5) in table (6), we register a positive and statistically significant incidence enter the statutory pressure regarding liquidity on the level of incentive(incitement) of risk-taking of liquidity for ten reserved banks and over the total period going of 1990 to 2012. Indeed, these results show a coefficient (θ6) positive which borders (0.065365), is T-Student equal to (2.92) significant in an interval of 99 % confidence. At first, the sign of this incidence between both variables (REGL) and (ΔLIQRISK) was not planned according to the second hypothesis. According to the results of some previous contributions, this impact was debated and seems not to be cut. As an example, Horvàthet et al. (2012), by estimating the financial implications of the statutory requirements of Basel III on the banking sector in Czech Republic, noticed the existence of a negative link of causality enter the level of risk of liquidity (their capacity to create liquidity) and their respect for the standards of prudent management regarding liquidity. Besides, Destinguin et al. (2012) found, on a sample of European and American commercial banks, that an incentive in the risk-taking of liquidity by these banks is not of link with the recent statutory directives regarding liquidity.

We remind firstly that the risk of liquidity is the risk for the bank not to be able to face a moment given to its commitments by mobilizing its assets. In more important proportions, this risk little end in the bankruptcy of the bank further to a wave of panic which shows itself at the depositor's (bank run). Within the framework of our analysis, the liquidity of the Tunisian banks is relatively low. The BCT always brought to the banking system liquid assets which were necessary and supported all the public or private banks who dealt with major difficulties. Indeed, the cash ratios of the Tunisian banks remain very weak in reference to the international standards, but show recently values which respect the prudent standard (100%). These Tunisian banks tend to maximize the use of their resources in credits. The common feeling through the whole Tunisian banking system is that the BCT will always supply if need the necessary liquidity. This ratio testifies of a finance in balance, and a policy of healthy short-term allocation of resources.

The positive and significant incidence of the statutory conditions on the variation of the risk-taking of liquidity testifies, not only a negligence of this risk, but also the stability of the cash ratio which does not consider the fatal effects of the increase of the risk of liquidity. These results are to be taken with caution because we do not possess more details of the characteristics of current assets (numerator of the ratio) and current liabilities (denominator of the ratio). Banks in Tunisia, so much assisted in liquidity by the Central Bank, do not care too much about the regulatory pressure as soon as the ratio is respected and register no imbalance at the level of their finances, then they manage their liquid assets in the day in the day and without greater caution. These results confirm those found by Darine (2008) and we have thus just enlightened the sense of the behavior of the Tunisian banks regarding risk of liquidity under regulatory pressure.

4.3 Relation between "Liquidity Buffer" and Liquidity Risk Taking

The interactive or composite variable (BUFFERX LIQRISK) is negatively connected with the level of the risk of liquidity of ten studied banks. Really, the results held in Table 6, show that this variable shows a negative and statistically significant association with the behavior of risk-taking of liquidity over 23 years. We register a coefficient (θ8) negative of the order of (-6.7137) with P-value equal to (3.58) significant in a threshold of probability upper to 1 %. The negative sign and the significativity of the weight associated with this composite variable show that when stockholders' equity buffers of safety increases, the incentive in the liquidity, what testifies of the existence of an effect of the regulatory requirement on the structure of the balance sheet(assessment) of these banks. This result confirms that found by Soumare et al. (2012) and that obtained, on the context of Tunisian banks, by Bouri and Ben Hmida (2011). The fourth hypothesis moved forward at the beginning of this paper is accepted, consequently. As underlined by Dietsch and Tillov (2014), banks preserve spontaneously a low level of reserves of liquidity (liquidity buffer) and cash ratios relative to the recent agreement of Basel III are necessary to avoid a crisis of banking liquidity. To reach this goal, establishments

have to hold a stock of transferable liquid assets and quality. This agreement fixes the quantitative and qualitative for the composition and the calibration of this "pillow of liquidity" through the ratio LCR. The latter obliges banks to maintain permanently a stock of assets considered as liquid and immediately available by the regulator allowing to face a shock of liquidity during a month. Consequently, the calibration of the reserves of liquidity rests on the respect for this short-term ratio which must be upper 100% on the horizon of 30 days. Ten Tunisian universal banks make appeal implicitly to their reserves of liquidity to face occasional massive retreats (withdrawals) by the depositors and avoid possible crises at the level of their availability through a balance balanced on the operations of finance and interbank, in the purpose to master-even to regulate the intensity of the risk of liquidity which threatens them, particularly in the short term.

4.4 Synthesis of the Results on the Liquidity Risk Behavior

Table 7. Summary of the results obtained on the behavior of banks in Tunisia: simultaneous relation between the ratio of capital and liquidity risk under regulatory pressures

Impact of REG on ΔCAR	Impact of REGL on ΔLIQRISK	Impact of ΔCAR on ΔLIQRISK	Impact of ΔLIQRISK on ΔCAR
-	+	**0**	**0**

Note. Source made by the authors. (+): positive Impact, (-): negative incidence and (0): no significant effect. REG: the statutory pressure in term of solvency, REGL: conditions statutory regarding liquidity ΔCAR: variation of the level of ratio of capital, ΔLIQRISK: variation of the level liquidity risk.

Table 7 summarizes the main part of the results of the estimations obtained in the term of the present article. The statutory pressure seems to influence only and positively the behavior of risk-taking of liquidity for ten Tunisian banks chosen in our panel. Besides, we notice that a significant incidence is detected only between the levels of ratio of capital and that of the credit risk considered the most dangerous in the banking activity in Tunisia. However, the legal and institutional conditions are positively associated and significantly with the discretionary adjustment of the ratio of capital of banking institutions over the last twenty three years detected respectively in two first specifications (5.1 and 5.2). The behavior of Tunisian commercial banks regarding ratio of capital conjugated with their risk-takings and under statutory pressure confirm the various results found in several previous contributions. It is about a not standard, unforeseen and flexible behavior according to the type of risk.

5. Conclusion

What is the incidence of a change at the level of the ratio of capital on the behavior of the incentive(incitement) in a risk-taking of additional liquidity under the prudent statutory conditions? In this article, we try to find elements of answer to this question, through the estimation of a model in two simultaneous equations by the technique of 3SLS, on a sample of ten universal Tunisian banks during period from 1990 till 2012. The obtained results show which institutional conditions concerning the adequacy of the statutory stockholders' equity, show a negative association with the change of the level of solvency of these establishments. In parallel, the statutory pressure (t-1), regarding liquidity, generates an impact anticipated the behavior of these banks in the form of a risk-taking of liquidity.

We also notice that every variation of the level of the liquidity risk involves no adjustment of the level of the ratio of the capital simultaneously (effect of return). This behavior leads to predict the existence of a certain carelessness towards this type of risk supported by the intervention of the Central bank of Tunisia to assure a balance of finance at the level of the short-term operations of the interbank availability. Besides, we put the accent on the effect of the reserves of liquidity (Buffer) on the risk inherent to these short-term transactions. ; Our results show a negative and significant link between these two components which testifies of the importance of these pillows of liquidity to keep a minimum level of liquidity. This is going to serve to protect these establishments, lenders or borrowers on the interbank market, the possible shocks at the level of their availability. The originality of this article is that it highlights not only the effect of the level of the capital on the capacity of banks to identify the risk of liquidity, but it also highlights the relation of causality inverse between these two endogenous variables. The obtained results confirm those obtained by previous works and which confirmed the existence of a certain instability at the level of the banking behavior in an environment regulated regarding liquidity risk.

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Capital Structure and Firm's Performance of Jordanian Manufacturing Sector

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Abstract

This study aimed to identify the effect of capital structure on the performance of the industrial Jordanian Companies listed on Amman Stock Exchange during the period between: 2005 to 2013, whereas this study was applied on all Jordanian industrial companies listed at ASE and which amount 72 companies as in December, 2013. In order to achieve the objective of the current study the unbalanced cross sectional pooled Ordinary Least Square (OLS) regression model was used. The results of this study showed that there was statistically significant inverse effect of capital structure, expressed by long-term debt to capital ratio, total debt to capital ratio and total debt to total assets ratio, on the performance of the Jordanian industrial companies listed at ASE expressed by Return on asset ratio (ROA), which means that the most profitable companies rely less on borrowing to finance their cash needs, and this result is supported by Pecking-order theory which states that the relationship between borrowing and profitability of the company is an inverse relationship so that the most profitable companies are less dependent on profits to finance their needs.

Keywords: capital structure, firm value, Jordan

1. Introduction

Capital structure varies between different industrial sectors and companies within the industrial sector, and a study by (Modigliani & Miller, 1958) was one of the studies on capital structure and its impact on the value of the company. This study has concluded, under the perfect capital market assumption, that the value of the company is not affected by the composition of capital. However, this result is incorrect practically, due to the lack of reality of study's hypotheses (M & M, 1958). In the last decade, there were several theories that illustrated capital structure for companies such as Pecking-order theory, The Static-order theory and the agency cost theory. Despite the dialectic of Optimal Capital Structure has not received general acceptance so far, but many studies have supported this idea (Wippen, 1966; Ozkan, 2001).

The Optimal Capital Structure is considered as an outcome of the reciprocal relationship (Trade-off) between the benefits of the tax savings resulting from the use of debt as a source of funding and the risk of bankruptcy resulting from high debt, which is pressing toward the use of property funds to finance the company's needs for funds level. Therefore, the funding decision is considered as one of the most complex decisions taken by the administration, which is represented by the optimal mix of property funds and borrowing money to finance the company's need for funds, which results in a reduction in the cost of capital to a minimum with risks remaining within the acceptable range, which is positively reflected on the market value of the company's shares, which is reflected in the wealth of the owners of the company.

Theoretically, there could be Optimal Capital Structure that works to reduce the overall cost of capital to a minimum. In practice, there are several factors that control the capital structure represented by the risk that the company is ready to bear, the nature of the activity of the company, size of the company, the company's growth rate and other factors that have an impact on the performance of the company, and therefore, the problem of the study lies in the lack of clarity of the impact of capital structure on the value of the company with the need for managers to choose a suitable financing structure for the company that contributes to maximize its value, and thus maximizing the wealth of the owners of the company. Accordingly, the study seeks to answer the following question: Does the capital structure statistically affect the value of the company?

This study aims to identify the effect of capital structure on the value of the Jordanian industrial companies listed on Amman Stock Exchange (ASE) during the study period from 2005 to 2013. Therefore, the null hypothesis that the study seeks to test is: There is no statistically significant effect of capital structure on the value of the Jordanian industrial companies listed on the Amman Stock Exchange at a significant level 0.05 or less.

2. Literature Review

Abdul Jalil (2014) aimed at examining the effect of capital structure on the performance of the Jordanian industrial companies listed at Amman Stock Exchange (ASE) .This study has concluded that there were statistically significant inverse relationship between Debt ratio and Return on Investment, and a statistically significant inverse relationship between the Debt to Equity Ratio and Return on Investment. Al Taani (2013) aimed to study the relationship between capital structure and profitability of industrial Jordanian public shareholding companies listed at Amman Stock Exchange (ASE) during the period 2005 to 2009.This study concluded that there were no statistically significant relationship between Debt ratio and Return on assets.

Ramadan and Aloqdeh (2011) aimed at identifying determinants of capital structure of Jordanian industrial companies and found a statistically significant inverse relationship between capital structure and debt ratio and profitability at Jordanian industrial companies. Shlash et al. (2008) aimed at identifying the most important determinants of the financial structure of the Jordanian industrial companies listed in the Amman Stock Exchange, and concluded that there was a statistically significant difference between the financial structure and each of profitability, liquidity and growth rate of the Jordanian industrial companies.

Fozia et al. (2011) aimed at studying the effect of capital structure on the profitability of the Pakistani companies during the period between 2004 to 2009. This study found a statistically significant inverse relationship between Debt ratio and Return on assets ratio. Prahalathan and Ranjani (2001) aimed at examining the relationship between the capital structure and the performance of Sri-Lankan companies listed on Colombo Stock Exchange during the period between 2003 to 2007. It concluded that there was no statistically significant relationship between Debt ratio and profitability of the Sri Lankan companies.

Matja and Mramor (2006) aimed at identify the factors affecting the capital structure of Slovenian companies, found a statistically significant inverse relationship between debt ratio in the capital structure and each of the tangible assets and the volatility of income and profitability of the company, and a statistically significant positive relationship between debt ratio and each of the company's size and rate of growth of the company. Also, this study has concluded that other factors that have been proposed as determinants of the capital structure were not within the neoclassical theory of capital structure (the power of workers and the owned capital) and was not statistically significant as capital structure determinants in Slovenian companies.

Ong and Heng (2001) investigate the relationship between capital structure and performance of Malaysian construction companies during the period 2005 to 2008. The result suggested significant relationship between capital structure and Malaysian Construction Company's performance. Abor (2005) investigated the effect of the capital structure on the profitability of listed companies on the Ghana Stock. The results suggested a significant positive relationship between short-term debt and the Ghanaian company's profitability, as firms earn more it use more short-term debt to finance their business. Gleason, Mathur, and Mathur (2000) investigated the association between capital structure and performance in 14 European countries; the results show that capital structure significantly affects the performance.

Fama and French study (2002) and Wald (1999), found that profitability was the most important factor in determining the capital structure, where they found a statistically significant inverse relationship between profitability and debt ratio in capital structure. Shyam and Myers (1999), Lemmon and Zender (2004) and Chirinko and Singha (2000) have concluded that the heterogeneous information between managers and investors makes companies to prefer to borrow funds to finance their needs over issuing new shares.

3. Methodology

This study utilizes the unbalanced cross sectional pooled Ordinary Least Square (OLS) regression model to investigate the effect of the of capital structure on the Jordanian firms' performance. Dependent and independent variables are pooled cross section time series for estimation.

3.1 Sample

This study utilizes the 72 (all) listed manufacturing Companies in Amman Stock Exchange (ASE) during the period of 2005 to 2013. There were 72 unbalanced cross section and 9 time periods, resulting in 629 firm/year observations.

3.2 Variables of the Study

The Financial dataset were obtained from the annual reports of the 72 listed companies available at the official website of ASE.

3.2.1 Dependent Variable: Firms' Performance (F_P)

Profitability of the company was used as a proxy for the firms' performance. Profitability of the company is usually expressed by using the company's return on assets (ROA) which is defined as net income before taxes divided by total assets, Calculated as:

$$ROA = \frac{Net\ Income}{Total\ Assets} \tag{1}$$

This scale is considered as the most common scale in the studies that examined the factors affecting the capital structure. The importance of this variable stems from the fact that profitability of the company strongly affects the financial risk faced by the company, where the greater the profitability of the company, the possibility of its failure decreases, and its ability to borrow increases, and thus its ability to achieve tax savings increases, on the one hand, and the greater profitability the company achieves, the company can finance its activities and finance its expansion from its profits, and thus, company's reliance on external sources of funding decreases. So, because companies that achieve large profits have greater capacity to borrow and can make better use of tax savings resulting from the borrowing, the Trade-Off Theory sees a positive relationship between the company's profits and debt ratio in its capital structure, while the Pecking-Order-Theory sees that companies that achieve large profits can benefit from these profits to fund their projects without resorting to external sources of funding, so this theory suggests an inverse relationship between the profitability of the company and debt ratio in its capital structure.

3.2.2 Independent Variable: Capital Structure

The expression of the capital structure will be of three variables:

Long term debt to total capital ratio (LD_C), a measurement of a company's financial leverage, calculated as the company's long-term debt divided by its total capital. Total capital includes the company's debt and shareholders' equity, which includes common stock, preferred stock, minority interest and net debt. LD_C can be calculated as:

$$LD\_C = \frac{Long\ term\ Debt}{Total\ Capital} \tag{2}$$

Total debt to total capital ratio (TD_C), a measurement of a company's financial leverage, calculated as the company's total debt divided by its total capital. Total debt includes all short-term and long-term obligations. Total capital includes the company's debt and shareholders' equity, which includes common stock, preferred stock, minority interest and net debt. TD_C can be calculated as:

$$TD\_C = \frac{Short\ term\ Debt + Long\ term\ Debt}{Total\ Capital} \tag{3}$$

Total debt to total assets ratio (TD_A), a leverage ratio that is defined as the total amount of debt to total assets. The higher the ratio is, the higher the leverage, and as a result, financial risk. This is a broad ratio that includes long-term and short-term debt as well as all assets. TD_A can be calculated as:

$$TD\_A = \frac{Short\ term\ Debt + Long\ term\ Debt}{Total\ Assets} \tag{4}$$

3.3 Econometric Model

This study seeks to investigate the effect of the Jordanian firm's capital structure on its market value by utilizing the unbalanced pooled multiple regression Ordinary Least Square (OLS) estimator framework. The regression model can be written as follows:

$$F\_P_{it} = \alpha + \beta_1 LD\_C_{it} + \beta_2 TD\_C_{it} + \beta_3 TD\_A_{it} + \varepsilon \tag{5}$$

Where: F_P_{it} is the firms' performance expressed as the firms' profitability defined as net income to total assets ratio, for the i^{th} cross sectional during the t^{th} period as i = 1, 2, 3, …, 72 and t = 1, 2, 3, …, 9. α is intercept. $\beta's$ are unknown coefficients to be estimated. *LD_C* is the long-term debt to capital ratio, the first proxy of the capital structure. *TD_C* is the total debt to capital ratio, the second proxy of the capital structure. *TD_A* is total debt to total assets ratio, the third proxy of the capital structure. ε is the error term.

4. Empirical Results

4.1 Descriptive Analysis

Table 1 shows the results of the descriptive analysis of the variables of the study.

Table 1. Descriptive analysis

Variables	N	Min	Max	Mean	Median	STDEV
P_F	629	-0.193	0.382	0.037	0.042	0.138
LD_C	629	0.048	3.676	0.487	0.437	0.617
TD_C	629	0.061	2.712	0.593	0.392	0.635
TD_A	629	0.025	0.831	0.327	0.294	0.193

Note. P_F Firms' performance defined as net income to total assets ratio (ROA), *LD_C* is the long-term debt to capital ratio. *TD_C* is the total debt to capital ratio, *TD_A* is total debt to total assets ratio.

The results of descriptive analysis in Table 1 showed that the performance of the Jordanian industrial companies P_F (study sample), expressed by Return on Assets (ROA) was relatively low, with an average of 3.7% and a standard deviation of 0.138.

The table also shows that the Jordanian industrial companies heavily rely on Equity to finance their cash needs where Total debt to assets ratio (TD_A) was about 33%, suggesting that the Jordanian industrial companies finance their assets by about 67% of Equity.

The Table also shows that Total Debt to Capital (TD_C) of Jordanian industrial companies has amounted to about 59.3% and the highest value has amounted 271.2%, while the less value was 6.1% with a standard deviation of 0.635.

4.2 Correlation Analysis

The results of the correlation analysis in Table 2 show an inverse statistically significant correlation between the capital structure and firms' performance of the Jordanian manufacturing companies.

Table 2. Pearson correlation analysis

	LD_C	TD_C	TD_A
P_F	-0.267**	-0.301**	-0.147*
	3.042	4.92	2.03
	629	629	629

Note. First line Pearson correlation coefficient, second line t-value, third line number of observations. **,* 1% and 5% significance level respectively. *P_F* firms' performance defined as net income to total assets ratio, *LD_C* is the long-term debt to capital ratio. *TD_C* is the total debt to capital ratio, *TD_A* is total debt to total assets ratio.

The correlation coefficient between the performance proxy (ROA) and the proxies of the capital structure LD_C, TD_C and TD_A were -0.267, -0.301 and -0.147 respectively.

4.3 Regression Analysis

The regression results of the econometric model (equation 5) are shown in Table 3.

Table 3. Multiple regression analysis of equation 5

Variable	β	t-value	Sig.
Constant	1.071	0.919	0.358
LD_C	-0.271	-2.027	0.043
TD_C	-0.007	-3.306	0.001
TD_A	-0.845	-2.090	0.037
F-value		51.11	
P-value		0.000	
R^2		0.197	

Adju-R^2	0.193
df Regression	3
Residual	625
Total	628

Note. LD_C is the long-term debt to capital ratio. *TD_C* is the total debt to capital ratio, *TD_A* is total debt to total assets ratio.

As shown in Table 3, the result of the multiple-regression analysis shows the F-value to be 51.11 and statistically significant at a 0.000 level. The Adju-R^2 shows that the econometric model of the study is able to explain about 0.193 of the variation in the firms' performance expressed as the ratio of the return on the assets. The β (regression Coefficient) of the *LD_C* has a value of -0.271 and statistically significant at 0.043 level. *TD_C* has a negative β value of 0.007 and statistically significant at 0.001 level, were *TD_A* has a negative β value of 0.845 and statistically significant at 0.037 level. Based on the regression analysis as shown in Table 3, the results conclude a statistically significant adverse effect for all proxies of the capital structure on the firms' performance of the Jordanian manufacturing listed companies.

5. Conclusion

This study aimed to identify the effect of capital structure on the performance of the industrial Jordanian Companies listed on Amman Stock Exchange during the period between: 2005 to 2013, whereas this study was applied on all Jordanian industrial companies listed at ASE and which amount 72 companies as in December, 2013. In order to achieve the objective of the current study the unbalanced cross sectional pooled Ordinary Least Square (OLS) regression model was used. The results of this study showed that there was statistically significant inverse effect of capital structure, expressed by long-term debt to capital ratio, total debt to capital ratio and total debt to total assets ratio, on the performance of the Jordanian industrial companies listed at ASE expressed by Return on asset ratio (ROA), which means that the most profitable companies rely less on borrowing to finance their cash needs, and this result is supported by Pecking-order theory which states that the relationship between borrowing and profitability of the company is an inverse relationship so that the most profitable companies are less dependent on profits to finance their needs.

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