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Liquidity Demand When the Opportunity Cost of Money is a *Perceived* Total Return

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Abstract

Since total bond returns contain a potential capital gain (or loss) component, there can be a wide divergence between a bond's interest rate return and its *perceived* total return, depending on expectations about future interest rates and bond prices. It is possible for money demand to *increase* when bond interest rates are rising if one's perception is of a declining total return. We study the liquidity demand behavior of a group of bond fund portfolio managers, for whom the perceived total return is paramount, and find evidence of a *positive* relationship between bond interest rates, the standard proxy for the opportunity cost of money, and the demand for cash balances. While these empirical results contradict the traditional presumption of a negative relationship between the demand for money and a bond interest rate return, they make economic sense if the perceived total return on a bond is the true opportunity cost of holding cash balances.

Keywords: opportunity cost of money, money demand, liquidity demand, Keynesian speculative demand for money

1. Introduction

It is a common assumption that the relationship between an individual's demand for cash balances is inversely related to its opportunity cost, where the latter is represented by the current interest rate of a bond. A bond's interest return, however, is but one part of its total return. The other component is capital gain, or loss, realized at some future date, assuming the bond is not held to maturity. Since the total return is uncertain, the true opportunity cost of holding money is a "perceived" total return and is based on one's expectations about the future movement of bond prices. It is possible for there to be a wide divergence between a bond's current interest rate return and an individual's perception of its total return, and therefore possible for one's demand for money to be perversely *increasing* in the bond interest rate while decreasing in its expected (perceived) total return. (Note 1).

In this paper we study the behavior of a group of individuals for whom the perceived total bond return is paramount: portfolio managers of bond mutual funds. Empirical evidence of a significant positive relationship, or a statistically insignificant one, between cash holdings and a bond interest rate would suggest that some perceived total rate of return, rather than simply a bond's interest return, is the true opportunity cost of money. Since individual households that include bonds among their asset holdings may also exhibit this behavior as well, such a finding would also confirm the Cooley-LeRoy (1981) caution about assuming that the standard Keynesian assumption always holds.

2. Data and Empirical Results

Any attempt to study the behavior of fund managers over time confronts the problem of management style continuity. Fund managers often move from managing one fund portfolio to another within a given family of mutual funds or leave one mutual fund company to join another. Sometimes a mutual fund within a family of funds is merged with another, involving changes in investment style, objectives or fund leadership. Although one can find a plethora of data for a wide variety of mutual funds, it is a challenge to assemble a data set for which there is a high degree of confidence about fund management homogeneity over the time period under study. Our data set consists of Fidelity Investments bond funds. The data were culled from the monthly issues of Fidelity's

Mutual Fund Guide, which provide detailed information on fund management, investment style, assets, etc. We study seventeen funds, eleven intermediate-term funds and six long-term funds, for which we have sixty monthly observations for the period April, 1991-March, 1996. While it is possible to extend the time period, the closing of weak performing bond funds and recombination of others would further reduce the number of funds under study.

Since our focus is on the liquidity (i.e., money) demand decisions of bond fund portfolio managers, we use a functional form motivated by Chordia (1996), who estimates the liquidity demands of mutual funds. It is important to note that bond funds usually are not fully invested. Cash balances are held for transactions purposes, to meet anticipated redemptions, and sometimes as a buffer for unanticipated redemptions. In addition, cash balances are often held for speculative purposes, influenced by expectations about bond price movements. Our regression formulation is given by

$$LIQ_t = \alpha_0 + \alpha_1 LNASST_t + \alpha_2 INFLOWS_t + \alpha_3 LNINTRATE_t + \varepsilon_t \quad (1)$$

where LIQ represents cash holdings, stated as a percentage of total net assets in the previous month, LNASST is the logarithm of total net assets, INFLOWS is a fund's net inflow during the month, stated as a percentage of its total net assets in the previous month and LNINTRATE is the logarithm of the bond interest rate. (Note 2). Cash holdings LIQ are taken to be fund assets not invested. i.e., money held as cash or in cash equivalents. Total net assets are included to capture the transactions demand impact on cash holdings, while the bond interest rate is included to capture the speculative demand motive. Net inflows are included as an adjustment variable. It is computed by subtracting beginning of month total net assets, corrected for the monthly returns, net of management fees and the expense ratio, from the end of month total assets. The inclusion of net inflows allows us to account for money demand changes that are due to monthly flows, as separate from the transactions demand impact of total assets on cash holdings.

We expect the sign of the total net assets variable to be positive since an increase in a fund's asset size would increase anticipated redemptions and may increase the cash holdings used to buffer against unanticipated redemptions. We regard the expected sign of the bond interest rate variable to be an open question. We purposely focus on a single bond interest rate in our formulation in order to avoid the Cooley-LeRoy (1981) critique that "one reason why most studies of money demand include more than one interest rate is that only by so doing does the feasible parameter space become sufficiently large that researchers can find a specification that confirms their prior belief of a significant and negative interest rate effect on money demand." (Note 3). If we estimate a statistically significant negative coefficient on the bond interest rate, the finding will not be easily dismissible on these grounds.

Although a single bond interest rate appears in the regressions, the particular interest rate used depends on the fund class. The intermediate-term bond funds have dollar weighted average maturities of three to nine years; the most relevant bench-mark interest rate is that of the 7 Year Treasury Note. Long-term bond funds have double digit dollar weighted average maturities of up to thirty years; the most relevant bench-mark interest rate for the time period under study is the 30 Year Treasury Bond. Consequently, the regression for the group of intermediate-term bond funds employs the 7 Year T-Note rate while the regression for the group of long-term bond funds employs the 30 Year T-Bond rate. (Note 4). We use the interest rate for the last week of each month.

We start by examining the stationarity properties of the variables that are in the regressions. We employ the augmented Dickey-Fuller (ADF) unit root test to test the null hypothesis that a variable is non-stationary (i.e., has a unit root) and also carry out Dickey-Fuller/Generalized Least Squares (DF/GLS) unit root tests in order to confirm the ADF test results, since the latter test exhibits better overall performance for small samples. Table 1 presents the results of the unit root tests for our variables. (Note 5). The null hypothesis of unit root can be rejected at the 5% significance level for the logarithm of the bond interest rate variables; these variables are stationary. However, for the remaining independent variables Inflows and Log of Total Net Assets, as well as for the dependent Liquidity variable, the null hypothesis of unit root is not rejected. This is the case for all conventional levels and for each bond fund group.

Table 1. Unit Root Test Statistics

	ADF	DF/GLS
Intermediate-Term Bond Funds		
Liquidity	-1.763	-1.395
Log Total Net Assets	-2.760	-1.437
Inflows	-2.244	-0.486
Long-Term Bond Funds		
Liquidity	-2.093	0.454
Log Total Net Assets	-1.537	-1.120
Inflows	-2.360	0.129
Interest Rates		
Log 7 Year T-Note	-2.944**	-1.941*
Log 30 Year T-Bond	-2.913**	-1.993**
Log 30 Day T-Bill	-2.528	-2.202**

Single asterisk indicates statistical significance at 10%; double asterisk at 5%. Since the Log of Total Net Assets for the Intermediate-Term bond funds exhibits an increasing trend, we use the test equation that includes both constant and trend.

Whether we analyze the intermediate-term bond funds or the long-term bond funds, the dependent variable in our regression specification in (1) is non-stationary. For both bond fund money demand regressions, the set of independent variables includes both non-stationary variables (Inflows, Log of Total Net Assets) and a stationary variable (Log of Interest Rate). Park and Phillips (1989) show that if the dependent variable (y) of a linear regression specification is non-stationary and if the set of regressors include both non-stationary (x) and stationary (z) variables, then, provided that y and x are cointegrated, the least squares estimates of the parameters of such a specification are consistent. We next examine whether Liquidity, Log of Total Net Assets and Inflows are cointegrated for each bond fund.

The results of the cointegration tests appear in Table 2. We report two test statistics: the Johansen trace statistic and the Johansen maximum eigenvalue statistic. The null hypothesis for the trace statistic is that there are no more than r cointegrating equations and the test accepts as the number of cointegrating equations the first r for which the null hypothesis is not rejected. The maximum eigenvalue statistic assumes some given r cointegrating equations under the null and tests this against the alternative of r+1 cointegrating equations. For the long-term bond funds, both tests indicate that there is a single cointegrating equation among Liquidity, Log of Total Net Assets and Inflows. For the intermediate-term bond funds, the tests indicate that there are two cointegrating equations among these variables. We also employ the Schwarz Bayesian information criterion to determine the number of cointegrating equations for each of the bond funds. Gonzalo and Pitarakis (1998) and Aznar and Santos (2002) show that choosing the number of cointegration equations that minimizes the Schwarz Bayesian information criterion provides a consistent estimate of them. The Schwarz Bayesian information criterion indicates that there are two cointegrating equations among these variables for the intermediate-term funds and confirms that there is one cointegration equation among these variables for the long-term funds. As a consequence of the above results, using Park and Phillips' (1989) findings, we conclude that the parameter estimates resulting from our least squares estimation of (1) are statistically consistent.

Table 2. Cointegration Test Statistics

	Number Cointegrating Equations	Trace Statistic	Maximum Eigenvalue Statistic
Intermediate-Term Funds	0	66.35**	41.71**
	1	24.64**	18.84**
	2	5.80*	5.80*
Long-Term Funds	0	36.11**	25.33**
	1	10.58	10.39
	2	0.18	0.18

Single asterisk indicates statistical significance at 5%; double asterisk at 1%.

The results are in Table 3. Two sets of regression results are reported, the first for the group of intermediate-term bond funds and the second for the group of long-term bond funds. Recognizing the problems associated with serial correlation in time series data, we employ the Newey-West (1987) variance estimator that produces consistent estimates for the variance of the least squares estimator in the presence of autocorrelation. TheNewey-West variance estimator handles autocorrelation up to and including a pre-determined lag. Thus, it assumes that any autocorrelation at lags greater than the pre-determined maximum lag value can be ignored. We choose the maximum lag value using the lag selection formula in Newey and West (1994). (Note 6).

The estimated coefficient for the total net assets variable is positive and statistically significant for the group of intermediate-term funds. The estimated coefficient on the bond interest rate variable is *positive* and statistically significant in each of the two regressions. For every one percent increase in the bond interest rate, intermediate term funds increase the percentage of total net assets held in money by 24.97 points, whereas the increase for long-term funds is 14.66 points. The corresponding elasticities are 3.52 and 2.71, respectively. (Note 7). The estimated coefficient of the net inflows variable is positive in each regression and statistically significant for the group of long-term bond funds.

The results depicted in Table 3 constitute the basic empirical finding of this paper. However, there are two extensions worthy of consideration. The first is to introduce a second interest rate variable, as a measure of the short-term return to holding money balances. Managers of the Fidelity bond funds under study are generally not free to pursue other assets, but they can (and do) hold monetary balances as part of their portfolios. One can conjecture that the degree to which they hold money, and indeed the degree to which they reduce bond holdings in favor of higher monetary balances, may well be tempered by the short-term interest rate on money balances. While the dominant motivation for reducing bond holdings in response to bond interest rate increases is avoidance of capital loss, the *degree* to which money is substituted for bonds, on the margin, may be influenced by the short-term money interest rate. We therefore introduce the log of the 30-day T-bill rate as an additional independent variable, in order to account for this potential phenomenon and re-estimate the two equations. Since this variable is stationary, by the preceding cointegration test analysis, we can estimate this new set of regressions with the least squares method as well. The results are depicted in Table 4.

Table 3. Bond Fund Money Demand: Base Formulation

	Intermediate-Term Funds	Long-Term Funds
Intercept	-163.09	-35.39
	(38.05)**	(33.57)
Log Total Net Assets	13.42	1.40
	(3.22)**	(3.25)
Inflows	0.23	0.51
	(0.16)	(0.12)**
Log 7 Year T-Note	24.97	
	(4.91)**	
Log 30 Year T-Bond		14.66
		(4.19)**
R-Square	0.60	0.52

Newey-West standard errors are in parentheses. Double asterisk indicates statistical significance at 5%; triple asterisk at 1%. Number of observations is 59.

Table 4. Extension of Base Formulation to Two Interest Rates

	Intermediate-Term Funds	Long-Term Funds
Intercept	-128.38	-88.86
	(33.68)***	(96.06)
Log Total Net Assets	10.64	7.02
	(2.71)***	(9.72)
Inflows	0.13	0.49
	(0.15)	(0.13)***
Log 30 Day T-Bill	4.42	1.90
	(2.14)**	(2.96)
Log 7 Year T-Note	16.74	
	(5.93)***	
Log 30 Year T-Bond		16.12
		(5.54)***
R-Square	0.66	0.52

Newey-West standard errors are in parentheses. Double asterisk indicates statistical significance at 5%; triple asterisk at 1%. Number of observations is 59.

Two sets of regression results are again reported. Overall, the pattern is similar to that in Table 3. With regard to the added variable, in each regression the estimated coefficient on the 30-day T-bill rate is positive; it is statistically significant for the intermediate-term bond funds. The addition of the short-term interest rate is important. Without it, the estimated coefficients on the respective target bond interest rates may spuriously mask their effect. In Table 3, the estimated effect of a one percent increase in the bond interest rate on the monetary holdings of intermediate-term bond funds is 24.97 points as compared to 14.66 for long-term bond funds, with corresponding elasticities of 3.52 and 2.71, respectively. In Table 4, after separating out the effects of the short-term money interest rate, these estimates nearly converge to a common value of about 16, with corresponding elasticities of 2.36 and 2.99. It is noteworthy that the estimated coefficients for the target interest rate variable, the 7 Year T-Note for the intermediate-term bond funds and the 30 Year T-Bond for the long-term bond funds, remain positive and statistically significant. Increases in bond interest rates are associated with *increases* in the holding of money balances.

The second extension is to account for the possibility that expectations are influenced by the degree of interest rate changes, not simply an alteration in their levels. We capture this by adding the lagged interest rate, using a lag of one. This is a general way of accounting for interest rate changes. The results are depicted in Table 5. Once again, the overall results are similar to the basic results in Table 3.

Table 5. Extension of Base Formulation to Lagged Interest Rates

	Intermediate-Term Funds	Long-Term Funds
Intercept	-168.58	-36.80
	(32.44)***	(30.72)
Log Total Net Assets	13.69	1.38
	(2.69)***	(3.03)
Inflows	0.09	0.45
	(0.13)	(0.13)***
Log 7 Year T-Note	6.20	
	(5.75)	
Log 7 Year T-Note Lagged	20.38	
	(7.61)***	
Log 30 Year T-Bond		2.96
		(8.39)
Log 30 Year T-Bond Lagged		12.50
		(5.80)**
R-Square	0.66	0.54

Newey-West standard errors are in parentheses. Double asterisk indicates statistical significance at 5%; triple asterisk at 1%. Number of observations is 59.

The empirical results reported above should not be considered perverse. Bond interest rate increases may lead to expectation of a capital loss, thus affecting the total return on bond holdings (i.e., the perceived opportunity cost of money), prompting bond fund portfolio managers to "lighten-up" on their bond holdings and to increase monetary balances.

Starting in the 1950s and progressing steadily in intensity since then, the role of financial intermediaries in general and of mutual funds in particular has grown enormously. Vast amounts of funds are now handled by bond portfolio managers and other institutional fiduciaries that specialize in fixed income assets. Speculation in bonds and money – where speculation is understood in the conservative sense of fiduciary responsibility to avoid capital loss and preserve capital - plays a large role in contemporary financial activity. We take the empirical findings above as suggestive of the importance of these forces.

3. Summary and Conclusions

The true opportunity cost of holding money is the *total* return on some bond, which contains an uncertain capital gain (or loss) component, not simply its interest rate return. There can be a divergence between the interest return and one's perception of the total return, resulting in a money demand response that is *upward* sloping with regard to a bond's interest rate return while being downward sloping with respect to the *perceived* total return. We study the liquidity demand behavior of a group of bond fund portfolio managers and find evidence of a *positive* relationship between bond interest rates and the demand for cash balances. For them, the Keynesian *speculative* component of money demand is sensitive to expectations of bond price movements, so that changes in interest rates can produce what may appear to be "perverse" empirical results. However, if the focus is on the perceived total bond return rather than its interest rate return, then the results make economic sense.

The amount of financial assets held by bond funds has grown enormously in recent decades, along with the direct holdings of bonds by consumers who include them among their asset holdings. The sample of bond funds analyzed above is small, in order to ensure continuity of portfolio management style. Our findings are therefore only suggestive. However, should they hold more generally, policy makers who rely on the traditional assumption of a negative relationship between money demand and a bond interest rate may need to proceed with caution, especially when there is heightened uncertainty about future interest rates and bond prices.

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Notes

Note 1. The expected return can be negative if one expects a capital loss that outweighs the bond interest return.

Note 2. Theoretical modeling of inter-temporal uncertainty indicates that the current interest rate, rather than some proxy for its future expected value, is the proper right hand side variable. Expectations of future interest rates and bond prices are taken to be based on current period values. When expected utility is maximized, the derived demand function for money has only current period variables as its arguments.

Note 3. Cooley and LeRoy (1981), p. 835.

Note 4. In recent years, the 10 Year Treasury Bond has become paramount. However, for the period under study, the 30 Year Treasury Bond was the "bellweather."

Note 5. The lag length in the unit root test equations is chosen using the Ng-Perron (1995) sequential procedure for testing the significance of the lag coefficients in the test equations. Specifically, one starts the unit root tests with a maximum lag length k. As suggested by Schwert (1989), k is determined by $k = [12(T/100)^{1/4}]$, where [x] denotes the integer part of x and T is the number of observations. If the absolute value of the t-statistic for testing the significance of the last lagged difference in the test equation is significant at the .10 level, then the lag length in the test equation is k. Otherwise, one reduces the lag length by one and repeats the same process.

Note 6. The number of Newey-West lags to use in calculating the standard errors is given by $[4(T/100)^{2/9}]$ where [x] denotes the integer part of x and T is the number of observations.

Note 7. Here we divide the interest rate coefficients by the sample means of the liquidity ratios.

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Financial Services Consolidation and Performance in New York State Savings and Loan Associations, 2000-2011

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Abstract

The market structure-performance relationship has been tested for US banking in industrial organization studies. Two divergent hypotheses with regard to this relationship are the Structure-Conduct-Performance (SCP) Paradigm and Efficient Structure Hypothesis (ESH). This paper presents the test results of both hypotheses with respect to the New York State S&L associations using the time-series and cross sectional (firm-level) data for the most recent period 2000-2010. The results of PEGLS regression indicate that performances of S&Ls vary with respect to operating cost, credit risk and capitalization. Neither market share nor concentration, however, plays a significant role in explaining profitability. The results partially support the ESH as an explanation for the market behavior of New York State S&L associatons. Given that profitable banks are efficient but also risk dependent, additional policies are warranted in order to mitigate risk and maintain the safety and soundness for the remaining S&Ls in the New York State.

Keywords: S&L industry, subprime mortgage crisis, Structure-Conduct-Performance (SCP), Relative Market Power (RMP), Concentration, HHI, Efficient Structure Hypothesis (EFS), X-Efficiency, scale efficiency

JEL: G21; B15; C50; E50; P16

1. Introduction

In recent years marked by financial instability, banking sector performance has become an increasingly noteworthy research topic. While this research has been largely limited to US and European banking, a growing body of research examined determinants of performance in non-bank institutions, particularly in the US Savings and Loan associations. For decades, S&Ls operated as specialized banks offering mortgage loans and savings accounts at low-interest and insured accounts. Studies highlighting firm-specific factors emphasized ownership and control, managerial efficiency and profitable ownership structure. Studies published during the mid-1980s and later extensively focused on regulation, deregulation and insolvency risks and the impact of change in ownership (stock versus mutual) on efficiency and cost structure (Balderston 1985; Benston, 1986; Kane, 1989; Barth, 1991; Curry and Shibut, 2000; Mester, 1993; Cebenoyan, Cooperman and Register, 1995; Fraser and Zardkoohi, 1996).

Since the unfolding of the US financial crisis in 2007, bank performance has received renewed attention in the ongoing effort to mitigate risks and revitalize the financial industry. Mergers and acquisitions have a bearing on S&L performance against a backdrop of frequent failures. The aim of this article is therefore two-fold: First, it aims to extend the literature by focusing on the S&L sector in the New York state. Since New York has been the epicenter of economic crisis, it is noteworthy to look at the current trends in the financial sector in that state. The second aim of this paper is to gain an insight into a significant determinant of financial performance mostly associated with market structures, namely concentration and competition. In this regard, two competing hypotheses--Structure-Conduct-Performance (SCP) Paradigm and Efficient Structure Hypothesis (ESH)--are tested against the background of previous literature. US anti-trust policy that evaluates bank mergers is based on the assumption of positive relationship between market structure (overall concentration level) and collusive profits. On the other hand, ESH suggests that market share of individual firms explains the positive relationship between market structure and firm profits (Evanoff and Fortier, 1988:277). It is hoped that testing the assumptions of these theories can provide new insights for anti-trust policy and financial regulation at the state level.

In determining performance, we use the most popular proxy measured by Return on Assets (ROA) and regress it with bank-specific and industry-specific indicators. We have not included macroeconomic variables given that all institutions operate in the same macroeconomic environment and there is no *a priori* reason to assume that profitability levels vary with growth rate of GDP. Our findings indicate that profits are negatively related to operating costs (operational costs/total assets), credit risk and liquidity risk. Risk is one of the most important components of profitability as indicated by the negative coefficient sign of credit risk. This reveals that banks with substantial amount of loan loss provisions-to-total assets make riskier loans than banks with less risky loans. A key finding is that neither market share nor the standard concentration ratio (HHI), commonly used in bank performance research, has a significant impact on bank profits. While our evidence partially supports the ESH as an explanation of firm-specific efficiency, it does not support either of the theories as an explanation for the market behavior of New York State S&Ls. An additional robustness check shows that findings are robust and consistent after controlling industry-related variables and inter-correlation in the sample banks.

The remainder of the article is organized as follows. Section 2 provides a brief overview of the main developments in the Savings and Loan Industry as background to the empirical work. In Section 3, we present an overview of the relevant literature on market structures/performance relationship and discuss the strengths and shortcomings of previous studies. Section 4 and Section 5 present the empirical model along with a description of the data and variables used in the study. Section 6 yields the results of the empirical analysis. Section 7 discusses the policy implications of empirical findings. Section 8 presents the conclusion and draws strategic lessons from this study for future researchers.

2. Historical Background: Consolidation of New York Savings and Loan Industry

In the early 1990s, the New York S&L industry (also known as thrifts) went through a major process of expansion and consolidation. Firms are generally fewer and larger today but operate in increasingly concentrated markets. S&Ls took larger risks as a result of the deregulation in the early 1980s. During this period, a large number of institutions failed due to undercapitalization, managerial inefficiency and engagement in large-scale speculation, especially in real estate and commercial loans. Various explanations put forward for the crisis include lack of adequate supervision, reduced capital ratios, adverse economic conditions and deregulation of asset structure and interest rates (Balderston 1985; Benston, 1986; Kane, 1989; Barth, 1991; Mishkin, 1999; Curry and Shibut, 2000). In addition, stock-owned institutions displayed more risky portfolios than did mutual institutions (Mester, 1993; Cebenoya et al, 1995;Fraser and Zardkoohi, 1996).

Jayaratne and Hall (1996) argue that consolidation among both types of depository institutions (commercial banks and thrifts) increased from 1989 to 1994 in the Federal Reserve Second District's five largest banking markets: Albany, Buffalo, Metro New York-New Jersey, Rochester and Syracuse. Overall, an increase in consolidation came from three fronts: Thrift failures contributed to increased market concentration more than mergers did, especially in Buffalo, Rochester and Syracuse. Prominent New York City institutions, such as Bank of New York, Dime Savings and Chemical Bank, withdrew entirely from the upstate markets. Additionally, the market share of midsized banks increased at the expense of larger institutions. Using local market deposit concentration (HHI Index) as a proxy for competition in retail banking, they show that HHI increased at a faster rate than the national average in four markets, with Albany experiencing 61 percent increase in concentration. Buffalo experienced the largest decline in the number of institutions while Metro New York-New Jersey experienced the smallest reduction but increased merger activity. Despite the process of consolidation, however, the banking markets remained un-concentrated, with HHI of less than 1000 and competition still vibrant. Overall improved efficiency, elimination of weaker banks, better diversified services and the growth of market share in midsized banks undercut assumptions that the New York market is excessively concentrated.

Failures, mergers and acquisitions reflected a trend towards consolidation at the national level as well. Among New York's 493 depository institutions in 1989, 55 (11.2 percent) were "eliminated" by mergers and 52 (10.5 percent) by thrift failures (Jayaratne and Hall, 1996:2). From January 1, 1986 to year-end 1995, "the number of federally insured thrift institutions in the United States declined from 3,234 to 1,645 or by approximately 50 percent" (Curry and Shibut, 2000:26). As some weaker institutions were eliminated, many prominent and large S&Ls like Washington Mutual and World Savings became subsidiaries of bank holding companies (Ely, 2008). Market consolidation continued unabated with the financial crisis in 2008, when failures such as IndyMac led to the third largest bank collapse in US history, costing "more than 10% of the FDIC's $53 billion deposit insurance fund" after Continental Illinois in 1986 and First Republic Bank in 1988 (Palette and Enrich, 2008). IndyMac speculated in Alt-A loans, one level up from subprime loans (Hudson, 2008). Washington Mutual, the largest American savings and loan association, also collapsed in 2008, ending in the largest bank failure in US history to date and facilitating its acquisition by J.P Morgan Chase for $1.9 billion.

During the 2007-2010 crisis, New York banking experienced some consolidation but the statistics do not confirm decreased competition in local markets. According to Wheelock (2011), the crisis eliminated 318 commercial banks and savings institutions, nearly 4 percent of total number of banks at the end of 2006. For example, the acquisition of Washington Mutual had little effect on competitive conditions in financial centers. Especially Houston and New York City stayed relatively un-concentrated after the acquisition. Except for a few rural banking markets, market concentration did not increase after acquisitions of failed banks by competitors. Banks that acquired some of the failed banks were already serving the same market.

When we examine all New York State S&L institutions in 2011, the consolidation over the 2000-2011 was in fact modest (Figure 2). Although the total number of institutions decreased in Metro-New York and upstate markets from 47 to 40 (Figure 1), market concentration has decreased 55 percent as measured by the Herfindahl-Hirschman Index (HHI). Used by the Department of Justice in order to analyze the competitive effects of bank mergers, HHI is determined by calculating sum of squared market shares of all banks in the New York State area. The highest level of concentration was 0.34 (3400) and the lowest 0.15 (1500), indicating "high concentration" in 2000 but "un-concentrated" markets in 2011. Paralleling reduced number of institutions, there has been a consolidation in total industry assets, as reflected in 29 percent decrease from $65 billion in 1995 to $46 billion in 2011. As shown in Figure 3, 5 S&Ls account for 70.77 percent of total industry assets ($46 billion) in 2011.With the exception of Albany, the largest institutions are concentrated in the New York Metro area: Astoria, Flushing, Trustco, Dime-Savings and Provident Bank.

Albeit their smaller share of the market but large concentration in nonprime loans (Alt-A and subprime), federally insured S&Ls suffered the greatest losses when the housing market collapsed in 2008. American Home Mortgage, which operated as a real estate investment trust, collapsed and filed for bankruptcy on August 6, 2007. In January 2008, Bank of America acquired Countrywide Financial, the largest U.S. mortgage lender, for $4 billion after its stock prices had dropped 80% in value since 2007 (Morgenson, 2007; Mildenberg, 2008). In April 2007, New Century Financial Corporation, another real estate investment trust and second biggest U.S. mortgage lender, filed for bankruptcy after effectively reducing its labor force by 54% (CNN, 2007).

There are fears that a reduced number of institutions would dampen market competition. There are also concerns that the remaining organizations are getting larger and the financial industry is becoming "too big to fail" again. Market concentration weakens competition (and consumer welfare) by fostering "collusive" behavior among banks and more than normal profits. Experts are divided over whether such collusion exists, and where they agree that it does, differ over the policyinterventions necessary to prevent it. The following review of literature highlights the debate around the underlying causes of bank performance and its relationship to market structures.

3. A Brief Overview of Research on Market Concentration, Competition and Financial Performance

There is a vast body of literature on the determinants of financial sector performance in different parts of the world (Short, 1979; Bourke, 1989; Berger et al, 1993; Berger, 1995a; 1995b; Goldberg and Rai, 1996; Demirguc-Kunt and Huizinga, 2000; Molyneux et al, 2004). Research on S&L performance has primarily drawn from broader research across the entire banking industry (Brigham, 1964; Benston, 1972; Verbrugge et al., 1976; Geehan and Allen, 1978; Mester, 1993; Bradley, Gabriel and Wohar, 1995; Cebenoyan et al., 1995; Kaushik and Lopez, 1996; Jahere, Page and Hudson, 2006). The argument that market structures influence firm behavior is prevalent among 3 schools of thought: The Structure Conduct Performance (SCP) Paradigm, Efficient Structure Hypothesis (ESH) and Relative Market Power Hypothesis (RMPH). Market structures refer to market competition of firms (or lack thereof) and sectoral variables (concentration ratios; market growth) that are external to firm-level variables such as bank size, capital ratios, operating expenses, liquidity ratios, financial leverage and ownership structure (Rasiah, 2010:1-2; Athasanoglu et al., 2006:8).

As Molyneux et al (2004) note, the SCP paradigm flows from the oligopolistic theory of banking and the "collusive" behavior of firms. It is based on the proposition that the level of competition weakens in concentrated markets, fostering "collusion" among fewer firms and resulting in super-profits for the banking industry. This hypothesis suggests that market competition has a direct influence on profitability as measured by return on assets, return on equity and net interest margin. Banks operating in monopolistic markets charge higher interest on loans, lower rates on deposits, and higher fees than banks in competitive markets. The degree of concentration negatively impacts competition but is positively associated with profits regardless of firm specific efficiencies—the larger the market concentration, the less the degree of competition and higher the profits (Gilbert, 1984:618; Loyd-Williams et al, 1994:437).

The majority of early studies of the financial industry support the traditional SCP hypothesis (Short, 1979). In a representative study of North American, European and Australian banking markets, for example, Bourke (1989)

found support for the traditional hypothesis of the positive relationship between collusive profits and concentration. Based on Bourke's approach in a pooled sample of European banks in 1986- 1989, Molyenux and Thornton (1992) showed that profits (pre-tax return on assets) are positively correlated with ten bank concentration ratio, payroll expenditures, nominal interest rates and government ownership. Their findings also lend support to the Edwards-Heggestad-Mingo hypothesis from the early SCP studies. In other words, banks with market power are more likely to display "expense preference" behavior. This type of behavior indicates that overhead expenses are beyond the profit maximizing level of competitive banks. Vennet's (1993) findings further indicate that in some European countries, Belgium, Ireland, Portugal and Spain, collusive profits prevail.

Related shortcomings of the SCP paradigm are summarized at greater length in Berger (1995b), Golberg and Rai (1996) and several others. In an important criticism of the SCP methodology, Gilbert (1984), Ruthenberg (1994) Goldberg and Rai (1996) note that bank regulation such as entry/exit barriers and direct efficiency measures tend to be neglected. For example, SCP should hold true in markets with greater entry barriers where market participants are effectively protected from competition. Widespread criticisms of neglected variables spurred two alternative explanations: The Relative Market Power Hypothesis (RMPH) and Efficient Structure Hypothesis (ESH). RMPH, which is a special variant of SCP, introduces "market share" as a proxy for the efficiency of firms. Profits increase in banks with larger market shares because of their ability to generate efficiency, which normally leads to higher market power. In this hypothesis, market share is positively related to firm-specific efficiencies (for example, through superior management and product differentiation), which also explains the positive relationship between concentration and profits. RMPH is supported when market share is positively related to profitability after controlling for the effects of concentration and efficiency. Additionally, higher profits do not always need to occur in concentrated markets (Goldberg and Rai, 1996:749). Smirlock (1985) introduces the market share as a proxy for firm-specific efficiency with a positive coefficient but finds that there is no relationship between concentration and profitability.

Goldberg and Rai (1996) draw a contrast to the two market-power theories (SCP and RMPH) through their Efficient-Structure-Hypothesis (ESH) that incorporates direct efficiency measures. They applied stochastic cost frontier approach, first proposed by Aigner et al (1977) and tested by Cebenoyan et al (1993) and Mester (1993) for the savings and loan industry. This approach derives measures of X-inefficiency and scale inefficiency and incorporates them directly into the tests under the Berger and Hannan (1993) model. Under the X-Efficiency (ESX) hypothesis, more efficient firms generate higher profits because they can produce a given combination output at minimum cost through superior management or technology. This gives efficient banks a "comparative advantage" to obtain additional profits regardless of the extent of market concentration and/or entry barriers. It is very likely that resulting market share leads to higher market concentration. Therefore, in this hypothesis, the direction of causality runs from efficiency to profits and market structures, not the other way around. When net interest margin is used as the measure of performance, however, efficiency measures are negatively correlated with performance because more efficient banks provide customers with more competitive loan and deposit rates (Goldberg and Rai, 1996:745-749). Under these assumptions, Goldberg and Rai find little support for the SCP hypothesis but they present evidence for one of the two versions of the ESH in 11 European countries in 1988-1991

In Berger's study (1995b) of 30 cross sections of 1980s banking data, the evidence lends partial support to X-efficiency version of ESH. A necessary condition for the ESH is that efficiency affects market structure, in other words efficient firms will capture higher profits and market share and will also be responsible for higher concentration. While X-efficiency is positively associated with profits in Berger, it is not sufficiently correlated with market share or concentration in order to support the profit-market structure relationship. On the other hand, Papadopoulou's analysis (2004) of European banking performance does not provide support for any of the assumptions of ESH, finding instead that efficiency and bank size are related (ie., "big banks are more X-efficient than small banks"). Similarly, Casu and Girardone (2006), who examined the competitive conditions of European banking for the period 1997-2003, note that the level of concentration is not related to the level of competition.

Recent evidence indicates that none of the hypotheses are fully adequate to explain bank profits, suggesting that alternative variables be tested. In the analysis of S&L performance, selecting variables for resolving the differences between SCP and two versions of ESH presents challenges. Today thrifts are operating in an environment very different from the 1980s and 1990s. Profits vary not only by market types (bank-based versus market-based financial systems), but also between different sizes of banks, different services and ownership types, which may affect competitive conditions differently. For example, small banks are often regarded as "community banks" with different competitive advantages than large banks, such as serving more opaque and

smaller borrowers and offering retail-oriented rather than wholesale businesses. Standard indices like HHI and CRn often treat the competitive advantages of different institutions equally, presenting "endogeneity problems" in bank performance analysis. This has invited the use of alternative measures of competition that include sunk costs and non-structural models like Panzar-Rosse statistic. As such, when examining the impact of market structures on profitability, researchers often incorporate regulation, the role of government, entry and exit barriers and other legal conditions for competition, such as shareholder rights, transparency, and trade openness among countries and within financial markets (Berger et al, 2004:436-437).

Furthermore, organizational forms can have a crucial effect on bank performance. Such forms include corporate governance structure, ownership and control and conflicts of interests between owners and managers. In a study of S&L ownership structure, Akella and Greenbaum (1988) reveal that managers of mutual S&Ls display greater expense preference behavior than managers of stock-holder S&Ls. Their results are consistent with earlier SCP studies, indicating that mutual S&Ls invest a high proportion of assets in loans and "source" a higher proportion of liabilities from deposits. Knopf and Teall (1996) examine the impact of ownership and regulation-the Financial Institutions and Reform and Recovery and Enforcement Act of 1989 (FIRREA)-on risk-taking behavior in the US thrift industry. This was a period of re-regulation aiming to increase capital ratios, regulate the use of brokered CDs and minimize real estate equity holdings. Their findings are consistent with classical agency theory that insider shareholders tend to pursue strategies that meet their own interests (utility) rather than the value of the firm. Increased risk activity in S&Ls is associated with high levels of insider (management) shareholdings. This relationship is explained by the role of "entrenched managers". Such managers display more risk-taking behavior than institutional shareholders with more diversified portfolios. Furthermore, the ability of insiders to extract private benefits from outside interests (such as real estate development firms; lobby groups) may decrease return on assets and may negatively affect firm performance.

Based on the notion of managerial control, ownership and deregulation, other researchers evaluated the efficiency and profitability of S&L institutions. The common finding has been that stock organizations are likely to be more effective than other types of organizations. Especially in the expense-preference theory, mutual thrifts are considered to be less efficient because they do not have greater access to capital and lack profit maximizing pressures from owners. Therefore, as Mester (1991) notes, mutual S&Ls operate with "an inefficient output mix" which leads to conflicts of interest between owners and managers. For example, managers of mutual firms might be willing to sacrifice profit by making safer investments so as to reduce risk or maximize interests through "expense preference behavior".

While different ownership types influence performance differently, there is no clear consensus in the empirical literature as to whether mutual firms are less profitable than stockholder firms. In an important extension of Akella and Greenbaum's work (1988) using a much larger sample, Gropper and Hudson (2003) report evidence in favor of better managerial efficiency and decreasing expense-preference in S&Ls that survived the financial crisis. This is due to the removal of barriers on competition rather than ownership type. In a stochastic cost frontier approach to a sample of 559 firms in Atlanta district, however, Cebenoyan et al (1993) report that there is no difference between the efficiency of joint stock and mutual thrifts.

The review in the preceding section discussed some of the factors influencing financial institution performance. The 3 hypotheses (SCP, RMPH, ESH) pertaining to this topic provide the useful framework for the performance analysis in this study. Additional problems, however, common to these theories concern the appropriate measure of market structure and performance. For example, SCP "offers no information on the absolute number or size distribution of firms necessary to exercise market power" (Evanofff and Fortier, 1988:280). While New York markets display regional characteristics that are hard to quantify, the SCP hypothesis should hold true in states with greater entry barriers. However, the ESH proposes that banks with efficient production should always reap higher profits regardless of the degree of concentration and entry barriers. This paper looks at how market structures and firm-level characteristics contribute to the performance of New York S&Ls over the period 2000-2010. Our methodology incorporates some of the developments in econometrics, namely panel unit root and panel regression tests that may illuminate recent trends in the New York thrift markets.

4. Data, Variables and Hypotheses

This study employs multi-dimensional panel data over the period 2000-2011. Our data include time-series and cross-sectional information for all insured and regulated S&L associations (40 as of 2011) in the New York State. The firm-level data, including the number of banking firms and all proxies, come from the Federal Deposit Insurance Corporation (FDIC) database: FDIC Institution Directory http://www2.fdic.gov/IDASP/main.asp. While there are missing values for some variables in our sample, each S&L is observed every year. Thus we have

used in our empirical work balanced panel data that amount to total observations of 420.

Following the ratios used in previous studies, we identify the determinants of S&L associationperformance as follows. The performance measure chosen is bank "profit" measured as return on assets (ROA). ROA is "annualized net income including gains or losses on securities and extraordinary items" divided by average total assets (FDIC, 2002). We have decided not to use return on equity (ROE) = Net Income/Total Equity as the dependent variable because some banks contain negative equity. While ROA and ROE have been used in most studies, other studies have also used net interest margin (NIM) as a proxy for the "pricing ability of banks" for deposits and loans. If the SCP hypothesis holds true, then the net interest margin will be higher. NIM indicates the ability of monopolistic banks to charge lower deposit rates and higher loan rates (Goldberg and Rai, 1996:752). However, individual prices may not always be a reliable profit measure because banking is a multi-product industry and pricing strategies differ across banks and across markets. Banks are likely to cross-subsidize in the presence of regulations (Evanoff and Fortier, 1988: 281). Use of the profit measure as ROA should filter some of these potential problems.

The independent variables include both market-specific (microeconomic/industry-related) and firm-level variables and are similar to those utilized in previous studies. In analyzing market structure, we consider New York State to be a market. The SCP and efficient structure hypotheses are tested by the addition of market structure variables--concentration ratios-and firm-specific market shares (MS) defined as ratio of each bank's deposits-to-total industry deposits. We have employed the two popular measures of concentration--the four-bank concentration ratio (CR4) and the Herfindahl Hirschman Index (HHI). While MS captures firm-efficiency (Relative Market Power Hypothesis), CR4 and HHI are market structure indicators. CR4 is defined as the ratio of total deposits of the four largest S&Ls to the total deposits of all S&Ls in the New York state. Similarly, HHI is defined as the sum of squared market shares of deposits of all the S&Ls. But since CR4 does not use market shares of all banks in the industry, we prefer to use HHI as an indicator of market structure. HHI provides a more comprehensive picture by giving weight to each bank's market share. Logarithm of total assets (the proxy for size-induced scale economies), while being insignificant in all regressions, is excluded for causing inter-correlation with MS.

Several control variables are introduced to account for firm-level risk and managerial efficiency. Since performance measure ROA is not risk adjusted, we employ three variables to account for differing leverage, credit and liquidity risks among firms. EQV, equity capital-to-asset ratio, indicates the level of leverage used by a company (bank risk) and relative portion of the equity used to finance a company's assets. We expect the relationship between leverage and profit to be both negative and positive. Higher equity ratio indicates more capital and less leverage, which could result in decreased borrowing costs. Firms with lower borrowing costs can become more profitable. Conversely, lower equity ratio or "higher leverage indicates aggressive asset/liability management which leads to higher interest margins (NIM) and profits" (Golberg and Rai, 1996:757). LIQ, average loan-to-average asset ratio, measures the riskiness of loans since loans are riskier and generate higher returns (ROE or ROA) than other assets such as government securities (Evanoff and Fortier, 1988:282). Therefore, a positive relationship ties liquidity and profitability. On the other hand, higher loan-to-asset ratio can also decrease profitability by increasing bank risks.

Following Athasanoglu et al (2006) and Pervan et al (2009), we use CRIS1, loan loss provision-to-loan ratio, as a proxy for credit/default risk and asset quality. Each year, banks set aside"loan loss provision" as an allowance for bad loans (customer defaults, unpaid loans, non-performing loans, etc.). The amount of provisions set aside increases with the riskiness of the loans. A bank having a larger loan loss provision makes a large amount of risky or poor loans compared to a bank setting aside smaller amount. Credit risk affects the performance of an institution since increased risk is normally associated with decreased profitability. Poor asset quality is one of the main causes of bank failures (Miller and Noulas, 1997). On the other hand, higher ratio of allowance for bad loans can affect profitability positively; banks with a large number of risky loans can charge higher interest rate for the likelihood of higher customer default. Therefore, while the coefficient of CRIS1 is expected to be negative, it can also be positive.

EEFR is the operating efficiency ratio available in the FDIC database as a bank-specific variable. We have used this ratio as a proxy for managerial and operating efficiency. EEFR is defined as "noninterest expense minus foreclosed property expense minus amortization of intangibles, expressed as a percentage of the sum of net interest income plus noninterest income" and reflects the "proportion of net operating revenues absorbed by overhead expenses" (FDIC, 2002). Since EEFR is an operating cost ratio, we expect the coefficient sign to be negative under the Efficient Structure Hypothesis (ESH). Lower ratio indicates lower overhead costs and greater operating efficiency of the institution, which could then result in higher profits.

While NIMY, the net interest margin, was used in previous studies as a proxy for performance (Angbazo, 1997; Demirguc-Kunt and Huiziga, 1999; 2000; Goldberg and Rai, 1996), this study uses it as a right-hand side variable. NIMY is the difference between interest income and interest expense as a percentage of interest bearing assets (FDIC, 2002). Demirguc-Kunt and Huizinga (2000) point out that profits and netinterest margins are higher in countries with lower levels of economic growth whereas the impact of growth on profits is exhausted in developed financial systems (countries with higher levels of GDP per capita). Banking research indicates that banks in highly concentrated markets charge higher rates on loans, and pay lower rates on deposits than banks in more competitive markets. Therefore, net interest margins and profits decrease as competition increases. In addition, Smirlock (1985) stresses that interest rate spreads are narrower in concentrated banking industry whereas Angbazo (1997) finds that higher net interest margins are associated with more risky loans and higher interest-rate risk exposure. Different types of risks are associated with "concentration in short-term assets and off-balance sheet hedging (OBS) instruments".

5. Econometric Methodology

Following Evanoff and Fortier (1988) and Lloyd-Williams et al (1994:438), we present the following equations to test the competing hypotheses for the New York State S&L associations. The reduced form of profit equation is displayed below:

$$PROFIT_{it} = \alpha_0 + \alpha_1 I_t + \alpha_2 MS_{it} + \sum_{\alpha i} X_{it}$$

where $PROFIT_{it}$ is a performance measure (ROA) for the firm *i* during the period *t*; X is a vector of control variables, which are intended to account for firm- specific variables for bank *i* at time *t*; I_t is a measure of market structure, usually a concentration measure HHI $\left(\sum_{si} S^2_{t}\right)$ --sum of squared market shares (*S*) of all banks at time *t* and accounts for industry/market-specific characteristics. MS_{it} is market share for firm *i* during the period *t* and used for controlling firm-specific efficiencies. ε_t captures the random error or disturbance in time denoted by *white noise* (residual), α_i the unobserved individual (bank-specific or "entity fixed effect") and u_{it} the remainder of the disturbance or error term. An unobserved variable varies from one bank to the other but is constant over time. We want to estimate Y_{ROA} (*PROFIT*), the effect on Y of X holding constant unobserved bank characteristics. In the fixed-effect model, this can be interpreted as having *n* intercepts one for each entity with the constant slope for all entities (Stock and Watson, 2011:354).

In the augmented regression equation below, the traditional SCP hypothesis holds true if $\alpha_1 > 0$ and $\alpha_2 = 0$; and the efficiency hypothesis (ESH) if $\alpha_1 = 0$ and $\alpha_2 > 0$ (Lloyd-Williams et al, 1994:438).

$$\ln PROFIT_{it} = \alpha_0 + \alpha_1 \ln HHI_t + \alpha_2 \ln MS_{it} + \alpha_3 \ln EQV_{it} + \alpha_4 \ln LIQ_{it} + \alpha_5 \ln EEFFR_{it} +$$
$$\alpha_6 \ln CRIS1_{it} + \alpha_7 \ln NIMY_{it} + \varepsilon_{it}$$
$$\varepsilon_{it} = \alpha_i + u_{it}$$

where all the variables are expressed in natural logarithms:

Log of PROFIT= bank *i*'s profit measured as the return on assets (ROA)

Log of HHI= concentration ratio in the New York State savings and loan industry (Herfindahl-Hirschman Index)

Log of MS= market share measure, total deposits of each bank-to-total deposits of industry ratio

Log of EQV=Equity capital-to-asset ratio (bank risk/leverage/capitalization)

Log of LIQ= Average loan-to-average asset ratio (liquidity risk)

Log of EEFFR=Noninterest expense-to-sum of net interest income and noninterest income ratio

Log of CRIS1=Loan loss allowance-to-loans ratio (credit risk)

Log of NIMY=Interest income minus interest expense-to-earning assets ratio (net interest margin)

With respect to the testing procedure, we apply both the Panel Least Squares method of fixed effects (FE) and Panel Estimated Generalized Least Square (PEGLS) method of random effects (RE). Fundamentally, both panels are applications of the OLS estimator to the augmented equation displayed above. While both of the models allows for cross-sectional and time-series effects (Baltagi, 2001), there is a need to control heterogeneity in units

of observation. In the fixed effects (FE) model, unobserved individual heterogeneity (firm-level characteristics) varies from bank to bank (different intercepts) but do not vary across time (constant slope). In the random effects model (PEGLS), however, there are no fixed or individual effects and heterogeneity in units of observation is uncorrelated with the independent variables (Yaffe, 2006). PEGLS has the advantage of generalizing beyond the sample in the analysis. Following a procedure advanced in previous studies, we use the Hausman (1978) specification test to determine which effect to use.

Before applying the Hausman test, however, we pretest if all variables are integrated of order one in levels. Variables with unit root exhibit trending or non-stationary behavior leading to spurious relationships between the explanatory and outcome variables (Cromwell, Labys & Terraza, 1994:23). Therefore, it is important to check whether the variables included in our models contain a unit root. Several panel unit root tests are used for verifying the non-stationary of the variables--for instance, Levin, Lin and Chu (LLC) (2002), Breitung (2000), Im Pesaran and Shin (IPS) (2003), and Fisher-type tests using ADF and PP tests. While LLC and Breitung tests assume a common unit root process, $\alpha = \rho - 1$, where the lag orders for the difference terms (ρ_i) are identical across sections, IPS, Fisher-ADF and Fisher-PP allallow for individual unit root processes so that ρ_i varies across sections. In LLC and Breitung, a null hypothesis of unit root for the common process, $H_0 : \alpha = 0$, is tested against the alternative hypothesis of no unit root, $H : \alpha < 0$. A unit root test renders the data stationary by applying first or second difference operator to the OLS estimator. We have selected the optimal length automatically using the Schwarz criterion. Individual intercepts and trend terms, which include both fixed effects and trends, are included in the test equation.

6. Results and Discussion

This section discusses the results of the empirical analysis. First, it reviews the descriptive statistics of test data. Next it evaluates the inferential statistics in order to reject or accept the competing hypotheses (SCP, RMPH, ESH) discussed in the previous section.

As descriptive statistics indicate, the continuing US economic downturn highlights some of the trends in ROA. Based on the average of cross-sections, the highest profitability is in 2002 and lowest in 2009. The maximum value corresponds to the beginning of real estate bubble and lowest value to the height of subprime mortgage crisis. The cyclical component of time-series indicates that profitability reached the highest levels during the housing boom (2000-2004) and then started to decrease after 2005. During 2000-2010, market concentration of firms averaged around 0.2344 as measured by HHI Index. An HHI index between 0.15 and 0.25 (or 1,500 to 2,500) indicates moderate concentration or oligopolistic competition. While the average concentration of 0.23 may support the hypothesis of collusive profits in the New York State, there is a general trend of decreasing concentration, as indicated by highest value in 2000 (0.34) and lowest (0.15) in 2011.

Low standard deviations indicate that the data points are not highly variable or dispersed. Whereas high deviation implies that the data points are spread out over a large range of values, low deviation indicates that data points tend to be close to the mean; there are no outliers in the data set. The standard deviation of HHI shows some statistical dispersion in data used for measuring concentration. This highlights the variation in sample size supporting the trend line in Figure 2. Table 2 summarizes the Pearson correlation coefficient of test data among independent variables. The estimated correlation coefficients show that there is no high-level correlation among variables included in the regression analysis. In other words, independent variables are not correlated to a degree to create multi-collinearity problem.

Time series panel unit root tests are reported in Table 3. Based on an automatic selection of optimal lag value, our tests confirm that all natural logarithm of variables except net interest margin (NIMY) contain unit roots. All variables seem to be stationary in first differences, while non-stationary in levels. Only LIQ is stationary in second difference. ROA fails the Breitung test in common root, but passes other tests in first difference. Based on the results of five panel unit root tests, all the variables in the model are integrated of order one and thus rendered stationary.

Table 4 reports the results of Hausman misspecification test. This test determines whether our model is appropriate for panel data analysis and it is free of misspecification. The null hypothesis of no misspecification is tested against the alternative of misspecification. The results indicate no evidence to reject the null hypothesis of no correlation between unobserved random error and independent variables. In other words, with the test probability (p value 0.0866) greater than the critical value of 0.05, it is appropriate to use the random effect model instead of the fixed effect model.

Returning to inferential statistics, all ROA based regressions provide evidence of the impact of firm-specific

variables on bank performance. Results of the random effect panel regression are reported in Table 5, which are based on 420 observations. When all variables are included for the final estimation, the regression model is significant at p value based on Probability (F Statistic). Probability (F Statistic) measures whether the relationship between the control variables and dependent variable is significant. Overall regression function has an explanatory power of 24 percent presented by R-squared; right hand side variables explain the dependent variable by 24 percent and the F statistic supports the regression. Overall, our regression model is significant at a level lower than 5 percent, so we can be reasonably confident that the good fit of the equation is not due to chance.

The traditional SCP hypothesis holds true if $\alpha_1 > 0$ and $\alpha_2 = 0$; and the efficiency hypothesis (ESH) if $\alpha_1 = 0$ and $\alpha_2 > 0$ (Lloyd-Williams et al, 1994:438). Both of these conditions must be satisfied in order to accept market structure theories unconditionally. Although the coefficient of HHI (absolute value) is different than 0, market share does not equal zero. Therefore, SCP is rejected. When controlling the effect of HHI, on the other hand, MS is still insignificant and fails to reject the RMPH that market share of firms determine profitability regardless of the degree of market concentration. ESH would be supported if efficiency, through the market share variable, were significantly correlated with profitability. Overall, none of the market power hypotheses (SCP, RMPH, ESH) support the importance of market structures as an explanation of firm performance in the New York S&L industry. Neither market share of individual firms nor market concentration has meaningful associations with profitability.

The profitability of New York S&L associations is dependent on several firm-level characteristics rather than market structures. When we add up market shares and microeconomic variables to the first model, effects of bank level variables do not change that much. More efficient banks are more profitable as indicated in Table 5. As the ratio of operational costs to total assets (EEFFR) increases by one point, the profitability of banks decrease by 0.001 points. Although market share is not significantly related to profitability in order to support ESH unconditionally, the significance of firm-level efficiency gives partial support to ESH. At the micro-level, efficiency is captured from cost saving advantages related to firm-specific/managerial efficiencies rather than market shares. While we expect efficient firms to capture higher market share, results do not necessarily support this conclusion.

Most importantly, our results show that risk is an important component of bank profits. While successful banks are more profitable, they are not less risk free. The role of risk is expressed through the incorporation of liquidity risk and credit risk variables. As banks become more risky (LIQ), their profits decrease in all regressions, as evident in decrease in return on assets (ROA) by 0.02 points. Riskier loans generate more lucrative returns than other assets such as government securities. Therefore, one would expect a positive relationship between LIQ and ROA. However, too much liquidity can also decrease profitability by exposing banks to credit risks, interest rate risks, defaults risks, etc. Likewise, credit risk (CRIS1), defined as ratio of loss allowance-to-total loans, can be the primary risk in the banking system. The loan loss provision set aside each year increases with the riskiness of the loans. A bank having a low loan loss provision makes a small amount of risky loans compared to a bank committed to a higher provision. As indicated in Table 5, credit ratio and profitability are inversely related, suggesting that S&Ls might be making risky loans. Management of credit risk is essential to bank performance; in fact, capital depletion through loan losses has been the proximate cause of most bank failures in the recent crisis.

Unexpectedly, net interest margin has no impact on profitability in any of the regressions. Previous research indicates that net interest margins are high in concentrated markets where collusive profits exist. Interest margins decrease with more fragmentation and development of competitive conditions in banking markets. Although the coefficient of NIMY becomes more significant after introducing HHI, it is still insignificant statistically.

Finally, capitalization (EQV) is inversely related to profitability. According to the literature, the coefficient of EQV can be both positive and negative. Higher ratio of equity-to-total assets indicates more capital and less leverage, which could result in decreased borrowing costs and thus higher profits. Conversely, lower ratio indicates more leverage and more aggressive asset liability management, which may lead to higher return on assets. Unlike debt capital, which is raised by incurring debt through the issuance of bonds, equity capital is invested money raised from owners of the company. The coefficient of EQV is compatible with the second explanation emphasizing inverse relationship. 1 unit increase in capitalization leads to 0.06 units decrease in profits. Similarly, 1 unit decrease in capitalization is associated with 0.06 units increase in profits.

Given that market share (MS) is insignificant in all regressions, it fails to support the ESH that profit is related to greater market share related to firm-specific efficiencies rather than market concentration. On the other hand,

efficiency (operating cost) influences performance regardless of market share, lending partial support to the ESH. This formulation provides more evidence in favor of the ESH than the SCP hypothesis. The coefficient of HHI is in contrast with the studies that supported the structure-performance relationship (Molyneux, 1992, Lloyd-Williams et all, 1994) and is more compatible with recent work supporting neither version of ESH (see Papadopoulos, 2004).

7. Policy Implication of Empirical Findings

Our results have certain implications for regulatory treatment of S&L associations in New York State. Since the SCP hypothesis finds a positive relationship between concentration and profits, it cautions against mergers and acquisitions and proposes policy interventions (anti-trust) to break up concentration. By contrast, ESH sees no role for anti-trust or government intervention in bank mergers. Proponents of ESH assume that efficient banks can "improve their market shares by providing more economical banking services in the market" (Seelanatha, 2010: 20). Therefore, in ESH paradigm, there is no need to employ anti-trust policy in order to improve market efficiency. Our results do not support the policy implications of either theory. There is some evidence to support the conclusion that New York S&L markets are sufficiently competitive. Neither market concentration nor market shares explain profits. Therefore both SCP and ESH are rejected.

While on average HHI remains close to oligopolistic competition in descriptive statistics, it has no impact on profit margin in regression analysis. Overall, New York markets appear to remain sufficiently diversified and non-concentrated. Given that profitable institutions are efficient, it can be concluded that S&Ls enjoy firm-specific advantages (cost saving); additional policies may be warranted in the future in order to maintain competitive advantage and prevent any abuse of market power and extra profits of the largest banks. Such approach should foster healthy market competition among firms allowing competitive and economical services for their clients.

Our analysis further indicates that risk appears to be the most important component of bank performance. Therefore, to maintain competitive advantage related to firm-specific efficiencies it is necessary to control risk and mitigate the pro-cyclicality of bank profits in un-concentrated markets. One option is the application of more robust internal and external risk rating processes. Policy interventions are warranted to increase the effectiveness of risk management and measurement at the firm and industry levels. FDIC and OCC are taking action to regulate risk more thoroughly, although it is too soon to tell the outcome. Overall, our results suggest policy makers to focus on prudential regulations, adequate level of capitalization against losses and improvements in risk management systems, which can enhance the performance of remaining S&Ls in the New York State.

8. Summary and Conclusions

The S&L industry has experienced poor performance as indicated by massive loan losses, mortgage defaults and institutional failures throughout the 1980s and 1990s. This paper analyzed the determinants of profitability using firm-specific and industry-specific data for the most recent period 2000-2010. It tested the market structure-performance hypotheses (SCP and ESH) for all S&L associations in the New York State. Using data from Federal Deposit Insurance Corporation (FDIC), we have utilized a total number of 420 observations across 40 financial institutions.

Overall, our results show that while credit risk undermines profitability (higher credit risk leads to lower return on assets), capitalization tends to weaken profits. A higher ratio of loan loss provisions–to-total assets (CRIS1) indicates the presence of S&Ls with riskier loans, and hence less profit. None of the market power hypotheses (SCP, RMPH, ESH), however, support the importance of market structures as an explanation of profitability in the S&L sector. Neither market share of individual firms nor market concentration has meaningful associations with return on assets. On average, New York S&L markets appear to remain diversified and modestly competitive in the period 2000-2010. In this regard, anti-trust policies are not a *sine qua non* since market concentration is relatively insignificant. However, this does not invalidate the need for anti-trust, which prevails to avert market power that may be associated with mergers and acquisitions.

Overall, evidence indicates that S&L profits are vulnerable to credit risks at the firm level. This suggests that it is crucial to control the pro-cyclicality of firm profitability in a less concentrated market. Capitalization has an inverse relationship with profitability. This implies that banks need to develop risk control systems that are flexible enough to absorb loan related risks without hindering earnings. Risk management should go hand in hand with adequate level of capitalization. Subsequently, a higher allowance for non-performing loans in normal times and lower amount in bad times can mitigate the impact of credit risk on ROA. The topic of prudential regulation includes how to subject banks to such provisions that might increase their operational costs. Also in

ROA specification, an important negative effect on profitability was caused by operational costs--the managerial efficiency variable. In other words, banks which pay more attention to cost control gain more profits.

Future research is necessary to test different measures of efficiency on profitability. A potentially useful direction is to derive direct measures of X-efficiency and Scale-efficiency that more accurately account for the relevant market. In order to derive them, some researchers used Data Envelopment Analysis (DEA). Also known as non-parametric method, DEA is used for the estimation of productive efficiency of different units in industrial organization studies. Likewise, future research can benefit from the correction of an endogeneity problem also known as "omitted variables" bias. Inclusion of legal, political and other institutional variables can highlight the impact of"regime change" on profit margins. GDP was excluded from the analysis given that all banks operate in the same macroeconomic environment. Inclusion of other control variables, however, can better reveal the performance of S&L sector in the New York State.

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Appendix

Table 1. Descriptive Statistics of Test Data

Variables	Symbol	Mean	Std. Dev.	Max.	Min.
Profitability	ROA	0.0045	0.0134	0.0396	-0.1060
Capitalization	EQV	0.1250	0.0679	0.8002	0.0566
Liquidity Risk	LIQ	0.6447	0.2088	0.9448	0.0163
Efficiency	EEFFR	0.8522	0.6615	56.607	-8.1364
Market Share	MS	0.0259	0.0736	0.5776	0.0001
Credit Risk	CRIS1	0.0083	0.0071	0.0656	0.0013
Concentration Ratio	HHI	0.2344	0.0556	0.3467	0.1550

Table 2. Correlation Among Independent Variables

Sample: 2000-2011

Included observations: 462

Balanced sample

Correlation	EQV	LIQ	EEFFR	MS	CRIS1	NIMY	HHI
EQV	1.000000						
LIQ	-0.271738	1.000000					
EEFFR	0.264956	-0.174112	1.000000				
MS	-0.171680	0.010380	-0.045992	1.000000			
CRIS1	-0.064237	-0.140786	0.015326	0.068756	1.000000		
NIMY	0.060425	0.343921	-0.212983	-0.269582	0.005611	1.000000	
HHI	-0.040111	-0.041812	0.001500	0.011224	-0.128690	0.065455	1.000000

Table 3. Panel Unit Root Test Results

Methods	LLC t*	Breitung t-stat	IPS W-stat	ADF-Fisher χ^2	PP-Fisher χ^2
Level					
ln(ROA)	-7.14 (0.00)	2.75(0.99)	-0.83(0.20)	104.47(0.03)	159.553(0.00)
ln(EQV)	-11.05 (0.00)	1.35(0.91)	-0.07(0.46)	84.77(0.33)	60.07(0.80)
ln(LIQ)	-12.66(0.00)	0.55(0.71)	-3.00(0.00)	146.413(0.00)	72.62(0.70)
ln(EEFFR)	-318.60(0.00)	1.54(0.9)	-30.88(0.00)	135.88(0.00)	182.10(0.00)
ln(MS)	-18.47(0.00)	3.55(0.99)	-0.23(0.40)	69.42(0.79)	48.63(0.99)
ln(CRIS1)	-6.97(0.00)	2.67(0.99)	-0.11(0.45)	97.19(0.09)	130.25(0.00)
ln(NIMY)	-17.30(0.00)	-2.31(0.01)	-3.74(0.00)	137.01(0.00)	123.76(0.00)
ln(HHI)	-30.02(0.00)	-4.70(0.00)	-18.63(0.00)	406.56(0.00)	69.52(0.79)
First Diff.					
Δ ln(ROA)	-12.92(0.00)	-0.92(0.17)	-4.34(0.00)	175.579(0.00)	300.696(0.00)
Δ ln(EQV)	-15.54(0.00)	-3.31(0.00)	-3.24(0.00)	154.02(0.00)	187.58(0.00)
Δ ln(EEFFR)	-1547.8(0.00)	-3.32(0.00)	-113.10(0.00)	181.09(0.00)	303.83(0.00)
Δ ln(MS)	-23.3(0.00)	-4.42(0.00)	-7.86(0.00)	230.83(0.00)	312.59(0.00)
Δ ln(CRIS1)	-24.93(0.00)	-1.01(0.15)	-6.75(0.00)	198.31(0.00)	267.93(0.00)
Δ ln(HHI)	-13.88(0.00)	-14.50(0.00)	-4.29(0.00)	125.45(0.00)	125.46(0.00)
Second Diff.					

Note: All variables are expressed in natural logarithms. Individual intercept and time trend are included in test regressions. These tests examines the null hypothesis of unit root (non-stationary) at 1 percent, 5 percent and 10 percent critical values using the Schwarz criterion for optimum lag differences. The figures in parenthesis are the p-values. The null hypothesis for the first two tests is the existence of a common unit root (non-stationary) while for the other three tests the null is the presence of individual unit root.

Table 4. Hausman Test Results

	Chi-Sq. Statistic
Cross Section Random	12.4527 (0.0866)

Hausman indicates the Hausman (1978) specification test for correlated random effects. This test examines the null hypothesis of no misspecification against the alternative of specification at 5 percent critical value. The figures in parenthesis are the p-values.

Table 5. Panel Estimated Generalized Least Square (PEGLS) Regression

Independent Variables	Profitability (ROA)		
Capitalization (EQV)	-0.070***(-3.60)	-0.070***(-3.49)	-0.06***(-3.29)
Liquidity Risk (LIQ)	-0.021*(-1.95)	-0.021*(-1.88)	-0.020*(-1.70)
Efficiency (EEFFR)	-0.001***(-6.65)	-0.001***(-6.64)	-0.001***(-6.42)
Credit Risk (CRIS1)	-0.914***(-7.63)	-0.914***(-7.37)	-0.907***(-7.09)
Net Interest Margin (NIMY)	0.009(0.14)	0.008(0.14)	0.004(0.064)
Market Share (MS)		0.001(0.023)	0.005(0.075)
Concentration Ratio (HHI)			-0.017(-0.72)
Intercept	0.0002	0.0002	0.0000
Observations	420	420	420
R-Squared	0.243	0.243	0.244
S.E. of regression	0.010	0.010	0.010
F. Statistic	26.61	22.12	19.02
Prob (F. Statistic)	0.000	0.000	0.000

*All variables are expressed in natural logarithms. ***Significant at 1 percent level or 0.01; ** Significant at 5 percent level or 0.05; *Significant at 10 percent level or 0.1. The figures are in parenthesis are values of t-statistics. Three regressions are estimated to control the effects of market share and concentration variables.*

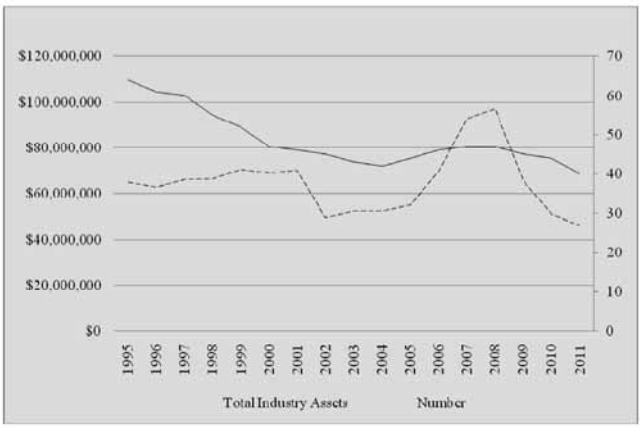

Figure 1. Consolidation in New York State S&L Industry

Source: Authors' own calculation. FDIC Institution Directory

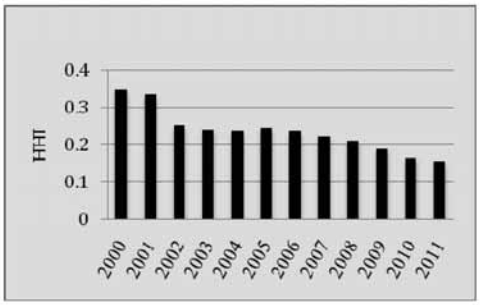

Figure 2. Market Concentration

Source: Authors' own calculation. FDIC Institution Directory

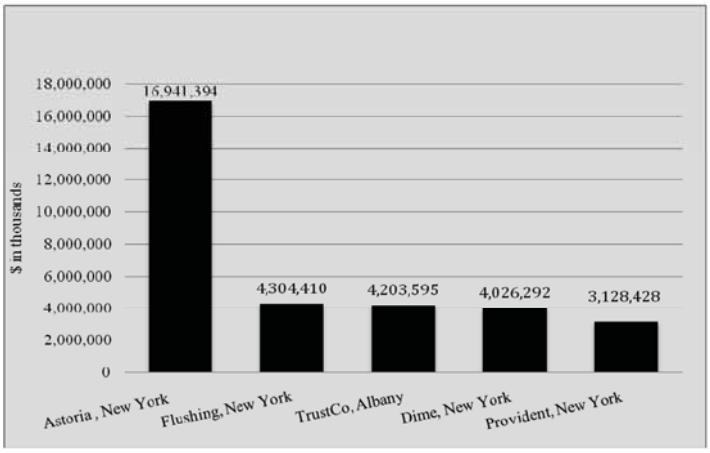

Figure 3. Largest S&Ls, Total Assets (September 31, 2011)

Source: Authors' own calculation. FDIC Institution Directory

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Four-Stage DEA Efficiency Evaluations: Financial Reforms in Public University Funding

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Abstract

Financial reforms in U.S. public higher education are well underway and are progressively replacing university enrollment based funding formulas with performance based models driven, in part, by graduation rates. Doing so, however, fails to account for the internal resource constraints and managerial efficiencies associated with production. Moreover, graduation rates are affected by external factors beyond the control of university decision-makers. This paper addresses these issues and uses a four-stage data envelopment analysis (DEA) model to evaluate university graduation rate performance. The four-stage DEA efficiencies correct for both environmental and statistical noise effects on university operations. Efficiency estimates control for the friendliness of the higher education operating environments as measured by differences in public financial support and educational quality. The results indicate that while universities are favorably efficient according to single stage estimates, additional efficiency gains of about three percentage points arise after accounting for good and bad fortune and external environmental effects. The number of efficient universities is found to more than double, thereby indicating significant shifts in the efficiency rankings of universities. Yet, better quality data is needed and should be forthcoming as universities and states gain greater experience with the implementation of performance based funding and ties to student success.

Keywords: DEA, four-stage, efficiency, finance, universities

1. Introduction

Financial reforms in U.S. public higher education are increasingly tying portions of university funding to student success outcomes, including university degree completion rates. In breaking with traditional student enrollment driven funding models, more than half of the U.S. state controlled public higher education systems have implemented or experimented with some form of performance based funding for allocating tax appropriated dollars (Miao, 2012). Although half of those states abandoned their early funding experiments, the American Association of State Colleges and Universities reports that "boosting college completion rates has led to a national productivity agenda for higher education" and a re-emergence in linking public university financing to student completion rates (Harnisch, 2011). More recently, four states are expected to allocate between five and eighty percent of state appropriated funding based on different performance measures, including degree completions. There are only fifteen states that have no formal activity related to a possible transition to performance based funding. In part, the re-emergence has been stimulated by a post-global financial crisis interest in public management reforms combined with specific concerns related to rising tuition costs and reports that only half of bachelor degree pursing students successfully obtain a college credential (Crellin, et al., 2011).

Using graduation rates to evaluate university performance, however, fails to account for the efficiency with which universities produce student success. That efficiency depends upon the quantity and quality of university resources and internal managerial performance in the allocation of those resources. In this regard, data envelopment analysis (DEA) has been long regarded as the standard non-parametric tool for evaluating operating efficiencies. And although a recent review puts the number of published DEA research papers at 4000 (Emrouznejad, et al., 2008), fewer than 20 studies have applied DEA, in one form or another, to higher education (Sav, 2012). Yet, standard DEA evaluations of university efficiencies are also misleading in that they neglect to account for external environmental factors that affect performance but are beyond the control of university decision makers. In practice, some universities operate in more friendly environments that offer greater financial support for education and better prepare students for success in higher levels of education. Other universities are

compelled to operate in more unfriendly environments. To correctly evaluate university efficiencies in producing student graduation successes, adjustments must be made for the differential advantages and disadvantages created by external environments. To date, that has not been done in any DEA evaluations of university operating efficiencies and, therefore, establishes the basis for the present paper.

The paper provides efficiency estimates of U.S. public universities in producing baccalaureate degrees. The Fried et al. (2002) multistage DEA adjustment model is applied to a sample of 227 Carnegie classified master level universities. Using stochastic frontier analysis (SFA), the model extends the Fried et al. (1999) environmental adjustment methodology so as to include the additional adjustment for statistical noise. Thus, in the context of the current inquiry, universities efficiency estimates are adjusted for the uncontrollable good and bad fortunes that fall upon universities, as well as, the friendly and unfriendly external environmental effects. Three variables are used to adjust for environmental effects. These include differences in financial support, student academic preparedness, and educational quality. The empirical analysis provides first stage DEA efficiency estimates absent of those effects. Second stage SFA estimates are provided and used in a third stage input adjustment process. Repeating the DEA with the revised inputs produces the final stage university efficiencies adjusted for environmental and noise effects. The results indicate the importance of making such adjustments before evaluating the graduation rate performance of universities. The adjustment process increases overall university efficiencies and improves the efficiency rank order for the majority of universities.

The next section of the paper provides details of the methodology, starting with the single stage DEA model and expanding that to the development of the full environmental and noise adjustment model. Included is an overview of the empirical literature. That is followed by an explanation of the data sources and variables, a section presenting the empirical results by DEA stage, and a final section of discussion.

2. Methodology

The evaluation of university operating efficiencies will begin with the variable returns to scale (VRS) DEA model developed by Banker, et al. (1984). The analysis will then proceed incrementally to consider extensions of that model to include effects of environmental factors on efficiency estimates and then the additional need to purge statistical noise from the evaluations. The empirical focus will be on the efficiency with which universities successfully graduate students. The output (y) will be the university graduation rate for undergraduate students. Given the declines in state funding of public universities, it is appropriate to choose an input oriented DEA approach to the efficiency evaluations. That is, over many years and especially since the budget cuts imposed by the global financial crisis, public universities are asked to produce the same or more with less. In addition, preliminary tests produced insignificant differences between the input vs. an output oriented evaluations. That is in general support of the conclusions offered by Coelli (1996) and Coelli and Perelman (1996) that orientation will usually have little effect on efficiency estimates.

2.1 Single Stage, First Stage DEA

We begin with each of k=1,..,N universities producing y through the employment and allocation of x_i inputs, i=1,...I. Ideally, university management has full control over these inputs. Using standard notation (e.g., Cook and Zhu, 2008) and denoting the university under evaluation by the subscript "o", the linear programing problem for the first stage DEA under consideration is

$$\begin{aligned} &\min_{\theta,\lambda} \theta, \text{ subject to:} \\ &\theta x_{i0} \geq \sum_{k=1}^{N} \lambda_k x_{ki} \\ &\sum_{k=1}^{N} \lambda_k y_k \geq y_0 \\ &\sum_{k=1}^{N} \lambda_k = 1, \quad \lambda_k \geq 0 \end{aligned} \tag{1}$$

where the λ are weights or measures of intensity levels for universities. Relaxing the last constraint, results in the original constant returns to scale (CRS) DEA model due to Charnes, et al. (1978). In the empirical implementation, the x_i inputs number seven in total and are explained in detail in the data section of the paper. The optimization process results in the evaluation of the operating performance of each university such that $0 \leq \theta \leq 1$. Universities evaluated as efficient units, $\theta = 1$, lie on the frontier and envelop inefficient units, $\theta < 1$.

The efficiency performances obtained in this stage of the DEA can be attributed to three combined effects: (1) differences in the perspicacity of university management in making decisions over the employment and allocation of institutional resources, (2) random events that impose harm such as tsunamis and terrorism or bestow good fortunes such as unexpected philanthropy, and (3) differences in the external operating

environments in which universities are positioned through their founding charters. Operating environments can differ in that some public universities operate in states within the U.S. that are less higher education friendly and less supportive in valuing higher education relative to other states. For example, differences exist in higher education government appropriated funding gathered through the tax mechanism. Consequently, DEA efficiency scores obtained without accounting for environmental effects would not be comparable for the same managerially competent universities operating in unfriendly state environments relative to those operating in friendly state environments. If resources could be adjusted so as to endow universities positioned in unfriendly states with the additional resources necessary to correct for the differential friendlessness, then the subsequent operating efficiencies could be equal for the same managerially competent universities. And, of course, after the process of resource adjustment, universities obtaining lower efficiency scores could no longer lay claim to hardships imposed by their external environment relative to their counterparts operating in other states.

2.2 Environmental Adjustment

Fried, Schmidt, and Yaisawarng (1999), hereafter FSY, offer a four stage methodology for making resource adjustments to account for effects of external operating environments and, therefore, isolate the performance inefficiency due to management. The adjustment occurs by first determining how external conditions affect the surplus use of inputs, i.e., the total input slacks $x_i - \sum \lambda x \geq 0$ from the first stage DEA. Allowing the external environment to be defined by a set of z environmental variables, a second stage econometric specification is used to estimate

$$s_i^k = f_i(z_i^k, \beta_i, \varepsilon_i^k) \tag{2}$$

where the dependent variables are the input slacks, the β are coefficients to be estimated, and ε represents the error term. FSY employ a Tobit regression for the estimation, although Simar and Wilson (2011) present clear arguments against employing Tobit regression in any second stage DEA approaches. In the third stage, estimated coefficients are used to predict input slacks for each university's input. The original inputs are subsequently adjusted as follows:

$$x(adj)_i^k = x_i^k + (\max^k(\hat{s}_i^k) - \hat{s}_i^k) \tag{3}$$

where the *x*(*adj*) are the adjusted inputs and the "^" denotes estimated slacks. The fourth and final stage is the implementation of the originally specified DEA with the adjusted inputs replacing the original observations. The efficiency estimates obtained in this final process are free of environmental effects. Therefore, any detection of inefficiency can be credited to the internal decision-making of university management combined, however, with the possible impact associated with random effects. Neglect of these latter effects is, therefore, a shortcoming of the FSY model.

2.3 Environmental and Noise Adjustment

Within a matter of three years, Fried, Lovell, Schmidt, and Yaisawarng (2002), hereafter FLSY, extend the FSY model to include the additional adjustment for statistical noise. As declared by FLSY, their model is a three stage approach but in practice it can be staged in four steps and, therefore, for present comparative purposes it will be referenced as a four stage model. Unlike the FSY adjustment, the FLSY second stage requires a SFA specification where the error term is composed of managerial inefficiency (*u*) and statistical noise (*v*). For their proposed cost frontier, the second stage implementation is

$$s_i^k = f_i(z_i^k, \beta_i) + v_i + u_i \tag{4}$$

where *v* is normally distributed with zero mean and standard deviation σ_v^2 and the $u \geq 0$ is normally distributed with mean u and standard deviation σ_u^2. Of course, for the production frontier of interest in the present paper, only minor modifications are necessary as $u \leq 0$. Estimation proceeds with a maximum likelihood method and reparameterization such that $\sigma^2 = \sigma_v^2 + \sigma_u^2$ and γ is estimated by $\sigma_u^2 / (\sigma_v^2 + \sigma_u^2)$. Thus, for a given input slack, if γ equals the value of (zero) one, then there is no (managerial inefficiency) statistical noise. As in the FSY methodology, the third stage requires adjustment to the originally observed inputs. In this FLSY extension, however, inputs are adjusted upwards so as to account for units operating in not only advantageous environments but also in climates showered with good fortune. The more demanding FLSY adjustment proceeds as follows:

$$x(adj)_i^k = x_i^k + (\max f(z_i^k, \hat{\beta}_i) - f(z_i^k, \hat{\beta}_i)) + (\max(\hat{v}_i^k) - \hat{v}_i^k) \tag{5}$$

where the v_i are estimated by

$$\hat{E}\left[v_i \mid v_i + u_i\right] = s_i - z_i\hat{\beta} - \hat{E}\left[u_i \mid v_i + u_i\right] \quad (6)$$

all of which are performed for each university. Once again, the fourth and final stage is a repeat of the input oriented DEA but with the adjusted inputs replacing the original observations.

2.4 Empirical Literature

FSY applied the four stage adjustment model to a 1993 sample of hospital-affiliated nursing homes. Control for environmental climate included nursing home location, ownership structure, and bed size. The mean pre vs. post adjusted efficiencies were approximately 0.52 and 0.68, respectively. In addition, the number of efficient home declined by about 33%. The decline in efficient homes led to the conclusion that the larger number of efficient units in the single stage DEA was due to their enjoyment of favorable operating environments. FLSY use the same sample and variables in employing their environmental and noise adjustment model. With the added noise adjustment, the mean efficiency for nursing homes increased from 0.52 to approximately 0.91. In contrast to the FSY results, however, the number of efficient homes increased and did so rather dramatically by more than twofold. Thus, many homes received low first stage efficiency evaluations due to the combined effects of bad luck and poor operating environments. In a more limited framework, four stage DEA adjustment models have also been applied to energy production (Hu, et al., 2011) and nonprofit social service organizations (Medina-Borja and Triantis, 2011). However, a literature review reveals that only one study exists with respect to an application pertaining to education. Cordero-Ferrera, et al. (2008) use the more limited FSY environmental adjustment to evaluate the efficiencies of 80 Spanish public schools operating during 2001-02 school year. Using two outputs and only two inputs along with three environment variables, they report an efficiency improvement over a single stage DEA of approximately 3.7% with about 58% of the schools achieving efficiency increases greater than 5%.

To date, their does not appear to be any higher education DEA studies that have followed in the footpaths of three or four stage DEA adjustment models. However, there are at least 18 single stage DEA studies that have examined the performance aspects of academic departments or programs in select universities and the efficiencies of universities in different countries. These studies are reviewed in Sav (2012 a). Only one of the studies, however, focused on the interest of the present paper in estimating university level efficiencies related to the production of student academic success. That study by Agasisti and Johnes (2009), however, includes both bachelor and master student graduations along with external research funding in a three output, five input DEA. Thus, it is not possible to disentangle their three outputs and examine only graduation rate outcomes. For their 2003-04 academic year samples of Italian (N=57) and English (N=127) universities, the overall efficiency estimates varied from approximately 0.81 under CRS to 0.89 under VRS. In a more recent study, Sav (2012 b) uses graduation rates as a single output along with ten inputs in DEA estimates for 198 private universities and 216 public universities operating in the U.S. over the 2005-09 academic years. For the public university sector, mean efficiencies varied from 0.57 under CRS to 0.65 under VRS. Private universities, considered to be more academically selective in regards to student admissions, had graduation CRS and VRS efficiencies of 0.60 and 0.71, respectively. In either sector, the budgetary cuts accompanying the global financial crisis could not be sorted out and may be, in part, responsible for the lower efficiencies when compared to the Agasisti and Johnes (2009) findings. In any event, neither of these single stage studies accounted for possible impacts on university operating efficiencies that could be due to differences in external environments, be they academic, regulatory, or financial. That absence establishes the need and motivation for the present study.

3. Data

3.1 Sources

University level data are drawn from the U.S. National Center for Education Statistics, Integrated Postsecondary Data System (IPEDS). The sample includes Carnegie classified master level universities offering baccalaureate degrees and involved in graduate program education to a limited extent. The higher level research intensive-doctoral granting classified universities are not evaluated due to the fact that they tend be more selective in undergraduate admission standards and engage heavily in professional education, including law, medical, etc. for which separate input data are unavailable in a national data base. Since the methodology is based in both DEA and SFA, four academic years of data, 2005-09, are averaged so as to smooth university production (e.g., Ruggiero, 2007). From IPEDS, the output is the university's graduation rate defined as baccalaureate degree completion within 150% of standard time. On the input side, it was possible to construct

seven variables believed to capture the effect on graduation rates due to institutional characteristics and managerial decision-making. For each state in the U.S., there are three higher education environmental variables obtained from the National Center for Higher Education Management Systems (NCHEMS) data base. Merging the IPEDS and NCHEMS data produced a useable sample of 227 public universities operating in 42 states. A summary of the variables along their descriptive statistics is presented in Table1 and is discussed in the following.

Table 1. Output, Inputs, and Environmental Variables

	Mean	Std. Dev.	Minimum	Maximum
Output				
Grad-Rate, %	45.17	13.19	14.01	86.14
Inputs				
Enroll-Size, #	8610.16	5510.76	1136	31673
Prepared, #	895.63	85.95	706	1240
Low-Inc, %	33.00	14.43	8	73
Post-Bacc, #	1600.37	1341.26	20	7116
Faculty, #	342.21	185.93	59	950
Student-Exp, $	1403.00	590.68	418.38	4856.99
Instruct-Exp, $	35.94	6.40	19.48	54.02
Envirnonments				
Govt-Support, $	6894.18	1123.42	3505.00	10294.00
Sch-Quality, #	190.03	39.62	125.40	271.40
Import-Export, #	1.15	0.56	0.13	3.35

3.2 1nput Variables

In one form or another, the input variables have been used in previous DEA or SFA higher education studies and, therefore, require only brief explanations (see Sav, 2012b and 2012c for a review of such studies). The first three inputs in Table 1 are student-institution related. The first (Enroll-Size) measures the size of the institution based on the total undergraduate student enrollment. Conventional wisdom holds that larger institutions are less individually student oriented and would, therefore, produce lower rates of student academic success, *ceteris paribus*. Academic preparation of students presents an increasing issue of concern in higher education and is measured here by student SAT (Scholastic Aptitude Test) standardized admission test scores (Prepared). Low-Inc is the percentage of enrolled students on low-income federal government grants and is intended to capture the financial difficulties of student retention but also the possibility of arriving from low income, underfunded primary and secondary school districts. Also included is the total enrollment of students at the post baccalaureate level (Post-Bacc) as a measure of a university involvement in graduate level education. The data is unrefined data, so this could include students enrolled in traditional graduate programs as well as non-traditional certification or re-training type programs. Greater involvement in graduate education could either enhance or detract (given resource constraints) from a university's focus on undergraduate education. The current literature provides no *a priori* insights into the effect on undergraduate student success as could be effected by graduate programs or graduate student presence. The last three inputs in Table 1 would generally be expected to have positive effects on a university's overall success in graduating students. That includes the positive effects of faculty employment (here measured by teaching faculty employment and excluding administrative faculty, e.g., department chairs and deans), the allocation of university expenditures in providing student services, and the allocation of university resources in supporting academic instruction.

3.3 Environmental Variables

Three environmental variables are included to capture different aspects of the external operating environment pertaining to the states in which public universities are chartered, regulated, and funded. The Govt-Support variable is the state and local government contribution to public university operating expenses per full-time equivalent student. States (i.e., constituents) that place a greater value on higher education and, therefore, are more educationally supportive in offering their tax dollars are deemed more friendly in creating an operating environment for public universities. As noted in Table 1, that support varies across states from a low of approximately $3,500 to over $10,000 per student. In addition, it is necessary to consider the quality of education delivered throughout the primary-secondary school experience as that affects the academically prepared pool of

students for university admissions. Thus, a school quality (Sch-Quality) variable is included as a means of controlling for the primary-secondary environment facing universities. The variable is the number of high school students per 1,000 that score at the 80th percentile and above on either the SAT or ACT (American College Testing) tests. The better the Sch-Quality, the better the environment for producing higher education graduates. However, students attending public universities do not always attend the same resident-state institution. Inter-state differences in tuition, program offerings, and overall university quality, among other things, drive students across state borders. College choices and migration of college-going students is beyond the scope of the present paper. Rather, it is assumed here that the total effect of a state's higher education friendlessness-cost-quality combinations influence its ability to keep resident students and attract students from other states. The net effect is measured by the variable Import-Export that is calculated as the number of college freshman imported from other states relative to the number of resident freshman attending college out-of-state. An Import-Export greater (less) than one is assumed to be indicative of a more friendly (unfriendly) higher education environment.

4. Results

4.1 First Stage DEA

The first stage DEA results are offered in Table 2 for both constant and variable returns to scale estimates. With the presence of scale inefficiencies the lower CRS efficiencies indicate that universities are approximately 71% efficient on average. The VRS mean efficiency is 94% and is comparable to, for example, the mean efficiency of approximately 90% for Italian and English institutions (Agasisti and Johnes, 2009), although direct comparisons are questionable given the differences in sampling of academic years, model specifications, and the inter-country differences in the regulation and financing of higher education. In the present evaluations, the minimum efficiency under CRS is surprisingly low at 0.239. Under VRS, the minimum appears more reasonable at 80%. By the same token, only 15 universities are efficient under CRS but that rises to 48 or more than 20% of all universities under VRS. With regard to the returns to scale, none of the universities are found to operate under decreasing returns to scale. Increasing returns prevails among a full 86% of the institutions.

Table 2. DEA First Stage Unadjusted Efficiencies

	CRS	VRS	Scale
Mean	0.713	0.944	0.754
Median	0.710	0.945	0.762
Minimum	0.239	0.788	0.259
Maximum	1	1	1
Std. Dev.	0.166	0.046	0.162
Efficient, #	15	48	
Efficient, %	6.61%	21.15%	
Decreasing			0%
Constant			6.07%
Increasing			85.83%

4.2 Second Stage SFA and Third Stage Adjustments

Table 3 reports the second stage SFA estimates. Following FLSY, the estimates are based on the half normal specification of the inefficiency component. The SFA slack estimates are presented for four of the seven inputs, including Enroll-Size, Prepared, Post-Bacc, and Faculty. Tests on the slack estimates for Low-Inc, Student-Exp, and Instruct-Exp rejected the frontier specification and the OLS results produced adjusted R^2s that did not exceed 0.05. Thus, it was determined that no adjustments were to made with regard to these three inputs. But for the four significant slack estimates, managerial inefficiency is significant in determining the excess use of inputs. In fact, in the Enroll-Size and Faculty estimates, the gamma estimates are very close to indicating that all of the slack is due to management. That inefficiency is weaker but statistically significant in the Prepared and Post-Bacc slacks where statistical noise, therefore, carries relatively greater impact. The results also indicate that the external environment affects input slacks. The coefficients for all three environmental variables are consistently negative in the Enroll-Size and Faculty slacks, thereby suggesting that greater government funding support, better primary and secondary schools, and a state's ability to be a net importer of college-going choice is consistent with a friendly or favorable higher education environment. The better those environmental conditions,

the less excess there is of student enrollment and faculty employment at the university level. In the remaining two slack estimates, the environmental effects are weak and only the Sch-Quality effect could be considered significant but only if the level of significance was moved to approximately 20%. But again, gamma, along with the likelihood ratios, is statistically significant and supports the frontier specification.

Table 3. SFA Estimates of DEA Input Slacks for Environmental Variables

	Enroll-Size	Prepared	Post-Bacc	Faculty
Constant	*32.498	0.157	*10.801	*15.787
	(0.666)	(0.266)	(5.381)	(5.508)
Govt-Support	*-1.653	0.009	0.188	*-0.768
	(0.187)	(0.029)	(0.684)	(0.400)
Sch-Quality	*-1.585	*-0.036	*-0.810	*-0.553
	(0.225)	(0.005)	(0.328)	(0.261)
Import-Export	*-0.275	0.007	-0.087	*-0.207
	(0.160)	(0.009)	(0.201)	(0.113)
Sigma Sq.	*35.246	*0.015	*33.243	*14.848
	(3.067)	(0.001)	(3.410)	(0.552)
Gamma	*0.999	*0.980	*0.997	*0.999
	(0.0003)	(0.002)	(0.002)	(0.00007)
Likelihood	*-566.54	*261.76	*-571.11	*476.89
Likelihood Ratio	108.828	214.598	32.819	57.763
Max s_i	27138.35	1.042	1.47	171.03
Mean s_i	13769.29	1.009	1.17	34.02
Max v_i	27138.26	1.0032	1.0003	1.062
Mean v_i	77.41	1.0003	1.0002	1.06

Note: Asterisk denotes significance at the 10% level and better. Max si ,vi are for Eq. (5) and are presented in original measurement units.

The stage two parameter estimates are used to predict university input slacks and determine the necessary values for performing the adjustments to observed inputs. The maximum and means from that the estimation process are reported in the lower portion of Table 3. These correspond to the maximums and means of the predicted slacks due to the environment and due to statistical noise. The means from the predicted results are consistently positive and indicate that, on average, unfriendly higher education environmental effects are present with regard to each of the four university inputs. Also, there is some good fortune at work as indicated by the presence of statistical noise.

4.3 Final Stage DEA

The final stage DEA estimates are based on the adjusted inputs and are given in Table 4. Compared to the first stage estimates, all university efficiency measures improve with the adjustments for education environmental effects and good or bad fortune. For both the CRS and VRS, the efficiency gain is a little over 0.03 or 3% points, e.g., the VRS efficiency increases from 0.944 to 0.976. With the input adjustments in place, the median VRS efficiency is 0.995, an increase of 5% points. With the scale inefficiencies present in the CRS estimates, there is not much movement in the minimum efficient university (0.252 from 0.239). Under VRS, however, there is nearly a 7% point increase (0.788 to 0.856). Although these efficiency improvements are not as dramatic as those reported in the FLSY study of nursing homes, it must be noted that the initial DEA efficiency for those nursing homes started at a low of just over 50% (i.e., 0.522) in comparison to the present first stage university efficiencies of 94%. Here, however, as with FLSY results, there is more than a 100% increase in the number of efficient universities; 108 vs. 48. That, along with the mean, median, and minimum efficiency improvements, lends support to the notion that the efficiency with which universities can produce student graduates is affected by government funding and support of not only higher education, but also primary and secondary education in preparing students for college success.

Table 4. Final Stage DEA Input Adjusted Efficiencies

	CRS	VRS	Scale
Mean	0.747	0.976	0.764
Median	0.756	0.995	0.774
Minimum	0.252	0.856	0.27
Maximum	1	1	1
Std. Dev.	0.167	0.033	0.163
Efficient, #	21	108	
Efficient, %	9.25%	47.58%	
Decreasing			0%
Constant			8.50%
Increasing			83.40%

University efficiency rankings can offer additional insights into the effects of the adjustments made for different operating environments. However, unlike the FLSY nursing home application with categorical environmental variables, presently there are three continuous environmental variables varying across 42 states. Thus, it is not practical to present all possible outcomes. From a more aggregate perspective, a comparison was made between the efficiency rankings based on the first stage unadjusted estimates and the rankings based on the final input adjusted efficiencies. The mean rank change was found to be 25.45, using the VRS estimates. The rank correlation was 0.78. The aggregate effects of the adjustment process led to 171 universities improving their ranking, 9 universities losing ground, and 47 universities maintaining the same rank position. Note that the efficiency rankings are shifting simultaneously with a shift in the efficiency distribution, the latter being the effects as presented in Table 4.

In attempt to uncover how the adjustment process leads to rank changes for a given environmental effect, the Govt-Support environments are collapsed into three categories of funding levels and presented in Table 5 along with a decomposition of the rank changes.

Table 5. University Efficiency Rank Changes: Final vs. First Stage

		Efficiency Rank Changes (Δ)			
Govt-Support (G)	*N*	$\Delta > 0$	$\Delta = 0$	$\Delta < 0$	Mean Δ
High (G>$7,000)	111	84	24	3	41.13
Medium ($6,000 $\leq$ G $\leq$ $7,000)	58	52	6	0	50.50
Low (G<$6,000)	28	35	17	6	25.44
Total	227	171	47	9	39.51

Thus, 84 of the 111 universities operating in the highest government financial support environments experienced rank improvements following input adjustments. Rank improvements occurred with respect to 35 of the 58 universities housed in the lower support environments and for the 52 of the 58 universities in the categorized middle support environment. The problem, of course, is that it is not appropriate to attribute all of the university rank changes presented in Table 6 to adjustments for government financing environments. There are two other external environmental factors at work along with good and bad fortune coming into play. Unfortunately, given the large number of environmental combinations involved, it is impractical to present marginal effects for each possible combination. Somewhat of an artificial comparison is that shown in the last column of Table 6. The mean rank improvement for universities operating in the highest government funding category (41) is smaller in comparison to the mean rank improvement (50) in the less friendly mid government funded category.

5. Discussion

Changes in the financial landscape facing public universities are well underway and are placing future funding accountability on the ability to produce student academic success, including degree completion rates. While a focus on graduation rates breaks with conventional enrollment based funding, it falls short of traditional

measures of economic efficiency to evaluate university performance. To investigate those efficiencies, this paper employed DEA and compares efficiency estimates obtained from single stage evaluations to four stage adjustments for both environmental and noise effects. The final stage non-parametric efficiencies rely on second and third stage SFA parametrically determined adjustments to university inputs. Thus, the efficiency adjustments occur on the basis of good and bad fortune falling upon universities as well as external factors affecting efficiency but beyond the control of university decision-makers. The latter are determined by state governing boards and legislators and end up as measures of differences in the government financial support of higher education, the college preparedness of high school graduates, and the quality of higher education as determined by the import and export of college going students.

The results indicate that the mean university efficiency improvement is on the order of 3% points, increasing from 0.944 in a single stage DEA evaluation to 0.976 when employing the FLSY (Fried et al., 2002) adjustment process for noise and environmental effects. Given that the present analysis is believed to be the first to apply the FLSY adjustment model to higher education, there does not exist a benchmark evaluation for comparison. For the nursing home results produced in the FLSY application the efficiency improvement over single stage DEA was 0.91 vs. 0.52. Thus, the current university efficiency improvement is not as dramatic as that presented for nursing homes, suggesting greater managerial inefficiencies and more important environmental effects in that portion of the health care industry relative to higher education. Nevertheless, the smaller efficiency differential for universities does not diminish the need for and importance of the adjustment process when the stakes involve the allocation of millions of dollars of tax appropriated university funding. Moreover, a striking difference resulting from the adjustment process was found to be the increase in the number of efficient universities from 48 to 108 or more than a 100% increase. Thus, the combined evidence is supportive of both a positive shift in the efficiency distribution and a change in the efficiency ranking of universities. The latter would be of particular importance if any public university performance based funding model appropriately accounts for efficiency differences in delivering the academic success of students.

The analysis is not without its shortcomings, most of which have also plagued previous single stage DEA evaluations of higher education and pertain, in general, to issues associated with the quality of data. A particularly troublesome area relates to the absence of controls for variations in teaching quality. Here, as elsewhere, faculty employment had to be used to measure teaching inputs. The national data base does not provide any data related to teaching loads, grade distributions, or other information at the instructor level that could possibly proxy teaching quality. On the student input side, the analysis did include a measure of incoming student preparedness based on achievement test scores. However, for continuing students, the data did not permit any distinction between part-time and full-time student graduation rates or the effect on graduation due to student transfers between universities. There was an attempt to include some measure of the minority and ethnic composition of the student body but missing observations would have severely reduced the sample size. With respect to the variables used to measure external university environments, the major focus was at the state level. There are local environmental factors that likely affect university graduation success but escaped the analysis. For example, many master level universities draw the majority of their students from local markets, i.e., school districts. Those school districts can vary widely in quality and affect the student preparedness pool for university enrollments. There may also be some regional environmental variations associated with accrediting boards that need to be taken into account. We should expect a supply of better quality data as states and individual universities gain experience in the implementation of performance based financing that ties funding to student academic success. That data should benefit future research in investigating the efficiencies with which universities produce student academic success and, ultimately, graduations.

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Risk-return Predictions with the Fama-french Three-factor Model Betas

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Abstract

A three-factor model regime has replaced the CAPM regime in academic research. The CAPM regime may be said to have ended with Fama and French's (1992) finding that market beta does not predict return. Strangely, the three-factor model has not received scrutiny relative to the ability of the model to predict return and variation in return for portfolios. In this paper we test the ability of the three-factor model to predict return and return variation. We find that portfolios can be formed on the basis of the three-factor that vary with expectations in terms of risk and return. We find, however, that the CAPM performs these goals with greater efficiency. In particular expected returns for extreme portfolios are poor predictors of actual returns. Raising questions about the use of the three-factor model to risk adjust. We dissect the three-factor model's predictive ability and find that inclusion of the systematic risk variable dealing with the book-to-market ratio distorts predictions and that a model including the market beta and the factor loading dealing with firm size seems to predict more efficiently than either the three-factor model or the CAPM.

Keywords: capital asset pricing model, beta, fama-french three-factor model, risk-adjusted return, book-to-market ratio

JEL Classifications: G10, G11, G12.

1. Introduction

Modern Portfolio Theory as developed by Markowitz (1952) and others, asserts that investors need only to assess systematic risk and may ignore idiosyncratic risk of an individual security when creating a well-diversified portfolio. If the market is efficient, accurate modeling and measurement of systematic risk allows for determination of expected portfolio return. Comparisons of actual return to the expected return based on systematic risk in turn allows for measurement of risk-adjusted return and portfolio performance. One may identify two regimes in the academic literature for the measurement of systematic risk and subsequent measurement of risk-adjusted returns: the Capital Asset Pricing Model (CAPM) regime, which may be dated from the Mid 1960s through the early 1990s, and the Fama-French three-factor model (FF-3FM) regime, which may be dated from the early 1990s through the present day.

The CAPM, as developed by Sharpe (1964), Lintner (1965) and Mossin (1966), states that the systematic risk of a security can be determined by a single variable, the security's sensitivity to changes in the overall market, the security's market beta. Although difficulties existed with the application of the model (for example how to measure total market return), during the CAPM regime expected return for a portfolio was measured as:

$$E(R_{pt}) = \beta_p \cdot E(R_{mt}) \tag{1}$$

Here the expected return of a portfolio in excess of the risk free return for a particular time period, $E(R_{pt})$, is determined by the portfolio's beta, and the expected return of the market in excess of the risk free return for the same time period, $E(R_{mt})$.

The CAPM provided a straightforward means of risk-adjusting returns and measuring the portfolio manager's performance. Under the CAPM regime the manager sought to earn a return in excess of the return predicted by equation (1). That is, the portfolio manager attempted to earn a positive "alpha" as shown in equation (2):

$$R_{pt} = \alpha_p + \beta_p \cdot R_{mt} \tag{2}$$

where the portfolio and market excess returns are the realized returns rather than the expected returns for a given time period.

Empirical studies in support of the theoretically developed CAPM such as Black, Jensen and Scholes (1972) and Fama and MacBeth (1973) found a positive relationship between portfolios betas determined in estimation periods and portfolio returns in a subsequent test periods. These results sustained the use of the CAPM during the extended regime of the model, but two lines of research developed which ultimately ended the CAPM regime. First, the CAPM's claim that beta risk was the sole determinant of the expected return for a well-diversified portfolio was challenged by the discovery of a number of anomalies. For example, portfolios of small-firm securities and portfolios of securities with high book-to-market (BtM) ratios were shown to earn higher returns than justified by beta risk [see for example Banz (1981) and Rosenburg, Reid and Lanstein (1985)]. The second line of research found temporal inconsistencies in the relationship between estimated portfolio betas and realized portfolio returns. Reinganum (1981) found inconsistencies in the relationship between betas and returns across years and Tinic and West (1984) found inconsistencies across months of the year, although Pettengill, Sundaram and Mathur (1995) showed that these results followed from a failure to distinguish between up and down markets in the test periods. These two lines of research blended in a seminal study that saw the end of the CAPM regime.

The beginning of the end of the CAPM regime may be dated as the publication of the landmark study, Fama and French (1992). In this study, Fama and French find that for securities firm size and BtM ratios explain returns but beta does not. They argue that firm size and the BtM ratio must proxy for systematic risk but that beta evidently does not. Fama and French (1993) introduce a three-factor model, FF-3FM, which explains the returns for portfolios examined in their study. The model they introduced has widely supplanted the CAPM in risk-adjusting returns in academic studies and in studies published in the practitioner literature. Because the three-factor model has become dominant in research studies we may speak of the existence of a three-factor model regime. The FF-3FM model is specified as:

$$E(R_{pt}) = \beta_{pm} \cdot E(MKT_t) + \beta_{ph} \cdot E(HML_t) + \beta_{ps} \cdot E(SMB_t) \quad (3)$$

In this model the expected return in excess of the risk-free rate for a portfolio, $E(R_{pt})$, depends on the level of three systematic risk factors and the portfolio's exposure to each of these factors. The first factor (ironically given the finding that the CAPM beta does not explain returns) duplicates the factor in the CAPM, (R_m, now denoted as *MKT*). The second factor, *HML*, measures the return of a zero-investment portfolio long in securities with high BtM ratios (value securities) and short in securities with low BtM ratios (growth securities). The third factor, *SMB*, measures the return of a zero-investment portfolio long in small-firm securities and short in large-firm securities. The factor loadings of β_{pm}, β_{ph}, and β_{ps} measure portfolio *p*'s respective exposure to each of these systematic risk factors.

The FF-3FM model has clearly replaced the CAPM in terms of risk-adjusting in research studies. The CAPM, however, remains the dominant model in business applications (Note 1). And surprisingly there has not been, as there was with the CAPM, studies of the ability of the FF-3FM to build portfolios which produce return variation in accordance with model predictions. This lack of study is curious as it was in large part the failure of the CAPM to meet this criterion, according to some studies, that led to the end of the CAPM regime.

Koch and Westheide (2010) study the relationship between the FF-3FM betas and future returns. They find that all three factors have significant predictive ability for the returns for the twenty-five portfolios formed based on BtM and size [as created by Fama and French (1993)] when markets are divided into up and down markets based on these factor loadings. They find, however, that the factor loadings on *SMB* and *MKT* beta are not paid a risk premium. Robustness tests for other portfolios formed on factors such as momentum provide additional questions as to the predictive ability of the factor loadings of the three-factor model.

In this paper we provide a more direct test of the FF-3FM model by forming portfolios based on estimated security returns as predicted by factor loadings and historic factor values. We seek to determine if portfolios formed on this basis will show the risk-return profiles predicted by the FF-3FM. For comparison purposes we include predictions based on the CAPM. The rest of the paper proceeds as follows. In Section II, we present the methodology used to form the portfolios based on the FF-3FM and CAPM and report results of portfolio performance. We find that the FF-3FM and CAPM both allow the creation of portfolios which exhibit expected risk-return profiles. Indeed the results from these two models appear to be surprisingly similar. There are, however, difficulties with the predictions of both models. In Section III, we dissect the FF-3FM to determine which factor loadings are essential for accurate predictions. We find that a two-factor model including the size

and market betas appears to provide superior predictions to the FF-3FM. We present our conclusions in Section IV.

2. Predicting Returns and Risk: FF-3FM and CAPM

2.1 Methodology

For nearly two decades, the FF-3FM model has been the dominant model to risk-adjust return in research studies. Perhaps because of the empirical nature of the FF-3FM, it has not been subject to the same type of testing of its predictive power as was applied to the theoretical CAPM. In this paper we build portfolios using the FF-3FM which should vary in terms of a risk-return continuum. For comparison purposes we apply identical sampling procedures to the CAPM, building portfolios that should likewise experience differentiation along a risk-return continuum.

Our methodology most closely follows the seminal work of Fama and MacBeth (1973) as applied to the CAPM. We estimate security betas in a sample period, create portfolios at the end of the period and then monitor portfolio performance in a subsequent one-year period. We estimate beta for securities with monthly return data available in the CRSP dataset using three-year estimation periods. In our estimation process we include all securities available on the CRSP tape with the exception of ETFs, Closed-End Funds and ADRs. We require that each security included in the estimation process has at least 24 months of return data during the three-year estimation period. For the FF-3FM we estimate three betas for security using equation (4):

$$R_{it} = \beta_{im} \cdot MKT_t + \beta_{is} \cdot SMB_t + \beta_{ih} \cdot HML_t + \varepsilon_{it} \tag{4}$$

and for the CAPM we estimate the single market beta using equation (5):

$$R_{it} = \beta_{im} \cdot MKT_t + \varepsilon_{it} \tag{5}$$

where all variables are as defined for equations (3) and (2) except we have realized values instead of expected values for each of the factors. In our estimation of *MKT* beta we use the CRSP value-weighted index to determine market return. To determine the *SMB* beta and the *HML* beta, we acquire the returns for the two zero-investment portfolios from Kenneth French's website.

At the end of each three-year period we form ten portfolios based on estimated security betas. For the CAPM the portfolio formation follows the procedure of the Fama and MacBeth (1973) methodology. We rank all securities based on estimated market beta placing the ten percent of the securities with the highest beta into portfolio 1, and so on, until the 10% of the securities with the lowest betas are placed into portfolio 10. The CAPM predicts that Portfolio 1 should enjoy the highest realized return at the cost of the highest realized risk. Likewise, Portfolio 10 should enjoy the lowest realized risk at the cost of the lowest realized return.

We follow portfolio formation in the same spirit of the Fama and MacBeth (1973) procedure as we form portfolios for the FF-3FM. We use the same three-year estimation periods and regress monthly security excess returns against monthly values for all three factors. Thus, we gain three beta estimates for each security that we will jointly use to create portfolios with a goal of producing outputs consistent with a risk-return tradeoff. When creating portfolios based on the CAPM a single beta is used to create portfolios. When creating portfolios based on the FF-3FM, three factor betas are used and the formation procedure cannot be a straight forward result of beta values. The FF-3FM is an empirical rather than a theoretical model, and, as such, does not provide a theoretical basis to combine the three betas to form total risk. Because the three betas measure the sensitivity of a security's return with respect to each of the three factors whose values are distinct, it is not meaningful to simply add the three betas to determine total systematic risk. We can, however, use the model to predict expected return in excess of the risk-free return. If the risk-return tradeoff holds and the FF-3FM accurately measures risk, those securities with the higher expected return according to the model should also have the higher expected risk. Thus, using the observed average value from the entire sample period for each factor we predict expected excess return (Note 2) for each security at the end of each estimation period using equation (6).

$$E(R_{it}) = \beta_{im} * (\overline{MKT}) + \beta_{ih} * (\overline{HML}) + \beta_{is} * (\overline{SMB}) \tag{6}$$

where all variables are as defined in equation (3) except that the factor values represent average values over the entire sample period instead of expected values.

Based on these expected returns, we place each security in one of ten portfolios. As with the CAPM formation process, Portfolio 1 contains the securities with the highest expected return and, by inference, the highest expected risk. Portfolio 10 contains securities with the lowest expected return and by inference the lowest expected risk.

We hold portfolios for a one-year period including in the portfolio any security with a reported return for any month during the holding period. We calculate the portfolio return for each month of the one-year holding period as the equally-weighted return of all securities in the portfolio. We use overlapping sample periods to estimate the betas and observe portfolio returns. The portfolios are rebalanced at the beginning of each estimation period. Our first estimation period uses data from January 1927 through December 1929. Based upon these estimates we form portfolios that are held for the period from January 1930 through December 1930. Our penultimate estimation period uses data from January 2005 through December 2007. Based upon these estimates we form portfolios that are held for the period from January 2008 through December 2008. Our final estimation period uses data from January 2006 through December 2008. Based upon these estimates we form portfolios that are held for the period January 2009 through December 2009. There are a total of 80 such estimation (and holding) periods.

Our goal is to investigate if the FF-3FM can create portfolios with a risk-return profile consistent with the model's prediction and to compare the performance of the FF-3FM to the performance of the CAPM. If these models effectively measure risk and the market rewards investors for assuming risk, for both models Portfolio 1 should achieve the highest average return and experience the highest risk. Portfolio 10 should experience the lowest risk at the cost of the lowest average return. Moving across portfolios from Portfolio 1 to Portfolio 10 both realized returns and risk should decrease monotonically.

To achieve our goal of measuring the efficiency of the model in the creating portfolios that vary along a risk-return continuum our methodology must differ from previous studies. Studies such as Fama and MacBeth (1973), Tinic and West (1984), and Fama and French (1992) test the CAPM by comparing portfolio or security betas to returns. There are two reasons why we must take a different tack on this study. First, while the CAPM allows a test between a single beta and returns, the FF-3FM assumes a relationship between return and three betas with no guidance as to how to combine the several betas into a single measure of risk. Second, we seek to examine risk on an ex-post basis in which case the appropriate measure for risk becomes total risk not systematic risk. Thus, we measure portfolio performance by computing the average monthly return for the portfolio across the 80 sample holding periods and the standard deviation of monthly return across the 80 sample holding periods.

Because the use of the standard deviation of return as a post-formation measure of risk may strike the reader as inappropriate, we provide some additional clarification. We acknowledge that the standard deviation of monthly returns is not an appropriate *ex ante* measure of risk for a security, because only systematic risk should be considered in adding a security to a portfolio. On an *ex ante* basis one might measure a security's covariance with the market to determine that security's addition to total portfolio risk. We are, however, examining risk post-portfolio formation for the entire portfolio. On this *ex post* basis the variation in portfolio returns as measured by standard deviations in monthly returns is the appropriate measure of realized risk. If we measure return performance on an ex-post basis we should do the same for portfolio risk performance! Previous tests have, for the most part, assumed that *ex ante* beta risk repeats. In their second stage of model test, Fama and MacBeth (1973) implicitly test this assumption by examining whether the rank of portfolio betas follow the ranking of the created betas. Because on an *ex post* basis the question for a portfolio manager is the total variation in the portfolio, we directly examine risk on this basis.

2.2 Portfolio Performance: FF-3FM and CAPM

We have formed ten portfolios based on expected return and risk in accordance with factor loadings on the FF-3FM. Portfolio 1 is built with securities which have the highest expected return and expected risk according to the FF-3FM. We build nine additional portfolios each with a lower expected return and risk based on beta loadings on the FF-3FM equation until we create Portfolio 10 which has the lowest expected return and risk. Our goal is to test whether measuring risk using the FF-3FM could allow a portfolio manager to reliably build portfolios along a risk-return continuum. Results reported in Panel A of Table 1 indicate the average monthly return and standard deviation of monthly return for the ten FF-3FM portfolios. These results suggest that the FF-3FM can be used to build portfolios tailored for an investor's risk-return tradeoff. Portfolio 1 has the highest realized average return among the ten portfolios and average returns generally fall across portfolios as *ex ante* risk falls. Likewise, Portfolio 1 has the highest realized risk among the ten portfolios as measured by the standard deviation in monthly returns. Thus *ex post* risk generally falls across portfolios as predicted by the declining *ex ante* risk.

Table 1. Portfolios sorted by expected returns

	Portfolios sorted by expected returns from the highest (1) to the lowest (10)										Spearman's Rank	
	1	2	3	4	5	6	7	8	9	10	Rho	P-value
(A) FF-3FM[a]												
Expected return	0.0216	0.0144	0.0117	0.0097	0.0082	0.0068	0.0055	0.0041	0.0024	-0.0017	---	---
Realized return	0.0188	0.0166	0.0140	0.0145	0.0146	0.0121	0.0115	0.0113	0.0111	0.0130	0.8303	0.0022
Std Dev.	0.1111	0.0914	0.0814	0.0749	0.0702	0.0631	0.0556	0.0529	0.0521	0.0671	0.8788	0.0004
Return/Risk	0.1696	0.1812	0.1723	0.1929	0.2084	0.1923	0.2061	0.2134	0.2133	0.1937	-0.7818	0.0070
(B) CAPM[b]												
Expected return	0.0145	0.0108	0.0091	0.0079	0.0068	0.0059	0.0050	0.0041	0.0031	0.0012	---	---
Realized return	0.0167	0.0155	0.0153	0.0148	0.0132	0.0129	0.0118	0.0127	0.0115	0.0131	0.8667	0.0007
Std Dev.	0.1147	0.0979	0.0836	0.0801	0.0686	0.0633	0.0552	0.0560	0.0488	0.0528	0.9758	0[c]
Return/Risk	0.1456	0.1586	0.1830	0.1843	0.1927	0.2040	0.2131	0.2265	0.2367	0.2479	-1.0000	0

a. FF-3FM: Fama-French three-factor model. Stocks are sorted by the estimated returns from the following equation: $\hat{E}(R_{it}) = \hat{\beta}_{im} \cdot \overline{MKT} + \hat{\beta}_{is} \cdot \overline{SMB} + \hat{\beta}_{ih} \cdot \overline{HML}$, where $\hat{\beta}_i$'s are the estimated betas from the regression $R_{it} = \beta_{im} \cdot MKT_t + \beta_{is} \cdot SMB_t + \beta_{ih} \cdot HML_t + \varepsilon_{it}$ during the three-year estimation periods, and $\overline{X}$ is the mean of the *X* factor (*X*=*MKT*, *SMB*, or *HML*) from the entire sample period (1927-2009). The reported realized return is the mean of the monthly portfolio returns from the 80 holding periods after the estimation periods.

b. CAPM: Stocks are sorted by the estimated returns from the following equation: $\hat{E}(R_{it}) = \hat{\beta}_{im} \cdot \overline{MKT}$, where $\hat{\beta}_{im}$ is the estimated beta from the regression $R_{it} = \beta_{im} \cdot MKT_t + \varepsilon_{it}$ during the three-year estimation periods. The reported realized return is the mean of the monthly portfolio returns from the 80 holding periods after the estimation periods.

c. These P-Values are nonzero but small than 0.00005.

To provide a statistical measurement of the ability of the FF-3FM to create portfolios delineated along a risk-return continuum, we utilize the Spearman rank order coefficient of correlation. Portfolio 1 is provided a rank of 10 in terms of expected return and so on with Portfolio 10 receiving a rank of 1. These ranks of expected return are matched with rankings of actual returns to determine the Spearman coefficient of correlation. A similar procedure is followed with regard to actual and expected risk levels. In both cases a significantly positive correlation would support the ability of the FF-3FM to provide investment guidance.

As shown in Panel A of Table 1 the formation process based on FF-3FM creates portfolios that adhere to an appropriate risk-return tradeoffs. The Spearman coefficient of correlation between expected and actual return rank is 0.8303 and the corresponding p-value is a highly reliable 0.0022. The evidence for a positive correlation between ordering of expected and actual risk is even stronger with a Spearman correlation coefficient of 0.8788 with a p-value of 0.0004.

Our results generally support the ability of the FF-3FM to guide investors in choosing portfolios with appropriate risk-return tradeoffs. In general, portfolios built with high measures of *ex ante* model risk produce high actual risk and high realized returns and *vice versa.* There are, however, several important questions raised by our results. In Panel A of Table 1, we report average expected returns across the ten FF-3FM portfolios based on sample estimated betas and historic average for the three factors included in the model. Expected returns for the two extreme portfolios appear unrealistic. Portfolio 10 has a negative expected return. One would not expected investors to accept negative expected returns. Because the values for each of the factors used to predict returns are reliably positive, negative expected returns result from negative betas for one or more of the three factors. Likewise the outsized value for the expected excess return for Portfolio 1 suggests inaccurate return predictions from the FF-3FM. Portfolio 1 has and average expected monthly excess return of 2.16% given estimated betas and average factor loadings. This expected monthly return is high in an absolute sense and also high relative to predicted excess returns for other portfolios. The average expected return for portfolio 1 is 50% higher than the average expected return for Portfolio 2.

Actual returns for Portfolio 10 and Portfolio 1 are more realistic than the predicted values. Portfolio 1 has realized returns that are 13% higher than the next riskiest portfolio instead of 50% higher as suggested by expected returns. The average realized return for Portfolio 10 is positive in contrast to predictions. The positive realized return for Portfolio 10 is comforting for an investor building a low-risk portfolio based on the FF-3FM, but it is discomforting for the accuracy of the prediction of the FF-3FM. The accuracy of the predictions of the FF-3FM is further challenged because the investor building a low-risk portfolio using the FF-3FM, however,

would be perplexed to find a realized risk level higher than four of the other portfolios. The relatively high realized risk for Portfolio 10 would not be particularly comforting to the investor trying to build a low risk portfolio. These inaccuracies suggest caution in the use of the FF-3FM in risk-adjusting returns using estimated historic betas for securities.

These variations in risk and returns especially for Portfolio 10 suggest an investigation of the reward-to-risk ratio for the ten portfolios in Panel A of Table 1. We calculate the reward-to-risk ratio by dividing the average monthly return for each portfolio by the standard deviation of monthly returns for that portfolio. Modern Portfolio Theory suggests that the market price of risk as given by the capital market line should provide equal return to risk ratios for efficient portfolios. We have not attempted to build efficient portfolios in terms of the capital market line, but we would expect to find an absence of a pattern in the risk-return tradeoff. That is, if the allocation of risk and return is efficient we would have no reason to expect that the reward-to-risk ratio would systematically increase or decrease across portfolios. Likewise we would not expect any portfolio to have a reward-to-risk ratio significantly out of line with other portfolios.

We observe a general upward trend in the reward-to-risk ratio as expected return declines. To gauge the significance of this trend we calculate the Spearman rank order coefficient in the same manner that we used above. As shown by the low p-value the observed trend is statistically significant. Investors accepting higher risk according to the FF-3FM received a lower reward for risk than investors accepting lower levels of risk.

Because the CAPM factor is included in the FF-3FM, the CAPM beta is included in the rankings created by the FF-3FM. This inclusion raises the issue as to whether the successful predictions of the FF-3FM may be due to the inclusion of the CAPM beta rather than model improvement of the FF-3FM and whether the discrepancies found in the FF-3FM result from the CAPM factor. So, we repeat all of our model procedures using the CAPM beta alone and report these results in Panel B of Table 1.

The CAPM is approximately as successful as the FF-3FM in building portfolios that will achieve an appropriate risk-return tradeoff. Portfolio 1 has the highest realized average return and the highest realized risk. Both risk and return generally fall across portfolios and a significant relationship exists between both expected and realized return and expected and realized risk. As reported in Panel B of Table1, for actual and expected return rankings the Spearman correlation coefficient is 0.8667 with a p-value of 0.0007. The CAPM is efficient in predicting portfolio return rankings, slightly more efficient than the FF-3FM as measured by the sample Spearman rank order coefficient. Also, for actual and expected risk rankings the Spearman correlation coefficient of 0.9758 with a p-value of 0.0000, indicates a slightly superior sample result in predicting portfolio risk.

Certainly, the similar performance of the CAPM and the FF-3FM does not support the desirability of the FF-3FM regime given a general preference for simpler and theoretically based models. This assertion may seem questionable because Fama and French (1992) find that *MKT* beta does not explain security returns. Therefore, we seek to be careful not to overstep the conclusions from our results. Although our findings are consistent with the market pricing risk as measured by *MKT* beta, we cannot assert that the market actually prices *MKT* beta risk. There may be a spurious correlation between *MKT* betas and returns and between *MKT* betas and risk. Pettengill, Sundaram and Mathur (2002) for U.S. stocks and Fletcher (1997) for U.K. stocks both show that a significant relationship between *MKT* betas and returns disappear when the influence of size is included in the relevant regressions. Nonetheless, *MKT* betas when considered on their own seem to have predictive power for future portfolio return and risk regardless of causation.

Above we identified several concerns about the predictions of the FF-3FM to create portfolios with particular risk-return properties. The expected return for Portfolio 10 according to the FF-3FM is negative, a high price to pay for lower risk. The expected return for the CAPM Portfolio 10 is small but positive. Clearly the predicted negative returns from the FF-3FM results from the inclusion of either the *SMB* or the *HML* beta or both. In a similar concern we noted that the expected return for the FF-3FM Portfolio 1 seemed to be quite high relative to expected returns for the other nine portfolios. The CAPM Portfolio 1 may also be viewed as an outlier, but the expected return for the CAPM Portfolio 1 is only 34% higher than expected return for Portfolio 2 as compared to the 50% differential in the case of the FF-3FM. We noted above the difference in actual returns between Portfolio 1 and Portfolio 2 is less severe than the difference in expected returns for the FF-3FM. We note that this difference reduces the disadvantage of the FF-3FM in terms of an investor making investment decision but it suggests and advantage for using the CAPM alone in risk-adjusting. To illustrate, observe the values for the average expected and average realized returns for Portfolio 1 as reported in Table 1 (Note 3). The expected

return is 2.16% which if used to find risk-adjusted return based on the average observed return would provide a negative risk-adjusted return, despite the highest average return among the ten portfolios.

We also noted that the FF-3FM Portfolio 10 has both higher realized returns and risk relative to portfolios formed with higher expected returns. A similar, if less severe problem, exists for the CAPM Portfolio 10 (Note 4). As with the FF-3FM Portfolio 10, the CAPM Portfolio 10 has the sixth highest realized return. The realized level of risk, however, in terms of ranking is only 9th highest as opposed to the ranking of 6th highest for the FF-3FM. Thus, the CAPM Portfolio 10 will have a higher reward-to-risk ratio than the FF-3FM Portfolio 10.

We do address the question of reward-to-risk across portfolios for the CAPM portfolio as we did with the FF-3FM. As with the FF-3FM reward-to-risk ratios vary systematically across the CAPM portfolios becoming progressively higher with lower levels of expected risk. In the case of the CAPM portfolios the Spearman rank correlation coefficient of -1.0000 resulting in a p-value of 0.0000. High MKT beta portfolios seem to be particularly disadvantaged with regard to the reward-to-risk tradeoff. This results is consistent with the findings of Fletcher (1997) and Pettengill, Sundarum and Mathur (2002) indicating that the relationship between market returns and *MKT* beta are not symmetrical with regard to up and down markets in the presence of size. This deficiency, however, seems to be only reduced rather than eliminated by the inclusion of the *SMB* beta in the FF-3FM.

Our initial goal was to determine if an investor could rely on the FF-3FM in terms of its ability to create portfolios that provide results consistent with expectations along a risk-return continuum. We test this question by forming portfolios based on expected returns given expected returns for securities based on factor loadings and average factor values. We apply similar methodology using the CAPM for comparisons purpose. We find that the FF-3FM produces portfolios that achieve return and risk results consistent with model expectations. We also find, however, that the FF-3FM is not clearly superior to the CAPM in this regard using our sample methodology. Further both models display certain deficiency in meeting expectations. We summarize our findings with graphical presentation shown in Figure 1.

Panels A and B of figure 1 illustrate the comparative ability of the two models to create consistent risk-return tradeoffs based on expected returns. As shown in Panel A, both models produce portfolios where actual returns across portfolios vary with perceived risk. For both models Portfolio 10, which should have both the lowest risk and return, has a higher return than some of the other portfolios. For the FF-3FM returns to Portfolio 1 and 2 seem especially large relative to the other portfolios suggesting that an investor seeking high returns may benefit from information provided by the FF-3FM.

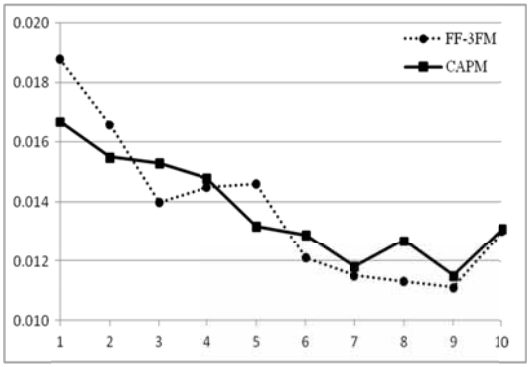

Figure 1A. Mean Returns

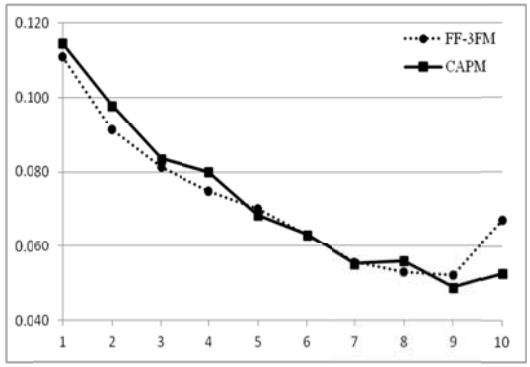

Figure 1B. Standard Deviation

Panel B shows the realized risk for the FF-3FM and the CAPM. Both models show an expected variation with realized risk falling with expected risk across portfolios one through ten. Indeed, the risk level variation for the portfolios formed from both models is very similar. That is, Portfolio 1 of the FF-3FM produces risk levels very similar to the risk level produced by Portfolio 1 formed using the CAPM. For both models Portfolio 10 displays higher risk than expected consistent with the higher than expected return. This is exception is especially pronounced for the FF-3FM, suggesting a low reward-to-risk ratio for this portfolio.

Panel C shows the reward-to-risk ratios for both sets of portfolios. Both models show a steady increase in the reward-to-risk ratio as expected portfolio risk/return increases. This effect is especially pronounced for the CAPM. High return CAPM investors get a smaller payment for risk than FF-3FM investors, but low risk

investors using the CAPM model receive a higher payment for risk. An investor may use the FF-3FM to achieve an expected risk-return tradeoff, but the results do not appear to be clearly superior to what can be achieved from the CAPM.

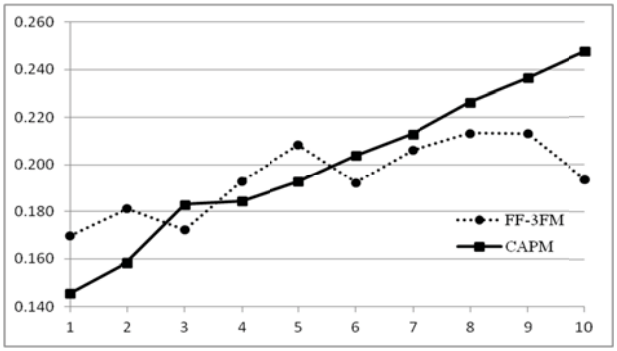

Figure 1C. Return-to-Risk Ratio

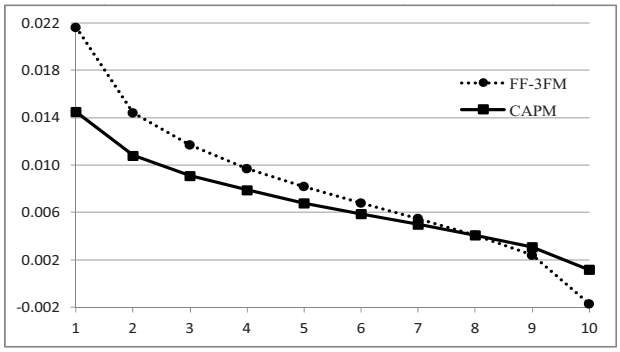

Figure 1D. Expected Returns

Other considerations seem to favor the CAPM. Panel D shows expected returns across portfolios for the FF-3FM and the CAPM. The FF-3FM has stronger outliers for Portfolio 1 and Portfolio 10. This may be seen as a benefit for the high risk investor, but for the low risk investor the prospect of a negative return cannot be appetizing. Panels E and F compare the realized return with expected returns for the portfolios formed by the two models (Note 5). For the FF-3FM the outliers for the extreme portfolios are moderated and the range of portfolio returns becomes closer for the two models. The range of the expected excess returns for the 10 portfolios formed from the FF-3FM is 2.33% compared to 1.33% for the CAPM portfolios. The range for the actual returns across portfolios is 0.58% for the FF-3FM compared to 0.36% for the CAPM. This moderation would be especially comforting for the low-risk investor selecting to use the FF-3FM, but these results suggest that the FF-3FM may produce inefficiencies in terms of risk-adjustment procedures resulting from inconsistencies between realized and estimated betas.

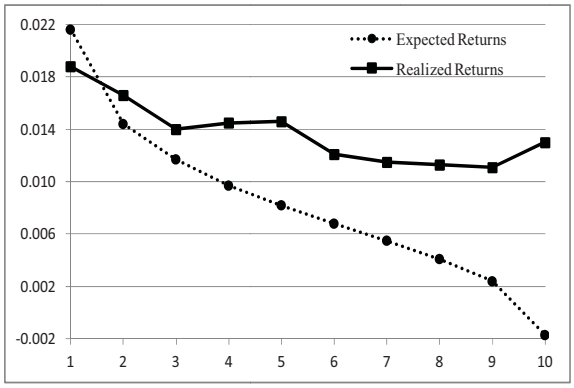

Figure 1E. Expected vs Realized Return for 3-Factor Model

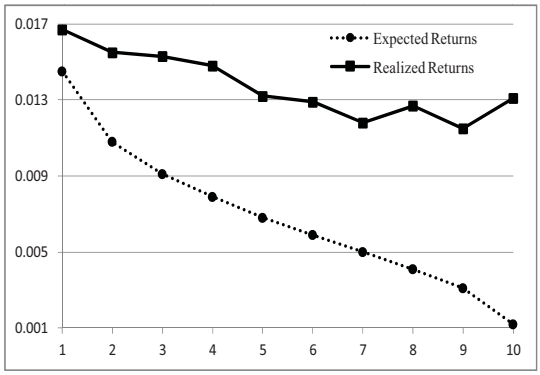

Figure 1F. Expected vs Realized Return for CAPM

To the extent that the CAPM produces results that confirm to the results produced by the FF-3FM, the question arises as to whether the results of the FF-3FM are dependent on the CAPM's MKT beta. We also seek to identify the inconsistencies in the FF-3FM betas that created differences in expected and actual returns especially for the extreme portfolios. Further, we seek to explore the cause of the superior performance of the high-risk FF-3FM portfolio relative to the high-risk CAPM portfolio and the more consistent reward-to-risk portfolios of the FF-3FM. In the next section we dissect the performance of both models, beginning with creating returns for a two-factor Fama-French model.

3. Dissecting Model Performance: FF-3FM and CAPM

In Section II we reported performance results for portfolios based on the FF-3FM and the CAPM. We find that both of these models are efficient in creating portfolios that vary along a risk-return continuum. Because both present certain deficiencies and because the CAPM MKT beta is included in the FF-3FM, we repeat our portfolio formation procedure building portfolios based solely on the HML beta and the SMB beta. We determine these betas values by applying the FF-3FM equation during the estimation period. We estimate expected returns using the betas from the SMB and HML factors as shown in equation (7) and use these expected returns to form ten portfolios which should vary on a risk-return continuum:

$$E(R_{it}) = \beta_{ih} * (\overline{HML}) + \beta_{is} * (\overline{SMB}) \quad (7)$$

where all variables are as defined earlier.

As above, we hold the portfolios for a one-year period and record average returns and the standard deviation in returns. We seek to determine if the MKT beta is a necessary input to achieve separation in risk and return across portfolios. Further, we seek to identify which of the irregularities in results for the FF-3FM are dependent on the inclusion of the MKT beta and whether other irregularities not found in the CAPM results are magnified with the exclusion of the MKT beta.

Results for the two-factor HML-SMB beta model (2F-HSB model) are reported in Panel A of Table 2. The results show that the MKT beta is not a necessary input to create portfolios which will produce average returns whose ranks are consistent with rankings based on expected returns. The 2F-HSB model produces correlation in expected and realized returns that is very consistent with the results produced by the FF-3FM and the CAPM. All three models produce similar Spearman rank order coefficients for expected and realized portfolio return. These range between 0.8182 for the 2F-HSB model, 0.8303for the FF-3FM, and 0.8667 for the CAPM. In all three cases the results are significant at the 0.5% level or lower. These results are certainly inconsistent with the theoretical contention of the CAPM that MKT beta is the only factor affecting expected returns for portfolios large enough to eliminate non-systematic risk. Just as certainly, the results reported in Table 1 are inconsistent with the argument that the MKT beta does not predict returns.

Both the FF-3FM and the CAPM produced portfolio segmentation whereby the portfolio with the lowest expected return, Portfolio 10, had actual returns much higher than expected. This result could be due to the impact of the MKT beta. Elimination of the MKT beta, however, does not cause Portfolio 10 to have a low average return consistent with expectation. Portfolio 10 created with the 2F-HSB model has the fifth highest return of all portfolios.

Elimination of the MKT beta had a more significant result on portfolio risk. If betas from the HML and SMB factors measure risk, portfolios formed with higher betas ought to produce more variation in return. The Spearman's correlation between expected risk and realized standard deviation in 2F-HSB is much less than it is for the FF-3FM which includes the MKT beta. More telling this correlation is much less than the predicted and realized risk for the CAPM which only includes the MKT beta. The rank order correlation between expected and realized risk for the 2F-HSB model is 0.5758 much lower than the rank order correlation of 0.9758 for the CAPM portfolios. The correlation coefficient for the 2F-HSB model is not significant at the 5% level. To determine portfolio risk MKT beta seems to be required or either the HML beta or SMB beta needs to be omitted. Of special note investors who seek to manage risk should not consider the combined input from the HML betas or SML betas. Portfolio 10 formed by the 2F-HSB which should have the lowest risk based on expected return has the third highest risk of all ten portfolios and the lowest reward-to-risk for all ten portfolios.

Table 2. Portfolios sorted by expected returns

	Portfolios sorted by expected returns from the highest (1) to the lowest (10)										Spearman's Rank	
	1	2	3	4	5	6	7	8	9	10	Rho	P-value
(A) Two-Factor Model (2F-HSB)[a]												
Exp. return	0.0128	0.0069	0.0047	0.0033	0.0021	0.0011	0.0002	-0.0009	-0.0025	-0.0062	---	---
Realized return	0.0196	0.0155	0.0148	0.0145	0.0134	0.0125	0.0112	0.0111	0.0111	0.0138	0.8182	0.0031
Std Dev.	0.1073	0.0873	0.0730	0.0723	0.0653	0.0575	0.0559	0.0573	0.0627	0.0816	0.5758	0.0918
Return/Risk	0.1827	0.1769	0.2034	0.2005	0.2057	0.2181	0.2007	0.1935	0.1763	0.1697	0.2727	0.4721
(B) Single-Factor Model - HML[b]												
Exp. return	0.0091	0.0050	0.0033	0.0020	0.0010	$-2x10^{-6}$	-0.001	-0.0022	-0.0038	-0.0076	---	---
Realized return	0.0185	0.0172	0.0155	0.0149	0.0148	0.0123	0.0109	0.0113	0.0109	0.0114	0.9152	0.0001
Std Dev.	0.0971	0.0935	0.0764	0.0713	0.0673	0.0640	0.0602	0.0620	0.0660	0.0800	0.5758	0.0918
Return/Risk	0.1904	0.1840	0.2023	0.2082	0.2203	0.1917	0.1819	0.1816	0.1653	0.1421	0.6606	0.0413
(C) Single-Factor Model - SMB[c]												
Exp. return	0.0065	0.0042	0.0032	0.0026	0.0021	0.0016	0.0012	0.0008	0.0002	-0.0007	---	---
Realized return	0.0171	0.0168	0.0154	0.0148	0.0133	0.0130	0.0121	0.0118	0.0110	0.0123	0.9273	0[d]
Std Dev.	0.1115	0.0959	0.0845	0.0732	0.0675	0.0621	0.0561	0.0543	0.0509	0.0645	0.8788	0.0004
Return/Risk	0.1535	0.1748	0.1824	0.2017	0.1973	0.2095	0.2164	0.2171	0.2151	0.1907	-0.697	0.0269

a. 2F-HSB: Stocks are sorted by the estimated returns from the following equation: $\hat{E}(R_{it}) = \hat{\beta}_{is} \cdot \overline{SMB} + \hat{\beta}_{ih} \cdot \overline{HML}$ where $\hat{\beta}_i$'s are the estimated betas from the regression $R_{it} = \beta_{im} \cdot MKT_t + \beta_{is} \cdot SMB_t + \beta_{ih} \cdot HML_t + \varepsilon_{it}$ during the three-year estimation periods, and $\overline{X}$ is the mean of the *X* factor (*X*= *SMB* or *HML*) from the entire sample period (1927-2009). The reported realized return is the mean of the monthly portfolio returns from the 80 holding periods after the estimation periods.

b. Single-Factor Model - HML: Stocks are sorted by the estimated returns from the following equation: $\hat{E}(R_{it}) = \hat{\beta}_{ih} \cdot \overline{HML}$, where $\hat{\beta}_{ih}$ is the estimated beta from the regression $R_{it} = \beta_{ih} \cdot HML_t + \varepsilon_{it}$ during the three-year estimation periods. The reported realized return is the mean of the monthly portfolio returns from the 80 holding periods after the estimation periods.

c. Single-Factor Model - SMB: Stocks are sorted by the estimated returns from the following equation: $\hat{E}(R_{it}) = \hat{\beta}_{is} \cdot \overline{SMB}$, where $\hat{\beta}_{is}$ is the estimated beta from the regression $R_{it} = \beta_{is} \cdot SMB_t + \varepsilon_{it}$ during the three-year estimation periods. The reported realized return is the mean of the monthly portfolio returns from the 80 holding periods after the estimation periods.

d. These P-Values are nonzero but small than 0.00005.

Ignoring the MKT beta of a security in portfolio formation does eliminate the significant inverse trend in the reward-to-risk ratio across portfolios found for the CAPM and the FF-3FM portfolios. If the MKT beta is not considered in portfolio the Spearman rank correlation between expected risk and reward for risk turns from significantly negative to positive but insignificant. High MKT beta securities seem in some sense to be inadequately compensated for risk.

Elimination of consideration of the MKT beta results in a portfolio formation process that still efficiently predicts relative return but does not predict relative risk. This result suggests caution in applying the FF-3FM to risk adjustment procedures. This caution is magnified by examination of the expected excess returns provided by the 2F-HSB model. Without consideration of the MKT beta the expected excess returns for the three lowest risk portfolios is negative. Of course, this is an absurd result and argues for consideration of the CAPM's MKT beta in determining expected return and in risk adjustment in empirical studies. For portfolios 8, 9 and 10, a positive risk-adjusted return can be achieved with a negative return. This means that based on estimations using only SMB and MKT betas approximately 30% of the securities in the sample have negative expected excess returns. For these securities if risk-adjustment procedures are conducted using measures of systematic risk determined in a sample period, test period positive risk-adjusted returns may result with negative realized returns. It would presumably be of little satisfaction for an investor to learn that the portfolio which is being held has a positive risk-adjusted return when the realized return is negative. This type of perverse result occurs if the SMB and HML betas are considered in risk-adjustment and becomes a significant result if the CAPM MKT beta is not included. This result argues against the use of the HML and SMB betas and by inference the FF-3FM in risk-adjustment procedures.

We have examined the efficiency of the MKT beta alone in creating portfolios with an efficient risk-return tradeoff, but we have had not considered the efficiency of the HML and the SMB betas in this regard. Because of the mixed results of using the 2F-HSB model we feel obliged to investigate the result from using them singularly

as further decomposition of the FF-3FM and as further comparison to the CAPM. We estimate betas using equations (8) and (9) as shown below:

$$E(R_{it}) = \beta_{ih} * (\overline{HML}) \quad (8)$$

$$E(R_{it}) = \beta_{is} * (\overline{SMB}) \quad (9)$$

where all variables are as defined earlier. We use identical portfolio formation and testing procedures.

Panel B shows the results of building risk-return portfolios based on security's loadings on the HML factor. The results present strong contrasts to results presented under previous specifications. Building portfolios based on the HML beta creates portfolios whose ranked realized returns vary in order with rank expected return. Just as the CAPM one-factor model will create portfolios whose realized returns are ordered consistent with expectations, a one-factor model based on the HML beta will do likewise. Indeed, the ordering using the single factor loading on the HML factor is more efficient than the ordering created by the FF-3FM, the CAPM or the 2F-HSB model. The Spearman rank order coefficient between expected and realized returns for the one-factor HML model is 0.9152. Of special note, Portfolio 10 which has realized returns of between 1.30% and 1.38% in the previous three models has realized returns of 1.14% for the HML one-factor model. The HML beta seems more efficient than any other factor loading in identifying securities that will have high or low realized returns.

Portfolio managers may be able to rely on the HML beta to form portfolios whose returns vary directly with factor loading, but the HML beta does not by itself provide a reasonable prediction of the level of return. HML Portfolios 6 through 10 have negative expected excess returns. That is according to a single factor HML model, approximately 50% of the securities in the sample are expected to have negative excess returns. Because the value for the HML factor is on average positive, these negative expected values indicate negative factor loadings on the HML factor for approximately half of the securities. The results are troubling on several levels. If responsiveness to changes in the HML is a measure of systematic risk, what sense does it make for approximately half of the securities to have negative risk premiums based on exposure to this systematic risk? How can a negative factor loading be stable if it implies a negative expected return? If the betas are not stable, how can these factor loadings be used to adjust for risk based on the systematic risk of a portfolio. Finally, if the negative betas are stable then the portfolios formed on the basis of this systematic risk factor cannot possibly associate with realized risk. Consider the following: Assume that the portfolios with the positive betas and the portfolios with negative betas have the same absolute values along a continuum from high to low absolute values. Thus, Portfolio 10 and Portfolio 1 will have the same absolute value for the HML beta, but for Portfolio 10 the value is negative and for Portfolio 1 the value is positive. The same would occur for Portfolio 9 and Portfolio 2 and so on with Portfolios 6 and 5 having the same absolute value with different signs. In this case what would we expect in terms of standard deviation if betas in the sample period and the estimation period are consistent? Portfolios 10 and 1 with the largest absolute values in HML betas should have the highest variation in return although Portfolio 10's return would be positive when Portfolio's 1 is negative and *vice versa.* The standard deviation in returns would reduce across portfolios pairs with Portfolios 5 and 6 having the lowest variation in realized return. Risk-adjusting returns based on a systematic risk factor for which a significant portion of the securities have a negative loading does not seem logical. We examine this dilemma further by first examining the stability of the HML betas and then by examining the realized variation in returns for the HML portfolios.

Figure 2 shows a comparison between realized and expected HML betas. The expected beta reported in Figure 2 is derived by averaging the expected beta for each portfolio from Portfolio 1 through Portfolio 10 across the eighty sample periods. The expected HML betas for each sample period are simply the average of the betas for the individual securities that comprise each portfolio in a particular sample period.

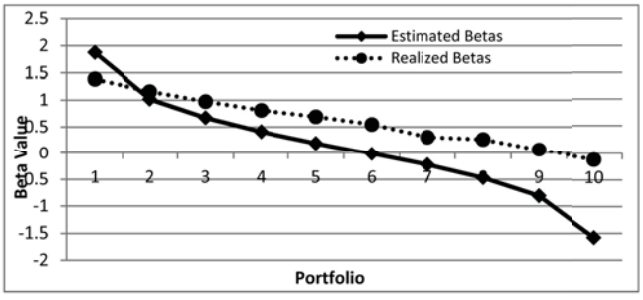

Figure 2. Estimated Beta vs. Realized Beta for HML Factor

The realized beta is determined by employing equation (8) once again, but this time regressing realized return for each portfolio in each test period against the HML factor. Thus, this regression holds 960 observations, twelve monthly observations in each of the eighty one-year test periods.

The results reported in Figure 2 are consistent with both realized and expected returns reported in Panel (B) of Table 2. Negative expected excess returns for Portfolios 6 through 10 are consistent with negative expected betas for Portfolios 6 through 10. The positive realized returns reported in Table 2 for all HML portfolios are consistent with positive realized betas across all portfolios for the HML betas except for Portfolio 10 where the coefficient is slightly negative. These results may prove comforting for portfolio managers who would like to use the HML beta to build low-risk, but positive return portfolios, but the results again strongly argue against the use of historic HML betas in risk-adjusting portfolio returns. Negative factor loadings which when applied in risk adjustment procedures suggest that a portfolio manager could "beat the market" with returns less than the risk-free rate seem fundamentally inappropriate.

The relationship with expected risk as measured by the systematic risk factor from loading on the HML factor also fails to efficiently predict realized risk for the HML portfolios. Although the sample Spearman rank correlation coefficient between expected risk and realized risk is positive, it is not statistically significant different from zero. Portfolio 10 which should have the lowest realized risk has the third highest realized risk. The Portfolios with high expected returns, achieve these returns without significantly higher levels of risk. Thus, the significantly negative correlation between the reward-to-risk ratio and expected return produced by both the CAPM and the FF-3FM is replaced by a marginally significant positive correlation between expected return and the reward-to-risk ratio.

To continue our decomposition of the FF-3FM we examine the performance of the SMB beta in forming portfolios along a risk-return continuum. Results reported in Panel C of Table 2 show the performance of portfolios formed on the SMB beta found using equation (9). Test and estimation procedures are identical to those used above. These results show that any one of the three factor loadings used in the FF-3FM by itself can efficiently identify securities to be placed in a return continuum. The SMB beta is more efficient in identifying high and low return securities than either the HML beta, MKT beta or the FF-3FM as it produces the highest rank correlation between actual and expected return. Unlike the HML beta, the SMB beta efficiently predicts realized risk variation based on factor risk loadings. Although the SMB beta is not as efficient as the CAPM in predicting realized risk. In particular Portfolio 10 shows much higher variation in return than expected based on its factor loading. The use of the SMB beta alone greatly reduces the creation of portfolios with expected negative returns that were found by the use of the HML beta alone. Only Portfolio 10 has a negative expected return. Similar to the results for the HML beta, actual returns for Portfolio 10 are positive and higher than other portfolios with low expected risk. Again the CAPM outperforms both the single-factor SMB model in this regard. Also, similar to the results with the CAPM, the single factor SMB model produces a significant inverse relationship between expected return and the risk-return tradeoff, although this relationship is weaker than that found for the CAPM. Because, both the CAPM and the single factor SMB model outperform the single factor HML model in terms of predicting risk, we combine the SMB beta and the MKT beta into a two-factor model and compare results from this model to the results of previous models. As we did with the 2F-HSB model we use the beta estimates derived from Equation (6) to form the two-factor MKT-SMB (2F-MSB). The same sampling and test procedures are used as with the other models. The results are reported in Table 3.

Table 3. Portfolios sorted by expected returns using MKT and SMB factors (2F-MSB model)

	Portfolios sorted by expected returns from the highest (1) to the lowest (10)										Spearman's Rank	
	1	2	3	4	5	6	7	8	9	10	Rho	P-value
Expected return	0.0158	0.0114	0.0097	0.0084	0.0074	0.0064	0.0055	0.0046	0.0035	0.0013	---	---
Realized return	0.0173	0.0159	0.0141	0.0145	0.0135	0.0138	0.0115	0.0122	0.0115	0.0130	0.891	0.0002
Std Dev.	0.1089	0.0958	0.0822	0.0756	0.0693	0.0642	0.0569	0.0583	0.0505	0.0539	0.976	0*
Return/Risk	0.1593	0.1655	0.1720	0.1918	0.1949	0.2146	0.2029	0.2094	0.2276	0.2420	-0.964	0*

Stocks are sorted by the estimated returns from the following equation: $\hat{E}(R_{it}) = \hat{\beta}_{im} \cdot \overline{MKT} + \hat{\beta}_{is} \cdot \overline{SMB}$ where $\hat{\beta}_i$'s are the estimated betas from the regression $R_{it} = \beta_{im} \cdot MKT_t + \beta_{is} \cdot SMB_t + \beta_{ih} \cdot HML_t + \varepsilon_{it}$ during the three-year estimation periods, and $\overline{X}$ is the mean of the *X* factor (*X*= *SMB* or *HML*) from the entire sample period (1927-2009). The reported realized return is the mean of the monthly portfolio returns from the 80 holding periods after the estimation periods.

* These P-Values are nonzero but small than 0.00005.

The results for the two-factor SMB-MKT beta model compare favorably with the results for the FF-3FM. The 2F-MSB model produces more efficient separation in terms of both realized return and risk than does the FF-3FM. The 2F-MSB model is more efficient than the CAPM in predicting realized return and as efficient as the CAPM in predicting realized risk. The inclusion of the MKT beta with the SMB beta reduces the risk of Portfolio 10 and eliminates the negative expected return of Portfolio 10 when the latter beta is used alone. The inclusion of the MKT beta, however, increases the tendency for the reward-to-risk ratio to fall as expected return increases. In some sense securities with high MKT betas appear to be inadequately compensated for risk. Because the FF-3FM is an empirical rather than a theoretical model, one is hard pressed to argue for its superiority to the 2F-MSB model.

4. Conclusion

We identify two regimes in the measurement of systematic risk during the era of modern portfolio theory. The Capital Asset Pricing Model, CAPM, a theoretical based model, was replaced by the empirical, Fama-French three-factor model, FF-3FM, in part based on the finding by Fama and French (1992) that a positive relationship does not exist between a security's covariance with the market and the security's return. This same study confirmed previous findings of a positive relationship between security's book-to-market value and return, and a security's market value and return. Together these findings led to the creation of the FF-3FM. Although the FF-3FM is widely used to measure systematic risk in academic studies, it has not been subjected to out-of-sample testing to validate the model's ability to measure systematic risk and predict return and its variation.

In part the failure to study the relationship between systematic risk as measured by the FF-3FM and returns results from the model's failure to have a single measure for risk as does the CAPM. We study the relationship between systematic risk and return by building portfolios based on expected risk as measured by the FF-3FM and compare the realized return and risk of these portfolios. We find that the FF-3FM does accurately predict variation along a risk-return continuum. Ironically, when we include the CAPM using the same procedures for comparisons purpose we find that the CAPM is roughly as efficient as the FF-3FM in creating portfolios that vary along a risk return continuum. Moreover, we find certain deficiencies in the FF-3FM, low-risk portfolios are predicted to have negative excess returns and high risk portfolios have outsized expected returns. We find that these deficiencies largely result from inclusion of the loading on the zero-investment portfolio associated with the book to market ratio. We find that a two-factor model including the market beta and the size related beta appears to be a more efficient predictor of returns and risk than the FF-3FM. Because the FF-3FM is not theoretically based, it appears to be an open question as to why this model should be used to predict risk and return. Further research should be conducted to provide answers to this question.

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Notes

Note 1. For instance the Wall Street Prep course in their training manual asserts that among several competing asset-pricing models, "The most popular and commonly used in practice is the capital asset pricing model (CAPM)." (p. 86) In addition, see Bartholdy and Peare (2005), Estrada (2011) and Graham and Harvey (2001).

Note 2. Notice that portfolio formation for the CAPM is also based on expected return as expected security return is perfectly correlated with the MKT beta for the security.

Note 3. The authors wish to recognize a deficiency in the current draft. For convenience we have reported excess expected returns and raw average returns. The difference between the two is the average monthly risk-free return which is small for the sample. We further note that for the comparison at hand, the deficiency in the FF-3FM is understated because of the difference in the reporting of actual and excess return.

Note 4. We test to see if the results for the low-risk portfolio results from our choice to build decile portfolios by creating ventile and quintile portfolios. For the FF-3FM portfolios, when ventile portfolios are created, the low-risk portfolio has the fourth highest realized return and the fourth highest realized risk. When quintile portfolios are created the low-risk portfolio that should have the lowest realized return experienced the fifth highest realized return and the fifth highest realized risk among the twenty portfolios. The CAPM portfolios had identical results in terms of the quintile portfolios, but much less dramatic deviation from expectations with regard to the ventile portfolios.

Note 5. Notice for both portfolios the average actual returns are larger than average expected returns. This is consistent with previous literature. For instance see Jegadeesh and Titman (1993) which studies momentum strategies showing the superior performance of winners to losers. Both portfolios of these extreme portfolios and all other portfolios show higher average returns than historic returns to market indexes.

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Economies of Scale in the Tunisian Industries

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Abstract

To date, empirical investigations of trade liberalization, under the conditions of increasing returns to scale (IRS) and imperfect competition (IC), have either assumed or imposed the market and productive structures necessary for such a model. However, of the recent IRS/IC models used to simulate the effects of trade liberalization, none have empirically tested for the presence of increasing return to scale prior to the analysis. With Tunisian data (1971-2004) and rigorous test procedures, we investigate evidence of IRS at the industry level. Using an econometric approach based on the estimation of the translog cost function and its associated cost share equations, we identify the sectors characterized by increasing returns to scale. Analysis of the results shows that specification of the model is sensitive to inclusion of time trend representing technology. For most sectors, the model accounting for technology did not fit the data well.Estimation results without time trend interactions are different and most sectors show signs of increasing returns to scale.

Keywords: economies of scale, trade liberalization, new trade theory, Tunisian industries, cost functions

JEL Classification Numbers: C32, C52, D24, F12, L00

1. Introduction

In recent decades, a large number of countries have modified their trade politics -from import-oriented to export-oriented policies. In most cases, consequences of such changes are the reduction or elimination of restrictions imposed on international trade relations. The elimination of these restrictive measures is generally destined to improve the performance of the economy. Indeed, some governments try to increase their exports, whereas others try to develop the local industry in order to attract foreign direct investment. Thus, certain governments in developing countries try to introduce trade policy changes in an attempt to develop their manufacturing exports and increase their incomes.

Economists generally agree that for an overly protected less development country (LDC), trade liberalization is a sound policy to redress external imbalance and to correct an inefficient allocation of productive resources. To demonstrate the worthiness of this policy, researchers have constructed models to measure the gains in trade liberalization. In most instances, net gains arising from such models were found to be quite small. This dilemma prompted several models to question fundamental assumptions underlying the construction of such models-principal among which were perfect competition and constant returns to scale.

In these contexts, the literature within the “New Trade Theory”, with increasing returns to scale and imperfectly competitive markets, suggest that the gain to trade liberalization will be larger than those predicted by models where markets are perfectly competitive and characterized by constant returns to scale. The primary mechanisms responsible for such gains are a reduction in the number of firms in an industry (industry rationalization) and the decrease in the domestic price and costs of production following liberalization (pro-competitive effect). Assuming domestic import is imperfectly competitive, reducing tariff barriers tightness competition and forces domestic oligopolistic firms to lower price along their declining average cost curves. This will lead the price and costs of production to fall and output to increase, while the number of firms in the oligopolistic industry will decline. Gains occur due to lowered prices and cost of production, exit of inefficient producers from the industry and an improved allocation of resources. This literature is concentrated on modelling trade in an environment where production

takes place under conditions of increasing returns to scale and where markets are imperfectly competitive. Krugman (1979), Dixit and Norman (1980) and Lancaster (1980) considered the implications of returns to scale for trade theory using as "little" market structure as possible, opting for monopolistic competition. As the literature developed, interest grew in imperfect competition for its own sake and accordingly, attention has been focused on oligopolistic interaction.

To date, empirical investigations of trade liberalization, under these conditions, have either assumed or imposed the structures necessary for such a model. Of these recent IRS/IC models used to simulate the effects of trade liberalization (Harris, 1984; Guanasekera and Tyers, 1991; Devarajan and Rodrik, 1991; Hertel, 1991; Markusen and Venables, 1988) but none has tested empirically for the presence of increasing return to scale, prior to the analysis. Recently Anguo, Ge and Kaizhong (2011) studied returns to scale in the production of selected manufacturing sector in China and find evidence of increasing returns to scale. For the empirical analysis and illustration, we use industry level data (is used) from Tunisia -which is a country with comprehensive trade liberalization policy.

The objective of this paper is to analyse Tunisian data to see if evidence of increasing returns to scale at the industry level can be found and to identify those sectors most likely their production structure to be characterized by increasing returns to scale. The information will be helpful to shed lights on the validity of assumptions underlying applications of the New Trade Theory and in preparation for the construction of a Computable General Equilibrium (CGE) model of trade liberalization. McDonough (1992) discusses the homothetic and non-homothetic scale economies in applied general equilibrium analysis.

The rest of the paper is structured as follows: The evolution of the activity of the Tunisian trade policy and industry is discussed in Section 2. Section 3 provides a brief description of some evidence cited by previous studies in the field. In Section 4, we present the research model, followed by the estimation procedure and data in Section 5 and 6. The empirical results are discussed in Section 7 and are compared with the previous findings. Section 8 concludes.

2. Evolution of the Tunisian Trade Policies and Industries

Four phases have marked the evolution and the development of the Tunisian industry. The first three phases (from 1960 to 1969, 1970 to 1979 and 1980 to 1986) has allowed the development and the installation of the physical infrastructure and the launching of basic industries, such as: the chemical, the food processing and the textile industries, characterized by a direct intervention of the government and a policy of protection of domestic market. These industries have shown positive growth due to a stable political climate, customs protections and the subvention given to the public companies. However, after the economic crisis between 1980 and 1986, and during the fourth phase, numerous measures have been taken to liberalize the international trade (Boudhiaf, 2000). These include the Structural adjustment programme (1986), adherence to the General Agreement on Terms of Trade GATT (1989), adherence to the World Trade Organization WTO (1994), and signing of free-trade agreement with the European Union (1995).

The measures listed above liberalized the economy (liberalization of the imports, the prices, the investment, progressive reduction of the customs rates) and it affected the competitiveness of the companies, both on and outside the frontiers. The reforms introduced during this phase implied also the introduction of certain measures to accompany liberalization, such as reforms to support the institutions, the simplification of the tax reform, the code reform of the foreign trade, and the simplification of the politics to enhance incentive to investment. These aimed at continuation of the process of structural adjustment and privatization, i.e. the disengagement of the government with all corporations' activities in production or services.

3. Some Previous Applications

There are several studies which, in one or another way, have used empirical investigations of trade liberalization under the assumption of increasing returns to scale and imperfect competition. However, none of these studies has tested empirically for the presence of increasing return to scale. A few of these studies are reviewed below.

Harris (1984), in his seminal study of Canadian trade liberalization, simply assumes that some sectors are characterized by increasing returns to scale, while others are constant returns to scale. De Melo and Roland-Holst (1990) motivate their model assumptions for Korea based on evidence from price-cost margins found in an earlier study. The evidence showed that sectors with a low import share in total sales had higher price-cost margins, suggesting an imperfectly competitive structure, possibly the result of a production process where returns to scale are increasing. Gunasekera and Tyers (1991) also construct an imperfectly competitive trade model based on

Korea. They cite secondary sources and discuss the "stylized facts" concerning the oligopolistic nature of Korean industry.

Devarajan and Rodrik (1991) construct an IRS/IC model for Cameroon but, due to data limitations, they are unable to provide any evidence other than an appeal to the idea that imperfect competition is probably more likely prevalent than perfect competition in a developing country context. List and Zhou (2007) is another study in which the authors use a general equilibrium model to explore the implications of firms' technology choices and the substitution of capital for labour for economic growth. In this model, increasing returns to scale arise from the fixed cost of production embodied in machines and it is internal to a firm. Trade effects of scale economies investigated by Peridy (2004), applied to EU data indicated that exports rise with the degree of scale economies. Recently Mouelhi (2009) measured the impact of the adoption of information and communication technologies on firm efficiency in the Tunisian manufacturing sector and finds evidence of increasing returns to scale.

4. The Model

4.1 Returns to Scale Studied via the New Trade Theory Models

The existing body of economic theory and empirical literature suggests four ways in which the case for increasing returns to scale might be studied.

Returns to scale using production functions

Ignoring the problems involved in the specification and estimation of production functions, estimates of the coefficients of a production function can be used to calculate directly the returns to scale. A problem with this and the cost function approach is that the estimates from aggregate industry level data do not allow identification of disaggregate firm level returns to scale. Individual firms may be characterized by increasing returns to scale while the industry as a whole exhibits constant returns to scale. In the top down approach, i.e. from aggregate to disaggregate level, intermediate deliveries from inter-industry and intra-industry sources complicate the issue. In aggregate economy, intra-industry cancels out but not the inter-industry component affecting return to scale in production functions.

Returns to scale using intra-industry trade

There is a need to explain the preponderance of intra-industry trade when previous studies predicted little or none (preferring instead inter-industry) led to the development of the "New Trade Theory". Significant intra-industry trade could be seen as indirect evidence for a "New Trade Theory" model, having characteristics of imperfect competition and increasing returns to scale. Clark (2010) shows industries with low scale economies more frequently have high, rather than low, intra-industry trade shares. A problem with this kind of approach is that the pattern of trade may be due to other factors not accounted for in either the theory or the empirical work. Although data for exports and imports are available, we choose not to rely on this information because evidence of intra-industry trade does not unequivocally prove the case of increasing returns to scale. Outsourcing and subcontracting to create cost saving opportunities, to share risk, to increase firms' specialization in areas with comparative advantage and to concentrate specialization are examples of intra-industry trade that are neglected in inter-industry studies, which overestimate the effect in bottom up models by double counting.

Returns to scale using market structure

The approach of market concentration ratios provide indirect evidence of imperfectly competitive behaviour, which may be the result of increasing returns to scale. This approach was used by Aw (1990), Gunasekera and Tyers (1991), Devarajan and Rodrik (1989) and Ethier (1982) in their work on imperfectly competitive trade models. A drawback of this approach is that the imperfect competition may be due to factors other than scale economies, e.g., government regulation, trade policy, etc. Recently Diewert and Fox (2008) derived a number of theoretical results on estimating returns to scale, technical progress and monopolistic markups when there are multiple outputs and inputs. The model is applied by Anguo et al. (2011) where they find evidence of increasing returns to scale in Chinese manufacturing industries.

Returns to scale using cost functions

Abstracting from the problems involved in estimating a cost function, a well estimated cost function provides direct evidence of returns to scale and the shape of the cost curves. In addition, the scale biased technological change, resulting from the impacts of technology on cost channelled through changes in the level of output, and contributions from its factor components can be identified and estimated.

4.2 The Translog Cost Function

Estimation of the cost function has some advantages over the production function estimation. First, estimation of the cost function, along with input share equations, adds a first order condition for input usage that places

cross-equation restrictions on the parameters and thereby improves the efficiency of the estimates. Second, in general, the cost function imposes fewer a priori assumptions on the substitution possibilities among the factors of production and it allows scale economies to vary with the level of output and allowing for size heterogeneity of scale economies. In keeping with a desire to impose few a priori assumptions on the technology, we opted for the translog cost function. (Note 1) The translog form allows scale economies to vary with the level of output and it can accommodate homothetic, homogeneous and unit elasticity of substitution forms within its general functional form structure.

The model used follows the one initiated in Christensen and Greene (1976) and modified and improved upon in later efforts. (Note 2) The general translog cost function for value-added with two inputs of capital and labour with input prices P_i respectively, referred to as Basic Model is written as:

$$\ln TC = \alpha_0 + \alpha_Y \ln Y + 1/2\gamma_{YY}(\ln Y)^2 + \sum_i \alpha_i \ln P_i + 1/2\sum_i\sum_j \gamma_{ij} \ln P_i \ln P_j + \sum_i \gamma_{Yi} \ln Y \ln P_i + \varepsilon \quad (1)$$

Where $\gamma_{ij} = \gamma_{ji}$ assumes symmetry, *TC* is total cost, *Y* is the value added, and subscripts *i* and *j* indicate inputs. For the reasons of simplification of the notations, at this stage we ignore the time and industry subscripts.

Given the time-series nature of this dataset, the effect of technology on the cost structure of industries must be taken into account. One possible solution is merely to add time as an independent variable to the above equation. However, the literature on cost function estimation prefers treatment of the time trend (Z) as an input. Moreover, in order to capture its non-linearity and non-neutrality impacts, interact time trend with the other prices and output explanatory terms. Thus, the cost function equation to be estimated, with time trend introduced explicitly, is referred to as the unrestricted model (Model I), and is written as:

$$\begin{aligned}\ln TC = {} & \alpha_0 + \alpha_Y \ln Y + 1/2\gamma_{YY}(\ln Y)^2 + \sum_i \alpha_i \ln P_i + 1/2\sum_i\sum_j \gamma_{ij} \ln P_i \ln P_j \\ & + \sum_i \gamma_{Yi} \ln Y \ln P_i + \alpha_t Z + 1/2\gamma_{tt} Z^2 + \gamma_{tY} Z \ln Y + \sum_i \gamma_{ti} Z \ln P_i + \varepsilon\end{aligned} \quad (2)$$

where Z indicates technology and often is represented by a time trend variable. In addition to the time trend inclusion, sub-sample period might be estimated such as 1971-1979; 1980-1989; 1990-1999; and 2000-2004. However, due to overparametrization of the model, the later is avoided. In order to correspond to a well-behaved production function, a cost function must be homogeneous of degree one in input prices, i.e., for a fixed level of output the total cost must increase proportionally when all input prices increase proportionally. This implies the following relationships among the parameters of the model:

$$\sum_i \alpha_i = 1, \ \sum_i \gamma_{Yi} = 0 \ , \ \ \sum_i \gamma_{ij} = \sum_j \gamma_{ij} = \sum_i\sum_j \gamma_{ij} = 0 \quad (3)$$

A convenient feature of the cost function approach is that the derived demands for the factors of production are computed by reference to Sheppard's lemma (Sheppard, 1953). A differentiation of the logarithmic cost function, with respect to the logarithm of factor prices, results in the cost share equations for the inputs. For instance, the capital and labour share equations are derived as:

$$\begin{aligned} S_K &= \partial \ln TC / \partial \ln P_K = (P_K K)/TC = \alpha_K + \sum_j \gamma_{ij} \ln P_j + \gamma_{YK} \ln Y + \gamma_{tK} Z \\ S_L &= \partial \ln TC / \partial \ln P_L = (P_L L)/TC = \alpha_L + \sum_j \gamma_{ij} \ln P_j + \gamma_{YL} \ln Y + \gamma_{tL} Z \end{aligned} \quad (4)$$

In similar way and as in the literature related to the measurement of technical change and total factor productivity growth (Note 3), the rate of technical change is obtained by taking the derivative of the cost function with respect to time:

$$S_Z = \partial \ln TC / \partial Z = \alpha_t + \alpha_{tt} Z + \sum_i \gamma_{ti} \ln P_i + \gamma_{Yt} \ln Y \quad (5)$$

It can further be decomposed into neutral $(\alpha_t + \alpha_{tt} Z)$, non-neutral $(\sum_i \gamma_{ti} \ln P_i)$, and scale augmenting $(\gamma_{Yt} \ln Y)$ components. The measure of scale economies is defined as the elasticity of total cost with respect to output. (Note 4) This elasticity is obtained by partial differentiation of the logged cost function, with respect to the log of value-added and it represents the proportional increase in costs, resulting from a proportional increase in the level of value-added. The elasticity is written as:

$$SCALE = \partial \ln TC / \partial \ln Y = \alpha_Y + \gamma_{YY} \ln Y + \sum_i \gamma_{Yi} \ln P_i + \gamma_{tY} Z \quad (6)$$

These results are suggesting increasing returns to scale when the above measure of scale economies is less than one; a value greater than one represents decreasing returns to scale, while a value equal to one suggest constant returns to scale. In other words, returns to scale is obtained as the inverse of the scale effect. Increasing returns to scale implies that cost increases proportionally less than output.

It is to be noted that the formula for calculating scale economies in (6) will vary depending on the restrictions imposed on the cost function in (2). The translog cost function does not constrain the structure of production to be homothetic, nor does it impose restrictions on the elasticities of substitution. These restrictions can be tested statistically. If any of the restrictions are valid, it is preferable to adopt the simplified model. If not, it is of interest to investigate the impact of their imposition on the shape of the estimated cost curves. A cost function corresponds to a homothetic production structure if, and only if, the cost function is separable in output and factor prices. (Note 5) A homothetic production structure is further restricted to be homogeneous if, and only if, the elasticity of cost, with respect to output, is constant. For the translog cost function, the homotheticity and homogeneity restrictions are expressed as:

Homotheticity:

$$\gamma_{Yi} = 0 \tag{7}$$

Homogeneity:

$$\gamma_{Yi} = 0, \quad \gamma_{YY} = 0$$

The elasticities of substitution can all be restricted to unity by eliminating the second-order terms, in the input prices, from the translog cost function. Thus the unitary elasticity of substitution cost is as follows:

Unit elasticity of substitution:

$$\gamma_{ij} = 0 \tag{8}$$

5. Estimation Procedure

It is feasible to estimate the parameters of the cost function using ordinary least squares. (Note 6) However, this would neglect the information contained in the cost share equations (4) for capital and labour, which are also estimable. The now standard, more effective, and well-known procedure, followed here, is to estimate the cost function jointly with the cost share equations. However, in the actual estimation procedure, the share equation for labour is dropped to avoid a singular covariance matrix. Given that the sum of the input shares for the two share equations equals one, the sum of the error terms across the two equations will be zero at each observation, resulting in a singular variance-covariance matrix. The standard solution to the singularity problem is to drop one of the cost share equations from the estimation process. (Note 7)

Regarding the error structure, additive disturbances are assumed for each of the cost and share equations. The error term for each industry cost function is assumed to be uncorrelated with any other industry's error term. Given that the share equations are derived via differentiation of the cost function, the share equation will not contain the error term for the cost function. However, in keeping with the Seemingly Unrelated Regression (SUR) format, the error terms for the cost and share equations, for any one industry, are assumed to be correlated due to the effect of exogenous shocks affecting both equations. Therefore, following Christensen and Greene, we have used a three stage least squares estimation (3SLS) procedure.

We conclude that the optimal procedure is to estimate the above cost function jointly with the cost share equation for capital. It not only adds degrees of freedom without adding any unrestricted regression parameters, but given the relationship between the share equation and the cost function, several cross equation restrictions can be placed on the parameters to increase the efficiency of the estimates. For example, the constant in the capital share equation must be equal to the coefficient on lnY in the cost function. Furthermore, as noted above, in order for the cost function to correspond to a well-behaved production function, it must be homogeneous of degree one in the prices. The restrictions necessary for compliance with this condition were all imposed throught this paper.

In addition to the above conditions, one can test and then, if warranted, impose further restrictions regarding homotheticity, homogeneity and unitary elasticities of substitution between inputs. These restrictions take the form of setting certain coefficients in the cost and cost share equations to zero. Depending on the property restrictions imposed in above, four models are considered in this study. Model I corresponds to the unrestricted general one. Model II imposes homotheticity. Model III correspond to the Model II, but with assuming homogeneity. Model IV imposes homotheticity and homogeneity with unitary elasticities of substitution. All four models account for the rate of technological change represented by a time trend (Z). The four variants of the translog cost function,

distinguished by the restrictions imposed on the general model, together with the capital share equation, along with the implied definition of scale economies, are presented in Table 1.

Table 1. The different cost model specification

Model and restriction	*Cost function*	Capital cost share	Scale elasticity
Model I	$\ln TC = \alpha_0 + \alpha_Y \ln Y + 1/2\gamma_{YY}(\ln Y)^2 + \sum_i \alpha_i \ln P_i + 1/2\sum_i\sum_j \gamma_{ij} \ln P_i \ln P_j + \sum_i \gamma_{Yi} \ln Y \ln P_i + \alpha_t Z + 1/2\gamma_{tt} Z^2 + \gamma_{tY} Z \ln Y + \sum_i \gamma_{ti} Z \ln P_i$	$S_K = \alpha_K + \sum_j \gamma_{ij} \ln P_j + \gamma_{Y1} \ln Y + \gamma_{tk} Z$	$Scale = \alpha_Y + \gamma_{YY}(\ln Y) + \sum_i \gamma_{Yi} \ln P_i + \gamma_{tY} Z$
Model II $\gamma_{Yi} = 0$	$\ln TC = \alpha_0 + \alpha_Y \ln Y + 1/2\gamma_{YY}(\ln Y)^2 + \sum_i \alpha_i \ln P_i + 1/2\sum_i\sum_j \gamma_{ij} \ln P_i \ln P_j + \alpha_t Z + 1/2\gamma_{tt} Z^2 + \gamma_{tY} Z \ln Y + \sum_i \gamma_{ti} Z \ln P_i$	$S_K = \alpha_K + \sum_j \gamma_{ij} \ln P_j + \gamma_{tk} Z$	$Scale = \alpha_Y + \gamma_{YY}(\ln Y) + \gamma_{tY} Z$
Model III $\gamma_{Yi} = 0, \gamma_{YY} = 0$	$\ln TC = \alpha_0 + \alpha_Y \ln Y + \sum_i \alpha_i \ln P_i + 1/2\sum_i\sum_j \gamma_{ij} \ln P_i \ln P_j + \alpha_t Z + 1/2\gamma_{tt} Z^2 + \gamma_{tY} Z \ln Y + \sum_i \gamma_{ti} Z \ln P_i$	$S_K = \alpha_K + \sum_j \gamma_{ij} \ln P_j + \gamma_{tk} Z$	$Scale = \alpha_Y + \gamma_{tY} Z$
Model IV $\gamma_{Yi} = 0,\ \gamma_{YY} = 0$ and $\gamma_{ij} = 0$	$\ln TC = \alpha_0 + \alpha_Y \ln Y + \sum_i \alpha_i \ln P_i + \alpha_t Z + 1/2\gamma_{tt} Z^2 + \gamma_{tY} Z \ln Y + \sum_i \gamma_{ti} Z \ln P_i$	$S_K = \alpha_K + \gamma_{tk} Z$	$Scale = \alpha_Y + \gamma_{tY} Z$

Glossary of variables: TC=total cost, Y-value added, P=input prices, S=input cost shares, Z=technology (represented by a time trend).

In these models, the scale economies are both time and industry specific. It varies from one level of output to another and one time period to another. The scale economies and cost shares, representing cost elasticities of inputs or responsiveness of cost to percentage changes in input prices, (at each observation) varies across industries and over time and at each observation. In order to conserve space, the value reported in Appendix I and II is calculated at the mean of the independent variables. For the last two model specifications of the cost function (homothetic and homogeneous; and homothetic, homogeneous and unit elasticity of substitution), the estimate of scale economies is invariant with respect to the output level. However , it does vary with time due to the presence of this variable in the definition of the cost elasticity. For matters of sensitivity, the analysis of the four models are also estimated by ignoring the technology variable (Z).

6. Data

The data used, in the empirical estimation of the four models outlined above, comes from the economics research unit of the Tunisian Ministry of Plan, the Tunisian National Statistics Institute (INS, 2001 and 2005) and from the Quantitative Economy Institute (IEQ, 1998 and 2005). These data sets cover fifteen major sectors of the economy for the time period 1971-2004. It contains information on capital, labour, production, intermediate consumption, exports, imports, and prices for the above mentioned input factors of production. The data set was constructed by the Tunisian Ministry of Plan from documents published by the national statistical institute and is the database underlying all official Ministry of Plan projections. The sectors included are agriculture & fishing, food processing industry, textiles, clothing and leather industry, chemical industry, construction material, ceramic and glass industry, mechanical electric industry, and other manufacturing industry, mining, oil and gas industry, electricity, transport, tourism, water, building and public works, and services.

Most of the variables were available directly from the Tunisian database, while others required either simplifications or references to secondary data sources. Total cost is assumed to consist entirely of variable costs. It was calculated as the sum of payments to labour and capital at the industry-specific market rate of return of these two factors, or $TC=P_KK+P_LL$.

The cost of capital is equal to P_KK, where P_K is the price of capital assumed equal to the price of acquiring new capital or FBCFB (Prix de formation de capital fixe par branche d'activite). Capital Stock K is assumed to be quasi-fixed in the short-run, following an investment decision. It is measured as the value of capital equipment. The cost of labour is equal to P_EE, where P_E is calculated by using the Wages defined as the average annual wage per worker obtained by dividing total wages in each industry by the total number of employees in that industry or service. Thus, the wage variable is industry/service-specific. The total employment E is the total number of employees in each industry or service. The output variable, defined as value-added, is measured as value of production less material and energy expenses. The technology is represented by a trend or year dummy variables. Wages, value-added, and capital stock are given in Tunisian dinars and are transferred to fixed 1990 prices using the producer price index.

7. Empirical Cost Function Results

The cost function, ignoring technology (equation 1) and technology (Z) considered as an input (equation 2), jointly with the capital cost share (equation 4) are estimated with and without homotheticity, homogeneity and unit elasticity of substitution restriction. The estimation results, in limited form to conserve spaces, are reported in Appendix I and II and discussed below. In order to conserve spaces we do not report the full estimation results for the time trend variable or its decomposed underlying components. A negative sign of the Z-variable indicates a negative shift in the cost function over time or technical progress, while a positive sign suggest technical regress. The non-neutral component indicates biased technical change. It is worth to mention that early studies, using panel regression analysis of time series data, are criticized for the absence of testing the stationarity and thereby causing spurious regression problem. However, some recent studies adopt cointegration test and error correction model as econometric technique to overcome spurious regression problem. In current case of production functions, with focus on estimation of inputs effects on output, we have not observed any indications of such problems.

Based on the results reported in the Appendix I (Translog Cost Function Results, where Time is considered as an input-like variable in the cost function), the estimation of the cost function equation show that only Textiles, and Building and Public Works are characterized by an increasing return to scale and have positive sign for the variables (lnY, lnPk, and lnPw) in all the models (model I, model II, model III, and model IV). Electricity, Transport, Mechanical, and Oil and Gas industry, and Tourism are also characterized by an increasing return to scale, and having a negative sign for the variables lnY or lnPk in at least one of the 4 models. The cost functions of the remaining 8 industrial sectors including Chemicals, Diverse Manufacturing, Construction Materials, Services, Agriculture and Fishing, Food Processing Industry, Mining, Water shows a negative sign for two or more variables (lnY, lnPk, ln Pw) in at least one of the four models.

The results of the translog cost function, where time is not considered as an input-like variable in the cost function (Appendix II), show that some sectors like electricity have a positive sign for lnY, lnPk and lnPw explanatory variables -in all the four models. Water and Diverse Manufacturing industry have only one variable (lnY or lnPk) with a negative sign in one of the models at least, and are characterized by an increasing return to scale. Regarding Tourism, the cost function shows a negative sign for more than one explanatory variable.

7.1 Time Considered in the Specification

Appendix I present a summary of the coefficients and the significance levels of each for the principal independent variables (Y, P_K and P_W), as taken from the cost function equation. This Appendix also shows the estimates of the scale elasticity calculated at the mean values of the independent variables. Although the estimates of scale economies across different specifications of the cost function are relatively robust, several of the cost function parameter estimates have an unexpected negative sign or are only weakly significant. The negative signs, technology (Z) related coefficients being excepted, indicate violations of regulatory conditions.

To facilitate interpretation and comparison across industrial sectors, Table 2 categorizes the results as "Good" (all coefficients with the correct a priori sign and are statistically significant), "Fair" (one coefficient with incorrect a priori sign and are statistically insignificant), or "Poor" (two or more coefficients with the incorrect a priori sign and are statistically insignificant). This classification seems to be ad hoc, but helps to shed lights on the performance of the various models. While most sectors show signs of increasing returns to scale, the unfortunate conclusion emerging from this table is that the specified translog cost function with time trend did not fit the data well for most sectors. This is indicated by the large number of sectors in the "Poor" category, implying that the

estimated cost function for these sectors had several variables with a negative sign -violating regulatory conditions. This is interpreted as an attempt to account for the rate of technical change which may lead to distortions in the models' properties concerning fulfilment of the regulatory conditions.

Table 2. Classification of Cost Function Results: Time considered as an input-like variable

"Good" Results	"Fair" Results	"Poor" Results
IRS	IRS	
Textiles	Oil and Gas Industry	Chemical
Building and Public Works	Mechanical and Electrical	Diverse Manufacturing
	Electricity	Construction Materials
	Transport	Services
	Tourism	Agriculture and Fishery
		Food Processing Industry
		Mining
		Water

Note: The translog cost model and cost shares are estimated including Z, it's square and interactions.

The results for Textiles, Building and Public Works were "Good" in the sense that all variables presented a positive sign and were statistically significant, but these two sectors appear to be characterized by an increasing return to scale. The industries falling into the "Fair" category all show a sign of increasing returns to scale. Electricity, Transport, Mechanical and Oil and Gas industry are all primarily public enterprises with few private firms and preferential treatment regarding external trade policy. For several sectors in the "Fair" category, the estimated cost elasticity is negative. Generally, this is the result of a negative coefficient on *lnY* and the interaction term *Z*lnY*. This effect forces the scales to be negative and it decreases the estimated scale for several sectors.

7.2 Time Not Considered in the Specification

Several explanations are possible for the weak results presented above, principally among which is probably multicollinearity. A priori, given the large number of independent variables (many of which are the product of squares and interactions of independent variables) and the small size of the data set, one should expect multicollinearity to be a major problem. The dataset spans the years from 1971 to 2004 or 34 observations per equation, which translates into 68 observations for both the cost and capital share equations. The unrestricted translog model contains 20 parameters, of which 15 are unique (the other five being restricted across equations). To these the intercept and variance are to be added. Multicollinearity negatively impacts the results due to the high degree of linearity between independent variables results in imprecise individual parameter estimates and it renders the results sensitive to small changes in the equation specification. As one might expect in a model with few degrees of freedom and many interaction variables, evidence of multicollinearity abounds. (Note 8)

As (it) is well known, the presence of multicollinearity does not invalidate the estimates, but the robustness of the estimates and their precision is in question, as the effects are confounded. For the part, the standard errors of the scale estimates are sufficiently small to be able to reject the hypothesis of constant returns to scale for many sectors. However, the estimated coefficients do occasionally change both in magnitude and in sign. One way to reduce the degree of linear dependence amongst the right-hand side variables is to use a functional form with fewer parameters. (Note 9) Consider the results of estimating a variant of the original translog cost function, specified above, with the square and interaction terms for Z-variable omitted. This reduces the number of unique parameters to 11 and the number of restricted parameters to 4. In translog form, this cost function is expressed as:

$$\ln TC = \alpha_0 + \alpha_Y \ln Y + 1/2\gamma_{YY} (\ln Y)^2 + \sum_i \alpha_i \ln P_i + 1/2 \sum_i \sum_j \gamma_{ij} \ln P_i \ln P_j + \sum_i \gamma_{Yi} \ln Y \ln P_i + \alpha_t Z + \varepsilon \quad (9)$$

The estimation procedure is the same as outlined above, i.e., joint estimation of the cost function (9) with the capital share equation (4), imposing the necessary within and across equation restrictions for a well-behaved cost function. The results of estimating this simplified model variant are more favourable relative to the specification where time trend enters non-linearly in form of squares and interactions with other explanatory variables (Appendix II).

To aid in interpretation, in similarity with the previous results, the results based on time trend (Z) not considered as an input-like variable are categorized in Table 3 as "Good", "Fair", and "Poor" based on sign and significance of the explanatory variables.

Table 3. Classification of Cost Function Results: Time not considered as an input-like variable

"Good" Results	"Fair" Results	"Poor" Results
IRS	IRS	
Electricity	Diverse Manufacturing	Food Processing Industry
Building and Public Works	Mechanical and Electrical	Chemical
Textiles	Construction Materials	Mining
	Oil and Gas Industry	Services
	Transport	Tourism
	Water	Agriculture and Fishery

Note: The translog cost model and cost shares are estimated without the Z variable.

Results from Table 3 show that with the Z interaction terms dropped, good results are obtained for Electricity (ELEC), but the result for Water and Construction Materials (MCV) were classified as fair. The translog cost function without Z interaction terms fit the data well for the Electricity, Building and Public Works, and Textiles with the hypothesis of increasing returns to scale. As before, all sectors in the "Fair" category show signs of increasing returns to scale. The remaining sectors in the "Fair" category are primarily public enterprises (like Hydrocarbon) with few private firms.

For Chemicals and Food processing industries, the scale estimate for both sectors indicates increasing returns to scale but, given the poor quality of the estimates, the case for modelling them as IRS cannot rely solely on the empirical evidence. Rather, it should be evaluated in the light of other stylized facts regarding industry structure and import protection. (Note 10) The question of which of the four functional models outperforms the others can be answered by referencing the t-statistics on selected coefficients. For example, a homothetic cost function is observed whether the coefficients on $lnY*lnP_K$ and $lnY*lnP_L$ are statistically insignificant, i.e. statistically not different from zero. A homogeneous cost function is observed by homotheticity and a statistically insignificant coefficient on $½(LnY)^2$.

Table 4 groups the industrial sectors by the functional forms and analysis of the regression coefficients. Only the alternatives for the translog cost function without Z-interaction terms (9) are considered here.

Table 4. Classification of Industries by Functional Form

Model I Unrestricted Model	Model II Homothetic Model	Model III Homothetic and Homogeneous Model	Model IV Homothetic, Homogeneous and Unit Elasticity of Substitution
Agriculture & Fishery	Food Processing	Tourism	Chemicals
Construction Materials			Water
Mechanical and Electrical Industry			Building and public Works
Textile			Services
Diverse Manufacturing			
Mining			
Oil and Gas Industry			
Electricity			
Transport			

The results of estimating this cost function indicate that the unrestricted model includes the entire "Fair" category and some of "Good" category, with increasing returns to scale. But the estimation of the Homothetic, homogeneous and unit elasticity of substitution model indicate that the functional form includes the entire "Poor" category and some of the sectors classified as "Fair".

7.3 Comparison with Previous Results

Our finding that Textiles, Building and Public Works were classified as "Good" and appear to be characterized by an increasing return to scale seems different with Kress' (1994) finding based on Tunisian data. In fact, Kress finds that the construction materials industry were good and characterized by constant returns to scale, as this null hypothesis could not be rejected. Electricity, Transport, Mechanical and Oil and Gas industry show an increasing return to scale. They are all primarily public enterprises with few private firms.

In summary, we find that the translog cost function, without Z-interaction terms, fits the data well in particular for sectors that are consisting of primarily public enterprises and few private firms. The results from Kress (1994) indicate that several sectors where the estimated cost function did not fit the data particularly well, are nonetheless logical candidates for being modelled as increasing returns to scale sectors.

The difference can be explained by the measures that have been used to liberalize the economy which affected the competitiveness of the companies, and by the process of restructuration and privatization.

8. Conclusion

Empirical investigations of trade liberalization are conducted under the assumptions of increasing returns to scale and imperfect competition, without testing for the presence of increasing return to scale prior to the analysis. This paper, by specifying a translog cost function and rigorous testing procedures, seeks to test whether evidence of increasing returns to scale, at the Tunisian industry level, can be found and to identify those sectors most likely characterized by increasing returns to scale. In addition to establishing the appropriateness of the result and its usefulness concerning the IRS/IC investigations of trade liberalization and its effects, the result will be useful in preparation for the construction of a Computable General Equilibrium model of trade liberalization.

With the Tunisian data (1971-2004), and rigorous testing procedures, we investigate evidence of IRS at the industry level. Using an econometric approach, based on the estimation of the translog cost function, we identify the sectors characterized by increasing returns to scale. The classification of the results shows that specification of the model is found to be sensitive to inclusion of time trend representing technology. The model accounting for technology did not fit the data well for most sectors. The estimation results without time trend interaction with other explanatory variable are different. Here most of the sectors show signs of increasing returns to scale.

Two conclusions emerge from this study. First, we find that the estimation results based on the translog cost function, with technology considered as an input-like explanatory variable, indicates that the estimates of scale economies across different model specifications are relatively robust. While most sectors show signs of increasing returns to scale, the unfortunate conclusion emerging is that the specified translog cost function, with time trend, did not fit the data well for most sectors. This is indicated by the large number of sectors in the “Poor” category, implying that the estimated cost function for these sectors had several variables with statistically insignificant or negative sign violating the regulatory conditions.

Second, and because of the weak results of the estimation, several explanations are possible, principal among which is probably multicollinearity. This multicollinearity negatively impacts the results in that the high degree of linearity between independent variables results in imprecise parameter estimates and renders the results sensitive to small changes in the model specification. As one might expect in a model with few degrees of freedom and many interaction terms, evidence of multicollinearity abounds. It should be noted that, the presence of multicollinearity does not invalidate the estimates, but the robustness of the estimates and their precision is questioned. As a result of dropping the time trend interaction terms “Good” results are obtained. The restricted translog cost function fit the data well for the Electricity, Building and Public Works, and Textiles -with the hypothesis of increasing returns to scale confirmed.

All sectors in the “Fair” category show signs of increasing returns to scale. For Chemicals and Food processing Industries, the scale estimate indicates increasing returns to scale, but given the poor quality of the estimates, a modelling of them as increasing returns to scale cannot rely solely on the empirical evidence. Rather, it should be evaluated in the light of other stylized facts regarding industry structure and import protection. The results of estimating this cost function; combined with information on industry structure, help us to identify the sectors to be modelled under the assumption of increasing returns to scale.

We can conclude that the translog cost function fit well the industries data. In the course of liberalization period, the Tunisian industries have experienced a major change in their returns to scale. The returns to scale tend to increase specifically in sectors with many public enterprises and few private enterprises.

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Notes

Note 1. See Christensen, Jorgenson, and Lau (1973).

Note 2. See Caves and Christensen (1980), Caves, Christensen, and Swanson (1980 and 1981), Friedlander, Winston, and Wang (1983), Gupta and Taher (1984), Caves, Christensen and Tretheway (1984), Antle and Crissman (1988), and Kress (1994).

Note 3. For a survey of different parametric and no–parametric methods in estimation of rate of total factor productivity growth and its decomposition using manufacturing and services data see Heshmati (2003).

Note 4. Hanoch (1975) discusses the elasticity of scale and the shape of average costs. Beijnen and Bolt (2009) investigate the existence and extent of economies of scale in the European payment processing industry. They find ownership structure is an important factor explaining cost differences across Europeans processing centers.

Note 5. See Diewert (1974) for formal statements and deviations of the restrictions for homotheticity and homogeneity. See also Caves and Christensen (1980) for global properties of flexible functional forms.

Note 6. This technique, used by Nerlove (1963), is certainly attractive from the point of view of simplicity.

Note 7. A drawback to dropping one of the equations is that the estimates will not be invariant to the omitted equation. A remedy to this problem is the procedure outlined in Caves, Christensen and Tretheway (1984). They

propose a modification of Zellner's (1962) SUR technique in which all equations are retained in the first stage but one is then dropped in the last stage of the estimation process.

Note 8. Intuitively, the presence of so many interaction terms when the degrees of freedom were low led us to suspect multicollinearity. This suspicion was confirmed by an analysis of the principal components of the X'X matrix, where X is the data matrix of right-hand side variables. Several of the time trend interaction terms (Z*lnY, $Z*\ln P_K$, $Z*\ln P_L$) had very small characteristic roots (of the order of 10^{-4}), which is considered evidence of multicollinearity.

Note 9. An alternative sensitivity analysis concerning the impact of reducing the number of parameters to be estimated can be made by analyzing the regression coefficients from the less complex translog cost function. In general, as the number of parameters decreases (as we move toward the homothetic, homogeneous, and unit elasticity of substitution form) the signs on the independent variables tend more toward their a priori value and their significance increases. The model reduces to a generalized Cobb-Douglas form with squares but without interaction terms.

Note 10. The presence of high import tariffs and large numbers of domestic firms in an industry does not by itself constitute evidence of increasing returns to scale; it does however show evidence of practice of liberalization policy.

Appendix I. Translog Cost Function Results: Time considered as an input-like variable

Coefficients	Model I	Model II	Model III	Model IV
1. Agriculture and Fishery:				
lnY	-4.8595	-4.8366	-0.0318	0.0399
t-value	(-1.4153)	(-1.4023)	(-0.5462)	(0.6699)
lnPK	-0.0004	-0.1405	-0.1428	0.2699
t-value	(-0.0012)	(-0.9561)	(-0.9677)	(22.4925)
lnPW	1.0004	1.1405	1.1428	0.7300
t-value	(2.9616)	(7.7606)	(7.7444)	(60.8206)
Scale	0.0097	0.0223	0.0169	0.0370
Std error	(0.0809)	(0.0815)	(0.0276)	(0.0017)
2. Food Processing:				
lnY	32.1781	32.2104	0.1204	0.0441
t-value	(1.0775)	(1.0783)	(0.4165)	(0.2847)
lnPK	-0.0865	-0.0779	-0.0939	0.2160
t-value	(-0.3850)	(-0.4248)	(-0.5112)	(11.4834)
lnPW	1.0865	1.0779	1.0939	0.7839
t-value	(4.8382)	(5.8781)	(5.9581)	(41.6711)
Scale	-0.1773	-0.1751	-0.2316	-0.0850
Std error	(0.4871)	(0.4876)	(0.1994)	(0.0731)
3. Construction Materials:				
lnY	0.7248	-0.2223	0.4619	0.2801
t-value	(0.5578)	(-0.1794)	(4.3909)	(2.3868)
lnPK	0.0711	-2.7337	-2.7634	0.2953
t-value	(0.1764)	(-2.5632)	(-2.6167)	(8.2193)
lnPW	0.9288	3.7337	3.7635	0.7047
t-value	(2.3029)	(3.5008)	(3.5636)	(19.6172)
Scale	1.7719	0.5403	0.5465	0.4889
Std error	(0.2825)	(0.0711)	(0.0479)	(0.1183)
4. Mechanical and Electrical:				
lnY	5.3183	5.3301	-0.1683	-0.1717
t-value	(5.2689)	(5.4309)	(-3.1089)	(-3.2371)
lnPK	0.8636	0.7505	0.7426	0.2317
t-value	(2.6626)	(2.3533)	(2.0087)	(17.8816)
lnPW	0.1363	0.2495	0.2573	0.7683
t-value	(0.4204)	(0.7822)	(0.6961)	(59.2846)
Scale	0.2943	0.3413	0.2669	0.2933
Std error	(0.4981)	(0.5133)	(0.2465)	(0.2635)
5. Chemical:				
lnY	-2.9334	-3.5384	-0.2506	-0.1686
t-value	(-1.5593)	(-1.9263)	(-2.1439)	(-1.43590
lnPK	-2.5506	-1.8381	-1.8777	0.3419

t-value	(-5.0996)	(-4.2473)	(-4.3837)	(12.0075)
lnPW	3.5506	2.8381	2.8777	0.6581
t-value	(7.0991)	(6.5581)	(6.7183)	(23.1135)
Scale	0.2137	0.1981	0.1600	0.4099
Std error	(0.3026)	(0.3078)	(0.2326)	(0.3277)
6. Textiles:				
lnY	4.3496	2.6069	0.1015	0.1032
t-value	(3.1930)	(1.8756)	(2.2506)	(2.2147)
lnPK	0.2442	0.6507	0.6530	0.0914
t-value	(2.3878)	(5.2104)	(5.4653)	(11.6288)
lnPW	0.7558	0.3493	0.3470	0.9086
t-value	(7.3931)	(2.7976)	(2.9048)	(115.5651)
Scale	0.2658	0.2321	0.2274	0.2595
Std errror	(0.1070)	(0.0909)	(0.0713)	(0.0885)
7. Diverse Manufacturing:				
lnY	-13.4388	-17.7100	0.0897	0.0280
t-value	(-7.4052)	(-10.0100)	(0.7924)	(0.2989)
lnPK	-0.5846	-0.2516	-0.3280	0.2887
t-value	(-2.6484)	(-0.8702)	(-1.0280)	(23.1608)
lnPW	1.5846	1.0252	1.3279	0.7113
t-value	(7.1787)	(3.5455)	(4.16223)	(57.0576)
Scale	-18.8528	0.3244	0.4879	0.4554
Std error	(2.3219)	(0.4062)	(0.2256)	(0.2421)
8. Mining:				
lnY	13.9895	13.6119	-0.1929	-0.0525
t-value	(3.5801)	(3.4923)	(-1.5648)	(-0.4879)
lnPK	-1.3936	-0.9446	-1.0273	0.2062
t-value	(-3.4984)	(-2.9099)	(-2.9247)	(1.2622)
lnPW	2.3936	1.9446	2.0273	0.7938
t-value	(6.0087)	(5.9906)	(5.7716)	(43.3467)
Scale	0.0043	-0.0549	-0.0796	-0.0352
Std error	(0.4098)	(0.4160)	(0.0642)	(0.0098)
9. Oil and Gas:				
lnY	-10.4162	-80.3765	0.5638	0.3827
t-value	(-1.3744)	(-0.9657)	(2.7255)	(2.3140)
lnPK	0.5809	0.6448	0.6454	0.9157
t-value	(6.6905)	(7.4008)	(7.4231)	(187.3545)
lnPW	0.4191	0.3552	0.3546	0.08430
t-value	(4.8263)	(4.0764)	(4.0791)	(17.2461)
Scale	0.3641	-0.0292	0.0301	02006
Std error	(0.2863)	(0.33499)	(0.3023)	(0.1032)
10. Electricity:				
lnY	-12.5648	-11.7634	0.8504	0.9103
t-value	(-1.6381)	(-1.3833)	(2.2174)	(2.7867)
lnPK	0.2952	0.3236	0.3227	0.7426
t-value	(2.2744)	(2.3904)	(2.3906)	(73.8665)
lnPW	0.7049	0.6764	0.6773	0.2574
t-value	(5.4314)	(4.9964)	(5.0169)	(25.6059)
Scale	0.6653	0.1564	0.3535	1.1813
Std error	(0.4750)	(0.5113)	(0.2815)	(0.1535)
11. Water:				
lnY	-8.3831	-13.4671	0.6141	0.6208
t-value	(-2.6883)	(-3.9503)	(3.1411)	(3.6991)
lnPK	-1.1757	-1.6689	-1.6938	0.6488
t-value	(-4.4013)	(-3.5972)	(-3.6049)	(23.2222)
lnPW	2.1757	2.6689	2.6938	0.3512
t-value	(8.1451)	(5.7526)	(5.7331)	(12.5727)
Scale	0.5366	0.2060	0.2288	0.6249
Std error	(0.4519)	(0.5980)	(0.2183)	(0.0023)
12. Buildings and Public Work:				
lnY	0.9364	0.4541	0.3457	0.3369

t-value	(0.4705)	(0.2303)	(4.2201)	(4.9933)
lnPK	0.9505	0.7028	0.7032	0.0146
t-value	(7.5993)	(5.1414)	(5.1492)	(1.3077)
lnPW	0.0494	0.2972	0.2968	0.9854
t-value	(0.3952)	(2.1740)	(2.1731)	(88.3784)
Scale	0.3713	0.2985	0.2989	0.2797
Std error	(0.0196)	(0.0247)	(0.0265)	(0.0324)
13. Transport:				
lnY	11.1055	11.4710	0.1925	0.3561
t-value	(1.2031)	(1.2583)	(0.8119)	(1.7329)
lnPK	-0.1011	0.2243	0.2919	0.4039
t-value	(-0.1781)	(0.5864)	(0.7845)	(31.2117)
lnPW	1.1011	0.7757	0.7081	0.5961
t-value	(1.9393)	(20.0274)	(1.9028)	(46.0691)
Scale	0.5140	0.3923	0.3968	0.4605
Std error	(0.2288)	(0.2513)	(0.1158)	(0.0591)
14. Tourism:				
lnY	3.7531	3.7608	0.1372	-0.1464
t-value	(0.4779)	(0.4821)	(0.5977)	(-0.9505)
lnPK	3.0273	2.9323	2.9327	0.6303
t-value	(25.2022)	(36.3938)	(36.3803)	(21.7561)
lnPW	-2.0273	-1.9323	-1.9327	0.3697
t-value	(-16.877)	(-23.9826)	(-23.9754)	(12.7599)
Scale	0.1010	0.1092	0.1461	0.0331
Std error	(0.1014)	(0.0991)	(0.0051)	(0.1017)
15. Services:				
lnY	-86.5763	-86.5434	-0.5303	-0.4108
t-value	(-2.1700)	(-2.1715)	(-2.2284)	(-1.2260)
lnPK	1.6624	1.6756	1.6754	0.0920
t-value	(2.1586)	(12.6315)	(12.5878)	(4.6993)
lnPW	-0.6623	-0.6756	-0.6754	0.9080
t-value	(-0.8601)	(-5.0928)	(-5.0743)	(46.3993)
Scale	0.0329	0.3059	-0.04790	0.0898
Std error	(0.4755)	(0.4755)	(0.2733)	(0.2836)

Note: The translog cost and cost share equations are estimated using individual industry time series. In order to save spaces, here we report only the estimated output and price coefficients from the cost function and the computed scale effects. However the full estimation results are available from the authors upon request.

Appendix II. Translog Cost Function Results: Time not considered as an input-like variable

Coefficients	Model I	Model II	Model III	Model IV
1. Agriculture and Fishery:				
lnY	-3.8056	-0.7455	0.0355	0.0433
t-value	(-3.0055)	(-0.6524)	(1.0846)	(0.5813)
lnPK	-2.2066	-1.0278	-1.0216	0.6805
t-value	(-7.1746)	(-12.3475)	(-12.1779)	(19.1917)
lnPW	3.2066	2.0278	2.0216	0.3195
t-value	(10.4259)	(12.8101)	(24.0985)	(9.0106)
Scale	0.2505	0.0418	0.0355	0.0433
Std error	(0.0523)	(0.0227)	(0.0327)	(0.0745)
2. Food Processing:				
lnY	14.438	-3.4251	0.00308	-0.0036
t-value	(5.8060)	(-4.0942)	(0.0311)	(-0.0277)
lnPK	-0.1733	2.1779	2.4838	0.5219
t-value	(-0.5148)	(22.1240)	(19.2305)	(15.8151)
lnPW	1.1733	-1.1779	-1.4838	0.4781
t-value	(3.4850)	(-18.0733)	(-11.4882)	(14.4869)
Scale	-0.3703	0.1314	0.0031	-0.0036
Std error	(0.9727)	(0.2195)	(0.0991)	(0.1289)
3. Construction Materials:				
lnY	3.0642	1.9871	0.8979	0.5484
t-value	(10.8828)	(3.6040)	(11.8338)	(12.1532)

lnPK	-0.7883	-2.3029	-2.5714	0.6490
t-value	(-2.5577)	(-5.6184)	(-5.6388)	(16.0532)
lnPW	1.7883	3.3029	3.5714	0.3510
t-value	(5.8025)	(8.0580)	(7.8316)	(8.6814)
Scale	1.2638	0.6968	0.8979	0.5484
Std error	(0.1003)	(0.2206)	(0.0759)	(0.0451)
4. Mechanical and Electrical:				
lnY	3..9794	2.3651	0.6583	0.3006
t-value	(8.9975)	(4.4254)	(6.5586)	(7.8271)
lnPK	-0.7872	-1.2439	-0.6104	0.5204
t-value	(-2.7044)	(-5.4627)	(-2.8291)	(18.1695)
lnPW	1.7872	2.2439	1.6104	0.4796
t-value	(6.1400)	(9.8543)	(7.4641)	(16.7469)
Scale	0.7191	0.2374	0.6583	0.3006
Std error	(0.0829)	(0.2611)	(0.1004)	(0.0384)
5. Chemical:				
lnY	1.9757	3.0353	-0.0427	0.0925
t-value	(4.3129)	(5.4643)	(-0.5065)	(1.4220)
lnPK	-2.8935	-2.3608	-3.7501	0.6849
t-value	(-6.0611)	(-5.2851)	(-6.3210)	(18.2373)
lnPW	3.8935	3.3608	4.7501	0.3151
t-value	(8.1558)	(7.5237)	(8.0065)	(8.3918)
Scale	0.5577	-0.5131	-0.0427	0.0925
Std error	(0.0321)	(0.4915)	(0.0844)	(0.0651)
6. Textile:				
lnY	1.4192	0.6480	0.3075	0.1844
t-value	(13.0667)	(6.3677)	(10.6672)	(7.0758)
lnPK	0.6321	0.4776	0.4013	0.2303
t-value	(17.1439)	(9.1138)	(8.3036)	(14.3001)
lnPW	1.6321	1.4776	1.4013	0.7697
t-value	(44.2654)	(28.1959)	(28.9938)	(47.8044)
Scale	0.2261	0.1995	0.3075	0.1844
Std error	(0.0425)	(0.0500)	(0.0288)	(0.0261)
7. Diverse Manufacturing:				
lnY	2.9278	1.9332	1.6398	0.4706
t-value	(18.7344)	(9.1554)	(21.1020)	(6.7915)
lnPK	-0.7347	-0.0131	0.0438	0.5587
t-value	(-10.9890)	(-0.3344)	(1.1118)	(20.6726)
lnPW	1.7347	1.0131	0.9562	0.4413
t-value	(25.9457)	(25.8518)	(24.2644)	(16.3275)
Scale	0.8340	1.3317	0.6398	0.4706
Std error	(0.0678)	(0.0781)	(0.0777)	(0.0693)
8. Mining:				
lnY	5.0105	2.4099	0.0003	-0.1464
t-value	(3.9978)	(2.0990)	(0.0051)	(-2.0066)
lnPK	-2.8824	-2.5339	-2.6764	0.5446
t-value	(-16.0330)	(-14.2538)	(-13.8302)	(14.1450)
lnPW	3.8824	3.5339	3.6764	0.4554
t-value	(21.5955)	(19.8791)	(18.9976)	(11.8303)
Scale	0.2889	-0.0068	0.0003	-0.1464
Std error	(0.1427)	(0.1349)	(0.0596)	(0.0730)
9. Oil and Gas:				
lnY	-18.2184	16.0040	0.3925	0.4702
t-value	(-3.5220)	(1.7483)	(4.3189)	(4.9427)
lnPK	0.7928	0.3644	1.2331	0.9612
t-value	(10.2081)	(2.7027)	(13.6473)	(173.6212)
lnPW	0.2072	0.6356	-0.2231	0.0388
t-value	(2.6684)	(4.7145)	(-2.4689)	(7.0164)
Scale	1.5366	0.9926	0.3925	0.4702
Std error	(0.6406)	(0.4671)	(0.0909)	(0.0951)
10. Electricity:				

lnY		0.7914	1.4707	0.9832	0.6360
	t-value	(3.2645)	(5.3023)	(10.1354)	(7.1490)
lnPK		0.5775	0.2655	0.2438	0.8791
	t-value	(2.6571)	(1.7352)	(1.4299)	(57.998)
lnPW		0.4225	0.7345	0.7562	0.1209
	t-value	(1.9436)	(4.8002)	(4.4340)	(7.9728)
Scale		1.5192	0.6963	0.9832	0.6360
	Std error	(0.2573)	(0.1279)	(0.0970)	(0.0890)
11. Water:					
lnY		3.2170	-3.0855	2.1214	1.7557
	t-value	(2.8642)	(-2.6537)	(17.1980)	(14.9747)
lnPK		-0.4689	-1.2106	-0.9299	0.8430
	t-value	(-2.8759)	(-4.5430)	(-4.7288)	(31.7163)
lnPW		1.4689	2.2106	1.9299	0.1570
	t-value	(9.0093)	(8.2957)	(9.8142)	(5.9070)
Scale		0.9952	0.4562	0.1214	0.7557
	Std error	(0.4313)	(0.6001)	(0.1234)	(0.1172)
12. Buildings and Public Work:					
lnY		1.2171	3.9651	0.3524	0.4165
	t-value	(1.4469)	(6.4610)	(3.0823)	(10.1451)
lnPK		0.2980	-0.5707	-0.3167	0.2804
	t-value	(1.7362)	(-7.5721)	(-4.6105)	(11.4434)
lnPW		0.7020	1.5707	1.3167	0.7196
	t-value	(4.0904)	(20.8400)	(19.1672)	(29.3614)
Scale		0.7063	0.2243	0.3524	0.4165
	Std error	(0.1741)	(0.2006)	(0.1143)	(0.0411)
13. Transport:					
lnY		4.7765	3.7912	0.2516	1.2850
	t-value	(6.3142)	(6.6584)	(2.4109)	(4.8588)
lnPK		-1.8799	-1.4739	-2.2849	0.5309
	t-value	(-9.3651)	(-8.9752)	(-10.4762)	(34.6098)
lnPW		2.8799	2.4739	3.2849	0.4691
	t-value	(14.3466)	(15.0646)	(15.0610)	(30.5828)
Scale		0.3126	0.0518	0.2516	1.2850
	Std error	(0.1336)	(0.2606)	(0.1044)	(0.2645)
14. Tourism:					
lnY		1.9173	-0.6167	-0.1022	-0.0480
	t-value	(1.8576)	(-0.8284)	(-1.1150)	(-0.6806)
lnPK		0.5060	1.1134	1.2260	0.71406
	t-value	(3.0136)	(9.1358)	(11.5282)	(42.1935)
lnPW		0.4940	-0.1133	-0.2260	0.2859
	t-value	(2.9425)	(-0.9302)	(-2.1250)	(16.8966)
Scale		-0.4720	-0.0771	-0.1022	-0.0480
	Std error	(0.0524)	(0.0447)	(0.0916)	(0.0705)
15. Services:					
lnY		2.3015	-2.9702	-0.3596	-0.0532
	t-value	(2.1652)	(-3.4833)	(-1.8621)	(-0.1716)
lnPK		-2.4816	-0.7320	-0.9735	0.1367
	t-value	(-9.4679)	(-4.2936)	(-5.3033)	(12.9349)
lnPW		3.4816	1.7320	1.9735	0.8633
	t-value	(13.2832)	(10.1587)	(10.7510)	(81.6819)
Scale		-0.2915	-0.1626	-0.3596	-0.0532
	Std error	(0.2846)	(0.1556)	(0.1931)	(0.3098)

Note: The translog cost and cost share equations are estimated using individual industry time series. In order to save spaces, here we report only the estimated output and price coefficients from the cost function and the computed scale effects. However the full estimation results are available from the authors upon request.

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The Determinants of Working Capital Requirements in Palestinian Industrial Corporations

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Abstract

This study is trying to find the variables that determine working capital for Palestinian industrial firms. We used a sample of 11 industrial firms that are listed on the Palestine Securities Exchange. We used Working Capital as the endogenous variable, and some financial and economic variables, such as cash conversion cycle, operating cash flow, leverage, firm size, return on assets, interest rate on loans, and economic growth rate, as exogenous variables.

An econometric model was established and parameters were estimated based on the panel data for 11-industrial companies for eight years (2004-2011). The study found that the cash conversion cycle, return on assets and operating cash flow are a significant determinant and positively related to the working capital requirements, while leverage and firm size are significant but negatively related to the working capital requirements. On the other hand economic variables such as: the interest rate and real GDP growth rate has no significant impact on the working capital. These findings are consistent with several previous studies, for other countries such as Jordan, Brazil, Pakistan, India, Greece, Thailand, Cyprus and Sri Lanka. In addition, it was found that Palestinians firms maintain a sizable working capital which may be due to a long cash conversion cycle (over six months) and to conservative policies due to instable economic and political conditions.

Keywords: working capital, cash conversion cycle, operating cash flow, leverage, return on assets, economic growth

1. Introduction

Managing the financial needs and operations of any business is very important to the management of the company, because it has an effect on both profits and liquid assets of the firm. Financial needs are largely classified into two types of needs: working capital needs and fixed capital needs. That part of finance which enables an enterprise to conduct its day-to-day operations is called working capital. We need to analyze short term assets and liabilities carefully in order to manage the firm's liquidity, management of working capital helps managers to manage their operation of the firm through making available cash to pay for short-term debt and the maturity of long term debt as well as expenses resulting for daily operations. So, an optimal level of working capital must be kept to trade off between return and risk (Ranjith, 2008).

One of the integral components of the overall corporate strategy is to manage working capital efficiency. This needs to control short term obligation as well as decrease investment in liquid assets as much as possible in order to create shareholder value (Eljelly 2004). In practice, Narender, Menon and Shewtha, (2009) show that a firm may lose several profitable investment opportunities or suffer a liquidity problem if the working capital is too low or it is improperly managed.

While a number of previous research studies have examined the effects of the working capital on the profitability, efficiency, performance and earning before interest rate and tax (EBIT). (e.g. Nobanee, 2009; Padachi, 2006; Rahman and Nasr, 2007; Ramachandran and Janakiraman, 2009; Shin and Soenen, 1998; Wu, 2001), this subject is still a very important issue because it affects the short term investment decisions; and managers can increase the value of the firm by reducing the working capital ratio to its optimal level (Rahman and Nasr 2007).

Even though several studies about working capital management were undertaken, in both developed and under developed countries; this study adds to the literature by examining the issue of the working capital management

and its determinants in developing markets. In specific it examines the variables that affect the working capital requirements in Palestinian industrial firms, given that little attention was given to the money those firms make in short term assets. To the best of our knowledge, there is only one study about working capital in Palestinian companies which studied the effect of working capital on their stock prices (Awad and Al-Ewesat 2012).

The aim of this paper is to find the important variables that affect the size of the working capital in Palestinian firms. We are going to test the following variables: the cash conversion cycle, operating cash flow, returns on asset, firm size, debt leverage, economic growth rate, and interest rate on loans. A sample of 11 Palestinian industrial firms has been chosen. The data covers 8-years period 2004-2011 of those companies listed on the Palestinian Security Exchange (PSE). The industrial sector in Palestine is important to the Palestinian economy, because it is considered a major source of employment and economic growth. So finding the determinants of working capital requirements in Palestinian industrial sector is important for the firms to be able to understand the factors that contribute to improving their profitability and value. It is helpful to both firms' managers and economic policy makers.

This research article is planned as follows. Section II is a summary of the literature review. Section III discusses the sample and the variables. Section IV presents the data analysis. Section V deals with the regression analysis and Section VI summarizes the findings and conclusion.

2. Literature Review

Sagan (1955) showed that the working capital management has a vital effect on the health of the firm. Moreever it is still one of the most important issues that affect the short term investment decisions; the working capital management process needs very important decisions regarding cash required for investing the optimal level of inventories, and managing credit and debt account (Darun 2008). In this context Eljelly (2004) mentioned that the business's history and its type, determine its requirements for working capital. The cash gaps and the working capital differ from one industry to another; whereas some maintain short-term, or even negative cash gaps, because of their ability to obtain a large amount of credit from their suppliers. .

The literature itself indicates several factors that affect working capital management and they change over time. Hawawini, Viallet andVora (1986) in their study suggested that working capital policies are dependent on industry practices and concluded that its effect on working capital management is stable over time. Working capital policies differ from one industry to another, because the inventory requirements are different from one industry to another and even from firm to another in the same industry. Service industries need no inventory, while manufacturing need a large amount of inventory.

Filbeck, and Krueger (2005) and Yadav, Kamath and Manjreka (2009) in their studies concluded that working capital policy is dynamic over time, because it varies with economic cycles. Therefore in times of high business volatility, companies tend to use a large amount of working capital, and to adopt an aggressive approach in times of low volatility. Some studies showed that when there are more fluctuations in future cash flow the cash held and short term investment of a company will increase, so managing operating cash flow will have a significant effect on a company's working capital management such as Ranjith's (2008) study on Thailand firms.

The liquidity position of the firms also depends mainly upon the size of inventory, but other components, like debtors, loans and advances cash and bank balance, and bills receivable etc., are also responsible (Singh, 2008). In this context the results of Hill, Kelly, and Highfield. (2009) showed that the working capital ratio is negatively related to the rate of growth in sales, unexpected demand, rate of interest, and financial difficulties; and it is positively related to operating cash flow and capital market access.

Moussawi, Laplante and Kieschnick (2006) in their study focused on some factors that may influence working capital management such as the size of the firm, growth rate of sales, the percentage of outside directors on board, the compensation of executives, directors, and the percentage share of the CEO. They found that the inefficiency of a firm's working capital management is correlated with the size of the firm but not correlated with its industry concentration. They also found that the higher the proportion of outsiders of a firms board, the better performance of its working capital management. The higher the compensation of the CEO's, the better the firms' working capital management. However, the larger the CEO's share of the firm's stock, the contrary behavior is shown. These results are consistence with Hawawini et. al. (1986) results that there is a substantial industry effect on the firms working capital management practices and this effect is stable over time and that sales growth and industry practices are important factors, which influence a firm's investment in working capital.

In order to find out if the managers can determine the working capital, Frankel (2005) agrees with the above findings and showed that managers respond to working capital performance incentives. Thus, managers' concern

about the level of working capital, because compensation committees and investors; emphasize the minimization of non-cash working capital. He provided evidence that managers are striving to improve operating cash flow.

Pandey and Perera (1977) studied the working capital management policy and practices of private sector manufacturing companies in Sri Lanka, they found that the size of the firm is one of the major influences of working capital policy and approach. Many previous studies insured that the size is one of the determinants of the working capital requirements. Padachi (2006) in his study on small industrial firms in Mauritania concluded that even the working capital represents a concern of all firms; the small firms and the large firms, but it is more important to small firms because, they tend to have a relatively high level of current assets, less liquidity, volatile cash flows, and a high reliance on short term debt. The work of Howorth and Westhead (2003), on management of working capital on small U.K. firms, suggested that small firms tend to put emphasis on some areas of working capital management where they can increase their returns and improve their business performance.

In analyzing the determinants of working capital management, Chiou and Cheng (2006), found that there is an inverse relationship between capital structure of the firm and the two measures of liquidity: net liquid balance and working capital ratio. However variables such as business indicator, industry effect, growth opportunity, firm performance and the firm's size proved to have no effect on working capital.

Seeger, Locker and Jergen (2011), analyzed the working capital in the Swiss Chemical and Pharmaceutical industry. They analyzed 18 companies listed on the six Swiss Exchanges and compared them with their European and American competitors. They found that there was a huge potential for improvement especially in the area of managing short term assets and liabilities. in the Swiss industries.

With regard to the effect of working capital on the profitability, several studies have tackled the issue. The most important are: Rahman and Nasr (2007) who studied the effect of managing working capital on the firm’s profitability in Pakistani companies. They used data during 1999-2004 for 94 companies listed on the Islamabad Stock Exchange. They used several variables such as: Average Collection Period, Cash Conversion Cycle, Average Payment Period, Inventory Turnover, and Net Operating Profitability. They found a strong relationship between working capital and a firm’s profitability, and that cash conversion cycle can improve shareholders equity if the firm reduces it to an optimal level. Taghizadah, Akbari and Ebrati. (2012) studied the impact of working capital management policies on Iranian firm's profitability and value. They found that conservative investment policies and aggressive financing policy and leverage has a negative impact on firm's profitability and value; while firm size and firm growth has a positive impact.

There are three studies on Jordanian firms who examined the impact of working capital on firm's profitability and value. The first by Al-Mwalla (2012) she used Tobin's Q as a measure of Value and ROA as a measure of profitability. She found that a conservative investment policy has a positive impact on firm's profitability and value; while aggressive financing policy has a negative impact on both value and profitability. On the other hand she found that leverage has no effect on firm's profitability and value; while firm's size, sales growth and economic growth has a positive impact on both value and profitability. Al-Debie (2011) on the other hand, found that profitability increased with size and GDP growth, and decreased with leverage. He also found that Jordanian industrial companies invest significantly in working capital, so efficient working capital management can improve profitability of these firms. The third study by Hayajneh and Yassine (2011), on the same subject, found adverse relationship between profitability of the firm and the average receivable collection period, average conversion inventory period, average payment period, leverage, and cash conversion cycle. On the other hand they found a positive relationship between profitability and the firm's size, sales growth rate, and current ratio.

Nazir and Afza (2009) in their study on Pakistani firms used internal and external factors that have an effect on working capital; internal factors they used: operating cycle, operating cash flows, leverage, size, return on assets, Tobin's Q and growth rate, and they used the industry dummy and level of economic activity as external macroeconomic factors. They found a significant effect of operating cycle, leverage, return on assets and Tobin's Q on the working capital requirements.

3. Sample and Variables

3.1 Sample

In this study, we investigate the factors that affect the working capital requirements of Palestinian industrial firms. Our study sample consists of all industrial firms listed on the Palestine Securities Exchange (PSE). We included firms listed before 2004 and should neither have been delisted by the PSE nor merged with any other firm during the study period. Furthermore, firms must have a complete data for the period 2004-2011. The required financial data has been obtained from the annual reports of these firms from the website of the PSE. The

final sample was 11 industrial firms, and so the total of 88 observations are included in the analysis. This number is large enough to arrive at some meaningful statistical results. Moreover, the fact that this number accounts for about one-fourth of all listed companies, one can argue that the results are a good approximation of the Palestinian market**.**

3.2 Variables Description

3.2.1 The Dependent Variable

Working Capital Ratio (WCR). The study will try to find the determinants of working capital requirements of the industrial firms, so we have included the working capital deflated by total assets as a dependent variable and is measured by:

WCR*= (current assets- current liabilities)/ total assets*

3.2.2 The Independent Variables

There are several independent variables included in our models. These include:

1. Cash Conversion Cycle (CCC), cash conversion cycle is defined as the number of days needed to convert its purchases from raw materials to finished product and sell it for cash. The longer the cash conversion cycle, the greater the net investment in current assets, and hence the greater the need for financing of current assets, and it is calculated by:

CCC= Average collection period + inventory turnover in days – Average payment period

Since most of the variables in our model are in ratios we divided the number by 365 so we get the number per year instead of days (annual cash conversion cycle).

ACCC*=CCC/365*

2. Operating Cash Flow (OCF), is the cash the firm will obtain from its routine operations. We get it from the income statement then it is deflated by total assets. Positive operating cash flow enables firms to finance positive working capital requirements allowing a more conservative operating working capital strategy, thereby facilitating future sales growth; however firms with negative operating cash flows must finance positive working capital requirements through other sources (Ranjith 2008), (Hill et.al. 2010). It is calculated by:

OCF*=(EBIT + Depreciation – Taxes)/Total Assets*

3. Firm Size (Size), Pendey and Perera (1977), and Moussawi (2006) verify that the size of the company has an influence on the overall working capital policy and approach. They used the natural logarithm of total assets of the firm. Some other studies used log of sales as size measure (Deloof 2003). Other studies used the rate of growth of sales, but we prefer to use the log of total assets, because most of our firms have more than 50% of the total market share as there are few firms in each industry.

SIZE=*Log (Total Assets)*

4. Profitability, there are several indicators of profitability such as; ROE and ROA. Most studies prefer to use ROA to find the efficiency of management in generating profits from the firm's assets**.** It is calculated by dividing a company's net income by its total assets,

ROA*= Net Income/ Total Assets*

5. Leverage (LEV) which is the financial debt ratio that is used in order to establish the relation between the external financing of the firm and its total assets**.** According to the Pecking Order Theory, a company with short funds will tend to raise capital from inside before issuing new stocks or borrowing money from outside, since raising capital via new securities will have issuing costs besides more outside monitoring and limitations. Narendre et,al. (2009) found that a higher debt ratio is due to less capital available for daily operations, so the firm may have to raise capital from outside in response to a lack of funding, plus exercise caution in working capital management so as not to aggravate the shortage of funds. Nazir and Afza (2009) also used the leverage ratio as an independent variable in their study to determine the factors that affect working capital management in Pakistan. This variable can be measured through the following equation:

LEV*= (Short Term Loans+ Long Term Loans)/Total assets*

6. Real GDP Growth Rate (GDPR) Economic growth is probably one of the most reliable economic indicators, it is the best measure of changes in economic activities. The changes in economic conditions may have an effect on managing the firm more efficiently. Lamberson (1995) stated that small firms respond differently in working capital management to changes in economic activities. The working capital policy is not static over time; it

varies with the changes in the state of the economy. Rate of growth of GDPR is used as an indicator of economic growth.

7. Interest Rate on Loans and Advances(R) which is the cost of borrowing money. Filbeck and Kruger (2005) observed that the changes in interest rates has an effect on working capital management, because firms have less desire to make payments early when interest rate increase, this will stretch account payable.

4. Data Analysis

4.1 Descriptive Statistics

Table 1 presents the descriptive statistics for the variables used in the sample. It shows the average, and standard deviation the minimum and maximum values of all variables used in the study.

Table 1. Descriptive Statistics

Variable	Mean	Std. Deviation	Min.	Max.	N
WCR	.2744	.23176	-.208	735	88
LEV	.2822	.18688	.025	824	88
OCF	.0696	.0542	0.039	.2577	88
R	8.4113	.71771	7.447	9.183	88
GDPR	6.9287	4.38280	-5.2	10.42	88
ACCC	.4874	.26553	.084	105	88
SIZE	6.9907	.41690	.125	605	88
ROA	.0402	.06583	-.114	228	88

The working capital requirements variable has a mean value 27.44% of total assets i.e about $2 million with a standard deviation of .23. The positive and high values of working capital indicate that companies are maintaining relatively conservative policies for managing their working capital.

The average of the cash conversion cycle is .4874 year, this means that the average number of days that working capital is invested in the operating cycle is 178 days (about one-half of a year), where the standard deviation is 99 days. This is also long relative to industrial countries which are 1-3 months only.

The operating cash flow ratio has a mean value .0696, less than 7% of total assets the standard deviation is .0542. To check the size of the firm and its effects on the working capital management, natural logarithm of assets is used. The mean value of the size is 6.99 while the standard deviation is .42. Translate this into values; we got the mean of total assets JD 9.77 million and standard deviation of JD 2.6 million.

In the same way the average profitability measured by ROA for Palestinian firms is 4.02% with a standard deviation of .066 which is higher than industrial firms in industrial countries.

The results of the statistical analysis show that the average debt ratio (which equals to
Total Debt /total Assets) for the Palestinian companies is .2822 with a standard deviation of .187, this ratio is low compared to firms in industrial countries. This is due to the conservative policies Palestinian firms use in their leverage.

In the same context we checked the interest rate and the real GDP growth rate. The interest rate has a mean of 8.4% with a standard deviation of 0.72; While GDP growth rate mean is 6.9% with a standard deviation of 4.4.these ratios are high relative to both industrial and less developed countries.

4.2 Correlation Analysis

Table 2 shows the Pearson correlation coefficient between the different variables of the model and the significant ratio using two tail tests.

Table 2. Pearson correlation coefficient

	WCR	LEV	R	ACCC	GDPR	OCF	SIZE	ROA
WCR	**1**							
LEV	**-.567****	**1**						
R	**0.038**	**0.137**	**1**					
ACCC	**.392****	**-.420****	**-0.077**	**1**				
GDPR	**0.046**	**-0.047**	**-.355****	**0.163**	**1**			
OCF	**0.171**	**-0.032**	**-0.092**	**.282****	**0.099**	**1**		
SIZE	**-.326****	**0.191**	**-0.105**	**0.142**	**0.039**	**.698****	**1**	
ROA	**.255***	**0.037**	**-0.063**	**0.092**	**-0.01**	**.400****	**0.198**	**1**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The table above shows that working capital is positively correlated with cash conversion cycle (.392) significant at 1% level and profitability of the firm measured by ROA (.255) and is significant at 5% levels. This means that the more profitable firms are more able to manage the working capital. It can also be said that the better the firm manages its working capital the more profitable the firm will be. This is consistent with the findings of Al Debie (2011) on Jordanian companies. On the other hand, leverage is highly significant but negatively correlated with working capital (.567). These results are consistent with (Rehman, 2007) results.

The company size is positively correlated with operating cash flow (.698) and significant at 1% level which is consistent with the theory and with the other studies. The larger the firm the higher it's OCF. An interesting result shows a negative correlation between the size of the firm and working capital (.326), this may be due to the power over their suppliers to get credit on their purchases.

5. Regression Analysis

In order to find the most important variables that have an effect on working capital, we have used the multiple regression analysis, using time-series and cross-sectional observations. We used two models to find out the important variables that have an effect on working capital.

5.1 Model One

In this model we include all variables that might have an effect on working capital of Palestinian firms. The model that we have applied is as follows:

$$WCRit=\alpha+\beta 1LEVit+\beta 2OCFit+\beta 3WCR1it+\beta 4Rit+\beta 5GDPRit+\beta 6ACCCit+\beta 7SIZEit+\beta 8ROAit+et.$$

Where the variables as discussed earlier and (i) and (t) represent the firm and the year respectively. We used 11 firms and 8 years (2004-2011). β1- β8 are the coefficients of the exogenous variables. We used the Ordinary Least Square method of estimation and we got the following results:

Table 3. Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	1.132	.396		2.856	.005			
	LEV	-.360	.077	-.290	-4.645	.000	-.567	-.463	-.243
	OCF	3.490E-8	.000	.211	2.023	.046	.171	.222	.106
	WCRt-1	.493	.067	.500	7.401	.000	.783	.640	.388
	R	.019	.019	.058	1.013	.314	.038	.113	.053
	GDPR	.002	.003	.036	.633	.529	.046	.071	.033
	ACCC	.061	.055	.070	1.106	.272	.392	.123	.058
	SIZE	-.166	.051	-.298	-3.238	.002	-.326	-.342	-.170
	ROA	.603	.263	.171	2.292	.025	.369	.250	.120

a. Dependent Variable: WCR

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.885[a]	.783	.761	.11323	1.731

a. Predictors: (Constant), LEV, OCF, WCRt-1, R, GDPR, ACCC, SIZE, ROA

b. Dependent Variable: WCR

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	3.660	8	.458	35.686	.000[a]
	Residual	1.013	79	.013		
	Total	4.673	87			

a. Predictors: (Constant), LEV, OCF, WCRt-1, R, GDPR, ACCC, SIZE, ROA

b. Dependent Variable: WCR

So the model results will be:

$$WCR=1.132\text{-}.29LEV+.211OCF+.5WCRt\text{-}1+.058R+.036GDPR+.07ACCC\text{-}.298\ SIZE+.171ROA$$

(2.856) (4.645) (2.023) (7.4) (1.013) (.633) (1.106) (-3.238) (2.292)

Where values in parenthesis represent (t) statistics. R square = .783, F=35.7, DW= 1.731

In general the model fits very well in terms of R square (.783) as well as F (35.7) and Durbin-Watson (1.73). We have no autocorrelation if calculated D is more than DU (from the table 1.63), Durbin (1970). Since the calculated D is 1.731. So we accept the null hypothesis of $\rho = 0$, we have no autocorrelation

Taking all variables into consideration we found limited support for a direct correlation between working capital and interest rate, rate of economic growth, and operating cash flow. As with regard to regression analysis, the first two as well cash conversion cycle proved to be not significant at 5% level. This is contrary to the findings of Narender et al. (2009), but consistent with Lamberson (1995), Chiou and Cheng (2006), Nazir and Afza (2009), and Ranjith (2008) .

We used the ROA as a proxy for profitability; it shows a significant positive relationship with the dependent variable, which means that the firms with higher profits are less concerned with the efficient working capital. And this is consistent with Nazir and Afza's (2009) results, as well as Mahomet and Eda (2009) and Wu (2001) who showed that there is a positive relationship between return on assets and the working capital requirements.

Leverage of the firms is significantly and negatively correlated to the working capital management of the firm it has a *t* value of 4.6. This indicates that the higher the leverage the more attention has to be paid by the firms to reduce capital that is tied to current assets. So companies with high leverage show lower working capital requirements. That is in accordance with the Pecking Order theory, and is consistent with Nazir and Afza (2009) results on Pakistani firms, Chiou, Cheng and Wu (2006) on Taiwan companies listed on Taiwan Stock Exchange, and Nakamura et al. (2007) on Brazilian firms listed on the Sao Paulo Stock Exchange.

Operating cash is positively significant, which implies that Palestinian firms have enough cash from operation activities to finance their working capital. These findings are consistent with Ranjith (2008) and Hill et al. (2009).

Finally, the size of the firm has a negative and significant effect on working capital. The larger the firm the less working capital to total assets is required. Large firms may require larger investment in working capital because of larger volume of revenues or because they use their market power to force relationship with suppliers and get a reduction in payment term (Mousawi et al. 2006). But here we found that larger firms require lower investment in working capital which may be due to their power over suppliers and thus can have longer period for their payables.

5.2 Model Two

Excluding Outside Variables: Interest Rate, Economic Growth. This reduces the model to become

$$WCRit=\alpha+\beta_1 LEV_{it}+\beta_2 OCF_{it}+\beta_3 ROA_{it}+\beta_4 CCC_{it}+\beta_5 SIZE_{it}+et$$

The results of the regression are as follows:

Table 4. Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Correlations		
		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part
1	(Constant)	2.640	.389		6.792	.000			
	LEV	-.431	.097	-.348	-4.427	.000	-.567	-.439	-.300
	OCF	6.459E-8	.000	.391	2.974	.004	.171	.312	.201
	ACCC	.156	.068	.178	2.281	.025	.392	.244	.154
	SIZE	-.347	.058	-.624	-5.943	.000	-.326	-.549	-.402
	ROA	.828	.335	.235	2.471	.016	.369	.263	.167

a. Dependent Variable: WCR

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.883[a]	.780	.764	.11261	1.714

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.646	6	.608	47.915	.000[a]
	Residual	1.027	SIZE 81	.013		
	Total	4.673	87			

a. Predictors: (Constant), LEV, OCF ACCC, SIZE, ROA

b. Dependent Variable: WCR

The equation will become:

$$WCR=2.64 - .348LEV + .391OCF + .235ROA + .178ACCC - .624SIZE$$
$$(6.792)\ (-4.427) \quad (2.974) \quad (2.471) \quad (2.281) \quad (-5.943)$$

Numbers in parenthesis are for t values.

The model fits very well in terms of R square (.78), F(47.9) and Durbin Watson(1.714)with all variables are significant at the 1% level (as T is more than two for all five exogenous variables), and with the right signs. Contrary to what we found in the first model, Cash conversion cycle becomes significant, operating cash flow and profitability, measured by return on assets have a positive impact on the working capital; while leverages and size of the firm have a negative impact, as we have discussed in the first model. These variables explain about 78%of the change in working capital and have the right signs. These findings are consistent with the results found by Lazaridis and Tryfonidis (2006) for firms listed on the Athens Stock Exchange and with Charitou, Elfani and Lois. (2010) for firms listed on the Cyprus Stock Exchange, and with Al-Debie (2011) on Jordan firms in terms of leverage but disagree with him in terms of firms' size. It also agrees with most of the findings of Hayagneh and Yassine (2011) for Jordanian firms.

6. Conclusions

This paper tries to find the variables that determine the amount of working capital that the Palestinian firms hold. On the basis of the findings of the research, out of seven examined explanatory variables- cash conversion cycle, operating cash flow, size of the firm, return on assets, debt ratio (leverage), interest rate and real GDP growth

rate, the first five variables are found statistically significant determinants of working capital requirements for Palestinian firms. The last two are found not significant, this is clear from the second estimation without interest rate and real GDP growth rate, which indicates that limited support for a direct correlation between working capital and economic factors. Beta coefficients associated with all of them are statistically significant at 1% level and have the right sign. These variables explain more than three-fourths of the variation in working capital. So, it can be concluded that the listed companies in Palestine change their working capital requirements based on the total assets, leverage, operating cash flow, return on assets and cash conversion cycle.

We may further conclude that the firms can improve their profitability if they manage these factors in a more efficient way. In addition working capital is not affected by the economic variables, such as economic cycle and interest rate. Another interesting finding is the long period for cash conversion cycle which takes firms about six months on average to convert raw materials into cash which explains the high amount of working capital Palestinian firms maintain. Thus improving the cash conversion cycle and increase leverage would have positive effect on firms' profitability. Working capital requirements of 27% of total assets is very high which may be due to limited capital market access for external financing capabilities and due to unstable economic and political conditions.

The above results are consistent with earlier studies of Lamberson (1996), Wu (2001), Chiou and Cheng (2006), Mahomet and Eda (2009), and Nazir and Afza (2009) on Pakistan, Lazaridis and Tryfonidis (2006) on Greece, Nakamura et al.(2003) on Brazil, Ranjth (2008) on Thailand firms, Pendey and Parera (1977) on SriLanka, Al-Mwalla, Muna (2012), and Hayagneh and Yassin (2011) on Jordan. On the other hand, some of our findings contradict with some earlier studies on the issue like Narender et al (2009) who found that the size has a positive effect on working capital in the cement industry in India, and Al-Muwalla (2012) in Jordan who found that leverage and firm size have a positive impact on both value and profit.

There is much to be done about working capital in Palestine in the future, because this phenomenon may be attributed to the developing market of the Palestinian Security Exchange. Since there are few results that are in contradiction to some of the earlier studies, future research could further explore the reasons for this contradiction. Moreover, further research can be conducted on the same topic with different firms and extending the years of the sample. Future research could be also conducted on the same topic for other countries so that working capital management policies can be compared between developing and developed countries in order to improve firm's management, and their profitability and value.

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What Drives Interest Rate Spreads in Uganda's Banking Sector?

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Abstract

This paper investigated the main causes of the continuously large interest rate spreads in Uganda's banking sector for the 1995 to 2010 period. The main approach used was the test for cointegration where the Engle and Granger (1987) two-step procedure was applied to test for the long-run relationship. The error correction model was applied for short run relationship with the error correction term to determine the speed of adjustment between the short-run and the long-run. The variables that were investigated in this study included the bank rate, the treasury bill rate, exchange rate volatilities (XRTV), M2/GDP and the proportion of non-performing loans to total private sector credit. The empirical results show that the bank rate, treasury bill rate, and non performing loans significantly and positively affect the interest rate spreads, M2/GDP and real GDP were significant and negatively influence interest rate spreads both in the short and long-run period.

Keywords: interest rate spreads, financial reforms, banking sector

JEL Classification: E43, E52

1. Introduction

In the early 1990s, Uganda, like other emerging economies, embarked on the process of financial liberalization. One of the key objectives of financial liberalization was to increase the efficiency of the financial system as would be evidenced from the reduction of interest rate spreads- the difference between average lending rates and average deposit rates in the banking system (Sologoub, 2006).

Contrary to the expectations of the financial reforms, interest rate spreads have remained large and volatile in Uganda. Figure 1 shows that interest rate spreads were increasing and volatile before the financial reforms that is, between 1990 and 1992. After the reforms in1993, interest rate spreads continued to rise. The line in Figure 1 separates the period before and after financial reforms in Uganda. According to Bank of Uganda quarterly report, 2008, the large and volatile spreads have hindered provision of long-term lending in Uganda.

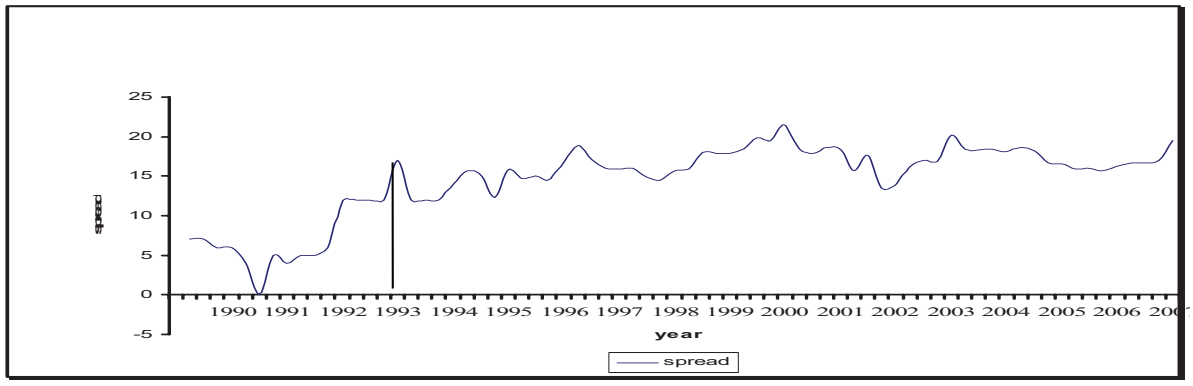

Figure 1. Interest rate spreads before and after financial reforms in Uganda

Source: Bank of Uganda, various issues

Kasekende, 2003 highlighted lack of competition and high operational inefficiency within Uganda's banking sector as the major factors driving large spreads in Uganda. As a solution to this challenge, bank of Uganda lifted

the moratorium on commercial banks to allow for more banks in the financial system. The expectation from this intervention was that more financial institutions would increase competition and efficiency in Uganda's banking sector and hence reduce the interest rate spreads. Since the lifting of the moratorium in 2005, commercial banks have increased from 16 in 2005 to 25 in March 2012. However, this intervention seems not to have delivered to its expectations because interest rate spreads have remained large and volatile to date. This is the motivation behind this study that investigated the factors driving the persistent large interest rate spreads in Uganda's banking sector

The rest of the paper is organized as follows: Section two reviews Uganda's banking system and the evolution of interest rates, while section three explores the empirical and theoretical literature on the main drivers of spreads. The model specification and the estimation procedure are described in section four. The empirical analysis is presented in section five while conclusions and policy implications are drawn in section six.

2. An Overview of Uganda's Banking System and Evolution of Interest Rates

2.1 Uganda's Banking System

Uganda's banking system comprised of only four commercial banks in the early 1960s. These included; Standard Chartered, Barclays, Grindlays and Bank of Baroda. These were foreign owned banks that were widely criticized for short –term lending and biased provision of financial services to foreign companies leaving financial access for the locally owned companies limited and hence threatening the development objective of government. It was therefore argued that government intervention was required to the extent that banks did not pursue a developmentalist role (Brownbridge, 1998).

Against this background, government of Uganda embarked on a program to extend credit services to indigenous enterprises. This was done by establishing the Uganda Commercial Bank, which arose from reshaping the member based Uganda Credit and Savings Society. As a result of this transformation, the Uganda Commercial Bank took over management of all government transactions from foreign banks and thus the indigenous companies were more involved in terms of access to financial services.

In 1992, government embarked on the process of financial sector liberalization. This process mainly consisted of interest rate control reforms which led to the introduction of a treasury bill auction. To further elucidate the role of bank of Uganda as the regulator of all financial institutions in Uganda, the financial institutions bill and central bank charter were enacted in 1993. This was further followed by the process of interest rate liberation which allowed the removal of restrictions from commercial banks' operations and holding of assets.

The process of financial liberalization led to entry of many new foreign and domestic banks. However, this resulted into a major banking crisis characterized by inadequate bank capital and high rates of non-performing loans within the banking system (Caprio et al 2005). This crisis led to closure of weak banks including, Greenland bank and the Co-operative bank. The banking crisis resulted into government intervention through bank of Uganda to renationalize UCB.

The renationalization process ended up by selling 80 percent of UCB's shares to stanbic bank and the remaining 20 percent were left to the government (Clarke et. al, 2006). Generally overtime, implementation of the reforms has greatly strengthened the banking system in terms of capitalization, profitability and resilience.

To date, Uganda's formal financial system comprises of commercial banks -Tier 1; which constitute the biggest component the financial system, bank-like institutions -Tier 2, microfinance deposit-taking institutions-Tier 3, The National Social Security Fund (NSSF), one Post-bank, 18 insurance companies, 3 development banks, 88 forex bureaus and one stock exchange- the Uganda Securities Exchange. The informal sector constitutes money-lenders, savings and credit cooperative societies (SACCOs) as well as rotating savings and credit association (ROSCAs)

2.1.1 Banking Performance

The lifting the moratorium in 2005 led to opening up of nine new commercial banks bringing the total number of banks in Uganda to 25 in 2012. On the overall, Uganda's banking system has continued to expand with an average bank branch network of up to 366 branches in March 2012. In terms of asset holdings, commercial banks have experienced stable growth since the lifting of the moratorium in 2005. During this period, commercial banks' total assets rose from a total of shs 2,991 billion in 2003 to shillings 13.5 trillion in 2012. Similarly total liabilities grew by the same amount in the same period.

Most of the growth was driven by loan advances to customers which increased from shs 855 billion in 2003 to shillings 6,515 billion in 2011. Regarding the liabilities, the increasing deposits accounted for most of the growth in liabilities. Total deposits increased from shs 2,115 billion in 2003 to shs 8,709 billion in 2011. Figure 2.shows the proportion of total commercial banks assets to total liabilities before and after the lifting of the moratorium in

2005.

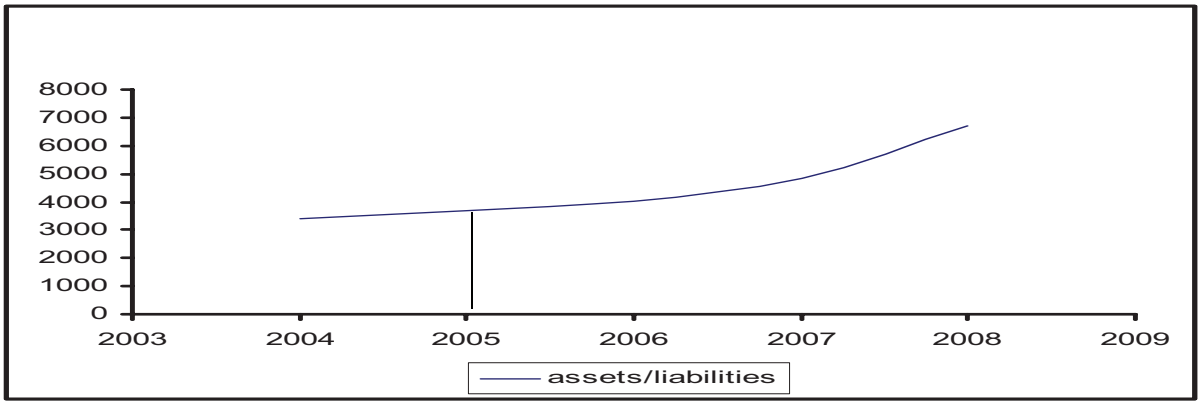

Figure 2. The proportion of total commercial banks assets to total liabilities (shs. Billion)

Source: Bank of Uganda, various issues

Similarly commercial bank profitability has steadily improved. Between 2003 and 2011, profits after tax increased from shillings 123 billion in 2003 to shillings 488.85 billion in 2011. Figure 3 shows the trend of the commercial banks profits after tax before and after the lifting of the moratorium in 2005. However, since 2005 this trend has not changed as bank behavior and responses to private lending has remained the same.

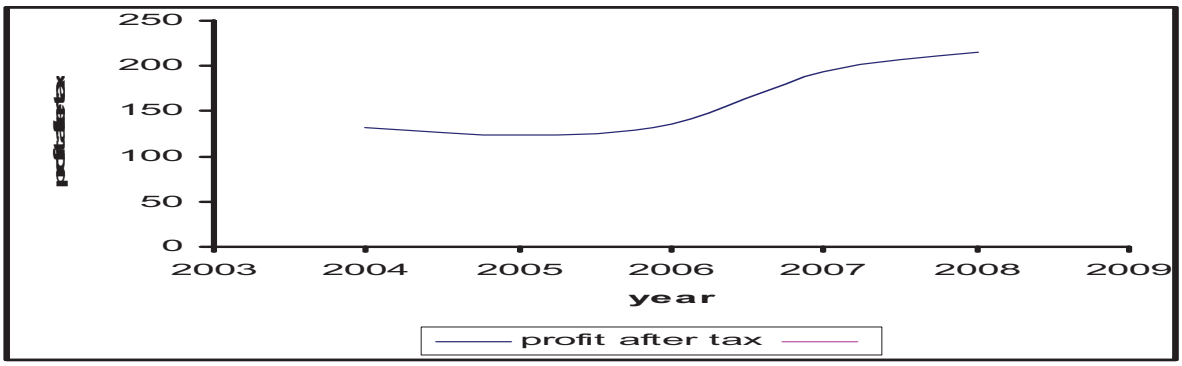

Figure 3. Uganda's commercial banks' profits after tax (shs. Billion)

Source: Bank of Uganda, various issues

2.2 Evolution of Interest Rates

In 1994, government of Uganda embarked on implementing the process of liberalizing interest rates. This process involved adjusting nominal interest rates to match the inflation rate as a way of ensuring positive real interest rates. This was followed by shifting the treasury bill market from adhoc issues to a market based auction system. This shift led to market determined treasury bill rates which were then used as the monetary policy instruments by the central bank.

The liberalization of interest rates had a marginal effect on Uganda's interest rates as reflected in the fall of interest rates from an average of 40 percent before liberalization to 20 percent after the liberalization process (see Figure 4).

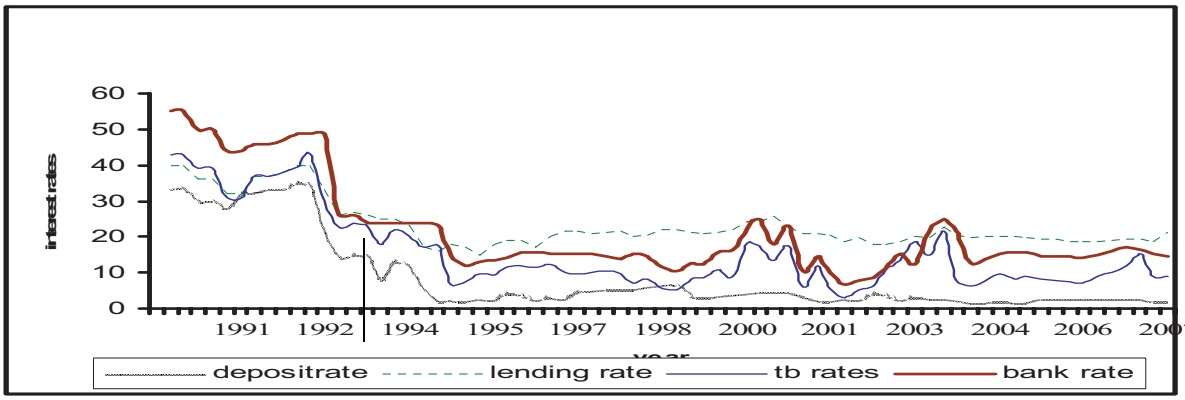

Figure 4. Interest rates before and after interest rate liberalization

Source: Bank of Uganda, various issues

3. Review of Related Literature

3.1 Analytical Framework

The analytical framework is based on the McKinnon and Shaw (1973) paradigm. According to this framework, McKinnon (1973) argues that removing financial restrictions from the financial system results into a considerable improvement of the economies' growth processes. This will occur in such a way that high interest rates attract households to save with the financial institutions and as a result bank deposits rise and hence an increase in banking efficiency

Additionally, Shaw (1973) focuses on the role financial intermediaries have to play in development. Financial liberalization in terms of increasing interest rates springs mainly from expanding the amount of financial intermediation occurring between savers and investors due to increased efficiency of the banking sector and lower level of spreads. The increase in investment funds causes an increase in the quantity of investment. He further argues vehemently that real cost of borrowing declines significantly and the average efficiency of investment is raised due to the fact that banks would be realizing economies of scale through risk diversification, lending and operational efficiency. This ultimately reduces the interest rate spreads.

3.2 Empirical Literature

The main determinants of interest rate spreads in banking institutions are classified into bank specific, market specific and macroeconomic factors. For example Demirguc-Kunt et. al, 1998, Moore et. al, 2000 and Sologoub (2006) argued that the major drivers of interest rate spreads are the bank specific factors such as; the bank size, bank ownership, the loan portfolio, capital adequacy, overhead and operating cost, and shares of liquid and fixed assets. In fact Beck et.al, 2006 agree with this and further stress that interest rate spreads in Uganda are mainly driven by the bank size, as well as overhead costs and sectoral compositions of loans.

Turning to the market specific factors, Samuel et. al, 2006 indicates that an oligopolistic market structure results in higher spreads. This is in line with Hannan et.al, 1993 and Barajas et al, 1999, who found out that industry concentration is positively linked to higher spreads.

Regarding macroeconomic factors, in one of their more recent and broader studies of the determinants of spreads in the banking system, Demirguc et al (1999) found several variables to be correlated with higher spreads, including higher inflation, higher real interest rates, and lack of banking sector competition. They also found that some variables such as institutional features for example lack of creditor rights or corruption, and reserves matter more in developing countries than in developed countries. In a related paper, Demirgüç et al (2003) found that inflation was associated with higher bank interest rate spreads.

Randall (1998) and Gelos (2006) stressed that higher costs would logically require banks to charge higher spreads in order to remain profitable. Most studies, have reached this conclusion. Randall (1998) and Gelos (2006) pointed out many sources of higher costs that have different implications for other aspects of bank management. The sources included personnel costs, required reserve ratios, poor governance, non performing loans, and general inefficiency. Higher capital to asset ratios would also increase costs, though the direction of causation in this relationship could be uncertain.

In fact the non performing loans are one the critical drivers of large spreads as bankers tend to offset "bad loans" by charging high lending rates. This argument was also fronted by Barajas et al (1999), Robinson (2002) and Meyer, et al., (2004) who argue that fraud incidences and lack of credit information sharing on borrowers result into high rates of nonperforming loans and hence increasing bank spreads.

From the literature, it can be concluded that the main driving factors of large interest rate spreads include; inflation rates, exchange rate volatilities, the discount rate, reserve requirement, credit to the government, level of banking efficiency, bank concentration, the nature of banks as to whether they are foreign banks or domestic banks, operating and overhead costs of the banking sector, real interest rates, treasury bill rates, bank size, non performing loans and sectoral composition of loans.

4. Methodology

4.1 Model Specification and Variables

The main objective of this study was to investigate the drivers of high interest rate spreads in Uganda's banking sector. Based on the factors highlighted in the literature review, five explanatory variables including the bank rate, treasury bill rate, ratio of non-performing loans to total private sector credit, exchange rate volatilities (XRTV) and ratio of M2 (broad money) to GDP were selected and tested on Uganda's data stretching from 1995 to 2010. The bank interest rate spread (the difference between the average lending rates and average deposit rates) is the dependent variable.

Among the independent variables is the discount rate (bank rate). This measures the cost of commercial banks' borrowing from the central bank. The discount rate is expected to be positively related with the spread.

The 91-day- treasury bill rate is regarded as the monetary policy instrument pursued by the central bank. Therefore, lower levels of treasury bill rates would lead to lower interest rate spreads and vice versa. The treasury bill rate is expected to be positively related with the spread.

The ratio of M2 (broad money) to GDP is an indicator of financial sector development. A well developed financial sector ensures efficient allocation of resources at acceptable and affordable interest rates. The growth in broad money (M2) reflects a rise in the level of intermediation given a wide array of financial assets and hence resulting into financial development and improved banking efficiency (Sikorski, 1996). Therefore, the ratio of M2 to GDP is expected to be negatively related to the interest rate spreads.

Uganda is a small open economy therefore it is prone to macroeconomic instabilities arising from both internal and external shocks. For purposes of this study, the exchange rate volatility (XRTV) is used as a proxy for macroeconomic instabilities. It is computed as the standard deviation of the real exchange rates for the three preceding years (Folawewo and Tennant, 2011). Further more changes in interest and inflation rates in Uganda's economy are captured by the same variable. The exchange rate volatility (XRTV) is expected to be positively related with the interest rate spreads since commercial banks are expected to increase lending rates to guard against risks arising from macroeconomic instabilities.

Finally, the ratio of non-performing loans to total private sector credit is included to capture the effect of credit risk on interest rate spreads. The higher this ratio (non-performing loans to total private sector credit) the higher the risk and the higher the level of non-current loans thus an increase in the spread.

The linkage between the interest rate spreads and the factors affecting it is specified as;

$$spd = f(br, tb, m2/gdp, xrtv, npl/cp, \varepsilon_t) \tag{1}$$

The empirical specification is given as;

$$spd_t = \beta_0 + \beta_1 tb_t + \beta_2 br_t + \beta_3 (m2/gdp)_t + \beta_4 xrtv_t + \beta_5 (npl/cp)_t + \varepsilon_t \tag{2}$$

where;

spd = interest rate spreads, tb = treasury bill rates, br = bank rate, m2/gdp = ratio of M2 to GDP , XRTV = exchange rate volatilities , npl/cp = ratio of non-performing loans to total private credit , t = time period, ε_t = error term

4.2 Data Type and Data Source

The study employed quarterly data for the 1995 to 2010 period. The main data sources were Bank of Uganda and the Uganda Bureau of Statistics. Data on average lending rates, average deposit rates, the bank rate,

non-performing loans, credit to the private sector, exchange rate volatilities, M2, treasury bill rates was collected from Bank of Uganda and data on GDP was collected from the Uganda Bureau of Statistics.

4.3 Estimation Procedure

The Engle-Granger (EG) Approach (1987) was employed for this study. To ascertain the order of integration and the order of differencing needed to make each time series stationary, the Augmented Dickey-Fuller (ADF) test was used. The unit root test statistics were applied to levels as well as first differences of individual time series regression with the maximum lag of 4. Secondly, a cointegration test was employed to select the vectors of cointegrated series for the regressions to check the long run relationship between dependant variable and explanatory variables. The Error-Correction Model (ECM) was employed to check the speed of adjustment of the independent variables towards the dependent variable. Finally Diagnostic tests were carried out to test the stability and significance of the model.

5. Empirical Results and Discussion

5.1 Time Series Properties

Descriptive statistics for the data were undertaken for variables in levels. The descriptive statistics in levels showed that most of the variables satisfy the normality test. Table 1 summarizes the descriptive statistics for the series in levels.

Table 1. Descriptive Statistics for variables in level

	Bank rate	**M2/GDP**	**NPL/CP**	**T-bill rate**	**XRTV**	**Spread**
Mean	14.82556	-0.171581	-2.294050	9.883843	20.58777	17.27129
Median	14.70500	-0.076710	-2.302585	9.242767	15.89298	17.04463
Maximum	25.10000	0.582229	-0.616186	21.44400	87.14810	21.32490
Minimum	6.750000	-1.168246	-3.912023	2.968518	0.00000	13.87900
Std.dev	3.928523	0.549654	1.084048	3.869794	17.88825	1.626142

5.1.1 Unit Root Tests

The results of the unit root test are presented in Table 2. Unit root test results for the variables in levels indicate that all the variables were stationary at 1, 5 and 10 percent levels of significance (see Table 2). This implies that the variables are integrated of order 0.

Table 2. Unit Root test for variables in levels

Variable	ADF Statistic	Order of integration
Spread	-2.875327*	I(0)
Bank rate	-3.573740***	I(0)
NPL/CP	-3.142013**	I(0)
XRTV	-5.589609***	I(0)
M2/GDP	-6.792282***	I(0)
Treasury bill rates	-4.881203***	I(0)

Notes :(i) ln is the natural logarithm and ADF is Augmented Dickey Fuller.

(ii) Critical values for ADF statistics are -3.5654, -2.9995 and -2.5979 at 1%, 5% and 10% respectively.

(iii) The asterisk ***, **, and * indicate significance at the 1 percent, 5 percent and 10 percent levels

5.1.2 Cointegration Test Results

Based on the unit root test explained in Table 2, the Engle and Granger (1987) two-step procedure was applied where the spread the dependent variable was regressed on the explanatory variables in levels and the results are presented in table 3. The error term from the regression in Table 3 was tested for stationarity. The results are presented in Table 4.

Table 3. Estimation of the cointegration equation by OLS

Dependent variable: Interest rate spread			
Method: Least squares			
Variable	Coefficient	Std. Error	Prob.
Treasury bill rates	0.227410	0.051811	0.0021***
XRTV	0.0495	0.02354	0.0407**
NPL/CP	10.14477	3.8141	0.0008***
M2/GDP	-0.935527	0.7363	0.0956*
Bank rate	0.434950	0.122968	0.0009***
C	70.4111	12.1027	0.00546***
R-squared	0.852302	Akaike info criterion	-2.735870
Adjusted R-squared	0.79120	F-statistic	12.1059
S.E. of regression	0.03455	Prob (F-statistic)	0.002000
Log likelihood	67.0214	Durbin-Watson stat	1.8874
Arch (F-statistic) 0.04 (0.922)			
Jarque-Bera 0.101 (0.902)			
Ramsey reset F-statistic 2.541 (0.14)			
Godfrey serial correlation F-statistic 0.07 (0.867)			

Notes: The asterisk ***, **, and * indicate significance at the 1 percent, 5 percent and 10 percent levels

Table 4. Cointegration test results

	ADF statistic	order of integration
res	-3.815164***	I(0)

Note: (i) critical values at 1%, 5% and 10% are -3.5654, -2.9995 and -2.5979 respectively

The test results reject the null hypothesis of no cointegration among the explanatory variables that is, the bank rate, treasury bill rate, M2 to GDP ratio, ratio of non-performing loans to private sector credit and the exchange rate volatilities with the spread which is the dependent variable at 1 percent level of significance.

5.2 Error Correction Model

The Error Correction Model was estimated for the cointegrated variables in Table 4.The results are presented in Table 5.

Table 5. Estimation of the Error Correction Model by OLS

Dependent Variable: D(Spread)			
Method: Least Squares			
Variable	Coefficient	Std. Error	Prob.
D(Treasury bill rates)	0.184969	0.045907	0.0002
D(NPL/CP)	36.70169	16.61079	0.0323
D(M2/GDP)	-1.7763	0.596810	0.0047
D(XRTV)	0.019595	0.006146	0.0026
D(Bank rate)	0.223232	0.051786	0.0001
ECM(-1)	-0.132565	0.040475	0.002
C	-0.000750	0.004686	0.8645
R-squared	0.82110	Mean dependent var	0.00015
Adjusted R-squared	0.78499	S.D. dependent var	0.068294
S.E. of regression	0.03	Akaike info criterion	5.4124
Log likelihood	104.235	F-statistic	15.0005
Durbin-Watson stat	1.6972	Prob(F-statistic)	0.00012
Arch (F-statistic) 0.030 (0.91)			
Jarque-Bera 0.112 (0.90)			
Ramsey reset F-statistic 2.011(0.10)			
Godfrey serial correlation F-statistic 0.064 (0.92)			

Notes: The asterisk ***, **, and * indicate significance at the 1 percent, 5 percent and 10 percent levels

5.2.1 Diagnostic Tests

Regression results in Table 5 which is the short-run model show the Adjusted R-squared of 0.78, this implies that the explanatory variables in the short-run model explain 78 percent of the variations in the spread. Results in Table 3 which is the long-run model show that the goodness of fit is satisfactory (Adj. R-squared of 0.79), implying that the explanatory variables in the long-run model explain 79 percent of the variations in the interest rate spread during the 1995-2010 period. The F-statistic of 15.00 with probability value of 0.00012 in the short-run model and 12.11 with probability value of 0.002 in the long-run model indicates that both long-run and short-run models are highly significant.

Furthermore, the Durbin-Watson statistics (DW) of 1.67 and 1.89 for both the short-run and long-run models indicates that there are no major autocorrelation problems. The Jarque-Bera statistics for testing for normality of the residual for the estimated short-run and long-run models are 0.112 and 0.101, with probability values of 0.909 and 0.902, respectively. This therefore indicates that the models are normally distributed. The Auto Regressive Conditional Heteroskedasticity (ARCH) for stability of the residuals yields F-statistics of 0.03 and 0.04 with probability values of 0.91 and 0.92 for the short-run and long-run models, respectively. This confirms that the models are stable

In addition, the Ramsey RESET test for specification error yields F-statistics of 2.011 and 2.541, with probability values of 0.10 and 0.14 for both models, respectively. This suggests that the models are not mis-specified. Also, the test for serial correlation among variables in the model using Breusch-Godfrey Serial Correlation LM test was carried out. The results indicate F-statistics of 0.064 and 0.07, with probability values of 0.92 and 0.87 for the short-run and long-run models, respectively. This confirms no serial correlation among the variables in the models.

5.2.2 Interpretation of Both Short-run and Long-run Empirical Results

Empirical results from the error correction model (short-run model) in Table 5 and the long-run model in Table 3 are interpreted from the following sub-section.

Effect of the bank rate

The coefficient of the bank rate (br) has a positive impact on the interest rate spread as expected. It is also significant at the 1 percent level of significance both in the short run and long run. Assuming all other factors constant, a 1 percent increase in the bank rate would lead to 0.22 percent and 0.43 percent increase in the interest rate spread in the short-run and long-run, respectively. This implies that an increase in the bank rate charged by the central bank on the commercial banks increases the interest rate spread both in the short run and long run in Uganda.

Effect of treasury bill rate

The coefficient of the treasury bill rate (tb) has a positive impact on the interest rate spread as expected. It is also significant at 1 percent level of significance both in the short-run and long run. Assuming all other factors constant, a 1 percent increase in the treasury bill rate would lead to 0.18 percent and 0.23 percent increase in the interest rate spread in the short-run and long-run, respectively. This implies that an increase in the treasury bill rate increases the interest rate spread both in the short run and long-run in Uganda.

Effect of non-performing loans

The coefficient of non-performing loans (NPL/CP) has a positive impact on the interest rate spread as expected. It is significant at the 5 and 1 percent level of significance both in the short run and long run level respectively. Assuming all other factors constant, a unit increase in the ratio of non-performing loans to private sector credit would lead to 36.7 and 10.1 percent increase in the interest rate spread in the short-run and long-run, respectively. This means that an increase in the ratio of non-performing loans to private sector credit increases the interest rate spread both in the short run and long run in Uganda.

Effect of exchange rate volatilities

Similarly, the coefficient of exchange rate volatilities (XRTV) increases the interest rate spread as expected. It is also significant at the 1 and 5 percent levels of significance both in the short-run and long-run. Assuming all other factors constant, a unit increase in volatilities in the exchange rate would lead to a 0.02 and 0.05 percent decrease in the interest rate spread in the short-run and long-run, respectively. This implies that exchange rate volatilities in Uganda decrease the interest rate spread both in the short- run and long- run.

Effect of the financial intermediation ratio (M2/GDP)

The coefficient of M2/GDP has a negative impact on the interest rate spread as expected. It is also significant at the

1 percent level of significance in the short-run and significant at the 10 percent level of significance in the long-run. Assuming all other factors constant, a unit increase in M2/GDP would lead to a 1.78 and 0.94 percent decrease in the interest rate spread in the short-run and long-run, respectively. This implies that the level of financial development can be instrumental in reducing the interest rate spread.

Results reveal that the error correction term (ECM $_{(-1)}$) in the model is significant and correctly signed that is, negative as expected and is significant at the 1 percent level. The error correction term ($ECM_{(-1)}$) coefficient of – 0.133 implies that in each period, the interest rate spread adjusts by 0.13 percent between the current level and the long run equilibrium level.

6. Conclusion and Policy Implications

6.1 Conclusion

The main objective of this study was to explore empirically the factors that drive the high interest rate spreads in Uganda. The econometric results reveal that the major drivers of interest rate spreads in Uganda include the bank rate, treasury bill rate, non-performing loans, financial intermediation ratio, and real gross domestic product.

6.2 Policy Implications

The results from this study identify a number of policy implications on government and bank policy approaches for reducing the interest rate spread and improving the financial sector intermediation in Uganda. Therefore the following policies if well implemented will help to reduce the interest rate spread.

6.2.1 The Government Should Target to Increase Financial Intermediation

According to the empirical results, the financial intermediation ratio which is a proxy for the level of financial development measured by M2/GDP is significant and has a negative correlation with the spread. This implies that increasing financial intermediation would lead to increased banking efficiency and hence reduction in the interest rate spread. Financial intermediation can be increased by increasing savings; this can be done by raising the deposit rate so that more deposits are attracted to the financial institutions. It can also be increased by expanding the banking sector by opening up new commercial banks and expansion of branch networks of the banks in addition to sensitizing the public especially in rural areas on how to use the banks. These two measures can increase the deposits in the commercial banks and thus M2.

6.2.2 Enhance Commercial Courts /Tribunals and Support the Credit Reference Bureau

The empirical results show that the ratio of non-performing loans to total credit to the private sector is significant and positively related to the spread. This implies that non-performing loans and the spread move in the same direction. In order to perform efficiently and effectively, the mechanism of sharing information on defaulters needs to be performing effectively so as to help commercial banks' reduce on the credit risk. Government should therefore continue to support the Credit Reference Bureau (CRB). This will close the information gap problem, and therefore the risk which brings about problems related to adverse selection and moral hazards. With the implementation of this, the problem of non- performing loans and the spread will reduce

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Modeling Fiscal-monetary Policy Interaction in Nigeria

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Abstract

This paper offers an analytical description of the nature of interaction between fiscal and monetary policy in Nigeria. It seeks to model how policymakers' preferences and loss functions as well as other underlying economic fundamentals and processes influence economic policy outcomes. Using a game theoretical framework, the study reveals that misalignment of policy instruments and strategies, particularly fiscal dominance over monetary policy is the major factor responsible for the ineffectiveness of economic policies in Nigeria. However, a framework that provides for an optimal threshold that synchronizes the policy preferences of the policymakers will result into an optimal solution that could improve the interaction between fiscal and monetary policy in Nigeria.

Keywords: interaction, economic fundamentals, fiscal dominance

JEL Classification: C01, C02, E60, E61, E62 and E63

1. Introduction

Over the last five decades, one of the key issues confronting economists and researchers is the interaction between fiscal and monetary policies. The interaction between fiscal and monetary policies as tools of economic management continues to attract research and policy attention for at least two reasons. First, the two policies and their instruments are critical in economic management of any nation or region. Second, the complementarities and conflicts of both policies have severe consequences for the stability of an economy as well as the ability to dampen business cycles (Sargent and Wallace, 1981; Dixit and Lambertini, 2001; Hannif and Arby, 2005, and Jensen and Lambertini, 2006).

Elements of mainstream economic literature relating to the interaction of fiscal and monetary policies cover issues such as the relationship between fiscal deficit financing and its consequences for monetary management and the fiscal theory of price level which shows how the monetary authorities' accommodation of fiscal expansion may precipitate or strengthen inflationary trends (Hannif and Arby, 2005 and Oyejide, 2005). Perhaps, an intriguing economic feature peculiar to most African nations particularly, countries in the sub-Saharan region is the challenge of sub-optimal interaction between fiscal and monetary policies with typifying budget deficits and its financing implications. A survey of evidence from recent studies (Note 1) reveal that the African region has been characterized by a great deal of dismal economic performance as evident in their rising inflation rates, low economic growth, rising unemployment rate, weak export base and high dependence on imports from developed and emerging market economies (Iyoha, 2003).

In some countries of Sub-Sahara Africa (SSA), particularly Nigeria and other West African nations, budget deficit has grown from low single digit levels in the 1980s to unprecedented two digit levels in the 1990 and the 2000 decades (Udo, 2007; Hefeker, 2008; and Debrun, et al., 2005). Specifically, the fluctuating nature of the country's tax base and the associated inefficiencies in the administration of tax policies are among the classical culprits accounting for these macro-imbalances.

So far, theoretical discussions about the interaction (Note 2) between fiscal and monetary policy abound but the thresholds on the conflicts of the goals, instruments, targets and coordination between them are still contentious in the literature (Sargent and Wallace, 1981; Rogolf, 1985; Pollard 1993; Mas, 1994; Dixit and Lambertini, 2001; Hannif and Arby, 2005; Oyejide, 2005 and Jensen and Lambertini, 2006). There are two main issues that often herald this policy conflict. These are the structure of the policy institutions and the credibility of the principal actors. For instance, Oyejide (2005) stress that the conflict between the authorities often arise from the conflict of objective, target as well as coordination between the two authorities. Radical central bank governors may resist the temptation to finance fiscal deficit, adjust exchange in tough times or refuse to inject liquidi g banking

stress in order not to play into the hands of the fiscal authority. Such conflict may ty durin worsen or trigger harder economic situation as in the Peruvian case (see, Pollard 1993 and Mas, 1994).

Thus, the ability to maintain and sustain policy stance depend on the leadership structure of policy institutions. Economic Policy analysis suggests that one actor must lead and another follow. Under fiscal leadership arrangement, in other words, in the environment of fiscal dominance, monetary policy is expected to play subservient role and in most times result into sub-optimal situations (Oyejide, 2005). However, monetary policy rule or dominance depends largely on the nature of the economy and the behaviour of the fiscal policy actors' vis-à-vis the adequacy of revenue and debt sustainability level given that monetary policy may be required to play counter-cyclical role. Another possible scenario is the kind where both policy goals and outcomes are synchronized by mutual agreement or in principle committing to policy targets. These considerations shape the interaction between the fiscal and monetary policy in any economic state. Intuitively, an optimally possible threshold between the two policy institutions and goals may be required to achieve credible policy targets (Walsh, 2003).

Lack of policy credibility and transparency equally bolsters the conflict between the authorities Kyland and Prescot (1977), Barro and Gordon (1983), Rogolf (1985) and Walsh (1993 and 2003). Policymakers often renege from policy targets. For instance, monetary policy targets often time deviate in attempts to finance fiscal deficits (time inconsistency problem). Walsh (2003) show that fiscal deficit emanate from the government expenditure rising beyond the sustainable inter-temporal budget constraint (non-Ricardian Equivalent). Sargeant and Wallace (1981) argue that rising and uncontrollable budget deficits may lead quickly to inflation if economic agents expect that monetary policy will not be maintained under the burden of rising government debts. According to Warlsh (2003), deviation from monetary policy derives largely from the inability of the central bank (monetary authority) to commit to policy targets due to overbearing fiscal policy actions. From the forgoing discussion, fiscal deficit management is central in the relationship between the fiscal and monetary policy. Moreover, the interaction between fiscal and monetary policy could also be influenced by the external factors due to changes in the economic environment particularly political game among politicians and policymakers.

2. Analytical Models

We develop some analytical models to analyze the interaction between fiscal and monetary policy. The framework is in the spirit of Okafor (2012) which follows Blanchard and Fischer (1989) and Visser (2005). In the mainstream economic analysis, fiscal and monetary policies are two critical policy instruments required to provide policy direction in any economic state. Hence, in modeling this, we assume that there are two sectors; the fiscal and the monetary policy institutions. The fiscal authority is concerned with revenue generation and expenditure while the monetary authority is in charge of the regulation and control of money supply.

Fiscal Sector

In the fiscal sector, fiscal policy is characterized by the interplay between tax revenue, seigniorage revenues and government expenditure which is set exogenously.

Revenue Function

Government revenue function provides wedge for its constraint expenditure. The revenue function is specified in the equation below as;

$$R = \tau_i + m/p \tag{1}$$

Where, government generates revenue (Note 3) (Note 3) R, through tax τ_i and seigniorage revenue from money creation m/p. It is implied that tax revenues are insufficient hence, money is created to ensure primary budget balance (Blanchard and Fischer, 1989; Easterly, 1999 and Hefeker, 2008).

Expenditure Function

$$E = \bar{G} \tag{2}$$

Equation (2) is the total government expenditure G assumed as exogenous under Keynesian hypothesis.

Balance Budget Condition

$$R = E \tag{3}$$

The balance budget condition in equation (3) may be optimal under two conditions; when government revenues and expenditures are equal and under an efficient fiscal-monetary policy interaction. However, we assumed that

fiscal system in Nigeria is inefficient which creates distortion for monetary policy management (see, Debrun, et al. 2005). This is accounted for explicitly in the model by modifying equation 2 as;

$$E = g_i + \psi_i \tag{4}$$

Where, ψ_i in equation (4) is the distortion in fiscal policy which increases the scope of government expenditure. This distortion is assumed to be equal with the seigniorage or money borrowed from the central bank in financing fiscal deficit as contained in equation 1 (see Debrun, et al. 2005).

$$\psi_i = E - R \qquad >0 \tag{5}$$

Equation (5) shows that government expenditure is higher than the revenue stream, which leads to fiscal deficit. This has consequences on the general price (Note 4) level as captured in equation (6).

$$\pi = \Delta M + \psi F \tag{6}$$

Monetary Sector

Theoretically, the monetary sector is characterized by the interaction between money demand and money supply in the money market. Both are influenced by some mechanisms in the market. Following Blanchard and Fischer (1989), money demand and money supply is linked as;

Money Demand Function

$$\frac{M^D}{P} = \eta Y + \varphi r \tag{7}$$

Equation (7) indicates that real money demand is determined by the level of income y and interest rate r. An increase in income and a decrease in interest rate influence real money balances.

Money Supply Function

$$M^s = \frac{\bar{M}^s}{P} \tag{8}$$

Equation (8) money supply M^S is assumed to be exogenously determined by the monetary authority.

Equilibrium Condition in the Money Market:

$$M^D = M^S \Rightarrow \qquad \frac{M^D}{P} = \frac{\bar{M}^s}{P} \tag{9}$$

Equation (8) indicates that money demand and money supply are equal. More also, we assume a condition where fiscal and monetary policy interact efficiently in equation (9) can hold. However, the distortion created by the fiscal activities causes equation (8) to follow a dynamic pattern which affect equation (9). Thus, under this assumption, equation (8) can be modified to accommodate fiscal deficit as presented below.

$$M^S = \frac{\bar{M}^S}{P} + \Psi_i \tag{10}$$

Thus, the new equilibrium monetary condition is stated as;

$$\frac{M^D}{P} = \frac{\bar{M}^S}{P} + \Psi_i \tag{11}$$

Equation (11) is consistent with Blanchard and Fischer (1988) debt financing models and indicates that borrowing from central bank to finance fiscal deficit increases money supply mechanism which leads to inflation.

The parameter ψ_i represents the degree of this distortion in monetary policy management and the source of conflict between the two policy institutions. Thus, a long-run equilibrium between the two sectors implies that;

$$\Theta \equiv Fs^{\Psi_i} = Ms^{\Psi_i} = 0 \tag{12}$$

Intuitively, the conflict between the fiscal and monetary sector emanates from the equation (12). Thus, if the central bank refuses to finance the deficit of the fiscal sector to ensure primary balance budget, policy conflict could manifest. The mechanisms for resolving such conflict could depend on the weights attach to policy makers preferences and loss functions.

3. Preference /Loss Function Analyses

We assume three scenarios upon the loss functions policymakers' attach to policy preferences. The loss function of the monetary authority may be to target low inflation while the fiscal sector targets economic growth. Thus, in a case of non-synchronization of preferences as evident above, a threshold is required to ensure that optimal policy preferences are attained.

Step 1: The fiscal authority chooses a policy variable x_i, which can be government spending on goods and services or public investment, a production subsidy, or a cut in distortionary taxation; a larger x_i means a more expansionary fiscal policy.

We assume that the fiscal authority minimizes its loss function define as;

$$L_i^F = \tfrac{1}{2}\theta_i^F (y_i - y_i^F)^2 + \tfrac{1}{2}(\pi - \pi_i^F)^2 \tag{13}$$

Where, $(y_i - y_i)^2$ is the weight on output gap and $(\pi - \pi_i)^2$ is the difference between actual inflation and expected inflation. Assuming further fiscal policy leadership over monetary policy implying that fiscal authority keeps its policy preference bias over monetary policy preferences; this can herald a policy conflict and disequilibrium. On the other hand, monetary policy leadership could produce similar outcome. Let us assume that the central bank chooses a similar policy variable π_o, such as money supply or nominal interest rate, towards controlling inflation. Higher π_o means a more expansionary monetary policy. Thus, let the central bank minimizes a similar loss function;

$$L^M = \tfrac{1}{2}\sum_i \theta_i^M (y_i - y_i^M)^2 + \tfrac{1}{2}(\pi - \pi^M)^2 \tag{14}$$

Equation (14) is similar to equation (13) even though the policy preference and target of the monetary authority differs from the fiscal authority. Each of these scenarios has their own implications on the interaction of fiscal and monetary policy. In clearer terms, these scenarios create misalignment of policies which leads to sub-optimal solutions. However, a model that synchronizes the policy preferences of the two institutions may be desirable to develop threshold for resolving the policy preferences.

Step 2: Integrating the Policy Preferences

The overall government policy preferences cover both the fiscal and monetary policy objectives. Thus, we choose a preference function that integrates the preferences of the policymakers into a loss function. This model relates to the Dixit and Lambertini (2002) model which follows the Barro and Gordon (1983) framework and interaction between the monetary authority (central bank) and the fiscal authority. We assume that the target GDP level of the country is given as;

$$y_i = \overline{y_i} + \sum_{i=1} a_i x_i + b_i(\pi - \pi^e), \qquad i = 1,...,n \tag{15}$$

Or in vector-matrix form;

$$y = \overline{y} + Ax + (\pi - \pi^e)b \tag{16}$$

Similarly, the target inflation level is given by

$$\pi = \pi_o + \sum_i a_i x_i = \pi_o + a'x \tag{17}$$

Where $\overline{y_i}$ in eqn. (15) is the natural rate of output, a_i shows the effect of fiscal policy on the country's GDP, and b_i is the spillover of fiscal policy on the monetary policy. These can be positive for Keynesian demand effects and negative for crowding out effects while the last term in the right hand side, π^e is the inflation expected by the private sector i.e. the usual supply effect of surprise inflation $b_i > 0$. An optimal solution for the policy preferences can be synchronized if the end goal of the policymakers as defined in eqn. (17) is achieved.

Thus, inflation is defined as the sum of the component π_o controlled by the central bank, and a contribution arising from the fiscal policies of the member countries.

Step 3: Policy Outcome/Analysis

The different policy preferences of the institutions produced sub-optimal situations. Thus, the integration of both policy preferences gives better solution. The condition under which this situation could arise is to import the law of contract proposed by Walsh (2003). This implies that each policy institution is expected to commit to the policy targets arising from the corporate (overall) government policy objectives. In other words, the fiscal and monetary authorities constitute the policymaker and would only attain a threshold of policy credibility if two conditions are met. The first condition is to set a realistic policy target in line with the aspirations of the overall national interest. Second is to ensure that policy makers are committed to policy target through rules and sanctions (Note 5).

The intuition of this reasoned analysis is derived from the broader goal of the government which is set to improve economic growth centered on price stability policy trust as contained in the Central Bank of Nigeria Autonomy Act, 2007. Thus, monetary policy should align to the fiscal policy goal and fashion out a central strategy even though the autonomous act provide for bounds for both policy institutions.

4. Conclusion

This paper has endeavored to analyze the interaction between fiscal and monetary policy in Nigeria. Both policies are formulated and implemented by economic agents who seek to achieve their policy goals depending on their policy preferences and loss functions. However, issues' relating to the ordering of a policymaker policy preference against the other policymaker's loss function is a veritable source of conflict between these agents. As argued in this paper, the structure of the policy institutions and the credibility of the actors as reflected in their behaviour influence the nature of their interaction. This paper summits that an optimal threshold that is able to synchronize the policy preferences of the economic agents could result into an optimal solution and improve the interaction between fiscal and monetary policy in Nigeria.

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Notes

Note 1. Iyoha (2003); Debrun et al., (2005) and Hefeker (2008) contain excellent review of literature

Note 2. Covers conflict of policy goals, policy preferences and target

Note 3. Tax revenue covers mainly proceeds from crude oil sales, oil license fees and personal income tax.

Note 4. Inflation in Nigeria draws from both monetary and fiscal policy actions.

Note 5. For instance, the suspension of the central bank governor or outright payment of fines in the event of violation of rules.

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Key Financials Performance Independent versus Integrated: Empirical Evidence from Indonesia Financial Service Industry (2001-2011)

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Abstract

The aims of the paper are to study the financial performance between the independent finance companies and the integrated finance companies over the period 2001-2011. From total 194 finance companies in the industry, the finance companies who affiliate with bank or automotive manufacturer are 65 companies that contribute to 71% of total asset of the industry. The banking industry that provides majority of funding, has made finance companies as part of their integration business model. The automotive manufacturers and dealers that provide the products of financing, have the similar strategy. The acquisition of finance companies has reached more than 30 transactions from 2002 until 2012. We analyzed seven micro key financial ratios (profitability, efficiency, growth, firm size, liquidity, solvability and risk). We use non parametric Mann Whitney and parametric Panel Data Dummy Regression. Our sample consists of 100 finance companies which continuously published their financial statement from 2001 until 2011. The empirical results show that the integrated finance companies are better in efficiency, profitability, size and growth. However, the integrated finance company has higher reserve policy and lower liquidity. On the other side, we also compare between the backward integration with bank and the forward integration with automotive manufacturer.

Keywords: acquisition, integration, financial industry, panel data

1. Introduction

Indonesia finance company industry has evolved from Rp37 trillion in 2001 to Rp221 trillion in 2010 with compounded annual growth rate (CAGR) of 122%. The financing contribution to Indonesia's gross domestic product has reached a value of 3.59% (Nuryartono 2012). The financing contribution to the total national credit Indonesia reached 12.5% in 2011.

The finance company industry is highly dependent on two other industries, the banking industry and the automotive industry. Banking industry serves as the major funding source for finance companies, ranging from 78% to 91% in the last eight years. This dependence results in a number of finance companies being acquired by banks. Out of the listed top ten banks, there are six banks that made acquisitions over finance companies during the last ten years. Banking, the major banks in particular, utilize finance companies as one of the sources for growth.

Finance company industry is an industry where demand is a derived demand (Hutabarat, 2012). Financing must involve underlying transaction or product and it may not provide financing or loans without any solid occurrence of transaction of goods or services.

Finance companies can be categorized into three major categories, as follows:

1. Finance companies that have affiliate relationships with manufacturers and distributors of goods as a source of financing.

2. Finance companies that have affiliate relationships with banks as a source of funding.

3. Independent finance companies that do not have affiliation either with manufacturer, distributors, or banks.

Figure 1 shows that the group of finance companies that are affiliated with banks control 28% of total financing amount, while the finance companies affiliated with the automotive manufacturers and dealers control 35% of total

financing amount. The number of independent finance companies in terms of quantity, amount to one hundred and fifty-two companies with asset of only 37%.

In line with the increased levels of competition, finance companies will consider going with an alliance or grow independently. If an alliance, finance companies can choose to integrate backward with banks (backward integration) or forward with automotive related companies (forward integration).

Backward integration is a resource-based strategy. The dependence of finance companies on source of funds is important in the competition. Finance company that has a bank parent holding company will enhance the subsidiary to perform more competitively. Forward integration is a market-driven strategy. Finance companies which conduct forward integration will have focused products or captive markets.

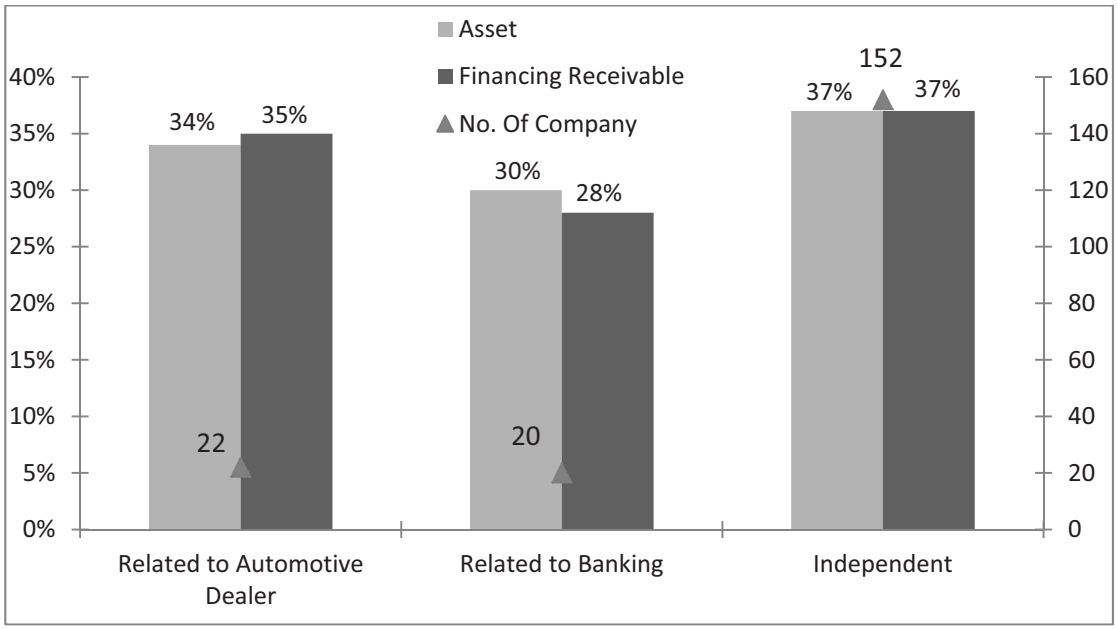

Figure 1. Category of Finance Companies

Source: Indopremier Securities Research (2009)

However, integration also provides limitations on finance companies. Finance companies become dependent on a particular party. The dependence on the parent company for funding support and captive market will reduce finance companies' competitiveness. Financial indicators that are measured in this research include growth ratio, firm size, profitability ratio, efficiency ratio, liquidity ratio, risk ratio and solvency ratio.

This study becomes unique by examining the integration between the three industries which are the finance company industry, the banking industry and the automotive industry. Research on the financial performance difference between integrated and independent industries is still uncommon, especially in developing countries like Indonesia. Among some examples are Healey (1992), Cornet and Tehranian (1992), Akhavein (1997), Berger (1997) Berger, Demzetz, Straham (1999), Berger (2000), Cheng (2006), Wang (2007), Chang (2006), Becalli (2008), Aktas (2008).

Maldenker and Lev (1972) found that companies that do mergers and acquisitions have performed better than companies that do not in the long term. The study measured the total of thirteen financial ratios.

Healey (1992) illustrates that companies who do mergers will have better performance in productivity of assets compared to the industry average. Mergers and acquisitions can change a company's solvency rate, bankruptcy risk or the raw material's price, quality and quantity after the merger (Haugen and Langetieg 1975).

Cornet and Tehranian (1992) researched fifteen acquisition transactions of major banks that do acquisitions as compared to fifteen other major banks that did not do any acquisitions during the years 1982 to 1987 in America. Research results show that banks that do mergers and acquisitions have better performance than the banking industry. Performance improves in obtaining funding, lending, employee productivity and profit growth.

Akhavein et al. (1997) examines the banking mergers from 1981-1989 with a minimum asset value of $1 billion. This study found that the merger has a significant improvement on profit efficiency compared to other major banks. These banks increase revenues, improve efficiency which previously was at a low level, but do not increase prices or yield of the portfolio.

Berger et al. (1997) observed the implications of mergers and acquisitions of financial institutions and lenders as well as competitor reactions to mergers and acquisitions. The research was conducted in the 1970s with a sample of six thousand transactions. This study found that the merger between two small and medium financing institutions will increase lending for Small and Medium Enterprises (SMEs). Meanwhile, the acquisitions made by large financial institutions will lower the credit financing of SMEs. Mergers and acquisitions will change the strategy and focus rather than changing the target of financial companies.

Berge, Demzetz, Straham (1999) obtained positive results in the consolidation of the financial industry, especially in the market competition, earning power and risk diversification. Financial consolidation will reduce the level of efficiency. Berger (2000) also found that the integration of the financial industry will have great potential in efficiency, but only a small amount of release. Integration increases the revenue efficiency compared to cost reduction. Risk diversification lowers the operational costs.

Cheng (2006) found that the consolidation of financial institutions will increase the return on equity and capital adequacy ratio (CAR), deposit growth and loan distribution. Institutional consolidation also lowers employee productivity by measuring total assets divided by the number of employees. Small banks have a more efficient performance and better growth while the big banks have a better ratio of profitability, credit quality and CAR.

Wang (2007) found that capital markets react positively to the alliance of financial companies. After the alliance, financial companies involved in an alliance will perform better than before the alliance occurred. Alliances tend to be joint ventures and mergers. The research was conducted from 1986 to 2003 with a sample of the banking, insurance, finance and securities industry.

Becalli (2008) found that bank mergers and acquisitions achieve efficiencies in its operations when compared to banks that do not do mergers and acquisitions. Healey et al. (1992) conducted a research on fifty mergers and acquisitions done by major companies in the industrial field in America between the years 1979 to 1983. Research results show an increase in the productivity of assets after the merger compared to the industry. Significant improvement occurred on the return on cash flow and companies maintain their investment in capital expenditure investments and research and development after the merger.

Chang *et al*. (2006) explained that Japanese and American companies that establish alliances will have a positive result within three years after the alliance. This positive performance results mainly in small-scale enterprises, has great growth prospects but whose profits are still below the industry. Wu (2004) found that the merger has a negative effect for the short-term merger than companies that do not merge.

On contrary, Zhang (2006) stated that there is no difference in scale, scope and efficiency of banking products on the consolidated results between the years 1999-2005. Aktas (2008) found that there were no significant differences between companies that conduct organic growth and those that do mergers and acquisitions. In the short term, companies that conduct organic growth will improve operating performance, cost reduction and economies of scale. This research was conducted on companies listed on the stock exchange in the U.S. from 1990-2004.

Langetieg et al. (1980) explained that the merger increases the risk to shareholders in the acquiring company. The merger increases systematic risks, both the total risk and diversification risk on the consolidated company. This study managed to find that the merger brings the risk for the acquiring company. These results have never been found in previous studies. Previous studies considered the merger as part of risk reduction by means of diversification and integration, therefore the merger is considered as one of company's attempt in reducing / decreasing risk. Decline in shareholder value will be reflected by the perfect and complete capital markets in response to the expected profit in appropriate amount. Increased risk in a merger is showed by an increasing on leverage of the post-merger company.

Although there are already numerous researches concerning the performance of an acquisition, there is no conclusive result yet. Therefore, it is important to conduct a research on this topic, especially in a specific industry with acquirers from related industry.

This paper will study the performance of finance company industry in Indonesia during 2001-2011. The performance measurement will be based on the financial performance between integrated and independent finance companies. The financial measurements are grouped into 7 dimensions, which are profitability, efficiency,

solvency, liquidity, size, growth, and asset quality.

The rest of the paper will be organized as follows, after the introduction, we describe the data and methodology in Section 2, followed by the result and discussion in Section 3. Finally, Section 4 gives summary and conclusion remarks.

2. Methodology, Variable and Data

2.1 Methodology

2.1.1 Dummy Variable Regression

Parametric test model in this study is developed from the dummy regression models by Vennet (2002). To test the financial performance between independent and integrated finance company, the integrated companies are coded differently from independent companies (DA = dummy). DA code for integrated company = 1, code for independent company = 0. Parametric tests are conducted by dummy regression towards each variable by the equation as follows:

Model 1a:

$$Y_{it} = a + b_1 DA_{it} + \varepsilon \quad (1)$$

Model 1b:

$$Y_{it} = a + b_1 DA_{it} + b_2 FSI_{it-1} + b_3 TAGR_{it-1} + \varepsilon \quad (2)$$

Note:

Y_{it} = EXIR, ROA, ROE, NPM, PROV, LEV, PATA, LIQ, EXPA, REPA, LITA, FSI, TAGR, PAGR, NIGR, REGR, EXGR

DA = dummy alliance, 1 for integrated and 0 for independent

FSI = Firm Size

TAGR = Total Asset Growth

To test the financial performance between backward and forward integration, the backward integrated companies are coded differently from forward integrated companies (DI = dummy integration). DI code for backward integrated company = 1, DI code for forward integrated company = 0. Parametric tests are conducted by dummy regression towards each variable by the equation as follows:

The hypotesis are as follow:

H1:There were differences in growth

H2:There were differences in efficiency

H3:There were differences in solvency

H4:There were differences in asset quality

H5:There were differences in firm size

H6:There were differences in liquidity

H7:There were differences in profitability

2.1.2 The Non-parametric Mann Whitney Test

Non-parametric test model in this study follows the model developed by Chang (2006), Wang (2007) and Hagendorff and Keasey (2009). This research model will focus on the performance difference between the two groups of independent and paired sample. This test aims to test the characteristics between the 2 groups of independent samples. Mann Whitney test is an alternative testing to the t test without any restriction. This test can also apply for a different number of samples tested in the 2 groups.

Mann Whitney U test Formula Test

$$U = n1n2 + \frac{n1\,(n1+1)}{2} - R1 \quad (3)$$

or

$$U = n1n2 + \frac{n2\,(n2+1)}{2} - R2 \quad (4)$$

where:

n_1 = number of sample 1

n_2 = number of sample 2

R_1 = number of ranks of the sample 1

R_2 = number of ranks of the sample 2

Non-parametric test performed with Mann Whitney Test

Using $\alpha = 5\%$

- Based on the t-statistics value and p-value, the variables that are significantly different between the integrated and independent companies will be noticeable.

2.2 Variable and Measurement

The five ratios were developed by Healey et al. (1992), Cornet and Tehranian (1992, 2004) and Cheng (2006). This study adds in the variable of growth developed by Mandelker (1972) and a variable of size developed by Vennet (2002). These variables are adapted and developed into seven measurement ratio groups with 17 research variables as showed in table 1.

Table 1. Financial Ratios

Ratio	**Formulation**
Growth Ratio	
Revenue Growth	$REGR = \frac{Revenue\ (t) - Revenue\ (t-1)}{Revenue\ (t-1)}$
Total Asset Growth	$TAGR = \frac{Total\ Asset\ (t) - Total\ Asset\ (t-1)}{Total\ Asset\ (t-1)}$
Net Income Growth	$NIGR = \frac{Net\ Income\ (t) - Net\ Income\ (t-1)}{Net\ Income\ (t-1)}$
Productive Asset Growth	$PAGR = \frac{Productive\ Asset\ (t) - Productive\ Asset\ (t-1)}{Productive\ Asset\ (t-1)}$
Efficiency Ratio	
Expense Income Ratio	$EXIR = \frac{Expense}{Income}$
Expense to Productive Assets	$EXPA = \frac{Expense}{Productive\ Asset}$
Expenses Growth	$EXGR = \frac{Expense\ (t) - Expense\ (t-1)}{Expense\ (t-1)}$
Productive Assets To Total Assets	$PATA = \frac{Producitve\ Asset}{Total\ Asset}$
Solvency Ratio	
Liabilities Total Assets	$LITA = \frac{Total\ Liablities}{Total\ Asset}$
Leverage Ratio	$LEV = \frac{Total\ Liablities}{Total\ Equity}$
Asset Quality	
Provisioning Policy	$PROV = \frac{Total\ Provisioning}{Total\ Productive\ Asset}$
Size Ratio	
Firm Size	$FSI_t = \ln Total\ Asset\ (t)$ $FSI_{t-1} = \ln Total\ Asset\ (t-1)$
Liquidity Ratio	
Liquidity Ratio	$LIQ = \frac{Total\ Productive\ Asset}{Total\ Liablities}$
Profitability Ratio	
Return on Assets	$ROA = \frac{Net\ Income}{Total\ Asset}$
Return on Equity	$ROE = \frac{Net\ Income}{Total\ Equity}$
Net Profit Margin	$NPM = \frac{Interest\ Income\ -\ Cost\ of\ Fund\ -\ Expenses}{Interest\ Income}$
Revenue to Productive Assets Ratio	$REPA = \frac{Revenue}{Total\ Productive\ Asset}$

2.3 Data

This study uses secondary data collected from various institutes and official literature which include published financial data of each company on various mass media, annual reports for public companies, research reports from various securities, research reports from magazines and Bloomberg database particularly regarding mergers and acquisition transactions.

The data are panel data consisting of cross section data from an observed period of the year 2001-2011. Formulation of these variables is presented in table 1. The data used in this study is panel data. Panel data are two-dimensional data and the combination of time dimension (time series) and individual company dimension (cross section).

All finance companies in Indonesia that published the financial statements in 2001 to 2011 are the objects of the research. The number of companies registered with Bapepam LK is one hundred and ninety-three companies. The sampling criteria are as follows:

1. Finance companies listed on the Capital Market and Financial Institution Supervisory Agency (Bapepam-LK) in 2011.

2. Finance companies that actively published financial statements during the period of 2001 to 2011.

3. Finance companies that announced the actions of corporate acquisitions during the period 2001 - 2011 in various mass media channels or annual report.

The sampling unit is finance companies. The sampling frame is the list of companies listed on the Bapepam-LK and those that published financial statements for the period of 2001-2011. The sampling size is the total of all finance companies listed at the Bapepam-LK and met the specified criteria. This study uses purposive sampling with judgment sampling. Samples must meet certain criteria established in this study.

3. Analysis and Discussion

3.1 Statistical Description

Of the total sample of 100 companies that continously published financial statements from 2001 to 2011, data were collected as many as 1100 panel data. A total of 55.2% is a group of independent companies or a group of non-alliance and 44.8% is a group of integrated companies, both are in alliance with automotive related companies and banking industry.

Table 2. Distribution of Data

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Non Aligned	607	55.2	55.2	55.2
	Aligned	493	44.8	44.8	100.0
	Total	1100	100.0	100.0	

Growth Ratio

For total asset growth (TAGR), finance companies reached an average growth of 1.61 times during 2001 to 2011, compared to the previous year. There were finance companies that did not experience growth, and also those that experienced growth up to 206 times of total asset from the previous year.

Productive asset growth (PAGR) experienced a higher average growth compared to asset growth which was equal to 2.87 times. As for the net income growth (NIGR), finance companies achieved net income growth of 2.27 times on average compared to the previous year. There were several finance companies that suffered declining net profit by -69.26 times and there were some that reached a maximum profit growth of 435.64 times. Revenue growth (REGR) of finance companies reached 2.23 times increase during the period of the study.

Efficiency Ratio

On average, finance companies have a ratio structure of productive assets to total assets (PATA) that amounts to 76%. This achievement is higher than government regulations which regulate a minimum of 40%. In terms of operating costs, finance companies have a ratio of operating expenses to operating income (EXIR) of 1.74 times. The high level of EXIR shows that finance companies also generate income other than interest income. Other income includes insurance sales revenue, fines revenue due to customer tardiness, customer installment payments

and other income. Meanwhile, the operating costs of productive assets (EXPA) in finance companies reach 55% on average. The growth of operating costs (EXGR) experienced a growth of 2.13 times on average compared to the previous year.

Solvency Ratio

For solvency ratio, the ratio of debt to total assets (LITA) reached 0.80 times on average. The ratio of debt to equity (Leverage / LEV) reached 0.32 times on average. This leverage is still relatively low compared to those allowed by the regulation, which is up to 10 times. However, there are finance companies that have negative equity, which results in a negative Leverage ratio.

Risk Ratio

For uncollectible receivables provisioning (PROV), finance companies reserve a provision of 3.84%. In tax policy, finance companies are allowed to do the uncollectible receivables provisioning amounting to 2,5% for business leasing and 5% for consumer financing.

Size Ratio

On average, the total assets (FSI) of finance companies reached Rp. 12 billion per company. This average value is the average total assets from 2001 to 2011. The largest finance company has asset of Rp. 18 Trillion.

Table 3. Statistical Description

	N	Minimum	Maximum	Mean	Std. Deviation
EXIR	1100	-.467	316.667	1.74638	11.867538
ROA	1100	-9.560	26.127	.06042	.910083
ROE	1100	-61.075	29.843	.10366	2.260085
NPM	1100	-16.177	7.536	.03550	.697311
PROV	1100	-1.095	4.518	.03846	.226607
LEV	1100	-3265.617	296.094	.32867	99.065149
PATA	1100	.000	1.764	.75556	.231468
LIQ	1100	.000	1077.571	6.93379	42.585406
EXPA	1100	-.535	201.628	.55306	6.142197
REPA	1100	-.407	19.015	.40063	.803798
LITA	1100	.000	159.125	.80408	4.823126
FSI	1100	.000	16.739	12.13712	2.074309
TAGR	1100	.000	206.220	1.60684	6.584531
PAGR	1100	.000	856.499	2.87197	27.539283
NIGR	1100	-69.258	435.643	2.27138	18.305991
REGR	1100	-.390	352.090	2.22665	12.537235
EXGR	1100	-3.079	456.272	2.13496	15.136933
Valid N (listwise)	1100				

Liquidity Ratio

The liquidity ratio (LIQ) of financing receivables to debts comparison is 6.93 times on average. This value reflects a fairly liquid state, where each Rp. 1 of the debt is born by Rp. 6.93.

Profitability Ratio

In terms of profitability, finance companies have a return on assets (ROA) of 6.04% on average. This value is categorised as high compared to other financial industries. As for the return on equity (ROE), the average reached 10.37%. This average value of ROE is relatively low compared to the Indonesia investors' expectations of return.

As for the Net Profit Margin (NPM), finance companies have a Net Profit Margin of 3.55% on average and operating income to earning assets (REPA) of 40.06%. REPA shows numerous customer financing portfolios on two-wheel motor vehicles and electronics. On consumer vehicle financing, finance companies charge interest and administrative costs around 40% effectively per year.

3.2 Differences in Financial Performances

The results of data processed for several ratio measurements shows significant differences between integrated and independent finance companies. Data processing uses non-parametric tests (Mann Whitney) and parametric tests (panel data).

Table 4. The Testing Result of Differences in Financial Performance

Equation	Non Parametric (Mann Whitney)		Parametric (Pooled Least Squared)			
			Model 1a		Model 1b	
EXIR	-4.167	***	-1.645	**	-1.155	
			(0.722)		(0.773)	
EXPA	-1.301		-0.312		-0.131	
			(0.372)		(0.431)	
EXGR	-1.065		-1.218		-1.523	
			(0.917)		(1.063)	
PATA	-6.441	***	0.065	***	0.001	
			(0.014)		(0.012)	
ROA	-3.398	***	-0.016		0.015	
			(0.055)		(0.063)	
ROE	-6.601	***	-0.002		0.043	
			(0.137)		(0.156)	
NPM	-2.735	***	0.074	*	0.079	*
			(0.042)		(0.047)	
REGR	-0.149		-1.371	*	-14.083	
			(0.759)		(0.880)	
REPA	-0.244		0.088	*	0.164	***
			(0.048)		(0.054)	
PROV	-5.409	***	0.017		0.026	*
			(0.014)		(0.015)	
LIQ	-5.415	***	-8.952	***	-5.667	*
			(2.568)		(2.883)	
LEV	-8.776	***	5.983		6.936	
			(6.001)		(6.967)	
LITA	-6.763	***	-0.199		-0.147	
			(0.292)		(0.339)	
FSI	-11.659	***	1.294	***	0.234	***
			(0.119)		(0.051)	
TAGR	-1.621		-0.229		-0.312	
			(0.399)		(0.463)	
PAGR	-1.633	*	-0.811		-0.178	
			(1.669)		(19.345)	
NIGR	-1.988	**	0.005		0.118	
			(1.110)		(128.677)	

Note:

1) Dummy estimation coefficient (1 for integrated companies and 0 for independent companies)

2) Numbers in ( ) states the estimated standard error

3) *) Significant at α = 10%

**) Significant at α = 5%

***) Significant at α = 1%

The significant results of Pooled Least Squared (PLS) will be re-tested using Fixed Effect Model (FEM) dan Random Effect Model (REM) test. Afterwards, The Chow test, Hausman test and LM test will be used to compare the results between PLS and FEM, between REM and FEM and between PLS and REM respectively.

Table 5. Panel Data Test Results

Equation	Model 1 a						Test						Selected
	PLS		FEM		REM		Chow		Hausman		LM		Model
EXIR	-1.645	**	0.091		-1.493		2.770	***	0.350		103.800	***	PLS
PATA	0.065	***	0.013		0.055	**	5.460	***	0.890		448.590	***	REM
NPM	0.074	*	-0.104		0.069		1.580	***	1.030		12.660	***	PLS
REGR	-1.371	*	-6.888	**	-1.372	*	0.970		2.970	*	0.220		FEM
REPA	0.088	*	-0.126		0.069		2.860	***	1.170		111.160	***	PLS
LIQ	-8.952	***	0.516		-8.451		2.030	***	0.790		38.590	***	PLS
FSI	1.294	***	1.369	***	1.326	***	15.220	***	0.030		1,734.000	***	REM
Equation	**Model 1 b**						**Test**						**Selected**
	PLS		**FEM**		**REM**		**Chow**		**Hausman**		**LM**		**Model**
NPM	0.079	*	-0.038		0.082		1.740	***	7.780	*	17.460	***	PLS
REPA	0.164	***	-0.027		0.153	*	2.800	***	1.510		101.100	***	REM
PROV	0.026	*	0.061		0.027		1.670	***	1.050		17.030	***	PLS
LIQ	-5.567	*	2.418		-5.598		1.630	***	2.680		14.210	***	PLS

Note: 1) *) Significant at α = 10%

**) Significant at α = 5%

***) Significant at α = 1%

2) PLS: Pooled Least Squared; FEM: Fixed Effect Model; REM: Random Effect Model

3.2.1 The Results of Testing H1 (Growth Ratio)

In terms of productive asset growth (PAGR), a statistical value of -1.633 is obtained with α = 10% by using non-parametric test. These results show that there are real differences between PAGR ratio of integrated and independent finance companies. PAGR ratio of integrated finance companies is greater than those of independent finance companies. It shows that the integrated companies have a greater asset growth than independent finance companies. This growth is supported by the parent of finance companies.

For growth in net income (NIGR), the test results using the non-parametric Mann Whitney test reach a statistical value of -1.988 and is significant at α = 5%. These results show there are apparent differences between NIGR ratio of integrated and independent finance companies. NIGR ratio of integrated finance companies is higher than those of independent finance companies. This shows that the integrated companies have a higher net profit growth than independent companies.

NIGR ratio shows a net profit growth of finance companies compared to the previous year. The higher this ratio, the higher the profit growth will be, and the better the finance company will be.

For earnings growth ratio (REGR), the test results by using the parametric test (Fixed Effect Model) obtains a statistical value of -6.888 and is significant at α = 10%. These results show there are apparent differences between REGR ratio of integrated and independent finance companies. The REGR ratio of integrated finance companies is lower than independent finance companies. This shows that the integrated companies have a lower revenue growth compared to independent finance companies. The results are consistent with findings by Beijerse (2000). Increase in organic growth is more focused on core competencies and capabilities in order to meet customer needs.

REGR ratio shows revenue growth of finance companies compared to the previous year. The higher this ratio is, the better a finance company will be.

3.2.2 The Results of Testing H2 (Efficiency)

Based on non-parametric approach using the Mann Whitney test (MW), a statistical value of MW test is obtained for the variable Operating Expenses Operating Income (EXIR) of -4.167 and is significant at α = 1%. The same is showed by a parametric test (pool least square) where the dummy variable (integrated-independent) reaches a value of -1.645 and is significant at α = 5%. The results explain that on average there are significant EXIR performance differences between integrated and independent finance companies, and that on average, the EXIR

value of integrated companies is smaller than independent companies. This means that the integrated companies are more efficient that independent companies.

EXIR shows a comparison between operating costs and operating income. This variable measures the efficiency level of a financial institution. The lower this ratio is, the more it shows higher efficiency compared to other institutions.

For the productive asset structure to total assets (productive assets to total assets / PATA) aspect, it is tested with Mann Whitney and a statistical value of -6.441 is obtained and is significant at $\alpha = 1\%$. The same is showed by a parametric test (Random Effect Model) where the dummy variable (alliance-non-alliance) is worth 0.055 and is significant at $\alpha = 5\%$. The results explain that on average there are significant performance differences between integrated and independent finance companies. The test results also show that on average, the PATA value of integrated companies is greater than independent companies. It also means that the integrated companies are more efficient in asset allocation compared to independent companies.

PATA shows a comparison between the productive assets and total assets. This variable measures the level of efficiency of a financial institution in asset allocation. The higher this ratio is, the more efficient the company allocates its productive assets compared to other assets.

These results are in line with the results of Healey (1990) who found that mergers and acquisitions will increase the productivity as compared to the average achievement of the industry. Similar results were also found by Becalli (2008) who found that mergers and acquisitions achieve more efficiencies in operations compared to its industry average.

3.2.3 The Results of Testing H3 (Solvency)

The capital structure aspect or leverage (LEV) is tested with the Mann Whitney and a statistical value -8.776 is obtained and significant at $\alpha = 1\%$. The results explain that on average there are significant differences between integrated and independent finance companies terms of leverage ratio. Companies in alliance with either with the banking or automotive related companies have stronger capital support compared to finance companies with no alliance. This results in a higher leverage on integrated finance companies.

Leverage ratio becomes a way to measure performance of finance companies as stipulated in the Decree of the Minister of Finance. Maximum leverage ratio allowed is 10 times of the equity.

For liabilities to total assets ratio (LITA), the test results by using the non-parametric Mann Whitney obtain a statistical value of -6.763 with $\alpha = 1\%$. These results show there are apparent differences between LITA ratios of integrated and independent finance companies. LITA ratio of integrated finance companies is higher than independent finance companies. This shows that the integrated finance companies have more efficient capital structure than independent finance companies. Ease in obtaining loan funds becomes the advantage of integrated finance companies.

Liablities to total asset (LITA) ratio shows a comparison of total debt ratio to total assets of a finance company. The higher this ratio is, the higher the risk a finance company will have.

3.2.4 The Results of Testing H4 (Asset Quality)

On risk management aspect, the ratio of provisioning (uncollectible receivables provisioning) is tested with Mann Whitney and a statistical value of 5.409 is obtained and significant at $\alpha = 1\%$. The results show that on average, integrated finance companies have a significant difference for the uncollectible receivables provisioning ratio compared to independent finance companies. Integrated finance companies have more stringent provisioning policies than independent companies. A finance company in alliance with a bank or a bank holding company has an obligation to follow the standard banking provisioning regulation by Bank Indonesia. This is consistent with the financing cooperation (joint financing) among finance companies in alliance with banks, where the composition of funding between the two parties ranges from 1% until 99% to 10% until 90%. This is consistent with the results of studies by Mandelker (1972). Mandelker found that the acquisition and the merger would cause a risk to the company.

3.2.5 The Results of Testing H5 (Firm Size)

By Mann Whitney test (MW), a statistical value of -11.659 is obtained for the variable Firm Size (FSI) and is significant at $\alpha = 1\%$. The same is shown by a parametric test (Random Effect Model) where the dummy variable (integrated-independent) is worth 1.326 and significant at $\alpha = 1\%$. By adding a variable lag (1) on firm size and asset growth in parametric testing (pooled least squares), firm size aspects reach 0.234 statistical value with $\alpha = 1\%$. These results show there are apparent differences between Firm Size ratio of integrated and independent finance

companies. FSI ratio of integrated companies is greater than independent finance companies, both by non-parametric and parametric testing. FSI ratio shows total assets ratio of finance companies. The higher this ratio is, the bigger a finance company will be.

3.2.6 The Results of Testing H6 (Liquidity)

With non-parametric testing, aspects of liquidity (LIQ) is tested with the Mann Whitney and a statistical value of -5.415 is obtained while a statistical value of -8.952 is obtained using parametric test; both are significant at $\alpha = 1\%$. By adding a lag factor (1) on firm size and asset growth in parametric testing (pooled least square), the liquidity aspect obtains the value of -5.567 with $\alpha = 10\%$. These results show there are real differences between the performances of liquidity in integrated and independent finance companies. Integrated finance companies' current ratio is lower than the independent finance companies. This explains a more efficient rate on integrated finance companies.

Liquidity ratio shows the comparison between productive assets and total debt. This variable measures the number of productive assets of finance companies that can be used to cover the debts of finance companies. The higher this ratio is, the more liquid a finance company is.

3.2.7 The Results of Testing H7 (Profitability)

In terms of profitability, Return on Assets (ROA) and Return on Equity (ROE) are tested by Mann Whitney (MW) and statistical values of -3.398 for the ROA and -6.601 for the ROE are obtained and are significant at $\alpha = 1\%$. The results explain that on average there are significant differences between the performance of ROA and ROE of integrated and independent finance companies. The average ROA and ROE of integrated finance companies are greater than the independent companies or they are more profitable than independent companies. This is consistent with research findings by Kemmpi et al. (2008) and Kling et al. (2009).

ROA indicates the return on total assets managed by a company. ROE shows return on shareholder investment in the finance company's equity. The higher these ratios are, the better the return is.

In terms of Net Profit Margin (NPM) which is tested with Mann Whitney test, a statistical value of -2.735 is obtained and is significant at $\alpha = 1\%$. The same result is indicated by a parametric test (pooled least squared) with statistical value of 0.074 with a dummy variable and is significant $\alpha = 10\%$. By adding variable lag (1) for firm size and lag (1) for asset growth, a statistical value of 0.079 is obtained and is significant at $\alpha = 1\%$. These results show that on average there is a difference between the NPM of integrated and independent finance companies. NPM of integrated finance companies is greater than independent finance companies. Integrated companies will have the power in funding especially those that are in alliance with banks. Finance companies that ally with automotive related companies will get a special promotional subsidy from its parent company.

For the ratio of operating income to productive assets (REPA), the test results by using the parametric test (Pooled Least Squared) and inserting a lag (1) variable for firm size and asset growth reach a statistical value of 0.088 and 0.153 with $\alpha = 10\%$. The results show that there are real differences between REPA ratio of integrated and independent companies. REPA ratio is higher in integrated companies than independent companies. This shows a more efficient level in integrated companies.

REPA ratio shows the return of productive assets / financing receivables or income derived from financing receivables. The higher this ratio is, the better a finance company will be.

4. Conclusion

This paper investigates whether related parent company influences the performance of finance company. Using a sample of 100 finance companies which published their financial statement over the period 2001-2011, we analyse whether parent company's value are reflected in improved performance of the finance company subsidiary. (measured using standard accounting ratios). The related parent company is categorized into 2 group which are banking industry and automotive industry. Banking industry provide the funding and automotive industry provide the product of financing to finance company. The integration with banking industry called as backward integration and the integration with automotive industry called as forward integration.

With the series of M&A taking place in financial sector in Indonesia, the target finance company owned by the related industry showed improved in expense to income ratio (EXIR), productive asset allocation (PATA), profitability (ROA and ROE), bigger firm size and higher growth in productive asset and net income Also, it has improved the net profit margin of the finance company. The integrated finance company also showed more conservative by putting higher reserve. However, the integrated finance companies have higher leverage, higher liabilities to total asset lower liquidity and lower in revenue growth. Overall, the result of the study indicates that in

the long run the acquiring firms are able to generate value creation in one or the other form such as operation efficiency, profitability, firm size and higher growth capabilities.

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The Introduction of Higher Banknotes and the Price Level in Nigeria: An Empirical Investigation

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Abstract

The planned restructuring of the Nigerian currency to include a N5, 000 note has generated a lot of controversy. Much of the furor is centered around the supposed inflationary effects of introducing higher denomination notes, which provides the motivation for this paper. Using five different measures of inflation, from 1973 to 2011, we examine the effects of the introduction of new notes since the launch of the Naira in 1973. Our empirical results show that none of the currency restructuring episodes has had any effect on inflation. There, however, seems to be a short-lived positive effect on food inflation every time a new note is introduced. We attribute this not to the introduction of the note itself but to the change in inflation expectations following the introduction. However, the change in inflation expectations more than completely dissipates by the second month after which there is no subsequent effect.

Keywords: inflation, banknote, money illusion

JEL Classification: E310 E420 E410

1. Introducation

One of the core mandates of the Central Bank of Nigeria – hereafter on referred to as CBN - like most monetary authorities in the world, is the issuance and management of the legal tender currency. This implies that the CBN is responsible for the entire process of currency management, which includes the design, production, storage, distribution and the disposal of banknotes. An important component of this responsibility is to ensure an optimal currency structure in terms of efficiency, cost effectiveness and balanced mix of various denominations. This requires that the Bank be responsive to the changing needs of the economy and keep pace with the evolving trends in an ever-changing world.

According to international best practices, monetary authorities are required to review their currency regimes at intervals of between five (5) and ten (10) years. This is with a view to addressing the inevitable weaknesses and challenges noted in the management of notes and coins in circulation. Reviews are also necessitated by innovations in technology, aesthetics as well as security considerations.

In Nigeria, the controversy generated by the planned restructuring of the nation's currency resonated and has been sustained by some economic experts, political actors and business owners who have vehemently been opposed to the policy. The CBN announced a holistic restructuring of the nation's currencies and the introduction of N5, 000 banknote as well as N5, N10 and N20 coins from first quarter of 2013. The policy also proposes to redesign some of the other older notes. According to the CBN, the introduction of the higher denomination banknote will complement the bank's cashless policy by reducing the volume of currency in circulation in the long term. The conversion into coins and the redesigning of other notes will also enhance the security features of the currency as well as introduce other transactional features. The restructuring exercise code-named 'Project Cure', seeks to ultimately change the naira currency structure to 12, comprised of six coins and six banknote denominations.

Although the CBN began a sensitization campaign in all the geopolitical zones of the country to drum up support, opposition to the policy does not seem to have waned. The proposal was greeted with spontaneous reactions from members of the business community, political class and other businesses interests who have expressed

divergent views on the new currency policy.

A number of critics of the policy articulated the fear that the introduction of the N5, 000 note at a time when the nation is recording double digit inflation will not be in the interest of the economy. Although other alleged negative consequences have been mentioned, the main concern seems to be the effect on inflation. The critics argue that the introduction of a higher denomination banknote, such as the N5000 note, will accentuate inflationary trends and be counter-productive to the CBN's drive to reduce inflation.

In this paper we hope to dispel the myth of an effect of introducing new banknotes on inflation in Nigeria. The objective of this paper is to empirically investigate and examine the assertion that the introduction of higher denomination notes is inflationary in the Nigerian economy. Nigeria has introduced higher denomination notes six times before. One way to examine the possible effects of the introduction is to examine the effects on inflation during previous introductions of higher denominated currency. We examine five different inflation time series spanning the period 1973 to 2011 for possible effects. We do this using intervention analysis or an event study. According to Box and Tiao (1975) this is an appropriate way to assess the impact of a special event, such as the introduction of higher denomination banknotes, on inflation time series. In this case the special event is the various years of the introduction of the higher denomination.

Following this introduction, the rest of this paper is structured in 4 sections. Section 2 is a review of theoretical and empirical literature, section 3 describes the statistical methods and data used, section 4 discusses the empirical results and section 5 concludes the paper.

2. A Review of the Theoretical and Empirical Literature

In literature, the theoretical foundation for this study was captured by Chen (1975), who sought to show that an improvement in the size mixture of money would be contractionary on the price level. He argued that the achievement of an appropriate mixture of money would typically have three types of effects on the real demand for money. First, it would cause a reduction in the real demand for money because fewer real units of the more efficient money would be required to handle a given transaction on a real flow of monetary expenditure. This he termed the 'efficiency effect'. Second, it would cause an increase in the demand for real cash balances since the more optimal size mixture implies that money is more attractive. This leads to the substitution of money for barter exchange and of money holdings for other asset holding including commodities. This implies an increase in the real balance to income ratio. He called this the 'substitution effect'. The third effect, he argued, is that the real flow of income would increase. Thus, the increased use and efficiency of money would imply a savings of labour and other real resources, thus engendering a positive 'income effect' on the demand for money.

With the current trend towards fractional reserve banking system, there is an additional contractionary force at work, because better denomination mix of currency will lead to a shift out of deposits into currency, that is, a rise in the currency to deposits ratio, which, in turn, will reduce the money multiplier. Thus, with an unchanged nominal quantity of high-powered money, the nominal stock of money will decline, rendering an additional contractionary force on the price level. This can be called the "tight money effect." Therefore, for an improvement in the currency denomination mix to be inflationary, the direct efficiency effect has to be so strong that it out-weighs the combined forces of the substitution effect, the income effect, and the tight money effect. Historical evidence, however, seems to suggest that the efficiency effect is not even strong enough to offset the substitution effect. Although the "efficiency" of money has almost surely increased over the past decades, the income velocity of money has declined secularly in most of the countries. This seems to suggest that the substitution effect of an increased efficiency of money has outweighed the direct efficiency effect. These assumptions were within the analytical framework of general equilibrium (Tobin 1969, 1970) and a supplementary explanation of Milton Friedman's well-known thesis that money is a luxury good.

Empirically, the relationship between changes in currency structure and inflation has also been examined across countries. Franses (2006) examines the causality between bigger banknotes and inflation. He analyzed 40 years of data on inflation and denominations for 59 countries. His results showed one-way causality from inflation to banknotes but not from banknotes to inflation, thus clearly debunking the fear by monetary authorities that the introduction of higher denomination banknotes would reflect an expectation of impending inflation. The study used a vector auto-regression (VAR) model for inflation and banknotes denomination.

The introduction of the Euro also presents an experiment for the effects of a change in currency structure on inflation. Although not as straightforward as the introduction of a higher denomination note, the introduction of the Euro represents an extreme example of a change in currency structure. Pollan (2002) and Angelini and Lippi (2005) examines the effects of this change in structure on inflation in Germany, Switzerland and Italy. Both papers find no evidence of the change in currency structure on inflation even in this extreme case.

Studies on the implications of the higher denomination banknotes on inflation in Nigeria have not been carried out. This provided more impetus for this study. We aim to show, empirically, the implications of the introduction of higher denomination banknotes on inflation in Nigeria. The introduction of higher denomination banknotes always seems controversial with attendant speculative effects.

3. Statistical Methods and Data

An appropriate method to evaluate the impact of the introduction of higher denomination banknotes on inflation is "Intervention Analysis". This provides a means of assessing the impact of a discrete change in inflation resulting from an event, such as the introduction. For our analysis we select a model of the form

$$I_t = \alpha_0 + \sum_{1}^{T} \left(\alpha_1 I_{t-1} \right) + \beta_0 Z_t + \mu_t \tag{1}$$

where I_t represents inflation at time t and μ_t represents the usual error term. Z_t is the intervention variable which takes on a value of zero prior to the introduction of the new banknote and unity from the date of the introduction of the new banknote. In this model β_0 is our variable of interest. A statistically significant β_0 implies an initial or impact effect of a new note on the inflation series. We examine six possible intervention points individually, corresponding to the introduction of each new note since 1973. As an alternative strategy we test the joint effect of the introduction of a new note. We do this by defining Z_t as unity for all time periods in which a new note was introduced and zero for all other periods. In this case β_0 would measure the impact of the introduction of new notes in general. A statistically significant β_0 also implies an effect on inflation.

For our empirical analysis, six intervention points were examined. The N20 note was introduced in February of 1977, the N50 in October of 1991, the N100 note in December of 1999, the N200 note in November of 2000, the N500 in April of 2001 and the N1000 note in October of 2005. We use five different data sets to test the impact of a new note on inflation. We use annual inflation data computed from the Consumer Price Index and the GDP deflator separately. This series is available from the World Bank1. We use data from 1961, following the independence of Nigeria, to 2011. Second we use monthly inflation data provided by the Central Bank of Nigeria. The CBN data reports monthly headline, core and food inflation from January 1995 to July 2012. To deal with seasonality in the monthly inflation series we include dummy variables for the 1st 11 months in all regressions.

4. Empirical Results

Following the standard assumption that inflation time-series contains a stochastic process, the first step is to model the series and select the most appropriate autoregressive integrated moving average representation. Figures 1 to 5 plot each of the five series used. Both annual inflation series suggest nonstationarity. From the graphs we note that the variance of both annual measures of inflation seem to change around the year 2000. We perform the augmented Dickey Fuller test on all the series. The test statistic suggests that all five series are stationary. We used the Hannan and Quinn information criterion and the Schwarz's Bayesian information criterion to select the appropriate number of lags. This results in no lag for monthly core inflation and one lag for all other series.

As indicated above, testing the effect of the introduction of a higher denomination banknote involves testing the significance of the coefficient on the intervention variable, β_0. We use a maximum likelihood estimator to obtain the results. Table 1 reports the coefficients using all five inflation series and for all intervention points selected. Outer product of gradients (OPG) standard errors is reported in brackets. In all cases the impact of the introduction of higher denomination bills is not significant.

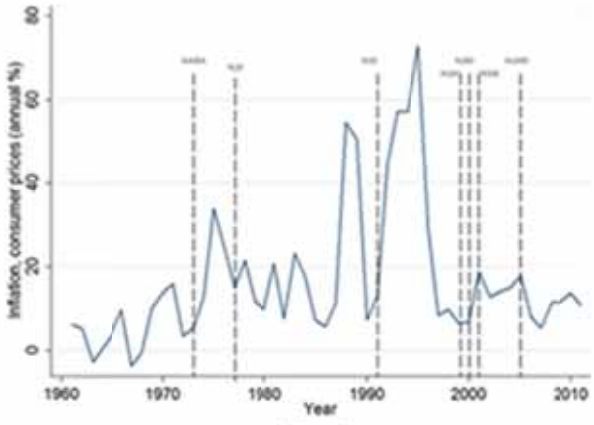
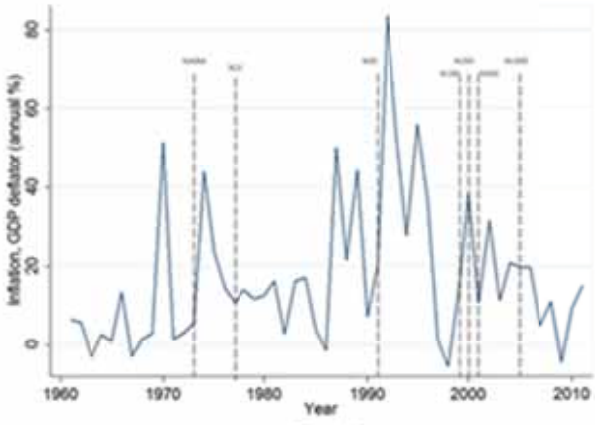


Figure 1.



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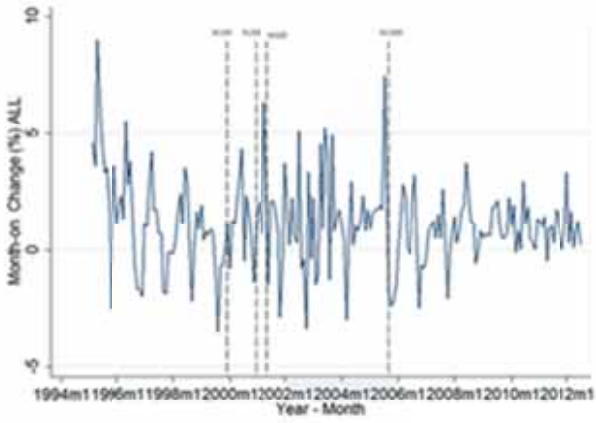

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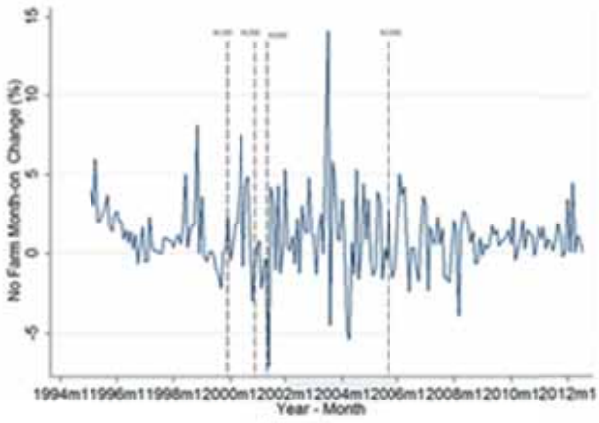

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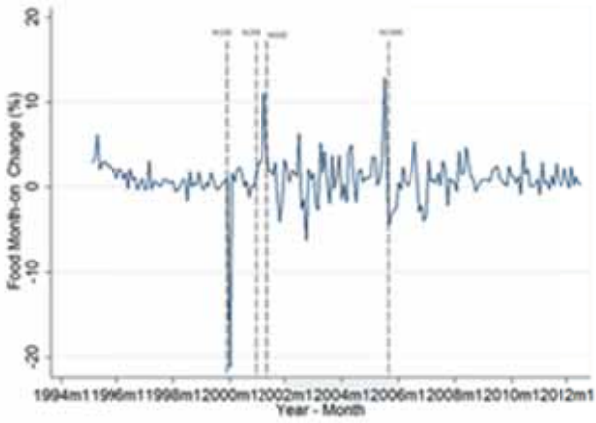

Figure 5.

Table 1. Individual effects of the introduction of a new banknote on inflation

		N20 (Feb. 1977)	N50 (Oct. 1991)	N100 (Dec. 1999)	N200 (Nov.2000)	N500 (Apr. 2001)	N1000 (Oct. 2005)	No. of Obs
ANNUAL	CPI	6.95	7.01	-5.38	-3.81	0.44	-2.67	51
ANNUAL	GDP	(11.35)	(9.35)	(27.56)	(28.59)	(17.53)	(25.64)	51
MONTHLY	Deflator	9.01	9.42	-1.16	-0.33	-5.49	-6.58	210
MONTHLY	CPI	(7.18)	(6.40)	(11.78)	(10.41)	(14.11)	(19.57)	210
MONTHLY	Headline			-0.27	-0.33	-0.25	-0.48	210
	CPI			(0.33)	(0.32)	(0.31)	(0.40)	
	Core			-0.26	-0.56	-0.34	-0.42	
	CPI			(0.43)	(0.37)	(0.37)	(0.44)	
	Food			-0.09	0.42	0.28	-0.24	
				(0.71)	(0.64)	(0.63)	(0.64)	

Notes: Outer product of gradient standard errors are reported in brackets. ***, ** and * indicate significance at 1%, 5% and 10% levels.

Table 2. Joint effect of introduction of new banknote on inflation

		Joint Effect	No. of Obs
ANNUAL	CPI	-3.40	51
ANNUAL	GDP	(7.67)	51
MONTHLY	Deflator	-1.55	210
MONTHLY	CPI Headline	(14.19)	210
MONTHLY	CPI Core	0.67	210
	CPI Food	(0.59)	
		-1.52	
		(1.53)	
		2.69***	
		(0.83)	

Notes: Outer product of gradient standard errors are reported in brackets. ***, ** and * indicate significance at 1%, 5% and 10% levels.

An alternative is to test for the joint effect of the introduction of higher denomination notes. In this case we are testing not for the effect from the introduction of a particular note, but for the effect of the introduction of any note. To examine the joint effect we include a dummy variable with a value of 1 for the period of introduction and zero for all other periods. As in our earlier regressions we use maximum likelihood estimator to obtain results. The results are reported in table 2 with OPG standard errors reported in brackets. The effect of the introduction of any note is not significant using four of the five different measures of inflation. The exception is monthly food inflation which shows a positive and significant effect on inflation. This suggests that there may be some effect of the introduction of new notes on food inflation in the month of introduction. We explore this further in the next section and make suggestions as to the cause of the effect.

- **Effects on Food Inflation**

The results from the previous section show no permanent effect of the introduction of any of the banknotes on food inflation individually. However there appears to be a joint effect of the introduction of any note on food inflation during the month of introduction. In this section we explore the persistence of the effect on food inflation. Extending the model to include lagged effects of the introduction of new banknotes suggest that the effect is short-lived. To evaluate this proposition we adjust our original model to include the effect of the introduction of any banknote on future values of inflation. The adjusted model takes the form

$$I_t = \alpha_0 + \sum_{i=1}^{T}\left(\alpha_1 I_{t-i}\right) + \sum_{d=0}^{D}\beta_d Z_{t-d} + \mu_t \quad (2)$$

where Z_{t-d} represents the d^{th} lag of the introduction. Estimating the effect of the d^{th} lag of the intervention, Z_{t-d} on I_t is effectively the same as estimating the effect of Z_t on future inflation, I_{t+d}. We estimated the model for up to four lagged periods using the same estimators as the standard model. The results are reported in table 3.

Including a one period lag, Z_{t-1}, results in a coefficient that is negative, significant and more than double the magnitude of Z_t. This suggests that the positive effects of the introduction in the first month are more than reversed by the second month following the introduction. Including further lags up to the fourth month show no significant effect on inflation. This implies that the effects die out relatively quickly. Testing the effect of the intervention on future inflation using our four other measures of inflation show no significant effect.

Table 3. Adjusted model for delayed intervention effects

		Z_t	Z_{t-1}	Z_{t-2}	Z_{t-3}	Z_{t-4}	No. of Obs
MONTH	CPI Food	2.69***					210
MONTH	CPI Food	(0.83)	-5.06***	0.01	0.68	-0.32	210
MONTH	CPI Food	1.69**	(0.62)	(1.06)	(2.77)	(2.42)	209
MONTH	CPI Food	(0.81)	-5.05***	0.15	0.61		208
MONTH	CPI Food	1.69**	(0.65)	(1.07)	(2.81)		207
		(0.82)	-5.02***	0.13			
		1.68**	(0.65)	(0.1.06)			
		(0.81)	-5.03***				
		1.73**	(0.65)				
		(0.88)					

Notes: Outer product of gradient standard errors are reported in brackets. ***, ** and * indicate significance at 1%, 5% and 10% levels.

The short lived effect of the introduction of a new note on food inflation is consistent with Shafir, Diamond and Tversky (1997) on the effects of money illusion. They argue that the presence of nominal accounting issues could sometimes affect decisions. The introduction of a new note perhaps represents such as case. Even though there is no real effect on inflation, introducing new denominations could lead to the expectation of higher inflation. The expectation of higher inflation is an important driver of actual inflation (Lucas and Rapping, 1969). The effect on inflation is however short-lived. Our results suggest a subsequent drop in inflation by a magnitude higher than the initial rise; perhaps because of the realization of no real effects on inflation. It is also not surprising that the temporary effect is only on food inflation. Food inflation is traditionally more sensitive to shocks than other measures of inflation.

5. Conclusion

The empirical results in this paper lead to the conclusion that the introduction of higher denomination banknotes does not lead to higher inflation in Nigeria. Hence the prediction of higher inflation triggered by the introduction of the N5, 000 by most Nigerians is not founded by empirical investigation. Using both annual and monthly inflation data, we examine the effect of past introduction of higher denomination banknotes in Nigeria. Employing intervention analysis of time series inflation data, there is no evidence from the results of unwanted consequences of issuing higher banknotes. Our results are consistent with other studies by Pollan (2002), Angelini and Lippi (2005) and Franses (2006) who find no effect of a change in the denomination of banknotes on inflation.

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Note

Note 1. Accessed from http://databank.worldbank.org on the 3rd of September, 2012

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Using Environmental and Social Information in Lending Decisions

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Abstract

There is no doubt that collecting and analysing information is the key element in the process of decision making. Lending decisions, taken by banks, are not exception. In order to ensure that lending decisions are serving banks' goals, the process of taking such decisions involves, inter alia, gathering and analysing information about the prospective and actual clients, who are seeking loans. Such information is mainly related to the financial performance of banks' clients. The recent trend of considering information other than financial one, particularly in developed countries, seems to be basically enforced, rather than promoted, by power of the law. This can be noted in the increasing interest of banks in environmental information, while social information is still, to some extent, far from the attention of such banks. Other factors, such as religious instructions are suggested to play a role in encouraging banks to consider social information. In the case of developing countries, social and environmental information alike seems to be out of banks attention due to many factors including the absence of related laws and the weakness of desire and capacity for enforcing such laws in case of their existence. This article tries to provide more explanation for these points.

Keywords: environmental information, social information, lending decisions, laws

1. Brief Introduction

This article discusses the role of banks as a user, instead of only a producer, of environmental and social information released by companies, which are applying for loans. This aspect distinguishes banks from companies acting in other sectors such as industry. As Crawford and Williams (2010) mentioned, producing and using such information makes banks forefront players in the field of social and environmental disclosure practices. Due to their role in financing companies' activities, banks are able to stimulate companies to control environmental, social and economic impacts of their activities (Moyo & Rohan, 2006). In order to do so, banks "must integrate environmental and social impacts as part of core investment risk evaluations" (Barako & Brown, 2008, p. 312). As such, it is reasonable to think that some of banks' decisions are likely to be affected by environmental and social information released by companies seeking loans, and this in turn influences banks' performance and relation with their stakeholders.

2. Using Environmental Information in Lending Decision

Considering the issue of environmental disclosure, the relationship between banks and environment can be seen through their correlation (both; banks and environment) with economy. On one hand, it is undisputable fact that banks play a major role in economic sectors by financing companies acting in these sectors (Campbell & Slack, 2011). In providing their services as intermediaries between borrowers and providers of money, banks are the most important channel to provide such service (Jeucken, 2001). Environment, on the other hand, is claimed to be vital to the existence of economy itself and life at large. Economic system is derived from ecological system, which provides natural sources to economy and receives and accommodates waste material, and thus, taking environmental issue into consideration is very important to the continuous of economic activities and life itself (Jeucken, 2001). As such, banks' activities can be influential to, or affected by, environment and this influence can be either negative or positive, on both banks and environment. The attention to the negative or positive role, financial sector can play, in environmental issue has increased since 1990s (Thompson, 1998), and this attention has become stronger and widely paid by many information users.

The impact of banks' activities upon environment can happen in a direct or indirect way. The first one happens by consuming energy, water, paper, etc. during the daily work of banks. Both; banks and environment as well,

can benefit from efforts of conservative use and reuse resources and waste disposal (Coulson & Monks, 1999). For example, Jeucken (2001) mentioned the case of one UK bank which controlled its consumption of energy to nearly the extent of 25% during four years, and as a result, the bank saved about fifty million Euro. The second way, that environment can be affected by banks' activities, is through loans banks provide companies with. Banks are capable of influencing environment by providing loans to, or withdrawing them from, companies which their activities have some environmental consequences (Cowton & Thompson, 2000; Gray & Bebbington, 2001; Campbell & Slack, 2011). Granting loans can be resulted in environmental risks (Deegan, 2004) when loans are provided to companies pollute environment. On the other hand, banks can exploit their position as lenders to ensure that their loans benefit environment and companies (borrowers), as well as banks themselves. Providing loans to companies, which consider environmental issue in their activities, (for example by financing the process of purchasing equipment of preventing pollution) benefit environment (by preventing a potential damage), companies (by avoiding penalties and unfavourable reaction of costumers), and banks (in shape of a new and more saver market). Thompson (1998) pointed out to some attempts of banks to encourage companies to conduct good environmental practices. For example, initiative of Barclays bank in 1997, which introduced an environment loan facility, encourages any projects benefit environment directly or indirectly. Coulson and Monks (1999) also mentioned the case of National Westminster bank, which offers loans with competitive fixed rate to companies considering the impact of their activities on environment, and working to prevent, or lessening any possible damage.

In addition to the fact that environment benefits from such initiatives, banks have some advantages in dealing with companies which are considered environmentally responsible. Thompson (1998) indicated direct and indirect benefits banks might gain from "Green market". Direct benefits can be gained from making transactions with companies considered to be related to environment and environmentally responsible by having less credit risk and loan loss, whereas indirect benefits can be obtained by enhancing banks' image, in the eyes of public, by appearing in a picture of banks environmentally responsible. On the other side, companies also have some benefits to gain. Coulson and Monks (1999) highlighted the benefits companies gain from taking environmental issues into consideration. Such benefits include "quick and easy loan provision, reducing costs of loan negotiations and more favourable loan conditions."(Coulson & Monks, 1999, p. 9) Another important advantage was also mentioned is a free advice on environmental management (provided by banks to those companies), which potentially influences the quality of risk management and success of companies as a whole.

Lending decisions are very important decisions, and they require assessing and managing credit risk. Assessing the potential risk of the credit is based generally on gathering and analysing information related, mainly, to the client seeking loans. Financial information is traditionally treated as a major part banks look at and consider in the process of evaluating borrowers' applications. Yet, environmental information has become (especially in developed countries) an essential part of risk criteria of many banks. Overall, it can be said that banks have the power to encourage, or push, companies to be careful with environment (and disclose environmental information about their activities), as Gray and Bebbington (2001, p. 208) stated "Ultimately, financial institutions have the greatest power over organisations, can greatly influence them in positive ways and profoundly hinder them in negative ways.". However, the question might be posed here is that: do banks willingly interested in protecting environment and exploit their position, as money provider, to compel companies to take care of environment in their activities?

In general, banks are not interested in playing the role of environmental regulators (Coulson & Monks, 1999), or environmental policemen (Thompson, 1998). In effect, they have to be aware of environmental consequences of their lending decisions because, as environment is affected by such decisions, environment in return has an impact upon banks to the extent that it may constitute a real threat to their operations. There are three types of risks, resulted from lending decisions, environment can cause to banks (Thompson, 1998; Campbell & Slack, 2011). These risks are: indirect risk, direct risk, and reputational risk. The first risk emerges when a borrower causes damage to environment, and being exposure to many costs as a result including: fines cost of cleaning up contaminated sites, cost of complying with increased environmental legislations, and losing revenues because of bad reputation. These losses and costs will impair the ability of the borrower company to repay loans, and may end with bank losing its loans. The second kind of risk, banks are likely to encounter because of their lending decisions, affects banks directly, when banks incur the liability of cleaning up the contaminated sites owing to insolvency of the borrower. This is because of the increased legislations, which treat the lender who has taken security (such as land) in these cases as a responsible party for remediation cost. The problem is that, in some cases, banks do not loss just their loans, but they have to pay the cost of remediation which can be more than the amount of the original loan itself. The last risk might result from lending decisions is reputational risk, when

banks become known as irresponsible in regard to environmental issues, owing to their finance to companies considered polluters to environment. Such reputation might generate unfavourable reaction from costumers, media, pressure groups, and governmental bodies in some cases. This last kind of risk is argued to be different to other two risks, and more difficult to gauge its financial consequences, since its effect may take some time and emerge in future when banks lose their ability to attract new customers (Thompson, 1998).

Gray and Bebbington (2001) mentioned the case of Fleet Factors where the lender were found responsible for cleaning up the contaminated land, because the bank participated in the financial management, and was able to impact the company's treatment of hazardous wastes. The authors noted that becoming responsible did not even entail the bank to exercise its capacity to influence company's decisions. Such case gives an example to the serious consequences which might be resulted from ignoring the possible negative impact of banks' loans on environment. As such, responding to those three risks and their possible impact on environment, the attitude of banks towards environment has developed considerably to be more caution and responsible. According to Coulson and Monks (1999), US bank surveys (following the case of Fleet Factors) indicated that banks had changed their policies in regard to lending process, the matter which resulted in refusing some loan applications on the bases of environmental consideration, and also excluding some industries from future operations of banks because of the negative impact of the activities of these industries on environment. At international level, Gray and Bebbington (2001) indicated the result of a worldwide survey on banks (conducted in 1995), where most of banks surveyed found to be deeming environmental issues as an influential to their business, and thus they take environmental risks into their consideration in their assessments.

As a result of increased awareness of banks in regard to the importance of environment to their business, some steps were taken as a response to this importance. First, banks include environmental issues in their financial negotiations (Coulson & Monks, 1999). The authors mentioned the case of Elm Energy companies as an example of this, where the company spent more than a year in its financial negotiation with a bank because of environmental concerns in relation to the project of the company. Second, banks started to apply a policy of refusing to finance any projects have a potential damage to environment, as the case of the co-operative banks (Thompson, 1998), and in some cases, excluding particular industries from the list of potential borrowers, due to the obvious negative impact of their activities on environment. Third, standard for assessing environmental risks has been introduced, as the case of HSBC (Campbell & Slack, 2011). One good example of the steps, implemented by some banks in evaluating funding requests, has been mentioned in the article of Coulson and Monks (1999). Those steps include considering land (if there is a possibility that the land will be contaminated, and whether such contamination will cause harm etc.), appraisal of the client's processes (evaluating operations conducted by the company so as to discover any potential risk in such operations), and client's management (how well the client manages all of these issues when discussing the business process) since some companies have a good management which can minimise the likelihood of any bad consequences of their operations.

There are many individual studies confirmed the increased interest of banks in environmental issue. Thompson (1998) examined the case of twelve UK banks in regard to their lending decisions and their relation to environmental issues. Findings of the study indicated-inter alia- that the importance of environmental issue to banks' lending decisions has been increasingly recognised by banks, and the main method to integrate environmental consideration and lending procedures is by changing the criteria of credit risk. In another study, with bigger sample (57 banks in UK, including foreign banks), Thompson & Cowton (2004) tested the relationship between lending decisions and banks' demand for environmental information, and found that banks had some interest in environmental information released by companies seeking loans. A desire for seeing such information more developed is found but on narrow bases rather than more comprehensive forms of environmental disclosure. At continental level, Weber (2005) examined the case of 129 European banks and financial service organisations in terms of integrating sustainability into their policies, strategies, products, services and processes. Only what so-called alternative banks (banks which deem having a positive influence on the environment as one of their principal goals) were found to be integrating sustainability into their general business strategy. Therefore, all their products were in line with sustainability notion. The potential motivations for such conduct, as the author mentioned, can be financial motivation, personal concern, philosophical background, or missions of public bank owners. Considering the issue of reporting pertaining to integrating environmental risks into corporate lending, the same author, Weber (2010) chose Canada as a place to conduct his study in. He found that Canadian banks and financial institutions perform well in regard to both; integrating environmental risks into credit risk management, and sustainability issues as a whole.

In contrast, the case in developing countries seems to be different. Financial information is still a core of banks' interest in regard to lending decisions. Walid, Husni & Abdalla (2011) investigated the methods used by the

credit managers and analysts in credit facilities administrations at the Jordanian Commercial Banks (listed in Amman Stock Exchange) to evaluate the credit worthiness of the credit facilities demanders in the process of lending decisions. He also investigated the limitations of the better use of financial analysis methods in enhancing such decisions. The sample of the study represented 84.6% of all credit managers and analysts. Findings indicated the increased use of some financial and accounting methods, indicators and models. The authors recommended taking the financial and accounting methods, indexes, and models into consideration in the process of lending decisions. Moreover they highlighted the importance of using different kinds of financial ratios and financial failure prediction models so as to have a sound credit policy. However, this study did not address environmental issues in the process of appraising the position of the client who seeks a loan, and whether it is in the interest of the bank (and environment) to grant a loan to such client. No single indication was made to the impact of the environment on financial indicators, although many cases, mentioned in different articles, illustrated that relying exclusively on financial statements in lending decisions can be a big mistake. Coulson & Monks (1999), in highlighting the importance of addressing environmental information in lending decisions, mentioned a case of Acme Metals Limited which applied for overdraft from its bank. The bank analysed the financial information (business plan, projections, cash flow forecast etc.) and non-financial information (track record, management quality etc.). The result of the analysis was encouraging, and then the bank agreed on the overdraft request. Some months later, the company faced financial difficulties, and the bank agreed on increasing the amount of overdraft. With another problems the company faced, it was decided to sell the site belongs to the company, to repay the bank's facility. During sell process, it was discovered that the site is heavily contaminated, and the cost of the clean-up is estimated to be much more than the expected value of selling the site itself. The authors commend on this case by concluding that such result was because of omitting environmental issues.

Based partly on the foregoing, it can be said that there are some explanatory factors behind the attitude of banks with respect to considering environmental issues in lending decisions. First, environmental laws and their increased legislations is the main engine for taking care of environment in bank business, especially in lending decisions. Refusing to lend companies with environmental problems can be attributed to the developments in environmental legislations (Coulson & Monks, 1999). Fear of losing their loans (indirect risk) and their reputation (reputational risk), as well as, becoming responsible for the clean-up of the contaminated sites (direct risk), is the main reason why banks consider environmental information before reaching the final decision in the process of lending. Thompson and Cowton (2004, p. 215) stated "The consideration of environmental issues in bank lending operations is prompted mainly by a concern to manage risk rather than to exploit lending opportunities or as a means of fulfilling their social responsibilities". They argued that "banks are not so much interested in the impact of bank lending upon the environment as in the impact of the environment (as filtered by regulators, etc.) upon bank lending." A manager of a major retail bank, interviewed in the study of O'Dwyer (2003, p. 534) stated "it had to be careful to manage environmental risk in lending". Even though considering environmental issues in business world offers banks opportunities (green market) for gaining financial benefits, banks focus more on risks than possible profits (Thompson, 1998).

Second, the mechanism of implementing environmental legislations effectively is very important factor (especially in developing countries) in pushing banks to concern themselves with environmental issues. Without an effective mechanism, legislations are not more than just wards. Third, pressure groups are a major party in constituting reputational risk to those banks which ignore environmental consequences of their lending decisions. The stronger environment group the more environmentally conservative loans banks grant. Forth, there is no doubt that availability of environmental information and its quality are a precondition for any consideration of environmental information within lending decisions. There is no much to do by banks when accounting practices, conducted by companies seeking loans, do not include producing and releasing environmental disclosure, as the case in some developing countries. This point is very clear in the comment of one of the corporate managers interviewed in the study of Belal and Owen (2007, p. 481) who stated "In Bangladesh, where companies do not disclose basic financial information properly and credibly, I'm not sure whether we can talk about things like social disclosures.". This point leads to the fifth and last factor, which can influence the matter of taking environmental issues into consideration in lending operation. That is the lack of qualified employees in the bank, in terms of how to address environmental information and use it in the process of leading decisions. For reasonable reasons, it can be said that these factors seem to be in a negative side in developing countries, and this might provide an explanation for omitting or downplaying the importance of environmental issue in lending operations in this kind of countries.

3. Using Social Information in Lending Decision

Thompson and Cowton (2004, p. 216) concluded their investigation (of the case of UK banks in relation to using environmental information in lending decisions) by providing a suggestion, as a future study, of investigating the

views of bankers in respect to usefulness of elements of social accounting in lending decisions, other than environmental information. The authors found it interesting to know whether banks are willing to use social information, in their lending decisions, as they are producing this information. In other words, is using social information as important as producing it. Posing such question reflects the lack of studies, which consider the materiality of social information (produced by companies seeking loans) to lending decisions.

Yet, there are references of some interest in social information. Solomon and Solomon (2006), considering the extent to which institutional investors integrate social, ethical and environmental disclosure into their investment, found- inter alia- that their results were in line with that of Miles, Hammond & Friedman (2002) in that mainstream financial community has increasingly become more interested in social, ethical, and environmental disclosure. Weber (2005) found also that social aspects of sustainability have been considered in work of European banks. In contrast, Murray, Sinclair, Power & Gray (2006) examined if there is an association between social and environmental disclosure and the financial market performance of the UK's largest companies, and found no direct association between such disclosure and share returns. Campbell and Slack (2011) confirmed such result after investigating the attitudes of UK sell-side bank analysts, since financial analysts are described as capital market gatekeepers and one of key stock market agents (Aerts, Cormier & Magnan, 2008). In the case of banks, a major 'player' in stock markets (Deegan, 2004), Thompson and Cowton (2004) found that although some interest in environmental information was found in lending decisions of this group, no interest has been expressed by the same group towards gauging some things including periodic net social contribution.

From another angle, it can be argued that those studies which indicated some interest in social information, in terms of its use in investment and lending decisions, may be affected by not distinguishing environmental information from other categories of social disclosure, in which some results of social information might generated on the case of environmental information, and vice versa . i.e. using one kind of those disclosures as a substitution of the other. For instance, Deegan (2004), emphasised the increased demand of banks for social and environmental information, but when he proceed to give an example of that, just environmental risk and liability were mentioned, and companies' concern was just "to demonstrate to a bank or other lender that there are no hidden environmental liabilities that could become the responsibility of the lender or that could diminish the value of the property or organisation." (Deegan, 2004, p. 93). The other evidence, which the author gave as an example of the demand for social and environmental information, was also about environment, specifically a study of the materiality of environmental risk to Australia's finance sector. Last, even though he concluded the sixth part of his article (about the changes in the market's demand for, or use of, social and environmental information) by expressing his belief that there is clear evidence that capital market participants are demanding and using environmental and social performance information, social information mentioned was nothing but environmental one.

Apart from environmental information, other components of social information, such as: human resources and community involvement, provided by companies seeking loans, have not (to the best of our knowledge) been considered as a potential factor influencing bank decisions in regard to loans. It is unusual to find banks refused to finance a company because it has not involved in the community activities for instance. In line with this, there is a lack, if not absence, of studies focusing on the issue of considering social information (excluding environmental one) in bank lending decisions. Indirectly, it is possible to find some studies' results, which can be construed as an indicator of taken social and environmental information into consideration in lending decisions. For example, in the study of Pessarossi, Godlewski & Weill (2010), it was investigated whether the desire of foreign banks, to participate in syndicated loans to corporate borrowers, is affected by information asymmetries. In accomplishing this aim, the authors focused on tracking the influence of ownership concentration on the participation of foreign banks in a loan syndicate. The sample included syndicated loans given by 79 Chinese banks and 293 foreign banks to Chinese borrowers during the period 2004–2009. The study unveiled a negative association between the greater ownership concentration (of the borrowing firms) and the extent of foreign banks participation in the loan syndicate. This result supports the possibility of taking, or being prepared to take, social and environmental information into account in lending decisions, since many studies proved that the concentration of ownership increases information asymmetries, and has a negative impact upon the extent of social and environmental disclosure, the matter which in turn affects the company's chance of being granted a loan. Another finding of Pessarossi et al. (2010) is that increased financial leverage does not also encourage the participation of foreign banks. This finding can be interpreted similarly to the previous one, as indirect evidence of the potential use of social and environmental information in lending decisions.

In order to understand why there is an absence or a lack of banks' use of social information in their lending decisions, at least in the same degree of using environmental information, it might be useful to look back at the

case of environmental information. It should be investigated why the attention was paid to such information, what the motivations of that attention, and the applicability of these motivations in the case of social information.

We have seen previously that banks have an impact upon environment directly (in form of consuming energy, water, paper, and so on) and indirectly in shape of loans provided to companies, which their activities have environmental consequences. Banks disclose information about this impact for several reasons mentioned in details in the previous pages. In the same vein, and as a result of providing loans, environment has also an impact upon banks' business. The later impact consists of three kinds of risk, namely; indirect risk, direct risk, and reputational risk. These risks constitute a real threat to banks' business, and it can lead to its demise. Thus, banks pay a great attention to such risks, and have no alternative option but to consider environmental information of their clients before taking lending decisions. It is obvious that law and legal legislations were behind the first two kinds of risk (indirect and direct risks). By law, banks might not just lose their loans, but also be responsible for the clean-up of the contaminated lands, which its cost can exceed the amount of the original loan itself. The last kind of risk, reputational risk is more likely to be caused by many parties such as pressure groups, media, and so on. Such potential risks are likely to lead ultimately to an improvement in companies' environmental performance and disclosure, as it is argued that banks, because of their position as money provided, have the power to make a pressure on companies to be environmentally and socially responsible (Crawford & Williams, 2010), and to improve the quality, and extend the volume, of social information to the benefit of all (Thompson & Cowton, 2004). However, what should be kept in mind (to understand the case of social information) is that the motivation behind conducting such role by banks is only its focus on their own interest at the first place.

Thompson and Cowton (2004, p. 215) stated "Indeed, it could be argued that banks are not so much interested in the impact of bank lending upon the environment as in the impact of the environment (as filtered by regulators, etc.) upon bank lending.". This argument seems to be applicable in the case of social information as well. Banks might care more about the impact society can have on banks' business and whether such impact can cause a threat to their business, rather than considering its impact on society. Similar to the case of environmental information, banks have an impact on society, directly (through community involvement, human resources, etc.) and indirectly (through loans provided to companies, whose their activities have social consequences). Banks produce information about this impact and emphasise, as it is evidenced by many studies, the positive role banks play in this regard. By the same token, society also has an impact on banks' business, but this impact is not as severe as that in the case of environment. There are two risks can be resulted from not considering social impacts loans can make to society. Indirect risk (resulting from a client being unable to repay the loan due to committing social violations and paying some costs such as compensations to his opponents) and reputational risk caused by some active groups in society. The first risk can be mitigated by taken over securities, while reputational risk is less likely to occur, since financing companies is often not seen as a potential participation in the violations. It is obvious that the direct risk does not exist in this case, and the reason for that is the absence of laws which make banks responsible for social liability, similar to environmental liability. The financial role of banks (as a financier of the offender) is normally not considered in courts. Coulson and Monks (1999, p. 3,4) stated "A primary issue for lenders has been their potential to be held liable for environmental damage attributed to their corporate borrowers". As such there is no primary issue for the lenders in case of social information, and thus no attention to be very careful with the potential social impact of lending decisions.

Based on the foregoing, three reasons can be provided to explain the lack or absence of banks' interest in considering social information in their lending decisions. Firstly, the absence of public awareness in recognising the role of banks, as a third party, in social violations committed by their clients, downplays the materiality of any correlation might link banks to any kind of responsibility. This led to the absence of any perceived pressure on banks to consider social issues in their lending decisions or at least to put pressure on their clients to provide more social information. It is argued that banks can encourage, or push, their client to behave in social responsible manner and to extend their social disclosures, but such proposed role seems not in mind of bankers. Banks are not likely to be willing to play the role of social regulator, policeman or volunteer. This was made clear by one of the interviewees in the study of O'Dwyer (2003, p. 534) who stated "If we decide we are going to be proactive and do a decent thing (a community crime prevention initiatives), we are not doing it for moral reasons. We are doing it for business reasons…it is important that we get maximum benefit from it…otherwise we will not do it." Moreover, In addition to the argument of Thompson and Cowton (2004) that banks is interested just in the case where they are likely to be affected, also there is also a support for their notice that banks can obtain extra information from their clients in a private way, and thus they are not willing to put a pressure on their clients to disclose more social information publically. The study of Solomon and Solomon (2006) revealed that when social, ethical, and environmental disclosures were perceived by institutional investors

as insufficient, for their portfolio investment decisions, there was a development of private social, ethical, and environmental disclosure channels between institutional investors and their investee companies.

Second possible reason for the lack or absence of banks' interest in using social information in their lending decisions is the difficulties in measuring the damages resulted from financing companies, which do not behave in socially responsible way. This matter makes it hard to target banks for such activity. In environmental issue, damages are basically material, measurable, and can be expressed in numbers. In contrast, how can it be assumed that banks financing a company which, for example, exploits their employees or does not involve in society (through donations, scholarships for student, and so on) are damaging the society by their finance, and how can the "damages" be measured?

Thirdly, and even more importantly, the absence of legal responsibility of banks in the situation of social violations, committed by borrower companies, can be deemed as a main cause of the issue discussed. It can be argued that there is a weakness in the capacity of laws in tracking all the elements which contribute in violations. It might be reasonable to think that banks financing a company which, for example, use children labour, should be considered as partners in such crime, because they enable such company to commit this violation. However, it seems that laws concentrate only on the last offender, ignoring the other actors who participated in the violation but in less obvious way. This method can be noted in many other legal cases. For instance, alcohol is found to be a cause of many crimes such as: rape, murder, theft, mugging, assault, domestic violence, vandalism, and causing a high proportion of road accidents. Yet, law does not punish companies producing alcohol; rather it considers only the person who committed the crime. No responsibility can be tracked in regard to those companies. Another example, for the weakness of law in judging some issues, is the case of the pregnant women. They drink Alcohol knowing that such action will result in some serious illnesses in their babies before and after the birth such as: Fetal Alcohol Syndrome and Fetal Alcohol Spectrum Disorder, which cause many health problems, and death in some cases. Yet, there is no legal punishment for such behaviour. These are just examples reflecting what can be seen as points of weaknesses in legislations. Confining the responsibility to just one party (and sometimes no one), and excluding others who participate in one way or another in causing the problem, may explain the attitude of banks towards the idea of using social information in their lending decisions. Moving to advanced position in this issue may not be easy by law. Other motivations such as religion might make difference in this field, and Islamic banks can be provided as an example. There is a saying of prophet Mohamed (peace be upon him) outlining the view of Islam in regard to responsibility. The Prophet Muhammad (peace be upon him) said: "Allah has cursed Khamr (intoxicants – alcohol, wine etc.), the one who drinks it, the one who pours it for others, the one who sells it, the one who buys it, the one who makes it, the one who it is made for, the one who carries it, the one who it is carried to and the one who consumes the money from its sale." (Hadithaday, 2010).This saying indicates that the sin includes all of those who participated, in one way or another, in drinking Alcohol at the end. Therefore, everyone is responsible since he contributed in the existence of the action. Applying such Islamic teaching, Islamic banks are not "involved or have material ownership in any prohibited business activities. These include alcohol, tobacco, pork-related products, conventional financial services (that is, riba-based financing), and the entertainment business" (Gray & Ismail, 2007). All of these activities mentioned are including some social effects considered to be harmful to individuals and society at large, even though they can be considered profitable activities to borrowers and banks. As such, it can be said that Islamic banks consider social information in their lending decisions because of its different conceptions of responsibility.

4. Conclusion

Possibility of using environmental and social information by banks, in the process of lending decisions, can be determined and justified by different factors. These factors are related to legal environment, pressure groups, banks' clients, and banks themselves. Legislations (especially in more developed countries) are the main engine of convincing banks to consider environmental information in their lending decision. Yet, creating the same case in regard to social information seems to exceed the capacity of laws. Other factors can be suggested instead, such as religious teachings. The process of making lending decision cannot be understood without taking the impact of external environment which includes legal environment, awareness of society, ability of clients to produce such information, and perception of environmental and social responsibility.

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Ownership Structure and Dividend Policy: Evidence from Thailand

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Abstract

This paper examines the relationship between ownership structure and dividend policy in Thailand in a sample of 1,927 observations over the period 2002-2010. The results show that Thai firms are more likely to pay dividends when they have higher ownership concentration or the largest shareholder is an institution and that firms pay higher dividends when the largest shareholder, especially an institution, holds more percentage of shares. It is also found that both the likelihood of paying dividends and the magnitude of dividend payouts increase (decrease) with higher institutional (individual) ownership, the findings mostly driven by the ownership of domestic investors.

Keywords: dividend policy, ownership structure, ownership concentration, Thailand

1. Introduction

Following Miller and Modigliani (1961) dividend irrelevance proposition, many researchers have attempted to explain why firms pay a substantial portion of their earnings as dividends if the amount of dividends paid to shareholders does not affect firm value. One of the most cited reasons for why firms pay dividends is the free cash flow hypothesis, which is based on the notion that there is a conflict of interest between managers and shareholders. Rather than act in shareholders' best interests, managers could allocate the firm's resources to benefit themselves (Jensen and Meckling, 1976). Managers' selfish behaviors can include undertaking unjustified mergers and acquisitions or lavish spending on perquisites. Hence, free cash flows can create agency problem because they may be used to fund negative NPV projects. To mitigate agency problem, Easterbrook (1984) and Jensen (1986) suggest that firms return free cash flows to shareholders by paying dividends. Easterbrook (1984) argues that dividends require managers to raise external funds more often and thus are more monitored by outsiders. According to Jensen (1986), dividends reduce the amount of cash that could be wasted by managers. Thus, dividends may be used as a mechanism to alleviate agency cost of free cash flows.

Based on the agency theories, recent studies have focused on examining the effects of governance standard and ownership structure on corporate dividend policy. For example, La Porta et al. (2000) find that firms in countries with low corporate governance and poor shareholder protection tend to pay low dividends and that firms with high ownership concentration tend to make higher dividend payments. Likewise, Mitton (2005) shows that, in emerging markets, firms with stronger corporate governance pay higher dividends. For US firms, Grinstein and Michaely (2005) document that institutions prefer dividend-paying firms to non-dividend-paying firms. However, institutions are not attracted to firms that pay high dividends and higher institutional holdings do not lead to higher dividends.

Examining the impact of foreign ownership on dividend policy of Japanese firms listed on the Tokyo Stock Exchange, Baba (2009) finds that a higher level of foreign ownership raises the probability of dividend payouts and dividend increases but lowers the probability of no dividend changes and dividend decreases. Similarly, Jeon et al. (2011) find that, for firms listed on the Korean stock market, higher dividends attract more foreign investors and the reverse is true when foreign investors have substantial shareholdings. Their results, however, are mostly driven by foreign institutions rather than domestic ones. Examining dividend policy of Japanese firms, Harada and Nguyen (2011) demonstrate that firms with higher ownership concentration pay lower dividends and are less likely to raise dividends when earnings increases or debt decreases. Likewise, Khan (2006) finds that ownership concentration is negatively related to dividends in the UK. The author also finds a positive relationship between institutional holding by insurance companies and dividends and a negative relationship between individual ownership and dividends.

Although much empirical evidence on the relationship between ownership structure and dividends in the US and other developed countries has been documented, there is a scant literature on such issue from emerging markets, especially from Thailand. The Thai capital market offers an interesting setting in which to explore this issue for several reasons. First, according to La Porta et al. (2000), Thailand is characterized as a country with low shareholder protection and the ownership structure of Thai firms is highly concentrated. Second, it is documented that Thai firms are mostly owned and controlled by individuals, families, and related partners (see, e.g., Aivazian et al., 2003; Claessens et al., 2000; Wiwattanakantang, 2001). These characteristics can increase the agency costs of free cash flow and dividend payments are more likely to be used as a mechanism that helps mitigate agency problems. Further, Limpaphayom and Ngamwutikul (2004) document that, of the shares owned by the five largest shareholders of Thai firms, the majority is held by institutions, with a substantial average holding of 27 percent of total outstanding shares. Accordingly, this paper aims to investigate the roles of ownership structure on dividend policy of firms listed on the Stock Exchange of Thailand (SET).

The key contribution of this study is that it helps shed additional light on the inconclusive issues regarding the effects of ownership structure on dividend policy. In addition, it extensively examines the link between ownership structure and dividend policy, which is still unexplored in an emerging market like Thailand. To the best of the author's knowledge, there is no other study examining the relationship between ownership structure and dividend policy in Thailand as extensively as this paper. Particularly, this paper investigates the effects of the largest shareholder and ownership concentration on dividend policy of Thai firms. Large shareholders could enforce managers to pay dividends in order to alleviate the agency costs of free cash flow but they could influence managers to set low dividend policy to consume private benefits at the expenses of minority shareholders. The existing research provides mixed results on the effects of large shareholders on dividend payouts. For example, Gugler and Yurtoglu (2003) find a negative relation between the largest shareholder's ownership and divided payout ratio while Truong and Heaney (2007) document a convex relation, i.e., at low levels of shareholding, the relation between dividend payout ratio and the largest shareholder's ownership is negative but this relationship becomes positive as the levels of shareholding increase. The relationship between ownership concentration and dividend payouts is also inconclusive. It is found to be negative in Harada and Nguyen (2011), Khan (2006), and Renneboog and Trojanowski (2005) but insignificant in Grinstein and Michaely (2005).

This paper also focuses on examining the impact of institutional holding on dividend policy of Thai firms. Jensen's (1986) free cash flow hypothesis suggests that institutional investors can provide effective monitoring activities, thereby forcing managers to distribute free cash flows as dividends, or dividends could be used to compensate institutional investors for their monitoring activities (Shleifer and Vishny, 1986). Assuming that institutions can offer effective monitoring roles, the agency theories therefore predict a positive relationship between institutional holding and dividend payouts. A positive association between institutional ownership and dividend payout ratio is documented by Khan (2006), Moh'd et al. (1995), and Short et al. (2002) but a negative association is found by Renneboog and Trojanowski (2007).

The results from this study show that, compared to a firm with an individual as the largest shareholder, a firm with an institution as the largest shareholder is more likely to pay dividends and tends to pay higher dividends. In addition, ownership concentration is found to have a positive effect on a firm's likelihood to pay dividends. The evidence also indicates that higher institutional (individual) holdings are associated with higher (lower) likelihood that firms pay dividends and higher (lower) dividend payouts, the results are mostly driven by domestic rather than foreign ownership. Overall, the findings are broadly consistent with the agency theories proposed by Jensen (1986) and Shleifer and Vishny (1986).

The rest of this paper is organized as follows. Section 2 describes the sample and variable descriptions. Section 3 reports the empirical results, including descriptive statistics, Logit regressions, Tobit regressions, and a test for endogeneity of ownership. Section 4 concludes the paper.

2. Data and Methodology

2.1 Model Specification

To examine the relation between ownership structure and dividend policy, the following regression is estimated:

$$DPR = \alpha + \beta_1 * OwnershipStructure + \beta_2 * FirmCharacteristics + \varepsilon \quad (1)$$

where all variables are described in section 2.3 below.

The dividend policy of Thai firms is analyzed in two steps: (1) decision to pay or not to pay and (2) how much to pay. In the first step, the impact of ownership structure on firms' decisions whether to pay dividends is analyzed

by performing binary Logit regressions where the dependent variable is a dummy variable equal to 1 for dividend-paying firms and 0 for no-paying firms. Then, the effect of ownership structure on the magnitude of dividend payouts is analyzed by estimating Tobit regressions where the dependent variable is dividend payout ratio (DPR), the ratio of dividends to net income. Given that a number of sample firms do not pay dividends and, accordingly, their dividend payout ratios are zero, Tobit regressions are utilized to eliminate biases from OLS estimates when the dependent variables are censored (see, e.g., Kim and Maddala, 1992; Wooldridge, 2010).

2.2 Sample

The ownership data was obtained from SETSMART (SET Market Analysis and Reporting Tool), the database of the Stock Exchange of Thailand (SET). The financial data was drawn from the database of Euromoney Institutional Investor (Plc.) via www.securities.com. The initial sample consists of 421 nonfinancial firms listed on the SET between 2002 and 2010. To calculate dividend payout ratio (DPR), which is equal to or higher than zero, firms reporting losses were removed from the initial sample. After eliminations of dividend-paying firms reporting negative earnings and firms with missing financial information, the final sample consists of 1,927 observations for 287 firms over the sample period.

2.3 Variable Descriptions

Following Adjaoud and Ben-Amar (2010), Farinha (2003), and Mitton (2004), the dependent variable is dividend payout ratio (DPR), the ratio of dividends over net income.

The main independent variables are ownership structure of Thai firms. TOP is the percent of shares held by the largest shareholder. Following Harada and Nguyen (2011) and Khan (2006), ownership concentration is measured by the percent of shares owned by the five largest shareholders (TOP5). I classify shareholdings of major shareholders (Note 1) disclosed by the Stock Exchange of Thailand (SET) into six categories as follows: INST is the percent of shares held by institutional investors (banks, financial institutions, insurance companies, funds, and unit trusts); DINST is the percent of shares held by domestic institutions; FINST is the percent of shares held by foreign institutions; INDV is the percent of shares held by individual investors; DINDV is the percent of shares held by domestic individuals; FINDV is the percent of shares held by foreign individuals; and FOREIGN is the percent of shares held by foreign institutional and individual investors.

In regression analysis, six firm characteristics are used as control variables. Industry dummies and year dummies are also included to account for industry-specific effects on dividend policy and unobserved economic variables, respectively. Return on assets (ROA), the ratio of operating income to total assets, is used to control for firm's profitability. Firms with higher profitability tend to pay higher dividends than firms with lower profitability. Therefore, a positive relationship between ROA and dividends is predicted.

Following Adjaoud and Ben-Amar (2010) and Baba (2009), free cash flow (FCF) is estimated by cash flows from operations. If dividends are used to mitigate agency problems, firms with higher free cash flows should pay more dividends. On the other hand, if managers expropriate shareholders, the results might indicate a negative relationship between free cash flows and dividends.

Firm size (SIZE) is the logarithm of total assets. Compared with smaller firms, larger firms tends to be more mature, have higher free cash flows, and are more likely to pay higher dividends. Thus, a positive relationship between firm size and dividends is expected.

Market-to-book ratio (MTB) is calculated as market value of equity divided by book value of equity. Following Fama and French (2001), market-to-book ratio is used as a proxy for future investment opportunities. A negative relationship between growth and dividends is expected because firms with higher growth opportunities are more likely to retain cash for future investments.

Leverage (LEV) is total debt divided by book value of total assets. Since firms with higher debt are more likely to be financially constrained and should be less able to pay dividends, a negative relationship between leverage and dividend payments is expected accordingly.

According to DeAngelo, DeAngelo and Stulz (2006) and Denis and Osobov (2008), the ratio of retained earnings to book value of equity has a significant positive relationship with corporate dividend policy in many developed countries. Thus, the ratio of retained earnings to book value of equity (RETE) is used to control for life-cycle of firms and it is predicted to have a positive relationship with dividend payouts in Thailand.

Finally, firm age (AGE), the logarithm of firm age since incorporation, is used as an instrumental variable in the tests for endogeneity problems.

The definitions of variables are provided in Table 1.

Table 1. Definitions of variables

Variables	Definitions
Dependent variable	
Dividend payout ratio	Dividends/net income
Ownership variables	
TOP	Percent of shares held by the largest shareholder
TOP5	Percent of shares held by the five largest shareholders
INST	Percent of shares held by institutional shareholders
DINST	Percent of shares held by domestic institutional shareholders
FINST	Percent of shares held by foreign institutional shareholders
INDV	Percent of shares held by individual shareholders
DINDV	Percent of shares held by domestic individual shareholders
FINDV	Percent of shares held by foreign individual shareholders
FOREIGN	Percent of shares held by foreign shareholders
Firm characteristics	
Return on assets (ROA)	Operating income/total assets
Free cash flow (FCF)	Cash flows from operations/total assets
Firm size (SIZE)	The logarithm of total assets
Market-to-book ratio (MTB)	Market value of equity/book value of equity
Leverage (LEV)	Total debt/total assets
Retained earnings to equity (RETE)	Retained earnings/book value of equity
Firm age (AGE)	The logarithm of firm age since incorporation

3. Empirical Results

3.1 Descriptive Statistics

Table 2 reports ownership structure of the sample firms over the period 2002-2010. Overall, the ownership structure of Thai firms had been stable over the sample period, despite a slight increase in individual ownership due to domestic individual ownership and a small decline in institutional ownership due to foreign institutional ownership. As indicated by La Porta et al. (2000) that the ownership structure in Thailand is highly concentrated, the figures show that the average shareholding is 56.94 percent for the top five shareholders. The average ownership figure of the top five shareholders reported here is similar to 56.39 percent documented by Limpaphayom and Ngamwutikul (2004) during 1990-1994, suggesting a pattern of high ownership concentration in Thailand over time, but is much higher than 25 percent reported in Demsetz and Lehn (1985) for US firms and 32.94 percent reported in Harada and Nguyen (2011) for Japanese firms. Of the total shares held by major shareholders, institutional investors (INST) hold a larger proportion (43.46 percent) than individual investors (INDV). However, domestic individual investors (DINDV) hold the largest proportion of shares (35.47 percent) among the four categories of ownership (i.e., DINST, FINST, DINDV, and FINDV).

Table 2. Ownership structure of the sample firms

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average
Obs.	145	162	191	217	241	237	236	246	252	1,927
TOP	26.35	26.51	27.66	28.52	29.32	28.89	28.89	28.07	28.49	28.23
TOPINST	0.41	0.51	0.48	0.47	0.50	0.49	0.47	0.46	0.48	0.48
TOP5	55.80	55.78	55.93	56.29	58.43	57.42	57.55	57.16	57.03	56.94
INST	47.06	47.47	44.56	43.08	43.71	42.59	42.68	42.01	41.00	43.46
INDV	34.47	33.49	34.10	35.91	37.33	37.93	38.26	37.68	38.38	36.68
DINST	29.73	32.82	30.29	29.67	29.27	28.30	28.32	29.09	29.07	29.47
DINDV	33.06	32.14	32.75	34.65	36.15	37.08	36.84	36.46	37.38	35.47
FINST	17.33	14.65	14.27	13.41	14.45	14.28	14.35	12.92	11.92	13.99
FINDV	1.41	1.36	1.35	1.26	1.18	0.85	1.41	1.22	1.00	1.21
FOREIGN	18.75	16.01	15.62	14.67	15.62	15.14	15.77	14.14	12.92	15.20

Table 3 shows the descriptive statistics for the sample firms. For dividend-paying firms, the average dividend payout ratio is 46.9 percent, which is significantly higher than 33.5 percent reported in Adjaoud and Ben-Amar (2010) for Canadian firms and 32.80 percent reported in Harada and Nguyen (2011) for Japanese firms. The results indicate that, except for foreign individual ownership (FINDV), the average ownership variables of dividend-paying firms are significantly different from those of no-paying firms. Particularly, dividend-paying firms have higher ownership concentration (TOP5), institutional ownership (INST), domestic institutional ownership (DINST), foreign institutional ownership (FINST), and foreign ownership (FOREIGN) but lower individual ownership (INDV) and domestic individual ownership (DINDV). However, firm age (AGE) is not significantly different between dividend-paying and non-paying firms.

Table 3. Descriptive statistics of the sample firms

	Paying firms (n=1,382)			Non-paying firms (n=545)				
Variable	Mean	Median	SD	Mean	Median	SD	Mean Diff.	t-statistic
DPR	0.469	0.447	0.234					
TOP	28.74	24.42	15.59	26.77	23.61	15.82	2.024	2.542**
TOPINST	0.50	0.50	0.50	0.42	0.00	0.49	0.083	3.283**
TOP5	57.64	57.10	15.36	54.95	56.24	17.66	2.769	3.197**
INST	46.72	48.82	27.16	35.24	28.87	26.58	11.392	8.296**
INDV	34.53	30.67	26.29	42.00	41.06	27.25	-7.374	-5.455**
DINST	31.69	31.52	23.23	23.84	16.91	21.31	7.798	7.019**
DINDV	33.43	30.03	26.08	40.55	39.38	26.92	-7.035	-5.251**
FINST	15.03	8.83	18.18	11.40	2.33	16.97	3.595	3.967**
FINDV	1.10	0.00	4.28	1.45	0.00	4.43	-0.339	-1.523
FOREIGN	16.13	9.75	18.51	12.85	3.94	17.36	3.255	3.525**
ROA	0.111	0.096	0.072	-0.012	0.011	0.109	0.124	24.203**
FCF	0.106	0.104	0.109	0.035	0.041	0.128	0.071	12.264**
SIZE	15.326	15.136	1.450	14.660	14.473	1.204	0.664	10.240**
MTB	1.518	1.162	1.206	1.211	0.764	1.361	0.306	4.808**
LEV	0.392	0.399	0.192	0.525	0.548	0.225	-0.133	-12.129**
RETE	0.407	0.415	0.297	-0.876	0.000	4.237	1.281	7.009**
AGE	1.3846	1.3979	0.2264	1.3808	1.3979	0.2185	0.0038	0.346

**, * denote statistically significant at the 1% and 5% levels respectively.

3.2 Multivariate Analysis

In this section, I start by examining the influence of ownership structure on firm's decision whether to pay dividends. The results from Logit regressions in Table 4 show that, among control variables, ROA, SIZE, and RETE are significant determinants of firms' dividend payout decisions and their coefficients are positive, suggesting that firms with higher profitability, larger size, and more retained earnings are more likely to pay dividends. These results are in line with DeAngelo et al. (2006), Denis and Osobov (2008), and Fama and French (2001).

Table 4. Logit analysis of firm's decision whether to pay dividends

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Intercept	-6.106**	-6.836**	-4.540**	-5.261**	-3.714**	-3.708**	-6.113**
	(36.068)	(41.985)	(18.968)	(23.272)	(10.057)	(10.026)	(34.468)
ROA	26.262**	26.816**	26.327**	26.385**	26.137**	26.294**	26.253**
	(164.893)	(168.952)	(167.751)	(166.525)	(165.967)	(165.457)	(166.766)
FCF	-1.466	-1.375	-1.613	-1.658	-1.601	-1.630	-1.321
	(3.093)	(2.712)	(3.692)	(3.847)	(3.659)	(3.779)	(2.526)
SIZE	0.310**	0.335**	0.192**	0.248**	0.207**	0.206**	0.338**
	(20.833)	(24.831)	(6.811)	(10.321)	(7.592)	(7.502)	(21.668)
MTB	-0.050	-0.072	-0.059	-0.047	-0.015	-0.019	-0.045
	(0.305)	(0.645)	(0.435)	(0.269)	(0.026)	(0.043)	(0.252)
LEV	-0.373	-0.269	-0.315	-0.406	-0.362	-0.332	-0.426
	(0.684)	(0.356)	(0.489)	(0.811)	(0.666)	(0.554)	(0.893)
RETE	1.910**	1.842**	1.948**	2.014**	1.972**	1.972**	1.875**
	(63.783)	(60.305)	(66.212)	(68.856)	(66.156)	(66.202)	(61.881)
TOP	0.007						
	(2.033)						
TOPINST	0.392*						
	(6.350)						
TOP5		0.011*					
		(5.819)					
		(5.819)					
INST			0.015**				
			(21.377)				
DINST				0.021**			
				(30.424)			
				(30.424)			
FINST				0.003			
				(0.285)			
INDV					-0.012**		
					(13.899)		
DINDV						-0.012**	
						(13.899)	
FINDV						-0.001	
						(0.006)	
FOREIGN							-0.001
							(0.096)
Year dummies	yes	yes	yes	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes	yes	yes	yes
Total obs.	1,927	1,927	1,927	1,927	1,927	1,927	1,927
Nagelkerke R^2	63.2%	63.0%	63.7%	64.1%	63.4%	63.4%	62.8%

Dependent variable is a dummy variable equal to 1 for dividend-paying firms and 0 for no-paying firms. The values reported in parentheses are Wald statistics. **, * denote statistically significant at the 1% and 5% levels respectively.

Model 1 indicates that the ownership of the largest shareholder (TOP) has no effect on a firm's decision whether to pay dividends. However, as indicated by a significantly positive coefficient on TOPINST, the identity of the largest shareholder appears to be associated with a firm's dividend decision. Essentially, compared with firms having an individual as the largest shareholder, firms with an institutional investor as the largest shareholder are more likely to pay dividends. This finding is consistent with Truong and Heaney's (2007) evidence showing that a firm is more likely to pay dividends when there is a financial institution as the largest shareholder.

In Model 2, the coefficient of TOP5 is positive and significant, indicating that firms with higher ownership concentration are more likely to pay dividends. This finding implies that large shareholders use dividends to constrain managerial opportunism, consistent with Shleifer and Vishny's (1986) argument that ownership concentration is a condition for large shareholders to provide monitoring roles. It is also found in Model 3 and

Model 4 that the coefficients on INST and DINST are positive and significant. These findings suggest that as institutions, especially domestic ones, emerge as a major investor group, they play a key role in sponsoring a firm's dividend payouts. This is consistent with Short et al.'s (2002) evidence showing a positive association between institutional ownership and dividend payout ratio in the UK.

Model 5 and Model 6 of Table 3 reveal that the coefficients on INDV and DINDV are negative and significant, suggesting that powerful individual shareholders, especially domestic ones, appear to expropriate minority shareholders by lowering the likelihood that firms pay dividends. This is broadly consistent with Gugler (2003) evidence showing that, for Austrian firms, family-controlled firms are more likely to cut dividends than state-controlled firms. Further, as shown in Model 7, foreign ownership has no significant influence on a firm's decision whether to pay dividends.

Then, I proceed to investigate the influence of ownership structure on the amount of dividend payouts. The results from Tobit estimations in Table 5 generally reveal that coefficients on ROA, MTB, RETE and SIZE are positive and significant, while those on LEV are significantly negative. These findings suggest that firms with higher profitability, higher growth opportunities, more retained earnings, and larger size, pay higher dividends whereas firms with more debt pay lower dividends. The positive effects of profitability and firm size, and a negative impact of debt on dividend payouts are generally supported by prior literature (e.g., Fama and French, 2002; Jensen et al., 1992). Consistent with DeAngelo et al. (2006), Denis and Osobov (2008), and Thanatawee (2011), the retained earnings to book value of equity is positively related to dividend payouts. However, a positive relationship between growth opportunities and dividend payouts contradicts the findings by Fama and French (2002) and Jensen et al. (1992).

Model 1 shows a positive and statistically significant coefficient for TOP, suggesting that the higher ownership of the largest shareholder, the higher the dividend payouts, a finding consistent with Truong and Heaney (2007). In addition, the coefficient on TOPINST is positive and statistically significant. This is an indication that firms having an institutional investor as the largest shareholder pay higher dividends than do firms having an individual investor as the largest shareholder. Although ownership concentration (TOP5) appears to have a positive influence on a firm's decision whether to pay dividends, it is insignificant determinant of dividend payouts as shown in Model 2 (Note 2).

Model 3 and Model 4 show that INST and DINST are positively significant determinants of dividend payout ratio in Thailand. A positive coefficient on INST suggests that firms pay higher dividends when institutional shareholding is high, a finding consistent with Khan (2006) and Short et al. (2002) but contrary to Renneboog and Trojanowski (2005). A positive coefficient on DINST but insignificant one on FINST indicates, however, that dividend payouts of Thai firms are positively driven by domestic institutions rather than by foreign institutions. This finding contradicts Jeon et al.'s (2011) evidence from Korea showing that dividend payouts are significantly driven by foreign institutional investors but not by domestic institutional investors.

As indicated in Model 5, the coefficient on INDV is significantly negative, indicating firms pay lower dividends when the individual shareholding is higher. A negative relationship between individual ownership and dividends is also found by Khan (2006). In addition, as indicated by Model 6, the coefficients on DINDV and FINDV are negative and statistically significant, showing that both categories of individual ownership, domestic and foreign ones, have negative impact on dividend payouts in Thailand. Consistent with Shleifer and Vishny's (1997) argument, these findings suggest that when individual investors emerge as major shareholders, they appear to extract private benefits not shared by minority shareholders by paying out lower amounts of dividends. Finally, Model 7 shows insignificant coefficient on FOREIGN, indicating that aggregate equity ownership by foreign investors has no significant impact on dividend payouts by Thai firms.

Table 5. Tobit analysis of dividend payouts

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Intercept	-0.0385	-0.0924	-0.1641	0.0599	0.1784	0.1730	-0.0628
	(-0.4046)	(-0.9361)	(-1.3563)	(0.6118)	(1.5821)	(1.5368)	(-0.6565)
ROA	1.3339**	1.3368**	1.3324**	1.3319**	1.3389**	1.3222**	1.3230**
	(9.0693)	(9.0472)	(9.0066)	(8.9864)	(9.0753)	(9.0189)	(8.9233)
FCF	-0.1125	-0.1031	-0.0991	-0.1216	-0.1167	-0.1053	-0.0959
	(-1.2631)	(-1.1561)	(-1.1144)	(-1.3725)	(-1.3211)	(-1.1992)	(-1.0774)
SIZE	0.0080	0.0119*	0.0126**	0.0017	-0.0004	-0.0000	0.0136*
	(1.3196)	(1.9724)	(2.0919)	(0.2599)	(-0.0557)	(-0.0052)	(2.1488)
MTB	0.0179*	0.0176*	0.0167*	0.0184*	0.0195**	0.0200**	0.0182*
	(2.3677)	(2.3244)	(2.1902)	(2.4311)	(2.5922)	(2.7152)	(2.3997)
LEV	-0.2152**	-0.2150**	-0.2141**	-0.2133**	-0.2101**	-0.2141**	-0.2246**
	(-4.3724)	(-4.3531)	(-4.3158)	(-4.2857)	(-4.2226)	(-4.3145)	(-4.5064)
RETE	0.2708**	0.2699**	0.2678**	0.2754**	0.2752**	0.2762**	0.2724**
	(7.6501)	(7.5721)	(7.5070)	(7.7476)	(7.8194)	(7.8523)	(7.4939)
TOP	0.0011*						
	(2.2346)						
TOPINST	0.0383*						
	(2.4417)						
TOP5		0.0080					
		(1.5547)					
INST			0.0013**				
			(3.9847)				
DINST				0.0017**			
				(4.6177)			
FINST				0.0005			
				(0.9997)			
INDV					-0.0012**		
					(-3.4674)		
DINDV						-0.0011**	
						(-3.2149)	
FINDV						-0.0049*	
						(-2.3520)	
FOREIGN							-0.0003
							(-0.6998)
Year dummies	yes	yes	yes	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes	yes	yes	yes
Total obs.	1,927	1,927	1,927	1,927	1,927	1,927	1,927
Left censored obs.	545	545	545	545	545	545	545
Log likelihood	-696.9783	-701.6586	-694.5794	-691.9577	-696.2782	-694.1024	-702.6297

Dependent variable is dividend payout ratio (DPR). The values reported in parentheses are Huber/White robust standard errors z-statistics. **, * denote statistically significant at the 1% and 5% levels respectively.

3.3 Possible Endogeneity Test

The results from Tobit regressions in prior section generally indicate that the association between dividend payout ratio and percentage of equity ownership is positive for institutional investors but negative for individual investors. However, such findings can be spurious in the existence of endogenous relationship between ownership structure and dividend policy. To test the endogeneity problem in a Tobit model, I employ Smith and Blundell's (1986) two-stage procedure as suggested by Wooldridge (2010).

Table 6. A two-stage procedure test for endogeneity of ownership

Dependent variable	Model 1 DINST Stage 1	Model 2 DPR Stage 2	Model 3 DINDV Stage 1	Model 4 DPR Stage 2	Model 5 FINDV Stage 1	Model 6 DPR Stage 2
Intercept	-65.6545**	-0.0463	198.3412**	-0.04735	7.7226**	-0.0499
	(-9.9058)	(-0.2676)	(28.6516)	(-0.1069)	(7.2872	(-0.4983)
ROA	5.3625	1.3304**	23.1793**	1.3128**	-4.7074**	1.3256**
	(0.8511)	(9.009)	(3.1652)	(8.0689)	(-2.8561)	(8.7219)
FCF	11.2746*	-0.0999	-15.3856**	-0.0996	2.4657*	-0.0949
	(2.4454)	(-1.0363)	(-2.6353)	(-1.0164)	(2.1499)	(-1.0426)
SIZE	4.5624**	0.0117	-9.7685**	0.0119	-0.1955**	0.0122*
	(12.2216)	(0.7967)	(-26.8695)	(0.4890)	(-3.0403)	(1.9354)
MTB	-0.3112	0.0178*	0.4027	0.0186*	0.3141*	0.0175*
	(-0.3112)	(2.3179)	(0.7932)	(2.4299)	(2.1382)	(2.1065)
LEV	3.8913	-0.2146**	7.3717*	-0.2200**	-1.4325**	-0.2197**
	(1.3524)	(-4.2940)	(2.2542)	(-4.0404)	(-2.9008)	(-4.3281)
RETE	-0.2584	0.2766**	0.5245	0.2743**	0.0606	0.2730**
	(-0.7938)	(7.7157)	(1.6341)	(7.7648)	(1.8737)	(7.6144)
DINST		-0.0000				
		(-0.0089)				
DINDV				0.0000		
				(0.0137)		
FINDV						-0.0005
						(-0.0403)
AGE	11.5360**		-14.1847**		-3.0496**	
	(4.2237)		(-5.8669)		(-5.5975)	
VHAT		0.0016		-0.0011		-0.0041
		(0.5395)		(-0.4524)		(-0.3556)
Year dummies	yes	yes	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes	yes	yes
Total obs.	1,927	1,927	1,927	1,927	1,927	1,927
Adjusted R^2	12.96%		28.33%		7.05%	
Left censored obs.		545		545		545
Log likelihood		-692.3263		-697.7223		-699.7628

This table reports results of Smith and Blundell's (1986) two-stage procedure for endogeneity test in Tobit regression. Stage 1 is the OLS regression. Stage 2 is the Tobit regression. DPR is dividend payout ratio measured by dividends over net income. AGE is an instrumental variable, measured by logarithm of firm age since incorporation. The values reported in parentheses of OLS regressions are White robust standard errors z-statistics. VHAT are residuals obtained from stage 1 OLS regressions. The values reported in parentheses of stage 2 Tobit regressions are Huber/White robust standard errors t-statistics. **, * denote statistically significant at the 1% and 5% levels respectively.

Specifically, I test for the potential endogenous variables, LINST, DINDV, and FINDV, which are found to have significant relations with dividend payouts in the two-stage procedure as follows: First, I estimate the reduced form OLS regressions of LINST, DINDV, and FINDV on all exogenous variables (i.e., control variables) and an instrumental variable, AGE, which is firm age since the firm is incorporated (Note 3). Second, I estimate the Tobit regressions of DPR on exogenous variables, potential endogenous variables (LINDV, DINDV, and FINDV) and VHAT, the residuals from estimating the reduced form OLS of LINST, DINDV, and FINDV in stage 1. If the coefficient on VHAT is statistically significant, the variable tested is endogenous.

Model 1, Model 3, and Model 5 of Table 6 show the first stage OLS estimates of LINST, DINDV, and FINDV, respectively. Note that, the coefficients of AGE are highly significant at 1% level in all three Models, indicating that AGE is a strong instrumental variable (Note 4). Model 2, Model 4, and Model 6 show the second stage Tobit estimates of dividend payout ratio (DPR), controlling for firm characteristics and including VHAT as an additional explanatory variable, on LINDV, DINDV, and FINDV, respectively. The results reveal that coefficients of VHAT are not significant in all three Models, indicating that LINDV, DINDV, and FINDV are

exogenous variables. Therefore, the findings of relationship between ownership structure and dividend policy in this study are not exposed to endogeneity problem.

4. Conclusion

This study investigates the impacts of ownership structure on dividend policy in Thailand over the period 2002-2010. The results show that Thai firms have highly concentrated ownership structure and are mostly owned by institutions. The dividend policy of Thai firms is analyzed in two steps: (1) decision to pay or not to pay and (2) how much to pay. The results reveal that, among controlled variables, profitability, firm size, and the ratio of retained earnings to book equity, have positive effects on a firm's decision whether to pay dividends and how much to pay dividends. In addition, the amount of dividend payouts is found be positively related to growth opportunities but negatively related to financial leverage. Free cash flow, however, is not found to have a significant relation with dividend policy of Thai firms.

The results also demonstrate that a firm with higher ownership concentration and an institution, compared with an individual, as the largest shareholder is more likely to pay dividends and that the largest shareholder's holding is positively related to dividend payouts. In addition, firms are more (less) likely to pay dividends and tend to pay higher (lower) dividends when they have higher institutional (individual) holding, the findings are mostly driven by domestic ownership rather than by foreign ownership. Consistent with agency theories (e.g., Jensen, 1986), the findings of this paper suggest that powerful individual shareholders expropriate minority shareholders by restraining dividend payouts while major institutional shareholders could provide effective monitoring roles and influence managers to pay more dividends.

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Notes

Note 1. According to definition of the Stock Exchange of Thailand (SET), an investor holding at least 0.5% of total shares outstanding is considered a major shareholder.

Note 2. Alternatively, ownership concentration is measured by logarithm of the Herfindahl Hirschman Index (HHI), which is the sum of squared percentage of shares held by the five largest investors. However, the results are qualitatively the same.

Note 3. Harada and Nguyen (2011) also employ firm age as an instrumental variable in their study of ownership concentration and dividend policy in Japan.

Note 4. Additionally, AGE is not found to be related to dependent variable, DPR, suggesting that AGE in an appropriate instrumental variable. The result is not reported here but available upon request.

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A Re-Assessment of the Role of the Financial Sector in Driving Economic Growth: Recent Evidence from Cross Country Data

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Abstract

In this study, we evaluate the empirical relationship between financial development and economic growth for 75 countries classified into different income groups. The study covers the sample period of 1990-2009. The empirical results suggest that there is a long-run equilibrium relationship between financial development and economic growth. The estimated results of FMOLS and MWALD Granger causality tests indicate that banks play a dominant role in promoting economic growth across all income groups. Savings significantly drive growth for low and middle income groups. Economic growth propels stock market development for low income group, stock market and economic growth are reinforcing for middle income group. While, stock market emerges as an important driver of economic growth for high income countries. Our findings are consistent with prior research and are relevant for academician, policy makers as well as financial institutions and market players.

Keywords: panel cointegration, causality, economic growth, financial development, policy intervention

JEL: E02, E44, F23, O16

1. Introduction

The role of financial sector in accelerating the economic growth has long been an issue of debate among researchers and policy makers. Even after decades, empirical research has not yielded a consensus on this issue in both developed and developing economies. More recently, the subject has garnered attention due to its alleged role in recent global economic crisis and its subsequent contagion effects on Euro-zone countries. The impact of financial sector turbulence has been severe and it has impacted the global economy considerably. Taking the above discussion as starting point, the present study attempts to examine the relationship between financial development and economic growth across income groups using panel data of 75 countries, categorised further into different income based sub-groups. By doing so, it will be helpful for the researchers and regulators in undertaking the co-ordinated policy measures to revive the distressed economies and also to figure out the potential financial development channel for not only mature economies but also for emerging markets. Many studies have emphasized on the constructive role of the financial sector in mobilizing and intermediating saving, and ensuring that these resources are allocated efficiently to productive sectors (Ang, 2008). However, literature suggests that there is disagreement among the academicians on the role of financial sector in driving economic growth. Like for example, studies of Harris (1997) and Deidda (2006) suggest that the relationship between financial development and economic growth is strongly positive at relatively high levels of per-capita income and weak/negative or insignificant at relatively low levels of per-capita income which ultimately rests upon the efficiency of financial intermediaries and other related conditions in the economy Cameron, Olga, Hugh & Richard (1967), McKinnon (1973), King and Levine (1993a). On the contrary, few studies have also highlighted its negative effects and argued that financial development can hurt economic growth particularly when enhancing resource allocation may result in low savings rate. There is still evidence of widespread scepticism on the role of financial intermediaries' especially financial market.[1] Stiglitz (1994) argue that stock market will not produce the same improvement in resource allocation and corporate governance as banks because it produces too much speculative activities Keynes (1936), Kindleberger (1978), Singh (1997).

Beginning with the seminal cross-country analysis of King and Levine (1993a), several empirical studies by combining the endogenous growth theories and market microstructure of financial system have provided empirical support for the leading view that financial development promotes economic growth (Rajan & Zingales, 1998; Rousseaua & Wachtel, 2000; Levine, Loayza & Thorsten, 2000). On the other hand, some studies find no significant causal relationship between financial development and economic growth (Khan & Senhadji, 2003; Hong & Thai, 2004; Al-Awad & Nasri, 2005; Hassan, Sanchez & Yu, 2011). Thus, the empirical evidence on the subject can at best be described as mixed. More importantly, most of the cross country studies are sensitive to the sample countries, estimation methods, data frequency and functional forms of the relationship and proxy measures chosen. All of which raised doubts about the reliability of cross-country regression analysis. In order to avoid such difficulty, panel data estimation seems more appropriate because it minimizes the errors associated with time-series and cross-sectional variations in the data and avoids time series specification biases related with sample size and subsequent inclusion of variables which helps in obtaining valid inferences by taking into account fixed effects.[2]

This study attempts to examine the relationship between financial development and economic growth across income groups using panel data. The study has two major objectives: First, to examine the long-run relationship between financial development and economic growth across income groups using dynamic panel approach and multivariate time-series analysis. In so doing, the magnitude of the estimated long-run elasticities with respect to the measures of banking and stock market developments is likely to shed light upon the relative importance for economic growth. Second, to investigate the causal flows, i.e., between economic growth and financial development on one hand and economic growth and macroeconomic factors on the other.

This study uses the balanced panel data of 75 countries, classified further into four income groups, based on the World Bank criteria. The study incorporates banking and stock market indicators as well as level of gross domestic savings in order to substantiate the role of financial system in driving economic growth across countries ((Levine & Zervos, 1997; Arestis, Demetriades & Luintel, 2001). The study variables considered in this study are in agreement with neo-classical growth framework and with the studies of King and Levine, (1993a), Levine et al.(2000), Hassan et al. (2011) among others.

The study is organised into six sections including the present one. Section 2 provides a literature review. Section 3 describes the data and the proxy measures of financial development as well as real sector and economic growth. Section 4 describes the balanced panel estimations and multivariate time-series methodologies applied in the paper. Section 5 analyses the empirical results, while the last section contains conclusion and policy suggestions.

2. Literature Review

In recent decades, a pool of literature has provided the evidence of relationship between financial development and economic growth. During 1960s and 1970s, due to pioneering contributions of (Goldsmith, 1969; McKinnon, 1973) the relationship between economic growth and financial development has remained an important issue of debate among academics and policymakers. During 1990s, a large number of studies emphasized particularly on the role of the financial intermediaries in mobilizing savings, allocation of scarce resources, diversification of risks and contribution to economic growth (Gregorio and Guidotti, 1995) majority of these studies have concentrated only on the role of banking sector in financial development. Like for example, King and Levine, (1993a, b) used the banking development indicators such as the total liquid liabilities of financial intermediaries (e.g., M3) divided by Gross Domestic Product (GDP), which has later been augmented by the studies of Levine and Zervos (1998) and Beck, Levine, and Loayza (2000) by incorporation of new variable viz., credit to private firms. Very limited studies have analysed the stock market development due to paucity of data. The new growth theories argue that financial intermediaries and markets appear endogenously in response to market incompleteness and, hence, contribute to long-term growth. Financial institutions and markets, which arise endogenously to mitigate the effects of information and transaction cost frictions, influences decisions to invest in productivity-enhancing activities through evaluating prospective entrepreneurs and funding the most promising ones. The underlying assumption is that financial intermediaries can provide these evaluation and monitoring services more efficiently than individuals. Levine and Zervos 1998) conducted a study by estimating cross country regressions for a number of countries for the period 1976-1993, and concluded that equity market is positively correlated with measures of real activity and that the association is particularly strong for developing countries. They also provided the evidence of how stock market provides different financial services from banks and emphasized on the role of stock market in fostering the economic growth. Atje and Jovanovic (1993) using a similar approach, also found a significant correlation between economic growth and the value of stock market trades relative to GDP for forty countries over the period 1980-88. However, Harris (1997) showed that this relationship is weak. Re-estimating the same model for forty-nine countries over the period 1980-91, but

using current investment rather than lagged, and utilizing two-stage least squares, he demonstrated that in the case of the full sample (which includes both developed and developing countries), and of the sub-sample of developing countries, the stock market variable does not offer much incremental explanatory power. In the sub-sample of developed countries, although the level of stock market activity has some explanatory power, its statistical significance is weak. But the recent literature based on the application of time-series and panel data regressions provide evidence of causal relationship between financial development and economic growth by using various proxies of financial development (including banks and stock market). So far as many studies have analysed the direction of causality after establishing the long-run relationship. Some authors have theoretically and empirically shown that there is causal direction from financial development to economic growth (King & Levine, 1993a; Levine et al. 2000; Christopoulos & Tsionas, 2004). Other studies have supported the argument by establishing the causal direction running from economic growth to financial development (Gurley & Shaw, 1967; Goldsmith, 1969).

Many significant studies have also provided the evidence of bilateral causal direction i.e., that is financial development and economic growth reinforce each other. Patrick and Yung (1994) postulated the different stages of development hypothesis. At the early stage, causality runs from finance to growth, but at later stage causality runs from growth to finance. In the early stage of economic development, finance causes growth by inducing real per capita capital formation. Later on, the economy is in the growth stage and there will be increasing demand for financial services, which induces an expansion in the financial sector as well as the real sector. This implies causality from growth to finance. Blackburn and Hung (1998) also established a positive two-way causal relationship between growth and financial development. According to their analysis, private informed agents obtain external financing for their projects through incentive-compatible loan contracts, which are enforced through costly monitoring active ties that lenders may delegate to financial intermediaries. More recently, Khan (2001) also established a positive two-way causality between finance and growth. He postulated that when borrowing is limited, producers with access to loans from financial intermediaries obtain higher returns, which creates an incentive for others to undertake the technology necessary to access investment loans, which in turn reduces financing costs and increases economic growth. Levine (2005) surveyed a large amount of empirical research that deals with the relationship between the financial sector and long-run growth. (Levine, 1997) argued that financial systems can accomplish five functions to ameliorate information and transaction frictions and contribute to long-run growth. These functions are: facilitating risk amelioration, acquiring information about investments and allocating resources, monitoring managers and exerting corporate control, mobilizing savings, and facilitating exchange. These functions support investment and, hence, higher economic growth. The results in the literature, however, are contradictory. On one hand, cross-country and panel data studies find a positive effect of financial depth on economic growth after accounting for other determinants of growth and potential biases induced by simultaneity, omitted variables or country-specific effects (Levine, 2005) suggesting that the causality runs from finance to growth (Khan & Senhadji, 2003; Levine et al.2000). Furthermore, Claessens and Laeven (2005) related banking competition and industrial growth and found that the higher the competition among banks, the faster the growth of finance-dependent industries, suggesting also that higher financial development precedes economic growth.

On the other hand, Demetriades and Hussein (1996) and Shan, Morris and Sun (2001), using time-series techniques, found that the causality is bi-directional for the majority of countries in their sample. Furthermore, Luintel and Khan (1999) using a sample of 10 developing countries, concluded that the causality between financial development and output growth is bi-directional for the 10 countries they studied. Calderon and Liu (2003) using a sample of 109 developing and developed countries, found evidence that financial development generally leads to economic growth for developed countries, but that the Granger causality is two-way for developing countries. Since financial development is not easily measurable, papers attempting to study the link between financial deepening and growth have chosen a number of proxy measures and subsequently have come up with different results (King & Levine, 1993a; Khan & Senhadji, 2003; Chuah & Thai, 2004; Al-Awad & Harb, 2005, among others). However, the general consensus of these studies is that there is a positive correlation between financial development and economic growth.

Deidda (2006) developed a theoretical framework of financial and economic development which assumes the consumption of real resources by the financial sector. According to him, financial development occurs endogenously as the economy reaches a critical threshold of economic development. He argued that a role of financial intermediary helps in channelling the scare resources to productive investments which is not feasible in financial autarky. According to him whenever the technology financed by intermediaries is more capital-intensive than that operated in financial autarky, the growth effect of financial development is ambiguous.

Cole, Moshirian and Wu (2008) in their study analysed the relationship between banking industry and stock returns and future economic growth. Using dynamic panel data techniques on 18 developed and 18 emerging markets, they found a positive and significant relationship between bank stock returns and future GDP growth. Their proxy variables of financial development were stock prices and market capitalizations of individual banks and the market price index for each country. However, given the vast amount of literature available on this subject Ang (2008) provides a comprehensive survey of literature on relationship between financial development and economic growth.[3] Caporale, Christophe, Robert and Anamaria (2009) in their study tried to find out the relationship between financial development and economic growth for ten EU member countries by estimating dynamic panel model over the period 1994-2007. Their study though focussed only one the role of banking sector concluded that stock and credit markets are still underdeveloped in these economies, and that their contribution to economic growth is limited owing to a lack of financial depth. Cooray (2010) tried to augment the Mankiw, Romer and Weil (1992) model with a variable for the stock market. The study finds strong support for the stock market augmented model for a cross section of 35 developing economies. The variables used in the study were GDP per capita, Share of investment to GDP, annual average growth of labour force, average population growth rate, net secondary enrolment ratios, net primary enrolment ratios and stock market variables. However, Wu, Han and Su-Yin (2010) provided an evidence of a long-run equilibrium relationship among banking development, stock market development and economic development, and stock market capitalization and liquidity have positive long-run effects on economic development in 13 countries in European Union over the period 1975-2005. Iyare and Moore (2011) carried out a study to investigate the causal relationship between financial development and economic growth for four small open economies viz., Barbados, Jamaica, Singapore, and Trinidad and Tobago. The study results concluded that growth tends to lead financial development in Singapore and Jamaica, financial development leads growth in Trinidad and Tobago and there is a bidirectional link in Barbados.

Hassan, Sanchez and Yu (2011) carried out a study on the role of financial development in low and middle-income countries classified by geographic regions. Using panel regressions, causality and variance decomposition tests, they inferred that there is positive relationship between financial development and economic growth. They established two-way causality in case of two poorest regions. Finally their study concluded that a well-functioning financial system is a necessary but not sufficient condition to achieve steady economic growth in developing countries. In sum, the empirical evidence on the issue of causal relationship is mixed. The relationship between financial development and economic growth seems to vary across economic settings, time frames and empirical findings which are sensitive to the choice of estimation methods. Hence, the debate on this pertinent issue remains unresolved and warrants further research.

3. Data and Proxy Measures

3.1 Structuring the Panel Dataset

The sample period of panel data used in the study is 1990-2009, covering 75 countries, classified further into four income groups based on World Bank classification criteria.[4] Sample countries get reduced because of non-availability/non-existence of stock market data such as market capitalization to GDP ratio. This was required to create balanced panel for further estimation. Due to lack of data on stock market variables in low income group only three economies (viz., Bangladesh, Kenya and Zimbabwe) have been considered in the analysis and in order to avoid the estimation issues, the low income countries are merged with lower middle income group (hereafter, Low income group shall comprise of low as well as lower middle income countries). The number of sample countries in each group are as follows: Low income group (13), Middle income group (this includes only upper middle income countries, 24), High income-OECD (31) and High Income Non-OECD (7), making a total of 75 countries in the sample.[5] It may be noted that the panel dataset is constructed separately for each group in the study. The aggregate sample estimation is not performed. This is mainly to obtain the inference for each income group as the degree of financial development may have different impact on economic growth for different economic settings. This dataset allows us to analyse the various panel data models such as panel cointegration developed by Pedroni (1999, 2001) and Fully Modified Ordinary Least Squares (FMOLS) in order to measure the magnitude of long run relationship between financial development and economic growth. The sufficient number of data points also permits us to effectively estimate the dynamic panel estimation with sufficient degrees of freedom and analyse various multivariate time-series models within each income group. The main reason of choosing countries based on income group is to have an overview about the direction of level of financial development across income groups.

Apart from culture and geography, income is still regarded as one of the most important factors of fostering the level of financial development across countries. At the early stage, at low levels of per-capita income finance

leads to growth by inducing economic growth. Later on, the economy is in the growth stage and there will be increasing demand for financial services consequent to rise in income, which induces an expansion in the financial sector as well as the real sector (Deidda, 2006). This phenomenon is widely acknowledged and therefore, instead of constructing geography wise data we have formed a panel data based on income. Besides this, as Hassan et al. (2011) raise that geographic classification is assigned only to the low and middle income group by World Bank. Therefore, classification of countries based on income seems more appropriate than based on geographic regions.

3.2 Proxy Measures for Financial Development and Economic Growth

Numerous studies have used various indicators to measure the economic growth and level of financial development starting from banking indicators such as domestic credit to the private sector as ratio to GDP (DCPBS), Broad money (M3)/Narrow money (M1) supply as percentage of GDP (BM), domestic credit provided by banking sector as percentage of GDP (DMCPS). Very few studies have used the indicators of stock market development such as market capitalization as percentage of GDP (MARCAP), value traded as percentage of GDP (STRADED), turnover ratios, and number of listed companies (COMP) to study the level of financial development (Harris, 1997; Levine and Zervos, 1998; Enisan & Olufisayo, 2009). For banking and stock market development, we employ all the above mentioned variables except turnover ratios due to missing observations for large number of countries and instead we have considered number of listed companies to capture the level of financial development in the sample countries. The banking and stock market variables have been used to construct Banking Development Index (BDI) and Stock Market Development Index (SMDI) using principle component analysis.[6] The index construction exercise has been performed in case of income panels for which the banking proxy and stock market proxy groups exhibit statistically significant correlation within each group. The BDI is constructed for all income groups as there were significant correlations between banking proxies for all these groups. However, SMDI index construction exercise has been performed only for stock market proxies in case of high income-OECD and Non-OECD countries given the high correlation among stock market proxies. In the absence of any significant correlations, stock market development has been proxied by value traded to GDP ratio for low and middle income countries. The choice of stock market proxy is based on the premise that Foreign Institutional Investors (FIIs) play an important role in stock market activity for these countries and their actions, along with those of domestic investors, can be better reflected by observing value traded to GDP. Market cap to GDP ratio for these countries are highly volatile given the speculative pressure in these markets, while number of companies (number of listed companies) don't fairly represent market performance owing to the fact that a large number of these companies may be thinly traded and hence the company count doesnot reflect the breadth and depth of these market. Except number of companies listed, all other variables considered in this study are in agreement with earlier studies of (Levine et al. 2000; Levine & Zervos, 1998; Arestis et al. 2001;Wu, Han & Su-Yin, 2010; Hassan et al. 2011) provide justification of using these banking as well as stock market indicators. A high ratio of domestic credit to GDP indicates not only a higher level of domestic investment, but also higher development of the financial system. Financial systems that allocate more credit to the private sector are more likely to be engaged in researching borrower firms, exerting corporate control, providing risk management control, facilitating transactions, and mobilizing savings (Levine, 2005), that requires a higher degree of financial development.

Besides this, the present study also uses the broadest definition of money (M3) – as a proportion of GDP – to measure the liquid liabilities of the banking system in the economy. We used M3 as a financial depth indicator because the other two monetary aggregates (M2 or M1) may be a poor proxy in economies with underdeveloped financial systems because they are more related to the ability of the financial system to provide transaction services than to the ability to channel funds from savers to borrowers (Khan and Senhadji, 2003). A higher liquidity ratio means higher intensity in the banking system. The assumption here is that the size of the financial sector is positively associated with financial services (King and Levine, 1993b). It may here again be noted that M1 as percentage of GDP is considered for few countries whose data of M3 is missing. The gross domestic savings as percentage of GDP (GDS), (Hassan et al., 2011) conclude that the steady state growth rate depends positively on the percentage of savings diverted to investment, stressing that converting savings to investment is one channel through which financial deepening affects growth. In other words, financial development is expected to benefit from higher GDS and, consequently, higher volume of investment. In most developing countries, financial repression and credit controls lead to negative real interest rates that reduce the incentives to save. According to this view, a higher GDS resulting from a positive real interest rate stimulates investment and growth (McKinnon, 1973).

The study also employs three macroeconomic variables which may possibly bear the relationship with economic growth: Inflation, Trade and FDI. Trade and FDI as percentage of GDP ensure the external orientation of an economy. Inflation is an important policy variable that impacts economic growth. Especially in low and middle income countries, it remains a major problem to control rising inflation. Political regimes in these economies handle high inflation by tightening monetary policy, leading to slower capital formation and retardation of economic growth. Most economies are pursuing aggressively the policies of financial liberalization along with opening of trade, the role of FDI and trade expansion could be greatly acknowledged in this regard. However, the role of FDI is expected to be higher in case of low and middle income countries which are undergoing economic transition and hence attract higher external investments. Trade as percentage of GDP on the other hand shows stronger link with economic growth and plays a more critical for high income countries given the large share they enjoy in global trade. Finally, we use real GDP per capita to proxy the level of economic growth (log level of GDP per capita), labelled as LGDPPC (see Gries, Kraft & Meierrieks, 2009; Iyare & Moore, 2011). All the data is downloaded from World Bank's World Development Indicators (WDI), 2011 database. In case of missing values we also explored the respective central banks of countries and also retrieved the data from OECD database.

4. Methodology

Following the empirical literature, we specify the model as follows:

$$LGDPPC = \beta_0 + \beta_1 LBDI_{it} + \beta_2 STRADED_{it} + \beta_3 GDS_{it} + \beta_4 INF_{it} + \beta_5 TRADE_{it} + \beta_6 FDI_{it} + \mu_{it} \quad (1)$$

$$LGDPPC = \beta_0 + \beta_1 LBDI_{it} + \beta_2 LSMDI_{it} + \beta_3 GDS_{it} + \beta_4 INF_{it} + \beta_5 TRADE_{it} + \beta_6 FDI_{it} + \mu_{it} \quad (2)$$

Where *i* in equation (1) denotes income group 1 and 2 and *i* in equation (2) denotes income group 3 and 4, *t=1.....T* denotes the time period, and μ_{it} is assumed to be serially uncorrelated error term. The variables LGDPPC, LBDI, LSMDI, STRADED, GDS, INF, TRADE and FDI represent the natural logarithm of real GDP per capita, Banking development index and Stock market development index, Stock traded, Inflation, Trade and FDI, respectively. Next, we turn to estimate panel unit root tests viz., Levin, Lin and Chu (LLC), Breitung, Im, Pesaran and Shin (IPS), a Fisher-type test using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. Both LLC and Breitung tests assume that there is a common unit root process across the cross-sections. For these tests, the null hypothesis is that there is a unit root, while the alternative hypothesis is that there is no unit root. After the test of stationarity, we estimate Pedroni (1999, 2001) heterogenous panel cointegration test which allows for cross section interdependence with different individual effects. The model is estimated as follows:

$$LGDPPC = \alpha_i + \delta_i t + \gamma_{1i} LBDI_{it} + \gamma_{2i} STRADED_{it} + \gamma_{3i} GDS_{it} + \gamma_{4i} INF_{it} + \gamma_{5i} TRADE_{it} + \gamma_{6i} FDI_{it} + \varepsilon_{it} \quad (3)$$

$$LGDPPC = \alpha_i + \delta_i t + \gamma_{1i} LBDI_{it} + \gamma_{2i} LSMDI_{it} + \gamma_{3i} GDS_{it} + \gamma_{4i} INF_{it} + \gamma_{5i} TRADE_{it} + \gamma_{6i} FDI_{it} + \varepsilon_{it} \quad (4)$$

Where i=1….N for each country in the panel and t=1…….T refers to the time period. The parameters α_i and δ_i allow for the possibility of country-specific fixed effects and deterministic trends, respectively. ε_{it} denotes the estimated residuals which represent deviations from the long-run relationship. All variables are expressed either in natural logarithms or percentage of GDP so that γ's parameters of the model can be interpreted as elasticities. To test for the null hypothesis of no cointegration $\rho_i = 1$, the following unit root test is conducted to the residuals as follows:

$$\varepsilon_{it} = \rho_i \varepsilon_{it-1} + \omega_{it} \quad (5)$$

Pedroni (1999 & 2004) proposes two tests for cointegration. The panel tests are based on the within dimension approach which includes four statistics: panel v, panel ρ, panel PP and panel ADF statistics. These statistics essentially pool the autoregressive coefficients across different countries for the unit root tests on the estimated residuals. These statistics take into account common time factors and heterogeneity across countries. The group tests are based on the between dimension approach which includes three statistics: group ρ, group PP and group ADF statistics. These statistics are based on averages of the individual autoregressive coefficients associated with unit root tests of the residual of each country in the panel data set. The seven statistics for each panel data set reject the null hypothesis of no cointegration at the given level of significance.

Given the presence of cointegration, we estimate the long-run relationship between economic growth and financial and other macroeconomic policy variables. The OLS estimator is a biased and inconsistent estimator when applied to co-integrated panels. Therefore, we estimate the long-run relationship using FMOLS approach

suggested by (Pedroni, 2001). The FMOLS approach not only generates consistent estimates in small samples but also controls for the likely endogeneity of the regressors and serial correlation. The panel FMOLS estimator for the co-efficient β is given as follows:

$$\hat{\beta}_{NT} = N^{-1}\sum_{i=1}^{N}\left(\sum_{i=1}^{T}(X_{it}-\bar{X}_i)^2\right)^{-1}\left(\sum_{i=1}^{n}(X_{it}-\bar{X}_i)Y_{it}^{*}-T\hat{\tau}\right)$$

Where $Y_{it}^{*} = (Y_{it}-\bar{Y}_i) - \frac{\hat{L}_{21i}}{\hat{L}_{22i}}\Delta X_{it}$ and $\hat{\tau} = \hat{\Gamma}_{21i} + \hat{\Omega}_{21i}^{0} - \frac{\hat{L}_{21i}}{\hat{L}_{22i}}(\hat{L}_{22i} + \hat{\Omega}_{22i}^{0})$. The associated *t*-statistics follow normal distribution. The results of panel FMOLS are reported in Table 3.

After this, we move to test the Toda and Yamamoto's (1995) version of Granger causality. It is well known that F-test of causality in VAR is not valid in the presence of non-stationary series. Toda and Yamamoto however propose a procedure that is robust enough to address the cointegration features of the series (e.g., it is valid without regard to cointegration process to the cointegration process of the variables). The procedure basically involves four steps. First, find the highest order of integration in the variables (d_{max}). Second, find the optimal number of lag for the VAR model (m). Third, overfit (on purpose) VAR regression by estimating $(m+ d_{max})^{th}$ order using seemingly unrelated regression (SUR). We used SUR because the WALD test gains efficiency if the VAR is estimated using SUR (Pittis, 1999). Finally, test the null hypothesis of no granger causality using the Modified Wald (MWALD) test, which follows a standard χ^2-satistics with m degrees of freedom. A critical step of the Toda and Yamamoto (1995) procedure is the number of lags in the VAR. Using Schwartz Bayesian criterion, the optimal number of lags is two in case of low and Non-OECD income groups and three in case of middle and high income-OECD countries lags. Finally, we also apply the VAR based variance decomposition which is used to determine how much of the k-step ahead forecast error variance of a given variable is explained by innovations to each explanatory variable. In practice, it is usually observed that own series shocks most of the (forecast) error variance of the series are present in the VAR.

5. Empirical Results

We begin the empirical analysis with summary statistics (see Table 1) of all study variables for different income groups. The mean change in banking and stock market variables viz., Broad money (BM), Domestic Credit Provided by Banking Sector (DCPBS) as percentage of GDP, Domestic Credit Provided to Private Sector (DMCPS) as percentage of GDP, Market cap as percentage of GDP and STRADED, is more pronounced from middle to high income countries than from low to middle income countries. Mean GDS increases from 16% to 24% from low to middle income countries and then stabilises further high income and non-OECD countries.

We then move to the unit root tests, by and large the, results of panel uni root tests demonstrate that at 5% level of significance all study variables viz., LGDPPC, LBDI, STRADED, LSMDI, GDS, INF, FDI and TRADE are having unit root at level and attain stationarity after first difference.[7] The panel tests include a constant and a heterogenous time trend in their specifications. Since LSMDI variable is included only in case of High income (OECD) and Non-OECD groups and hence the unit root test results of LSMDI variable is replaced with STRADED in rest of the two groups.

Table 1. Summary of statistics by income groups (1990-2009)

	Financial Sector Development							Real Sector Development			
	Stock Market Development			Banking Development							
	MARCAP	COMP	STRADED	BM	DCPBS	DMCPS	GDS	GDPPC (US $)	INF	FDI	TRADE
Low Income (n= 13)											
Mean	28.7	584	10.77	44.5	49.32	30.61	15.9	2,191	33	1.73	59.7
Median	142.77	220	183.66	45.4	42.71	46.9	50.8	51	420.6	118.4	36.02
Min	0.4	2	0.01	12.2	4.91	3.66	-25.9	283	0.6	-2.76	15.68
Max	510.4	5,999	128.65	120.5	165.9	104.47	34.1	5,274	1,096.70	12.2	116.1
Middle income (n=24)											
Mean	42.6	315	15.2	50.5	58.9	48.8	24.1	7,817	60.6	3	76.7
Median	22.5	138	3	37.2	48.4	31.3	22.3	7,559	7.9	2.6	64.3
Min	0	3	0	6.2	-73	7.2	-10	1,101	-1.4	-6.9	13.8
Max	328.9	5,825	229.7	159.4	195.3	165.7	52	14,767	7,481.70	22.7	220.4
High Income-OECD (n=31)											
Mean	62.4	755	49.8	114	111	94.9	24	26,611	6	11.1	85.2
Median	47	222	25.3	76.8	102.3	87.5	23.7	26,339	2.7	2.1	71.6
Min	0.2	9	0	18.3	0.3	0.3	5.6	7,285	-4.5	-15	16
Max	323.7	8,851	409.5	636.5	328.4	319.5	53.2	74,114	555.4	564.9	326.8
High Income Non-OECD (n=7)											
Mean	112.5	206	58	96.7	84.6	84.6	31.5	22,915	3	6.9	167
Median	60.5	77	7.7	72.8	65.7	57.1	30.7	20,180	2.3	5.7	104.3
Min	8.5	14	0.1	24.9	-4	14.9	11.9	10,499	-4	-1.3	56.5
Max	1095	1,308	755.1	321.6	302.9	269.7	55.6	49,877	12.1	36.6	438.1

Note: Total number of countries in the sample (N=75).

5.1 Panel Cointegration Tests Results

The panel cointegration results (see Table 2) show that the model viz., LGDPPC, LBDI, STRADED, GDS, INF, FDI and TRADE, used for low income and middle income groups, except for the panel variance (only in case of middle income group), panel ρ-statistic, group ρ- statistics, and all other statistics are statistically significant. Hence, we reject the null of no cointegration. Similarly, the panel cointegration model of high income-OECD and non-OECD viz., LGDPPC, LBDI, LSMDI, GDS, INF, FDI and TRADE, all cointegration coefficients are significant except panel ρ-statistic, panel ADF-statistics (only in case of Non-OECD) and the group ρ-statistics, significantly rejecting the null of no-cointegration. Therefore, it can be inferred that there is a long-run relationship among study variables and across all income groups.

Table 2. Pedroni Cointegration test results

	Low income		Middle income		High Income (OECD)		High income non-OECD	
	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.
Within dimension								
Panel variance	1.6562*	0.0488	-2.8746	0.9980	11.1350*	0.0000	5.5282*	0.0000
Panel ρ-Statistic	3.5486	0.9998	4.8094	1.0000	4.2350	1.0000	2.7231	0.9982
Panel PP-Statistic	-4.0772*	0.0000	-8.0916*	0.0000	-6.8613*	0.0000	-4.4953*	0.0000
Panel ADF-Statistic	-5.5244*	0.0000	-6.0654*	0.0000	-7.0415*	0.0000	-0.2991	0.3303
Between dimension								
Group ρ-Statistic	5.6224	1.0000	6.8724	1.0000	7.5739	1.0000	3.7782	0.9999
Group PP-Statistic	-6.3810*	0.0000	-7.1657*	0.0000	-3.9858*	0.0000	-5.1735*	0.0000
Group ADF-Statistic	-1.9247*	0.0271	-2.9020*	0.0019	-2.7859*	0.0027	0.5873	0.7215

Note:* indicates the rejection of the null hypothesis at 5% and 10% level of significance, respectively. The lag lengths are selected using AIC.

5.2 Fully Modified OLS (FMOLS) Test Results

After establishing the cointegration relationship, the fully modified OLS (FMOLS) technique for heterogenous co-integrated panels is estimated to determine the long-run equilibrium relationship (Pedroni, 2000). Table 3 reports the FMOLS results. For low income countries, all the coefficients are statistically significant at 5% level of significance with acceptable signs (with the exception of TRADE). The results indicate that a 1% increase in banking index increases economic growth (LGDPPC) by more than 0.19%; a 1% increase in gross domestic savings increases real GDP by 0.12%; and, a 1% increase in stock traded (STRADED) increases LGDPPC by more than 0.03%. But a 1% increase in inflation decreases LGDPPC by 0.02%. Same is the case with TRADE which shows that a 1% increase in TRADE causes LGDPPC to decrease by 0.12%. The effect of FDI on GDP is positive as it shows a 1% increase in FDI causes GDP to increase by 0.02%. Similarly, the FMOLS results of middle income group show that there is a positive relationship between financial and real economy variables, though the sign of each co-efficient differ according to the hypothesized relationship. Except inflation, the sign of all coefficients, exhibit the positive relationship with economic growth. Barring FDI, all variables have the expected sign and are statistically significant at 5% level or better. The results of middle income group indicate that a 1% increase in banking index increases LGDPPC by more than 0.21%; a 1% increase in STRADED increases GDP by more than 0.09%. Savings emerges as the strongest driver of economic growth as a 1% increase in gross domestic saving GDS increases LGDPPC by 0.32%.

Table 3. FMOLS results

Low income					
LBDI	**STRADED**	**GDS**	**INF**	**FDI**	**TRADE**
0.1983	0.0388	0.1293	-0.0213	0.0221	-0.1295
[7.2788*]	[8.9887*]	[4.4544*]	[-0.3065]	[4.7804*]	[-3.8531*]
Middle income					
0.2137	0.0959	0.3229	-0.0913	0.1813	0.0746
[13.8292*]	[8.8479*]	[7.9825*]	[-9.0203*]	[1.2182]	[6.0158*]
High income-OECD					
LBDI	**LSMDI**	**GDS**	**INF**	**FDI**	**TRADE**
0.2171	0.1235	0.0284	-0.0137	-0.0086	0.1230
[33.2872*]	[8.0742*]	[9.0201*]	[-5.5712*]	[-1.1742]	[16.3102*]
Non-OECD					
0.0698	0.0874	0.0870	0.0379	0.0466	0.1880
[1.5803*]	[8.1965*]	[0.7304]	[4.3395*]	[0.8707]	[9.7876*]

Notes: The number of lag truncations used in calculation is 2. The values in parentheses denote the t-statistics following a standard normal distribution. Asterisk * indicates statistical significance at 5% critical value.

The impact of inflation (INF) continues to be negative on economic growth. The results indicate that a 1% increase in inflation decreases LGDPPC by 0.09%. The impact of FDI is also positive and significantly increases the LGDPPC by 0.18% for a 1% increase but it's not significantly impacting the LGDPPC. However, the results of FDI must be interpreted with caution. Large standard errors caused by high variability in FDI flows across middle income sample as well as for a given country across different time periods, cause the t-statistics to be significant only at 20% level despite a large observable co-efficient. A 1% increase in trade increases LGDPPC by more than 0.07%. The FMOLS results of high income-OECD group show that except inflation and FDI, the coefficient of all study variables are positively impacting the economic growth. Barring FDI, all variables are statistically significant at 5% level or better. The coefficients show that a 1% increase in LBDI, LSMI, GDS and TRADE increases the economic growth (LGDPPC) by 0.21%, 0.12%, 0.02% and 0.12%, respectively. But coefficients of inflation and FDI decrease economic growth (LGDPPC) by 0.01% and 0.008%, respectively. The FMOLS results of high income non-OECD group (in which most of the economies are having higher income compared to high income OECD group) indicate that all variables are positively impacting the economic growth and coefficients of LBDI, LSMDI and TRADE are statistically significant at 5% level or better. INF variable is significant at 10%, whereas, coefficient of FDI is insignificant. The long-run impact of all variables show that a 1% increase in LBDI, LSMDI, GDS, INF, FDI and TRADE increase the economic growth (LGDPPC) by 0.06%, 0.08%,0.08%,0.03%,0.04% and 0.18%, respectively.

5.3 MWALD Causality Test Results

After this, we test for causal relationship among study variables of four income groups. The MWALD based Granger causality results presented in Table 4 clearly indicates that in low income group there is bilateral causality between LBDI and LGDPPC (χ^2- statistics is statistically significant at the 5% level). But there exists a unidirectional causality running from LGDPPC to STRADED. The estimation results suggest a bi-directional causality between GDS and LGDPPC as well as between INF and LGDPPC. TRADE causes LGDPPC and there is a weak causal relationship between GDP and TRADE. But there is one-way causal relationship between FDI and LGDPPC running from LGDPPC to FDI. The Granger causality results of middle income group clearly suggest a bi-directional causality between LBDI to LGDPPC as well as between STRADED and LGDPPC. GDS and LGDPPC show unidirectional causal relationship running from GDS to LGDPPC but opposite is not true. However, INF and LGDPPC show unidirectional causal relationship running from LGDPPC to INF but the inverse is not true. The causality results further reveal a bi-directional causal relationship between FDI and LGDPPC and between TRADE and LGDPPC. The causality results are appealing because it substantiates the estimated results of FMOLS. However, the causality results of high income-OECD group show that there is a bilateral relationship between LBDI and LGDPPC as well as between LGDPPC and LSMDI. The causal direction between GDS and GDPPC is bilateral but the direction of causal relationship is found stronger from LGDPPC to GDS. The causality results also reveal a bilateral causal relationship between INF and LGDPPC as well as between TRADE and LGDPPC. Finally, there is bilateral and very strong casual relationship between LGDPPC and FDI. The causality results of high income non-OECD income group suggest a bilateral causality between LBDI and LGDPPC. Whereas, LSMDI and LGDPPC reveal a uni-directional causal relationship and in this case stock market causes the economic growth. Similarly, there is one way causal relationship between GDS and LGDPPC running from GDS to LGDPPC. In case of INF and LGDPPC, the causality results also suggest bilateral causal relationship between INF and LGDPPC. While, there is one-way causality running from Trade to LGDPPC but opposite is not true. But the causal relationship between LGDPPC and FDI shows that there exists very weak causal (statistically significant at more than 15 percent level) relationship running from FDI to LGDPPC.

Table 4. The Results of MWALD causality tests

Dependent Variable	Low-income group		Middle income group		High income group		Non-OECD income group	
	χ^2-statistics	p-values	χ^2-statistics	p-values	χ^2-statistics	p-values	χ^2-statistics	p-values
LBDI ⇏ LGDPPC	9.4010*	0.0091	7.6566**	0.0508	22.4480*	0.0001	8.4869*	0.0144
GDPPC ⇏ LBDI	23.4664*	0.0000	7.8606*	0.0490	7.8329*	0.0496	12.4406*	0.0020
STRADED ⇏ LGDPPC	0.3145	0.8545	1.3544	0.7163	--	--	--	--
LGDPPC ⇏ STRADED	3.6667*	0.1346	3.4400**	0.1862	--	--	--	--
LSMDI ⇏ GDPPC	--	--	--	--	45.6766*	0.0000	11.9266*	0.0026
LGDPPC L⇏ SMDI	--	--	--	--	6.4583**	0.0913	2.8019	0.2464
GDS ⇏ LGDPPC	6.1017*	0.0473	14.6017*	0.0022	4.4455**	0.2172	6.1546*	0.0461
LGDPPC ⇏ GDS	7.0446*	0.0295	2.1390	0.5441	10.8805*	0.0124	0.2215	0.8952
INF ⇏ LGDPPC	3.1048**	0.2117	0.5693	0.9034	7.6872*	0.0529	6.3970**	0.0406
LGDPPC ⇏ INF	6.4217*	0.0403	6.9117**	0.1784	4.8547**	0.1476	5.2511**	0.0368
TRADE ⇏ LGDPPC	3.8430**	0.1464	7.0592**	0.0602	6.6724**	0.0831	4.7359**	0.0937
LGDPPC ⇏ TRADE	2.5943	0.2733	8.0048*	0.0459	9.9388*	0.0161	2.1714	0.3377
FDI ⇏ LGDPPC	0.2968	0.8621	4.6736**	0.1973	26.4807*	0.0000	1.9348	0.3801
LGDPPC ⇏ FDI	7.9799*	0.0185	3.9443**	0.2675	12.8831*	0.0049	0.8002	0.6703

Note: ⇏ shows null hypothesis does not Granger Cause and the values in parentheses are probabilities.

* indicates significant at 5% and less critical value.

** indicates significant at 10% and more critical value.

5.4 Variance Decomposition (VAR based) Test Results

After analysing the causality results, we turn to VAR analysis for income groups. The forecast error variance decompositions of LGDPPC in VAR are presented in Table 5. The main role of variance decomposition is to

separate the variation in an endogenous variable into the component shocks to the VAR and provides information about the relative importance of each random residual in affecting the variables in the VAR. It is typical in VAR analysis that a variable explains a huge proportion of its forecast error variance, which is the case in our analysis of growth variation, which explains the biggest part of itself across all income groups. The columns provide the percentage of the forecast error variance due to each innovation in VAR framework, with each row adding up to 100.

Table 5. Variance decomposition results

Period	LGDPPC	LBDI	STRADED	GDS	INF	TRADE	FDI
Low income							
1	100	0.00	0.00	0.00	0.00	0.00	0.00
2	97.75	0.86	0.02	0.83	0.16	0.38	0.01
4	92.52	4.69	0.24	1.01	0.34	1.16	0.04
6	88.20	7.69	0.24	2.19	0.56	1.08	0.05
8	79.76	11.18	0.23	4.90	2.89	0.91	0.13
10	64.97	12.35	0.46	15.03	6.42	0.63	0.14
Middle income							
1	100	0.00	0.00	0.00	0.00	0.00	0.00
2	99.04	0.00	0.13	0.29	0.02	0.51	0.00
4	95.64	0.02	0.62	1.70	0.04	1.98	0.00
6	91.87	0.03	1.11	3.79	0.06	3.14	0.00
8	88.23	0.03	1.51	6.30	0.07	3.86	0.00
10	84.76	0.03	1.80	9.05	0.08	4.27	0.00
High income-OECD							
Period	**LGDPPC**	**LBDI**	**LSMDI**	**GDS**	**INF**	**TRADE**	**FDI**
1	100	0.00	0.00	0.00	0.00	0.00	0.00
2	95.80	0.75	2.73	0.14	0.29	0.26	0.03
4	91.29	1.30	5.29	0.32	1.20	0.56	0.02
6	89.38	2.11	5.07	0.36	2.17	0.90	0.02
8	88.15	3.04	4.27	0.32	2.97	1.24	0.01
10	87.08	3.97	3.54	0.26	3.56	1.58	0.01
Non-OECD							
1	100	0.00	0.00	0.00	0.00	0.00	0.00
2	94.23	0.26	3.93	0.33	0.04	0.64	0.56
4	81.44	1.87	8.46	2.01	0.60	2.30	3.32
6	74.0	2.70	9.10	4.28	2.03	3.49	4.40
8	68.61	3.08	8.70	6.31	3.74	4.75	4.80
10	64.16	3.27	8.11	7.89	5.34	6.17	5.06

For low income group, the LGDPPC forecast error variance decomposition shows that more than 64% after ten time period horizon is explained by its own innovations and rest is explained by innovations of other explanatory variables. Among those, share of GDS is highest (15.03%) followed by LSMDI (12.35%) and then INF is (6.42%), respectively. The shares of STRADED, TRADE and FDI are very low. The GDPPC forecast error variance decomposition of middle income group is significant and more than 84% are explained by its own innovations and only about 16% is explained by the innovation of other explanatory variables. Among all explanatory variables, more than 9.05% of total variance is explained by GDS followed by FDI (4.27%) and STRADED (1.80%) respectively. Similarly, the forecast-error variance of GDPPC of high income-OECD group depict that the GDPPC innovations are explained itself by more than 87%. Rest is explained by the error variance of LBDI (3.97), LSMDI (3.54), INF (3.56) and TRADE (1.58), respectively. The High income non-OECD group results reveal that the forecast-error variance of GDPPC up to ten periods is explained 64% by its own innovations and rest by other explanatory variables. Among all study variables, the share of LSMDI is highest 8.11%, followed by GDS (7.89%), TRADE (6.17%), Inflation (5.37%), FDI (5.06%) and LBDI (3.27%) respectively. This shows that in case of high income NON-OECD countries, the roles of financial variables are more than 20% compared to 16% by real economic variables. This implies that the role of financial development is prominent compared to real economic variables.

6. Conclusion and Policy Implications

The study results conclude that there is a long-run relationship between financial development and economic growth for all income groups. Based on the estimated results, the major findings of the study are as follows: Banking and economic growth exhibit strong bilateral causality for all income groups. This implies that while banking development drives economic growth, greater amount of banking services are also required at higher levels of development. Gross domestic savings is another important driver of economic growth for low and middle income group countries and plays a less significant role for high income groups. Economic growth causes stock market development for low income countries, stock market system and economic growth reinforce each other for middle and high income-OECD countries, while stock market drives economic growth for high income non-OECD countries. FDI is an important determinant of economic growth for low and middle income countries which is replaced by trade in case of middle and high income-OECD countries. Inflation hurts economies across income groups except in case of high income non-OECD group, which comprises of many oil exporting nations. Where rise in oil prices implies input-inflation for rest of the world, it results in higher export earning and growth for these oil exporting countries. From variance decomposition results, it may be noted that the proposed finance and economic variables explain 36% and 46% of variations in economic growth for low and high income Non-OECD group respectively. This implies that the role of financial development and policy interventions shall be higher in these economies. In contrast, the financial and economic variables explain merely 13% and 16% of variations in economic growth for middle and high income OECD income groups. The lesser role of innovations in explaining economic growth implies that one must look for additional economic variables that may drive economic growth. In their absence, time-series analysis of data seems to be more reliable and the role of financial development and other policy variable is relatively marginal. The important policy implications for countries belonging to different income groups are as follows:

a). Low income group: banking is the strongest driver of economic growth and hence the focus shall be on development of banking sector through institutional set-up, branch expansion, product innovation, better services, use of ICTs tools and a more comprehensive regulatory and governance framework. Governments need to encourage savings by providing alternative investment channels, increased monetization, fiscal incentives, strengthening pension sector and interest rate, interest rate liberalization and augmentation of financial deepening process. Stock markets are not the determinant of economic growth. On the contrary, economic development propels stock market development. In other words, stock market is not a critical policy variable for accelerating economic growth and hence its role in most such economies has been over-emphasized. FDI inflows should be encouraged through regulatory and fiscal response while inflation should be curtailed by managing supply side bottlenecks.

b). Middle income group: banking and GDS continue to be important drivers of economic growth and hence need policy support. Of course, banking development and savings growth reinforce each other. Stock market development is a driver of economic growth though it is not as significant as other financial variables such as banking and savings. The government should make an active effort to develop a competitive stock market system that encourages product innovation, provides services at lower costs by improving efficiency and using network economies as well as promotes investor education and activism leading to greater financial inclusion. FDI needs to be strongly encouraged while inflation needs to be kept under control through relevant policy measures.

c). High income-OECD group: stock market is the strongest driver of economic growth closely followed by banking and savings. Trade emerges as the strong determinant of economic growth while the role of FDI is virtually insignificant. This is understandable as the sample countries account for large part of international trade. They also account for large FDI outflows which are tapped by low and middle income countries. Such regimes need to support trade through institutional and fiscal measures, multi-lateral trade agreements, developing transporting networks and pursuing an active export-import polices.

d). High income Non-OECD group: trade is the strongest driver of economic growth and needs to be supported through policy measures. Stock market and savings are critical for economic development followed by banking. The regimes must invest in developing capital market active system through policy and regulatory support, encourage savings and deepen banking practices. Inflation management is not as critical as it does not hurt economic growth.

To conclude, we can say that the findings of this study are in agreement with (Levine & Zervos, 1998; Levine et al., 2000; Hassan et al., 2011) on the role of financial development and economic growth. Causality results are consistent with Shan, Morris, and Sun (2001) and (Demetriades and Hussein, 1996; Blackburn and Hung, 1998;

Khan, 2001), but contrary to (Christopoulos and Tsionas, 2004). The study results of stock market development and its causal relationship with economic growth are inline with (see for example, Levine and Zervos,1998; Levine et al., 2000). The outcomes on the role of macroeconomic variables are consistent with the study of (Gries et al., 2009) and (Hassan et al., 2011). Our research contributes to both financial development as well as economic policy literature. The findings are relevant for academicians', policy makers and financial market players. However, results with regard to low income countries must be interpreted with caution as due to paucity of data low and lower middle income countries were merged. Hence the policy recommendations for the low income group may need some review in light of individual country data relating to their economic settings and financial development.

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Notes

Note 1. Lucas (1988) emphasized on the downside risk of financial sector in economic growth and asserted against the over-stressed role of financial sector in economic growth.

Note 2. Levine (2005) provides valid arguments regarding use of fixed effect in cross country analysis.

Note 3. See recent study by Ang (2008) and citations therein for additional studies on the recent developments in the literature of finance and growth.

Note 4. The income based group-wise classification of World Bank is based upon 2008 GNI per capita. The groups are: Low income, $975 per capita or less; Lower and middle income, $976-$3,855 per capita; Upper middle income, $3,856-$11,905 per capita; and High income, $11,906 per capita or more.

Note 5. The list of sample countries is shown in Table 7 (Appendix).

Note 6. In appendix-A, Table 1, 2,3,4,5 and 6 show estimated principle component vectors.

Note 7. In order to conserve the space we have avoided mentioning the unit root results. However, the results are available upon request.

Appendix

Appendix 1. Principle component analysis for LBDI: Low income group

	PCA1	PCA2	PCA3
Eigen values	2.6037	0.2954	0.1010
% of variance	0.8679	0.0985	0.0337
Cumulative %	0.8679	0.9663	1.0000
Variable	Vector1	Vector 2	Vector 3
DMCPS	0.5561	0.8023	0.2172
DCPBS	0.5967	-0.2035	-0.7763
BM	0.5786	-0.5612	0.5918

Appendix 2. Principle component analysis for LBDI: Middle income group

	PCA1	PCA2	PCA3
Eigen values	2.6517	0.2643	0.0840
% of variance	0.8839	0.0881	0.0280
Cumulative %	0.8839	0.9720	1.0000
Variable	Vector1	Vector 2	Vector 3
DMCPS	0.5922	-0.2944	-0.7501
DCPBS	0.5832	-0.4857	0.6511
BM	0.5560	0.8230	0.1159

Appendix 3. Principle component analysis for LBDI: High income-OECD group

	PCA1	PCA2	PCA3
Eigen values	2.1496	0.7728	0.0776
% of variance	0.7165	0.2576	0.0259
Cumulative %	0.7165	0.9741	1.0000
Variable	Vector1	Vector 2	Vector 3
DMCPS	0.4070	0.9128	0.0339
DCPBS	0.6422	-0.3123	0.7000
BM	0.6496	-0.2631	-0.7133

Appendix 4. Principle component analysis for LBDI: Non-OECD income group

	PCA1	PCA2	PCA3
Eigen values	2.7339	0.2253	0.0408
% of variance	0.9113	0.0751	0.0136
Cumulative %	0.9113	0.9864	1.0000
Variable	Vector1	Vector 2	Vector 3
DMCPS	0.5836	-0.4767	0.6574
DCPBS	0.5914	-0.3052	-0.7464
BM	0.5564	0.8244	0.1039

Appendix 5. Principle component analysis for LSMDI: High income-OECD group

	PCA1	PCA2	PCA3
Eigen values	1.9812	0.7194	0.2994
% of variance	0.6604	0.2398	0.0998
Cumulative %	0.6604	0.9002	1.0000
Variable	Vector1	Vector 2	Vector 3
STRADED	0.6374	-0.2030	-0.7433
MARCAP	0.6004	-0.4737	0.6443
LCOMP	0.4829	0.8570	0.1801

Appendix 6. Principle component analysis for LSMDI: Non-OECD income group

	PCA1	PCA2	PCA3
Eigen values	2.3873	0.4512	0.1615
% of variance	0.7958	0.1504	0.0538
Cumulative %	0.7958	0.9462	1.0000
Variable	Vector1	Vector 2	Vector 3
LCOMP	0.5338	0.8395	0.1012
MARCAP	0.6045	-0.2952	-0.7399
STRADED	0.5913	-0.4562	0.6650

Appendix 7. Income group-wise list of sample countries

Low income	**Middle income**	**High income OECD**	**High income Non-OECD**
Bangladesh	Argentina	Australia	Barbados
Kenya	Brazil	Austria	Cyprus
Zimbabwe	Botswana	Belgium	Hong Kong SAR, China
Bolivia	Chile	Canada	Oman
Egypt, Arab Rep.	China	Switzerland	Saudi Arabia
Ghana	Colombia	Czech Republic	Singapore
Indonesia	Costa Rica	Germany	Trinidad and Tobago
India	Ecuador	Denmark	
Sri Lanka	Iran, Islamic Rep.	Spain	
Morocco	Jamaica	Estonia	
Nigeria	Jordan	Finland	
Pakistan	Mexico	France	
Philippines	Mauritius	United Kingdom	
	Malaysia	Greece	
	Namibia	Hungary	
	Panama	Ireland	
	Peru	Iceland	
	Romania	Israel	
	Russian Federation	Italy	
	Thailand	Japan	
	Tunisia	Korea, Rep.	
	Turkey	Luxembourg	
	Venezuela, RB	Netherlands	
	South Africa	Norway	
		New Zealand	
		Poland	
		Portugal	
		Slovak Republic	
		Slovenia	
		Sweden	
		United States	

Note: Low income group consists of three low income countries (Bangladesh, Kenya and Zimbabwe) and rest are from lower middle income countries.

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Do Bidders Gain in Related Acquisitions? Some Evidence from UK

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Abstract

This study examines the performance of related bidders over short- and long-term horizons. Acquisitions are examined between companies within the same industry from a sample of completed UK takeovers between 1994 and 1998. Performance is compared to unrelated acquisitions and also size and industry control portfolios. We also examine the effects of form of financing and the preferred method of payment by larger and smaller related bidders. It is found that related takeovers occur mainly in underperforming industries. Significant differences are found in long-horizon performance with regard to bidder size and also the method of payment.

Keywords: mergers, acquisitions, event-study, synergy, bidder, horizontal

1. Introduction

Morck *et al*. (1988) distinguish between disciplinary takeovers, designed to remove underperforming management and takeovers that promote synergy by bringing together two firms that are able to perform more efficiently together. This paper focuses on a type of takeover that is motivated by management's pursuit of synergy. This is perhaps one of the most convincing motives as it is based on the notion that two firms combined operate more efficiently and are worth more together, than separate, (Bradley *et al*. 1988; Jensen and Ruback 1983; Healey *et al*. 1992). Economies of scale, improved sales and fresh management may generate synergistic benefits. However, a large body of evidence indicates that the target enjoys most of the gains (Jensen and Ruback 1983; and Bradley *et al*. 1988), and the post-acquisition abnormal return may not solely reflect the synergy value (Hietala *et. al.* 2003). After controlling for the bidder firm characteristics, Fuller *et. al.* (2002) documented by using the US data that bidders lost value in the acquisition of publicly listed targets firms, but gain value in private and subsidiary targets. In similar a study, by using UK data, Antoniou *et. al.* (2007) has found that bidders break even in the short run when acquiring public firms but gains in buying private and subsidiary targets. However, over the long run bidders experience wealth losses regardless of the types of targets. While these studies provide us general evidence of acquisition value loss for the bidder firms, the main limitation is that samples were not chosen based on the acquisition motives. Therefore, we still do not know if bidder looses value when acquisition is clearly driven by any synergy.

Given the evidence of bidders' value loss in the post-acquisition period, we re-examine the issue with a set of selected UK acquisitions that were supposed to be motivated by the operational synergy. Synergy can be created from a mainly managerial; financial; or operational integration. Managerial synergy could arise if bidder management is superior to that of the target. This relates to Manne's (1965) theory of corporate control where takeovers are disciplinary and remove ineffective management. Financial synergy can lower the costs of internal financing as compared to external financing. For example, financial efficiency would occur when one firm has excess cash, but little investment opportunities, while the other firm is in an opposite situation. Financial synergy can also arise from the debt capacity of combined firms being greater than when the firms are separate. Operational synergy can be seen from economies of scale and increased market power through larger production capacity to cater to increased demand (e.g., Gupta and Gerchak, 2002). For firms to benefit from operational synergy the takeover needs to be of a horizontal or vertical nature, which means the acquired firm needs to be related to the bidder's business. This paper classifies takeovers that are most likely to be linked with operational synergy and tests the impact of the takeover on the bidder in the short-term and the long-term. The paper tests a number of hypotheses regarding the impact related takeovers have for the bidder firm compared to firms involved in unrelated takeovers. The examination of related and unrelated takeovers requires a classification into the correct categories. Many firms have operations in many different domains. As a result, related and unrelated

characteristics may be evident at the same time within a takeover. This is perhaps one of the reasons for inconclusive evidence in this area of corporate control. The classification used in this paper is based on the firm's central competencies. The three- or four-digit SIC code provides the core industry and indicates whether horizontal takeovers have occurred.

The remainder of the paper is organised as follows: the next section presents the literature review and sets up the hypotheses concerning the impact of related acquisitions over the short and long-term. In the third section, the methodology and data are described. Section four presents the results. The final section provides summary and conclusions.

2. Literature Review

There is mixed evidence regarding bidder performance surrounding the announcement of a takeover. Sudarsanam *et al*. (1996) report that UK bidders lose approximately by 5% value although they earn about 2% return overall. Other UK studies by Franks and Harris, 1989; Limmack, 1991; Parkinson and Dobbins (1993); and Antoniou *et. al.* (2007) concluded that no gains were made by bidder shareholders. Support also comes from the US (e.g., Franks and Harris, 1988; Datta *et al*. 1992; and Fuller *et. el.,* 2002 among the earlier studies and Kedia *et al* 2009 among the recent studies) and from the other European Markets (Flugt, 2009). Overall, it is generally acknowledged that bidders do not gain value, except in certain situations such as when acquisition occurs in imperfectly competitive market and when firms invest in the specialized assets. It is also acknowledged that bidders do not substantially lose from a takeover bid announcement.

Several studies have examined the issue of related mergers and whether the expected gains from such takeovers are seen between firms in related industries. Limmack & McGregor (1992) reported that related mergers slightly underperform relative to the unrelated mergers when the wealth gains are examined. Seth (1990) and Slusky & Caves (1991) add to the inconclusive evidence as the findings from these studies show little difference between related and unrelated takeovers. Sudarsanam, Holl, and Salami, (1996) also examine if industry relatedness leads to operational synergies and finds that this is not the case. Flanagan (1996) uses a more robust method of identifying purely related mergers, where the bidder and target share the same SIC code at either the three of four-digit level and for purely unrelated mergers the bidder and target do not have similar SIC codes. The findings of Flanagan (1996) show that shareholder returns were higher for acquirers involved in related mergers compared to that of unrelated mergers occurring in the US between 1972 and 1990. Moreover, Morck *et al*. (1990) discuss the view that perhaps unrelated mergers are the result of management's pursuit of their own goals at the expense of the shareholders. Among others, Choi and Russell (2004) found within the US construction sector that the acquisition time, method of payment, or target status do not influence the market performance, through related mergers perform slightly better than unrelated ones. As whole, the evidence on short term wealth effect in the related and unrelated mergers is not yet clear, though in theory the related bidders should benefit from the operational synergy achieved by vertical or horizontal integration. The literatures presented above are mainly concerned with the short term wealth effects on the bidder firms. The studies on long term wealth effects are reviewed below.

Evidence regarding the long-term horizon returns for the bidder firms is mixed. Agrawal *et al*. (1992) find that bidders significantly lose by approximately 10% in a five-year post-merger period and that the firm size effect and beta estimation problems are not the cause of negative returns seen in the post period. However, some studies do not report underperformance in the post-acquisition period (Bradley & Jarrell (1988), and Franks *et al*. (1991)). Franks *et al*. (1991) note that the negative post-performance reported in the past has been mainly the result of benchmarking errors. However, Agrawal *et al*. (1992) studied four large time frames compared to the one time frame studied by Franks *et al*. (1991). Their findings show significant negative abnormal returns in the post-period to the bidder in three of the time-periods. One period showed no real deviation – the same period studied by Franks *et al*. (1991). Franks *et al*. (1988) report negative post-merger returns for bidders in the US and UK. Loderer and Martin (1992), by controlling for size effects and beta risk, report similar negative returns in the period of three years after the merger was completed. However, the authors report that the negative abnormal returns are prominent in the 1960's and diminishes through the years until no abnormal returns are seen in the 1980's.

Rau and Vermaelen (1998) also examine long-horizon bidder performance, and adjust for both firm size and book-to-market effects. Their findings show that bidders underperform control portfolios consisting of similar sizes and book-to-market ratios by approximately 15% in the period of 3 years after the merger. This is consistent with the findings of Agrawal *et al*. (1992) that report significantly negative cumulative abnormal returns (-13.58%) in the same time-period after the merger. Langeteig (1978) also reported negative long-term performance, but when compared to control firms in the same industry, no significant deviation was found. Regarding the method of

payment and long-term performance, Loughran and Vijh (1997), note that acquirers gain significantly in the five years after the merger was completed when payment was made by cash, whereas stock acquirers earned significantly negative abnormal returns. Most studies have reported negative performance for bidders in the years after acquisition. However, Healy *et al*. (1992) add to the varied evidence by studying the post-acquisition performance of the fifty largest US mergers that took place between 1979 and 1984. The findings were that industry-adjusted post-merger performance was positive. Among other studies, Ramaswamy and Waegelein (2003), Andre et al.(2004) Kling (2006), Megginson et al. (2004) and Zhu (2008) also investigated the long term performance of acquisitions in different internationals markets.

When these findings are all brought together there is mixed evidence regarding the long-term performance of bidders after completion of the acquisition, but in the majority of cases, bidders seem to underperform. This can be attributed to the differing methodologies and sample selection. In addition, studies such as Healy *et al*. (1992) note that industry conditions may also be an important factor to the final outcome and how the results can be examined and validated. Nevertheless, when comparing the industry factor to that of the bidder performance it is assumed that the bidder has the same profile as the industry as a whole. However, in the market for corporate control the bidder is more likely to be larger than the average company and may therefore affect the results.

This paper examines the impact of UK takeovers motivated by operational synergy on the wealth of the bidder shareholders immediately surrounding the bid announcement and also in terms of long-horizon performance. We use a similar methodology to that of Flanagan (1996) where three- or four-digit SIC codes are shared (not shared) between the bidder and target to identify related (unrelated) takeovers. The performance of related bidders is compared to a sample of unrelated acquisitions. Furthermore, the performance of each related bidders industry is also examined to shed light on whether related takeovers occur in underperforming industries. An additional tool used to measure the overall long-term performance of related bidders is to compare their performance against portfolios of firms of similar sizes. One last area that we felt required attention was the long-run performance of the related bidder and the method of payment that was used. Overall, we utilise a number of methods of analysis to understand how related bidders perform. There is also little evidence regarding the short- and long-term performance of related bidders in the UK and how these companies perform against comparable control samples. As a result, this study will be of benefit to both academia and practitioners. Finally, based on the above background, following two hypotheses are tested in this paper:

H1: The shareholders of bidders involved in 'related' takeovers experience significant wealth gains in the period surrounding the announcement of the bid as compared to unrelated acquisitions.

H2: The long-term horizon performance of bidders engaging in related takeovers is superior to that of unrelated acquisitions.

3. Data and Methodology

3.1 Data

A sample of 340 successful takeovers by UK public firms was obtained from 1994 to 1998. The daily share price data was collected from Extel's Equity Research and FT Prices. The dates and information content of the first bid announcement was gathered from a news search using McCarthy CD-ROM and FT News. All four-digit SIC codes of the acquiring and acquired firms were collected from FAME. To measure the short-term returns of related bidders, complete data was available for 95 related bidders and 95 unrelated bidders. Our sample size reduced in both cases when studying the long-term returns. Complete data was available for 80 related bidders and 75 unrelated bidders.

3.2 Returns Measures

To assess the market reaction at the announcement of related and unrelated acquisitions, standard event study methodology is used (Dodd, 1980). Daily stock returns are defined as:

$$R_{it} = \left(P_{it} - P_{it-1}\right) / P_{it-1} \quad (1)$$

Where, $P_{i.t}$ is the closing price on stock *i* at time *t*. The next step is to calculate the predicted or normal return ($ER_{i.t}$); this is the return that would be observed if no event occurred. In this case, $ER_{i.t}$, is represented by the return on the FTSE All-Share Index for each day in the event period.

Each bidder's abnormal return is calculated over each day of the event period as:

$$AR_{it} = R_{it} - ER_{it} \quad (2)$$

The abnormal returns of the n bidder in each group (related and unrelated) are collected to determine the average abnormal return for each day as follows:

$$AAR_t = \sum_{i=1}^{n} AR_{it} \Big/ n \tag{3}$$

The final step is to calculate the cumulative average abnormal return for each day over the entire event window:

$$CAAR = \sum_{-15}^{+15} AARt \tag{4}$$

To test AAR_t for significance the following t-stat is applied:

$$t = AARt / S(AARt) \quad \text{where } S(AARt) = \left[\frac{1}{30} \sum_{-15}^{+15} \left(AARt - \overline{AARt} \right)^2 \right]^{1/2} \tag{5}$$

Finally, following Boehmer, Musumeci, and Poulsen (1991), we use the test statistic for the cumulative daily average abnormal return (CAAR), cumulating over the period specified and is computed as follows:

$$t = CAAR / S(CAAR) = \sum_{-15}^{+15} AARt \Big/ \sqrt{31}\, S(AAR) \tag{6}$$

3.3 Control Portfolio CAAR Approach

We classify our final sample of 80 related bidders (long-term study) into eight groups by market capitalisation. For each group we form a portfolio of firms of similar capitalisation. Thus we form control portfolios corresponding to the eight bidder groups. For example, control sample Portfolio1, consists of a random sample of firms that have market capitalisation greater than £5000M. We then carry out the process of determining which portfolio each related bidder's market cap falls into. Once we have identified which portfolio each bidder belongs to the next step is to treat each control firm in that specific portfolio as though it completed an acquisition at the same point in time as the related bidder. This process is carried out for each related bidder, i.e. 80 times. Therefore, returns are formed for each control firm within the specific portfolio, from a specific date - the announcement date of a related takeover. The average abnormal returns are calculated for the portfolio of firms for the same period of time as the related bidder, from the same point in time. This method allows us to take into account the size of the related bidder and compare how they perform against a range of similar sized firms over an identical time-period.

4. Results

4.1 Short-term Results

Figure I shows the cumulative average abnormal returns for both related and unrelated bidders from 15 days before the announcement of the bid to 15 days after the announcement of the bid. From inspecting Figure I and Tables 1 and 2, it is evident that the shareholders of bidders involved in related acquisitions experience significant wealth gains in the short period surrounding the bid announcement. This is in contrast to that of the unrelated acquirer shareholders who lose slightly over the same event-period.

Table 1. The behavior of share prices around the announcement date. (Related Sample)

Days	AAR	CAAR	Std. Dev.
-15	-0.00101	-0.00101	0.01397
-14	0.00010	-0.00091	0.01394
-13	0.00069	-0.00022	0.01321
-12	0.00039	0.00017	0.01356
-11	0.00264	0.00280	0.01502
-10	-0.00256	0.00025	0.02185
-9	0.00082	0.00107	0.01340
-8	0.00067	0.00174	0.01252
-7	0.00094	0.00268	0.01508
-6	0.00115	0.00383	0.01415
-5	-0.00167	0.00216	0.01689
-4	0.00213	0.00429	0.01283
-3	0.00290	0.00719	0.02589
-2	-0.00179	0.00541	0.01875
-1	0.00649	0.01189	0.05402
0	-0.00169	0.01021	0.02246
1	-0.00182	0.00839	0.02861
2	0.00420	0.01258	0.02226
3	-0.00067	0.01192	0.01700
4	0.00145	0.01336	0.01058
5	-0.00141	0.01195	0.01494
6	0.00201	0.01396	0.01594
7	0.00109	0.01506	0.01503
8	-0.00055	0.01451	0.01159
9	0.00118	0.01568	0.02024
10	0.00034	0.01603	0.01105
11	0.00093	0.01696	0.00899
12	-0.00035	0.01661	0.01531
13	0.00040	0.01701	0.01334
14	-0.00009	0.01692	0.01498
15	-0.00083	0.01609	0.01538

t-test on cumulative abnormal returns $CAAR_{-15,+15} = 0.01609$ (sig. at 95% one-tail level)

Table 1 presents the abnormal returns for the sample of bidding firms that have taken over a target in the same industry as itself. As Table 1 displays the CAAR over the event window is significantly positive. The CAAR results illustrate approximately a 1.6% increase over the period from fifteen days before through to fifteen days after the first bid announcement date. This is higher than has been noticed in past studies. Table 2 reports the abnormal returns concerning the sample of unrelated bidders, and Figure 1 illustrates the CAAR's over the event period studied. As Table 2 and Figure 1 demonstrate, the shareholders in this sample do not benefit from excess returns in the period surrounding the announcement date, and in fact slightly lose over the event-window. However, results are only significant for the related acquiring firms. The findings with regard to unrelated acquirers supports the previous studies of Barnes (1998), and Datta et al (1992) where no excess gains or losses are seen. The results from both related and unrelated samples emphasise the positive returns to the related bidder, and supports H1.

Table 2. The behavior of share prices around the announcement date. (Unrelated Sample)

Days	AAR	CAAR	Std. Dev.
-15	0.00097	0.00097	0.02863
-14	-0.00413	-0.00316	0.02158
-13	-0.00434	-0.00749	0.02229
-12	-0.00499	-0.01248	0.02258
-11	-0.00095	-0.01344	0.01727
-10	0.00158	-0.01185	0.01832
-9	0.00090	-0.01095	0.02925
-8	-0.00132	-0.01227	0.01679
-7	0.00254	-0.00973	0.02145
-6	0.00095	-0.00878	0.01898
-5	0.00023	-0.00855	0.02635
-4	-0.00177	-0.01033	0.02121
-3	-0.00157	-0.01190	0.01856
-2	0.00193	-0.00996	0.02391
-1	0.00093	-0.00903	0.03882
0	-0.00063	-0.00966	0.03400
1	0.00126	-0.00840	0.03408
2	-0.00152	-0.00991	0.02336
3	0.00026	-0.00965	0.01854
4	0.00321	-0.00643	0.02025
5	-0.00202	-0.00846	0.01746
6	-0.00197	-0.01042	0.01666
7	-0.00262	-0.01304	0.01677
8	0.00060	-0.01244	0.01893
9	0.00571	-0.00673	0.02604
10	-0.00077	-0.00750	0.01417
11	-0.00053	-0.00803	0.01555
12	-0.00078	-0.00881	0.01507
13	0.00044	-0.00836	0.02491
14	0.00032	-0.00804	0.01994
15	0.00055	-0.00750	0.02192

t-test on cumulative abnormal returns $CAAR_{-15,+15} = 0.00750$ (not sig.)

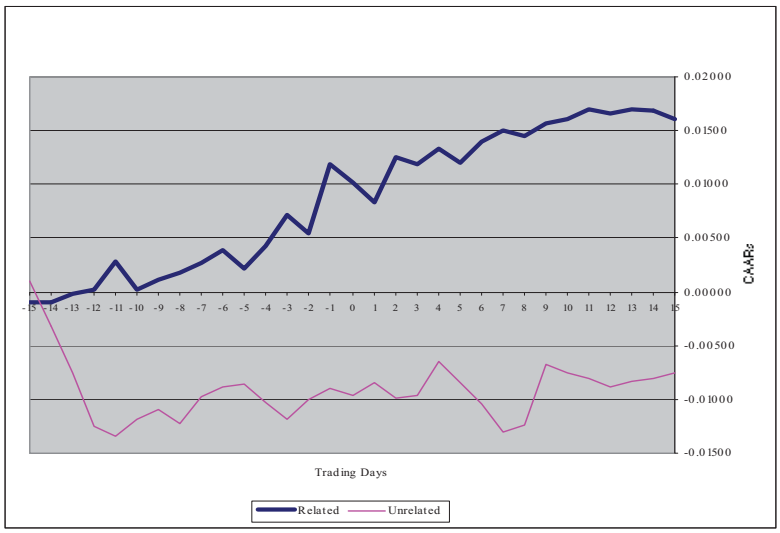

Figure 1. Cumulative Aerage Abnormal Returns (CAARs) for Bidding Firms

4.2 Long-term Results

Figure II and Tables 3 and 4 present the post-acquisition performance of bidders involved in related and unrelated takeovers. In the three years after the completion of the acquisition, bidding firms experience significant negative abnormal returns. This is observed in both related and unrelated acquisitions during the years 1994 to 1998. Significant underperformance regarding the related sample is seen over the three years after the acquisition (CAAR -17.6%). Overall, the unrelated sample performs worse than the related sample (CAAR -18.9%). However, Figure II illustrates the superior performance of the unrelated sample to that of the related bidders over the first and second years after the acquisition. However, related bidders seem to have bottomed out and are gradually picking up towards the end of the event-period. Over a 5-year period these returns for related bidders may increase even further. Unfortunately, adequate data was not available to analyse returns over a 5-year post-takeover period.

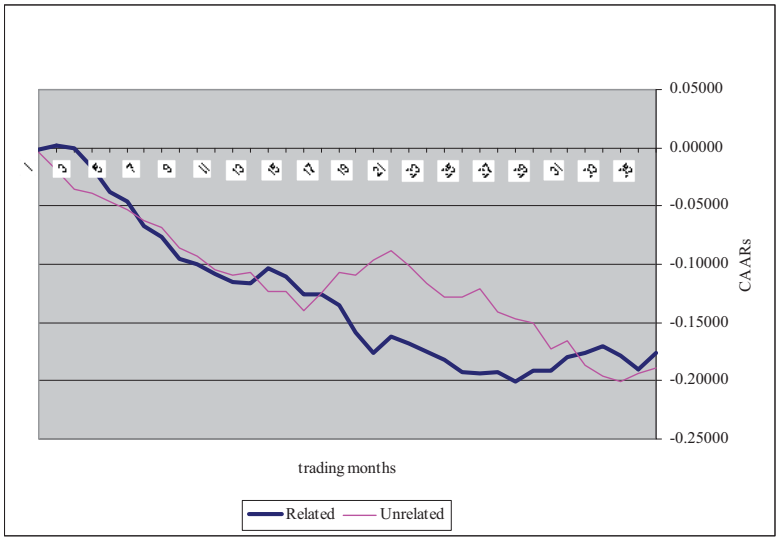

Figure 2. Long-term horizon performance for bidder firms

The findings of this study are similar to the studies of Agrawal *et al*. (1992) and Rau and Vermaelen (1998). Agrawal *et al*. (1992) find acquiring firms in mergers earn significantly negative cumulative abnormal of 13.58% over the three years after the merger. Furthermore, Rau and Vermaelen (1998) report

Table 3. The long-term performance behavior (Related Sample)

Months	AAR	CAAR	Std. Dev.
1	-0.00206	-0.00206	0.0227
2	0.00104	0.00145	0.0214
3	0.00379	-0.00081	0.0143
4	-0.00101	-0.01698	0.0145
5	-0.00049	-0.03738	0.0178
6	-0.00164	-0.04599	0.0162
7	-0.00164	-0.06748	0.0150
8	-0.00115	-0.07613	0.0136
9	-0.00206	-0.09533	0.0178
10	-0.00118	-0.10025	0.0287
11	0.00325	-0.10811	0.0331
12	-0.00032	-0.11567	0.0195
13	-0.00214	-0.11613	0.0177
14	-0.00037	-0.10327	0.0140
15	0.00007	-0.11003	0.0141
16	-0.00511	-0.12577	0.0208
17	0.00748	-0.12541	0.0709
18	0.00179	-0.13549	0.0182
19	-0.00249	-0.15849	0.0179
20	-0.00003	-0.17631	0.0161
21	-0.00107	-0.16256	0.0207
22	-0.00073	-0.16805	0.0175
23	0.00044	-0.17474	0.0151
24	0.00246	-0.18151	0.0187
25	-0.00112	-0.19292	0.0229
26	-0.00020	-0.19391	0.0192
27	0.00280	-0.19217	0.0182
28	0.00002	-0.20103	0.0185
29	0.00196	-0.19180	0.0185
30	-0.00190	-0.19184	0.0158
31	0.00479	-0.17956	0.0249
32	-0.00129	-0.17656	0.0184
33	-0.00173	-0.17033	0.0209
34	-0.00145	-0.17843	0.0391
35	0.00597	-0.19061	0.0222
36	-0.00145	-0.17618	0.0271

t-test on cumulative abnormal returns $CAAR_{0,+720}$ = -0.17618 (sig. at 99% conf. level)

Table 4. The long-term performance behavior (Unrelated Sample)

Months	AAR	CAAR	Std. Dev.
1	-0.00380	-0.00380	0.03350
2	-0.00251	-0.01911	0.01654
3	0.00027	-0.03579	0.01678
4	-0.00038	-0.03874	0.01616
5	-0.00019	-0.04585	0.01591
6	0.00332	-0.05277	0.02612
7	-0.00195	-0.06283	0.02389
8	0.00361	-0.06869	0.01629
9	-0.00148	-0.08540	0.01606
10	0.00386	-0.09312	0.04628
11	0.00153	-0.10501	0.01905
12	0.00247	-0.10963	0.02267
13	-0.00222	-0.10711	0.01835
14	-0.00337	-0.12287	0.02366
15	-0.00069	-0.12291	0.02394
16	-0.00309	-0.13984	0.02684
17	0.00341	-0.12406	0.01760
18	0.00107	-0.10761	0.02387
19	0.00847	-0.10952	0.03323
20	0.00002	-0.09617	0.01760
21	0.00297	-0.08838	0.02144
22	-0.00467	-0.10110	0.02133
23	0.00139	-0.11677	0.01877
24	-0.00087	-0.12760	0.02049
25	-0.00641	-0.12801	0.02606
26	-0.00111	-0.12067	0.01821
27	0.00116	-0.14047	0.01610
28	-0.00354	-0.14693	0.01730
29	0.00108	-0.15089	0.01811
30	-0.00334	-0.17323	0.01660
31	0.00403	-0.16592	0.01416
32	-0.00677	-0.18702	0.02637
33	-0.00076	-0.19627	0.02242
34	-0.00328	-0.20061	0.02884
35	0.00090	-0.19336	0.03532
36	0.00346	-0.18929	0.02448

t-test on cumulative abnormal returns $CAAR_{0,+720}$ = -0.18929 (sig. at 95% conf. level)

Bidders underperform by 15.23% compared to an equally weighted control portfolio. Our results show that in the first year after the acquisition both related and unrelated samples underperform by over 10%. This is different from the summarisation of seven studies by Jensen and Ruback (1983) that reports average abnormal returns of -5.5% in the year after the takeover. The differing findings may be the result of the period of study, as prior empirical evidence has highlighted.

Agrawal *et al*. (1992) also split the sample into conglomerate and non-conglomerate. They note that when the bidder and target have the same four-digit SIC code, then they are in the same industry, and define this merger as being non-conglomerate. Agrawal *et al*. (1992) report that both groups show negative performance over the five-year post-acquisition period. Perhaps surprisingly, they find that non-conglomerate merger performance is worse than the conglomerate sample. Furthermore, Agrawal *et al*. (1992) considered the possibility that non-conglomerate mergers were concentrated in industries that also underperformed in post-acquisition period studied. Agrawal *et al*. (1992) find this is not the case.

This paper also examines how the bidders in related takeovers have performed compared to the industry the company was concentrated in. Our findings are in contrast to that of Agrawal *et al*. (1992). Figure III and Table 5 display the performance of the related bidders against their respective industry.

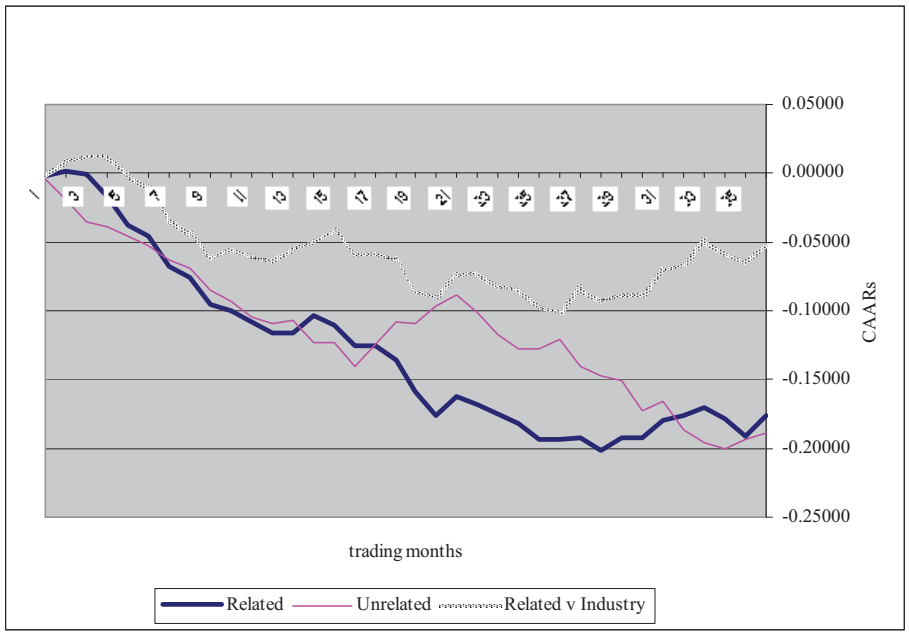

Figure 3. Long-term horizon performance for bidder firms

We find that the bidders in related takeovers underperform its industry counterparts by approximately 8.5% over a two year post-acquisition period, which picks up by around 3% in year three. It must be noted that when comparing the related bidder to its industry performance it is assumed that the profile of the bidder is the same as that of the industry as a whole. However, usually the bidder is larger than the average company within the industry and therefore may affect our results.

Table 5. The long-term performance behavior (Related v Industry)

Months	AAR	CAAR	Std. Dev.
1	-0.00231	-0.00231	0.02020
2	0.00172	0.00838	0.02282
3	0.00218	0.01153	0.01597
4	-0.00045	0.01309	0.01583
5	-0.00243	-0.00065	0.01682
6	-0.00145	-0.01124	0.01903
7	-0.00121	-0.03307	0.01504
8	-0.00191	-0.04439	0.01600
9	-0.00124	-0.06182	0.01640
10	0.00059	-0.05547	0.03171
11	0.00280	-0.06099	0.02019
12	0.00031	-0.06416	0.02003
13	-0.00192	-0.05489	0.01787
14	-0.00016	-0.05078	0.01386
15	-0.00001	-0.04208	0.01374
16	-0.00610	-0.05938	0.02109
17	0.00637	-0.05860	0.07806
18	0.00092	-0.06316	0.01777
19	-0.00411	-0.08646	0.01614
20	-0.00048	-0.09010	0.01571
21	0.00066	-0.07510	0.02003
22	-0.00394	-0.07201	0.01710
23	-0.00347	-0.08214	0.01480
24	0.00254	-0.08408	0.02111
25	-0.00130	-0.09757	0.02631
26	0.00089	-0.10148	0.02043
27	0.00331	-0.08410	0.02065
28	0.00165	-0.09293	0.01764
29	0.00403	-0.08823	0.02036
30	0.00044	-0.08869	0.01739
31	0.00241	-0.07164	0.01897
32	-0.00241	-0.06711	0.01791
33	0.00134	-0.04876	0.01866
34	-0.00382	-0.05882	0.04345
35	0.00377	-0.06542	0.02154
36	-0.00038	-0.05132	0.02904

t-test on cumulative abnormal returns $CAAR_{0,+480}$ = -0.08408(sig. at 90% conf. level)

4.3 Firm-size Effects

To take into consideration that our sample of related bidders may be of various sizes and our results may be distorted, portfolios were formed according to market capitalisation. This is shown in Table 6.

Table 6.

		Related Sample		***Control Portfolios by size***	
Deciles (by Market cap)		**n**	**~CAAR (long-term)**	**n**	**~CAAR (long-term)**
Portfolio 1	£5000M+	9	0.3148	16	0.2017
Portfolio 2	£5000M-2000M	15	0.0970	37	0.1163
Portfolio 3	£2000M-1000M	7	0.0904	24	-0.0158
Portfolio 4	£1000M-500M	4	0.0999	43	0.0719
Portfolio 5	£500M-300M	10	-0.2551	74	-0.0408
Portfolio 6	£300M-200M	10	-0.2205	67	-0.0361
Portfolio 7	£200M-100M	6	-0.0820	78	-0.0686
Portfolio 8	£100M<	16	-0.8359	38	0.0450
Total		77		377	

Table 7.

	Portfolios 1-4	*Portfolios 5-8*
Method of Payment		
Cash	65%	22%
Mixed	25%	15%
Share	10%	63%

As can be seen from Table 6, eight portfolios were produced. We find that on average bidders in related mergers underperform control portfolios of similar sizes by around 12% in a period of three years after the announcement of a successful takeover. However, Table 6 displays how the numbers of control firms within each specific portfolio compare to the related bidder counterparts. It can be seen that the portfolios consisting of much larger related bidder firms, portfolios 1-4, outperform firms of similar size in the majority of cases. Portfolio1 has an average CAAR of 0.3148 for the related bidder firms over 3-years as compared to 0.2017 for the control portfolio. A large difference is also seen in portfolio3. This is in stark contrast to the performance of related bidders in portfolios 5 through to 8 as compared to the range of control firms in the corresponding portfolios. Related bidders notably underperform the control firms in all four cases, especially in portfolios 5, 6, and 8. These findings may suggest that the smaller bidding firms have been the contributors to the overall negative performance of the related sample shown earlier in the study. This area requires further work to explain the reasoning and differences between larger and smaller related bidders. One suggestion may be that the larger bidders have the power to take over larger targets and subsequently increase their market power, which the market will view favourably.

4.4 Long-run Performance and Method of Payment

Prior research has indicated that the bidder performance is related to the method of payment used in the acquisition. Earlier studies are ambiguous with Firth (1979) and Dodds and Quek (1985) stating that a positive reaction around the announcement of the bid is seen in stock financed acquisitions and a negative impact from that of the announcement of cash financed deals. However, studies by Barnes (1984), Travlos (1987), Franks *et al*. (1988), Peterson and Peterson (1991), and Servaes (1991) find the opposite takes place. In terms of long-term performance of bidders Agrawal *et al*. (1992) also show that the post acquisition performance of bidders is weaker in stock acquisitions as compared to cash financed acquisitions in both mergers and tender offers. The more recent study by Loughran and Vijh (1997) also reports significantly higher returns for cash offers as compared to stock offers

The results of this study are comparable to what is found in the studies of Agrawal *et al*. (1992) and Loughran and Vijh (1997). Figure IV and Table 8 display our findings, where stock-financed acquisitions significantly lose by around 37% in the three years after the announcement of a successful takeover. Both cash and mixed offers show insignificant losses of around 8% and 5% respectively. Theory suggests that when management use their own shares for payment they are signalling to the market that they are spreading the risks towards the target shareholders and also that they may believe that their own shares are overvalued. Subsequently, the market will react negatively towards this action. From our sample of 80 related bidders, 30 paid by shares, 29 by cash, 15 with mixed offers, and information was not available on 6 of the company's payment methods. Emery and Switzer (1999) reported that bidders choose the method with the higher expected abnormal return, and that this was related to taxation effects and asymmetric information. Therefore, this brings into question why nearly 38% of related bidders use stock to finance the acquisition when it is generally well known that the market reacts in a far more negative manner to these acquisitions. The large majority of takeovers by shares are also counter to the findings of Fishman (1989) and Berkovitch and Nayaranan (1990) who report that there is greater potential for multiple-bidding when payment is by stock.

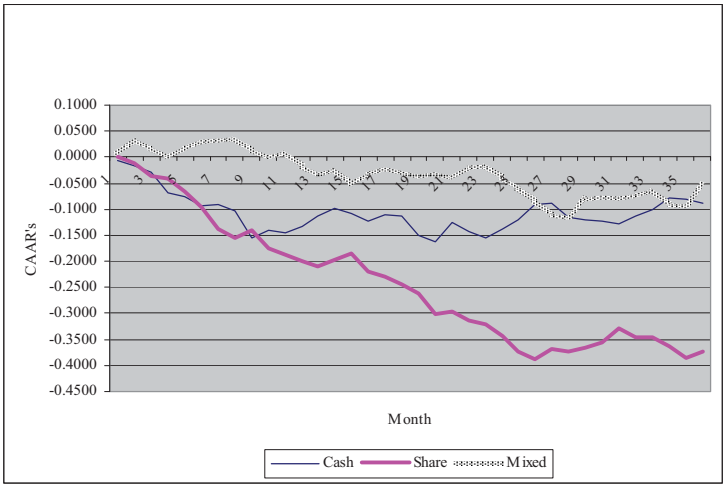

Figure 4. Long-term performance and method of payment of related bidders

Table 8. Long-term performance behavior (Related Sample & Method of Payment)

Month	*Cash offer CAR*	*Share offer CAR*	*Mixed offer CAR*
1	-0.0073	0.0018	0.0069
2	-0.0167	-0.0111	0.0343
3	-0.0295	-0.0364	0.0184
4	-0.0678	-0.0421	0.0006
5	-0.0758	-0.0658	0.0184
6	-0.0928	-0.0960	0.0310
7	-0.0910	-0.1376	0.0320
8	-0.1041	-0.1545	0.0355
9	-0.1553	-0.1409	0.0143
10	-0.1410	-0.1741	0.0015
11	-0.1463	-0.1886	0.0076
12	-0.1333	-0.2005	-0.0158
13	-0.1124	-0.2104	-0.0341
14	-0.0986	-0.1961	-0.0243
15	-0.1073	-0.1854	-0.0514
16	-0.1239	-0.2185	-0.0307
17	-0.1106	-0.2284	-0.0216
18	-0.1131	-0.2432	-0.0287
19	-0.1510	-0.2617	-0.0363
20	-0.1635	-0.3009	-0.0305
21	-0.1266	-0.2974	-0.0394
22	-0.1422	-0.3129	-0.0195
23	-0.1548	-0.3212	-0.0154
24	-0.1375	-0.3423	-0.0395
25	-0.1215	-0.3741	-0.0591
26	-0.0911	-0.3893	-0.0825
27	-0.0889	-0.3689	-0.1110
28	-0.1162	-0.3744	-0.1158
29	-0.1196	-0.3652	-0.0799
30	-0.1238	-0.3552	-0.0764
31	-0.1275	-0.3275	-0.0774
32	-0.1124	-0.3470	-0.0731
33	-0.1003	-0.3452	-0.0632
34	-0.0786	-0.3632	-0.0916
35	-0.0806	-0.3863	-0.0936
36	-0.0875	-0.3725	-0.0540
$CAAR_{0,+720}$ =	-0.0875	(0.3725)***	-0.0540

*** denotes significance at 99% level

When we categorise our related bidder sample by market capitalisation size and look at the method used to pay for the takeover, the results prove interesting. As indicated by Table 7, cash financing is the preferred method of payment for the larger companies (those companies in portfolios 1-4). Prior evidence has shown that cash financed takeovers gain positive returns. Our results support this by showing that the majority of related bidders in portfolios 1-4 gain over the long-term and use cash to fund the takeover. 65% of related bidders in portfolios 1-4 use only cash to finance the bid and a further 25% of this sample use some form of cash in a mixed bid. This is in contrast to the smaller bidder firms in our sample. Related bidders in portfolios 5-8 lose significantly in the three-year post takeover period. Table 7 shows that 63% of firms in this sample choose to pay by their own shares; this is compared to only 10% in portfolios 1-4. Martin (1996) finds support for the thought that the higher the acquirer's growth opportunities, the more likely that stock financing are the preferred payment. Those smaller firms in portfolios 5-8 resort to more share financing and support this theory. Smaller firms are expected to be involved in growth industries and once this growth stabilises, no excess cash will be available to fund the takeover and hence share are used to pay for the deal. Large firms with excess cash are more likely to be in mature industries. This may be in tandem with limited prospects and therefore these funds may be used to acquire firms, aiming for economies of scope, more power and larger profits.

5. Conclusions

This study employed a thorough categorisation process to identify related bidder and also unrelated bidders. The results indicate that shareholders of related bidders enjoy wealth gains whereas unrelated bidder shareholders suffer small losses. The long-term post-acquisition performance of the related bidders does not mirror the earlier success in the period of fifteen days surrounding the first public bid announcement. Related bidders underperform the market significantly over a three-year period. Related bidders also slightly underperform when compared to their respective industry. We find that shareholders lose around 18% in the three years after the acquisition, which is quite similar to that of the unrelated sample. This is similar to Agrawal *et al*. (1992) and Rau and Vermaelen (1998). Related bidders also underperform the industry they are in by approximately 8% over the same time frame, which is in contrast to that found in previous studies. Overall, the results of this study show that perhaps bidders in related takeovers overestimate the possible synergistic benefits from acquiring and once the market learns of this the share-price is adjusted downwards to reflect this. Therefore, this study supplements the earlier findings of Fuller, *et. al.* (2002) and Antoniou et al (2007) by adding that bidder firm losses value even though their acquisitions are motivated by the operational synergy.

Related bidder firms in the larger portfolios outperform firms of similar sizes, whereas the smaller bidder firms underperform firms of similar size to a great extent. There is also strong evidence that the larger bidders prefer to use cash to finance the bid, whereas the majority of smaller bidders fund the deal with their own shares. Furthermore, acquiring firms paying by stock, lose significantly in the long-term, far more so than cash and mixed offer acquisitions, raising the question why 38% of the sample in this study chose stock as the means of exchange.

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Customers' Perception of E-banking Adoption in Cameroon: An Empirical Assessment of an Extended TAM

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Abstract

The 21st century has witnessed dramatic transformation in the financial sector as advances in information technology have created new ways of handling financial transactions through e-banking. In Cameroon, e-banking is still at it infancy and is still to be used as an operating saving tool in reducing cost and promoting customer – banker's relationship. The main aim of this study was to identify the drivers to the customer's perception of e-banking adoption in Cameroon by considering an extension in the Technological Adoption Model (TAM). The extended TAM was assessed using a sample survey of 210 customers. The psychometric properties of the data were investigated using the estimation of internal consistency reliability and the convergent and discriminate validity of the instrument items. The results estimated using a path regression analysis showed that perceived security, trust, cost of service, usefulness, and accessibility have significant influenced on customer's attitudes and hence adoption of e-banking. The results further showed that characteristics such as age, education and marital status have significant influence on customer's attitude. It was also revealed that perceived reliability, trust, security, and accessibility have significant impact on the perceived usefulness of e-banking adoption. Practically, the results show the need to increase e-banking security, accessibility, trustworthiness and to reduce the cost of e-banking services so to encourage customer's attitudes towards the adoption of e-banking services.

Keywords: e-banking, customer's perception, technology adoption model, Cameroon

JEL classification numbers: G21, L11, L86, M40, O31

1. Introduction

The 21st Century has witnessed a dramatic evolution in the financial service industry as a result of the rapid advancement in technological transformation which has become known as e-developments. These changes have engulfed all areas of financial intermediation and financial markets such as e-finance, e-money, electronic banking (e-banking), e-brokering, e-insurance, e-exchanges, and even e-supervision. This new information technology (IT) is turning into the most important factor in the future development of banking, influencing banks' marketing and business strategies. As a result of the rapid advances in IT and intensive competition in the banking sector, the adoption of e-banking is being increasingly used as a channel of distribution for financial services (Mahdi and Mehrdad, 2010).

Electronic banking has experienced explosive growth and has transformed traditional practices in banking (Gonzalez, 2008). In Cameroon, commercial banks' huge investment in telecommunication networks and various e-banking services can be seen as an effort towards measuring up with global standard. This is among other reasons such as increased customer demand, increased competition among banks themselves; derive minimized cost, new entrants, and better service delivery (Muniruddeen, 2007). However, mirroring the development of e-developments, the adoption and diffusion of e-banking is far from uniform, especially between the developed and developing worlds. Yet it is believed that in the long run, developing countries could benefit more from e-banking than developed countries since they could leap frog their technology development by learning from the experiences of the developed nations (Mann, 2000). However, during this development processes, it is expected that the developing countries will face many unexpected and complex factors that inhibit the speed and scale of e-banking adoption (Quershi and Davis, 2007).

Despite the fact that the literature on internet banking is abundant with studies carried out mostly in the developed countries, this area is underrepresented in the developing countries especially those of the Sub

Saharan Africa region, where commercial banks are trying to introduce e-banking systems to improve their operations, reduce costs and increase productivity. This therefore means that e-banking is becoming a strategic weapon used in the distribution channel for their products in the face of intense competition from both home and abroad. However, the efforts aimed at developing better and easier electronic banking systems seem to have remained largely unnoticed by the customers who are yet to fully appreciate the availability of these services in the financial industry.

Consequently, there is a need to understand the relevance of e-banking in developing countries and to identify areas where the developing countries lag behind. There is need to identify factors which inhibit e-banking adoption and diffusion, and those that can affect customer's perception or attitudes towards the adoption of e-banking. These issues are important because it holds the key that will help the banking industry to formulate their marketing strategies to promote new forms of electronic banking systems in the future. Therefore, in order to address the current gap in the literature and encourage further e-banking adoption in developing countries such as Cameroon, a better understanding of the drivers and barriers influencing customer's perception towards e-banking adoption is critical.

This research aims at extending the Technological Adoption Model (TAM) to incorporate the role of demographic and infrastructural factors in influencing customer's perception towards e-banking adoption. In addition, the extended TAM is assessed empirically to validate its application in driving e-banking adoption in Cameroon. The rest of the paper is divided into four sections: the second section contains a review of the literature on the theories which can be used to explain electronic banking and information systems acceptance. In addition, the section reviews previous research on the critical factors which may have significantly influenced the acceptance of e-banking. The third section presents the methodology and developed the hypotheses used in this study. The fourth is made up of the qualitative and quantitative analysis. In this section, the data is analyzed using Partial Least Square (PLS) analysis and the results are presented and discussed. The final section consists of the conclusion and practical implications of the research in Cameroon and other developing economies.

2. Literature Review

Electronic banking (e-banking) is the newest delivery channel of banking services. The definition of e-banking varies amongst researches partially because electronic banking refers to several types of services through which a bank's customers can request information and carry out most of their banking transactions using computers, televisions or mobile phones (Daniel, 1999). According to the Federal Trade Commission (FTC), Fact for Consumers (2006), Electronic banking also known as an Electronic Fund Transfer (EFT), is defined as the use of computer and electronic technology as a substitute for checks and other paper transactions. EFT is initiated through devices like cards or codes that let you, or those you authorize, access your account. Many financial institutions use ATM or debit cards and Personal Identification Numbers (PINs) for this purpose. Some use other forms of debit cards such as those that require at the most, your signature or a scan. In addition, electronic banking can be considered as a variety of the following platforms: internet banking (or online banking), telephone banking, TV-based banking, mobile phone banking and e-banking (or offline banking).

Moutinho and Smith (2000) emphasized that human and technology based delivery channels were greatly linked with the customers' perceptions of how these bank services were delivered to them. They pointed out that these perceptual outcomes would affect the level of bank-customer-satisfaction, retention, and switching. However, for e-banking technologies to improve productivity, they must be accepted by intended users (Venkatesh et al., 2003). Venkatesh et al. (2003) noted that the research in understanding user acceptance of new technology has resulted in several theoretical models with roots in information systems, psychology and sociology.

The current study proposes the application of the Technology Acceptance Model (TAM) to capture the factors which have significant influence on customers' perception towards e-banking adoption. TAM is one of the most utilized models for studying IT acceptance (Al-Gahtani, 2001; Venkatesh and Davis, 1996; Davis et al., 1989). The TAM involves two primary predictors for the potential adopter — Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) of technology as the main determinants of the attitudes toward a new technology. PU is the degree to which a person believes that using a particular system would enhance his or her job performance; while PEOU is the degree to which a person believes that using a particular system would be free of effort (Davis, 1989). These two beliefs create a favourable behavioural intention toward using the IT that consequently affects its self-reported use (Davis et al., 1989). TAM's theoretical background is based on the Theory of Reasoned Action (TRA) and it was specially tailored for understanding user acceptance of information system model. The theory postulates that an individual's behavioural intention is the immediate determinant of behaviour, their attitude and subjective norm are mediated through behavioural intention and their behavioural

and normative beliefs are mediated through attitude and subjective norm. Intention is considered a direct determinant of behaviour in the TRA that is influenced by the attitude (attitude toward performing behaviour), and subjective norms (social pressures to perform behaviour). TRA has been tested and used extensively as well as its extension, the Theory of Planned Behaviour (TPB) by Ajzen (1991). Ajzen extended TRA by adding another construct called Perceived Behavioural Control, which refers to an individual's perception of the presence or absence of requisite resources and opportunities required to perform the specific behaviour.

TAM has been the instrument in many empirical studies and it has been found that its ability to explain attitude towards using an information system is better than TRA and TPB (Mathieson, 1991). King and He (2006) conducted a statistical meta-analysis of TAM as applied in various fields using 88 published studies and the results showed TAM to be a powerful, highly reliable, valid and robust predictive model that may be used in a variety of contexts. Wang et al. (2003) confirm the validity of TAM and support its use with different populations of users and different software choices.

Many researchers have suggested that external variables may be added to TAM as a way of improving the model's predictive power (Muniruddeen, 2007; Davis et al., 1989; Davis, 1993). In particular, Muniruddeen (2007) employed the extended TAM to examine individual's perceived security and privacy of internet banking in Malaysia. Siu-Cheung and Ming-te (2004) also extended the model with the Subjective Norm and Social Cognitive Theory (self-efficacy) of Bandura (1982) to explain the intention to use internet banking in Hong Kong. Jahangir and Begum (2008) also employed the extended TAM with attitude as defined by Theory of Reasoned Action to determine customer's adaptation to e-banking.

3. Methodology and Hypotheses

3.1 Extended TAM Model for Perceived E-banking Adoption

This study proposes an extension to the Technology Acceptance Model (TAM), since the original TAM with two main constructs; Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) is unable to fully explain users' behaviour towards new emerging information technology. From the review of the theoretical discussion above, it is deemed necessary to examine additional drivers influencing customers' perception and attitude towards e-banking adoption in Cameroon. We therefore account for the impact of additional variables not used in previous studies such as: Perceived Cost of Service, Perceived Accessibility and demographic characteristics such as marital status. Other variables also included in the extended TAM include: Perceived Quality of Internet Connection, Perceived Security, Perceived Trust, Perceived Reliability and demographic characteristics such as age, income level, and gender.

The extended Technological Adoption Model in electronic banking adoption is illustrated in Figure 1 below;

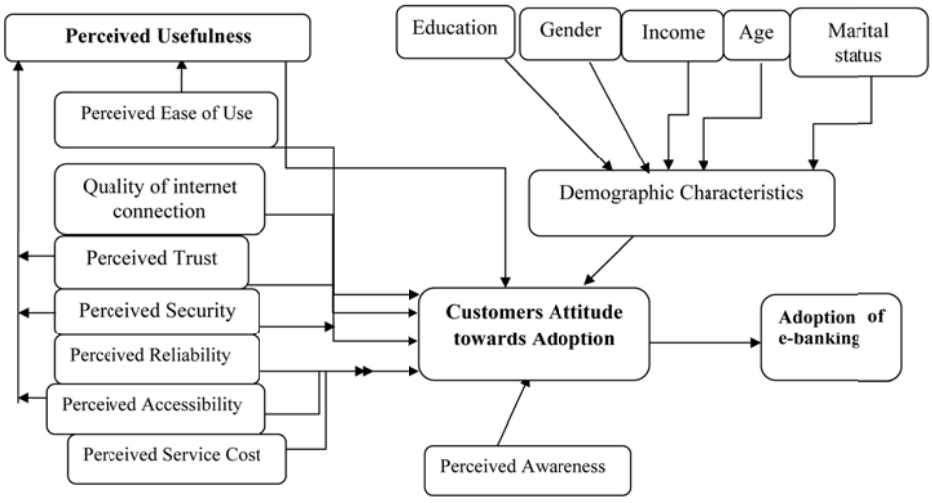

Figure 1. Extended TAM Model for E-Banking Adoption in Cameroon

The above framework modifies the original TAM by incorporating both the Behavioural Intention towards e-banking and the actual adoption of e-banking. In addition, demographic characteristics are considered vital in influencing customers' attitudes towards adoption and thus also included in the model. The variables used in the extended TAM are explained below.

3.2 Definition of Variables in the Model

Customers Attitude (CA) refers to users' positive or negative feeling towards the adoption of e-banking (Davis et al., 1989; Taylor and Todd, 1995). That is, a person's desirability to use the system or his/her perception about electronic banking credibility and reliability.

Perceived Reliability (PR) refers to the extent to which e-banking services are reliable to influence its adoption by customers.

Perceived Ease of Use (PEOU) refers to the degree to which the users perceived that using this electronic banking would be free of effort, that is, the ease of learning and using electronic banking (Davis et al., 1989).

Perceived Usefulness (PC) is the degree to which the users believed that adopting electronic banking will improve their bank transactions.

Perceived Security (PS) is defined as users' perception of protection of their transaction details and personal data against unauthorized access. Security refers to the protection of information or systems from an unauthorized intrusion, that is, the degree to which the customer perceives e-banking to be easily susceptible to fraud.

Perceived Trust (PT) refers to the belief that the promise of another can be relied upon and that, in unforeseen circumstances, the other will act in a spirit of goodwill and in a benign fashion toward the trust. Trust has three characteristics: ability, benevolence, and integrity (Mayer et al., 1995).

Perceived Cost of Service (PCS) refers to the degree to which the customers believe that the cost of using the e-banking services is expensive.

Perceived Accessibility (PA) is the extent to which customers can have access to e-banking services at anytime and anywhere. Accessibility to electronic-based services such as: cash withdrawal, deposits, check balances, transfer funds, loan applications, and other complementary services should be performed from anywhere at any time.

Perceived Awareness (PAw) refers to the degree to which the users are informed about the existence of the new technological innovation. That is the amount of information a customer has about electronic banking as well as its benefits and challenges.

Quality of Internet Connection (QIC) refers to the degree to which internet connection will enable the completion of e-banking transactions. This is seen to be an essential component for any internet-based application. Since internet banking is considered as the most prominent e-banking distribution channel, we obviously need a good internet connection to ensure completion of its transactions.

Demographic characteristics

Many studies have investigated the effects of the customers' demographic characteristics such as age, gender, income and educational level on their attitude towards different banking technologies and individual adoption of new technology.

Education refers to the degree to which users or non-users are educated, since it is believed to play a significant role with regards to attitude towards technology adoption and usage. According to (Burke, 2002) higher educated customers such as university graduates are more comfortable in using technology given that education is often positively correlated with an individual's level of internet literacy.

Gender illustrates the difference in attitudes between male and female towards the adoption and usage of new technology. It is hard to say if males or females may be more likely to adopt e-banking.

Customer's income is another demographic factor of interest. It refers to the extent to which the level of income of users or non-users will influence their attitudes to adopt e-banking. It has not featured prominently in empirical studies on the adoption and diffusion of technology. We believe that it can exert a positive impact on customer's attitude towards e-banking adoption, given that high income earners are more likely to use these services.

Age will capture the attitudes towards adoption of new technology amongst different age groups. Previous studies on technology acceptance propose that there is a strong relationship between age and the adoption of new technology. That is, it is observed that older customers are found to have negative attitude towards technology

and innovation as compared to younger adults who are more interested in using these new technologies. Thus, older customers are less likely to adopt e-banking.

Marital status refers to whether the respondent is single or not. This variable is not popular in the literature. It is expected that customer's attitudes towards e-banking adoption will be higher in singles than couples.

3.3 Hypotheses Development

From the theoretical model developed above, the following research hypotheses are formulated;

H1: Customers' Attitude positively influences the intention to adopt e-banking

H2: Perceived Usefulness has a positive influence on Customers' Attitudes

H3: Perceived Ease of Use has a positive influence on Customers' Attitude

H4: Perceived Trust influences Customers' Attitude positively

H5: Perceived Reliability influences Customers' Attitude positively

H6: Perceived Security has a positive influence on Customers' Attitude

H7: Quality of Internet Access influences Customers' Attitude positively

H8: Perceived Accessibility influences Customers' Attitude positively

H9: Perceived Cost of Service exerts a negative influence on Customers' Attitude, hence adoption of e-banking

H10: Perceived Awareness has a positive influence on Customers' Attitude

H11: Perceived Accessibility has a positive influence on Perceived Usefulness

H12: Perceived Reliability has a positive impact on Perceived Usefulness

H13: Perceived Trust has a positive influence on Perceived Trust

H14: Perceived Security has a positive influence on Perceived Usefulness

H15: Perceived Ease of Use influences Perceived Usefulness positively

3.4 Data Collection

The data in this study is collected using self-administered questionnaires that were distributed to 210 customers of commercial banks in three main cities notably – Bamenda, Douala and Yaounde considered to be the best representative communities which reflect the different live pattern in Cameroon. The main aim of using questionnaires was dedicated to capture respondent experience and perception about e-banking services offered. To ensure the validity and reliability of the questionnaire, a two-stage validation was conducted. First, whenever possible, items selected for the constructs were mainly adapted from prior studies with minor changes to fit the e-banking context in Cameroon. Second, a pre-test (pilot) of the questionnaire was administered to a sample of 20 bank customers randomly chosen in order to correct any issues related to language and response options. The appropriate changes were made in the survey questions before the final distribution and administration process.

4. Data Analysis, Quality Assessment and Discussion of Results

The data obtained was analyzed using both descriptive and quantitative techniques. Descriptive techniques involved the use of descriptive statistics while quantitative technique will involve two steps. Step one assessed the variables in our models for internal consistency, reliability and validity. Then based on our satisfactory results in step one, the data is analysed in step two using the Structural Equation Modelling (SEM) technique. This technique enables the assessment of the proposed relations among the variables in the model. This technique is considered adequate because of its ability to test causal relationships between constructs with multiple measurement items (Jöreskog and Sörbom, 1993).

4.1 Respondents Profile

The qualitative results revealed that 57.5% of the respondents were male and the largest proportion (47%) of respondents by age group, were those in the 20-30 years old category, followed by those in the 30-40 year category (40%) and 13% of the respondents were above the age of 40. The surveyed respondents were generally well educated with over 30% holding an advanced degree, 43% having a first degree and 27% having a Masters degree and above. On the basis of monthly income level, the majority of the respondents (32%) had monthly income level between 100,001 and 250,000FCFA while 22% had monthly income levels between 50,001 and 100,000FCFA; 14% had income levels of between 250,001 and 350,000FCFA; 17 percent had income levels less than 50,000FCFA, 15 percent of respondents had a monthly income greater than 350,000FCFA. The results

also showed that 28.33% of the respondents indicated internet banking as their preferred method for performing banking transactions and up to 57% of the respondents visited the bank to conduct their banking transactions 1 to 4 times in a month. ATM usage prevailed as the main means of carrying out banking transactions, followed by the internet and telephone banking respectively.

With regards to factors that could motivate customers toward the adoption of e-banking, we observed that respondents had more than one motive for adopting and using these e-banking services. The majority of the respondents indicated positive ratings thus, 48.3% of the respondents reported high perceptions of convenience, 40% of the respondents indicated high perceptions of accessibility, 32.5% of the respondents indicated high perceptions of queue management and 29.17% of the respondents had high perceptions of ease of use as factors that motivated them to adopt and use these services. However, as concern indicators that could pose as barriers for the adoption of e-banking services, some respondents indicated personal reasons, while a majority of the respondents indicated lack of trust, poor security and privacy corcern. Others highlighted poor internet connection. Lastly, some respondents felt they need time to learn about the new system before using it.

4.2 Reliability and Validity Test

Reliability and validity were tested for each set of the items which had a construct, that is, for variables that were captured by more than one question. Both the Cronbach's Alpha and the Composite Reliability were used to test for constructs reliability and validity, respectively. All reliability measures were well above the recommended level of 0.70 as an indicator for adequate internal consistency. The results are presented in Table 1 below.

The constructs also illustrated satisfactory convergent and discriminant validity. As suggested by Fornell and Larcker (1981), convergent validity is adequate when constructs have an Average Variance Extracted (AVE) of at least 0.5. Also, convergent validity can be examined when items loading are well above 0.5 on their associated factors as an indicator of adequate reliability (Hair et al., 1992). Table 1 also lists the psychometric properties of the constructs.

Table 1. Reliability Results

Variables	Items	Loading	Cronbachs' Alpha	Composite Reliability	Average Variance Extracted
Quality of internet connection (QOI)	QOI1	0.876	0.793	0.884	0.718
	QOI2	0.840			
	QOI3	0.825			
Perceived Security (PS)	PS1	0.782	0.756	0.847	0.583
	PS2	0.778			
	PS3	0.849			
	PS4	0.628			
Perceived Trust (PT)	PT1	0.858	0.724	0.846	0.648
	PT2	0.727			
	PT3	0.825			
Perceived Accessibility (PA)	PA1	0.796	0.701	0.870	0.634
	PA2	0.796			
Perceived Awareness (PAw)	PAw1	0.709	0.722	0.846	0.646
	PAw2	0.822			
	PAw2	0.873			
Perceived Reliability (PR)	PR1	0.879	0.700	0.872	0.772
	PR2	0.879			
Customer Attitude (CA)	CA1	0.773	0.820	0.884	0.656
	CA2	0.854			
	CA3	0.811			
	CA4	0.799			
Perceived Ease of Use (PEOU)	PEOU1	0.875	0.810	0.888	0.726
	PEOU2	0.867			
	PEOU3	0.812			
Perceived Usefulness (PU)	PU1	0.739	0.804	0.869	0.572
	PU2	0.762			
	PU3	0.615			
	PU4	0.850			
	PU5	0.796			
	PU6	0.796			

Source: Computed from data collected from field survey, 2011

As observed from the table above, all the constructs satisfy the conditions for internal consistency and convergent validity. Table 2 below gives the results for the discriminant validity of the constructs, with correlation among constructs and the square root of average variance extracted (AVE) on the diagonal. All indicators load more highly on their own constructs than on other constructs. Moreover, the correlation between the various construct is very low, indicating that multicollinearity is not a problem among the variables. All these results point to the fact that the convergent and discriminate validity of our instruments items are valid.

Table 2. Discriminant Validity Results

Variables	QOI	PS	PT	PR	CA	PEOU	PU	PA	PAw
QOI	0.847								
PS	0.511	0.763							
PT	0.478	0.281	0.805						
PR	0.357	-0.109	0.445	0.878					
CA	0.116	0.205	0.404	0.449	0.810				
PEOU	0.188	0.367	0.313	0.188	0.258	0.852			
PU	0.236	0.399	0.466	0.390	0.662	0.452	0.756		
PA	0.384	0.284	0.462	0.666	0.414	0.334	0.472	0.796	
Paw	0.231	0.354	0.562	0.126	0.213	0.196	0.285	0.328	0.669

Source: Computed from data collected from field survey, 2011

4.3 Results of Hypotheses Testing Using SEM

Table 3 presents the result of testing the structural links of the proposed extended TAM using a SEM analysis.

Table 3. Partial Least Square Results

Regression path		**Path coefficient (β)**	**R^2**	**P-Value**	**Remarks**
Dependent variable	**Path variable**				
Adoption	CA	0.249	0.166	0.098*	Significant
Customers' attitudes towards e-banking adoption	Age	-0.072	0.572	0.042*	Significant
	Income	-0.030		0.140	Not Significant
	Gender	0.007		0.889	Not Significant
	Marital status	0.069		0.098*	Significant
	Education	0.052		0.069*	Significant
	PU	0.011		0.101*	Significant
	PEOU	0.236		0.090*	Significant
	PT	0.023		0.082*	Significant
	PR	0.012		0.582	Not Significant
	PS	0.001		0.083*	Significant
	QOI	0.056		0.644	Not Significant
	PA	0.027		0.092*	Significant
	PCS	-0.050		0.065**	Significant
	Paw	0.163		0.086*	Significant
Perceivd Usefulness	PA	1.086	0.352	0.006***	Significant
	PR	0.689		0.100*	Significant
	PT	0.781		0.005***	Significant
	PS	0.285		0.081*	Significant
	PEOU	0.206		0.098*	Significant

NB: *, ** and *** denotes statistical significance at 10%, 5% and 1% levels, respectively.

The estimated path coefficients are given along with the associated p-values. Most of the coefficients are significant at the 10% level of statistical significance providing strong support for most of the hypothesized relationships. The results actually show that H1, H2, H3 H4, H6, H8, H9, H10, H11, H12, H13, H14 and H15 are

statistically significant while H5 and H7 are statistically insignificant. These results represent another confirmation of the appropriateness of the TAM for explaining voluntary individual behaviour. The results also provide support for the new links added to the extended TAM representing the effects of Trust (T), security (Se), perceived cost of services (PCS), perceived accessibility (PA), perceived reliability (PR), quality of internet connection (QIC), perceived awareness (PAw), demographic characteristics and costumer's attitude (CA) towards the adoption of e-banking.

From the results in Table 3, it is noted that the overall adoption of e-banking is predicted by customer's attitude which explained 16.6% of the variation in the adoption of e-banking. The path has a positive effect, with a coefficient of 0.249 indicating that the higher the customer's attitude towards adoption, the more likely the customers are to adopt e-banking.

As concern the drivers of customer's attitude, it is statistically explained by variables such as age, marital status, education, perceived usefulness, perceived trust, perceived reliability, perceived security, perceived accessibility, perceived awareness, perceived ease of use and perceived cost of service. These variables jointly explain 57.2% of the variation in customer's attitude towards e-banking adoption. All of these variables except age and perceived cost of service have a positive influence on customer's attitude towards e-banking adoption. However, the variables - gender, income and perceived reliability are statistically insignificant drivers of customer's attitude. The results of this study are consistent with some of the findings of Baraghani (2008) and Wu and Chen (2005).

The results also showed that perceived accessibility, perceived reliability, perceived trust, perceived security and perceived ease of use influenced perceived usefulness of e-banking services. These variables jointly explained 35.2 percent of the variation in perceived usefulness.

4.4 Discussion of Results

This study has made an attempt to describe the e-banking adoption of customers in Cameroon by extending the TAM. The results in this study reveal that customers' attitude has a positive effect on e-banking adoption. This implies that if customers have a positive attitude; feel more confident about e-banking and think adopting it will add more value to them then their desire to use and even encourage others to use it will increase. This result is in line with Al-Somali et al., (2012) contention that there is a significant relation between Customer's Attitude and internet banking adoption. In terms of the role of Perceived Ease of Use, our results show that Perceived Ease of Use affects both the perceived usefulness and the attitudes towards the adoption of e-banking. This result is contrary to the results obtained by Liu et al. (2003) who found out that that Perceived Ease of Use affects Perceived Usefulness but does not impact on Attitude towards adoption.

This study provides additional empirical evidence that supports the notion that, perceived trust, perceived ease of use, perceived awareness and perceived usefulness are useful predictors of customer's attitude towards e-banking adoption. Hence, based on the above results, if customers are aware and perceive learning to use these services to be free of efforts and have an added value in terms of time saving and security in performing their transactions, they will develop a positive attitude towards its adoption. If they also feel e-banking is trustworthy given that online transactions contain sensitive information and they are certain that the bank will ensure limited access to their critical files and information, they will be motivated to adopt and use these e-banking services. Furthermore, the results provide facts that perceived security significantly influences customers' attitude towards e-banking adoption. However, there is evidence to show that perceived cost of e-banking services has a negative and statistical significant influence on customer's attitudes towards e-banking. A result indicating that customer's attitude towards e-banking adoption will decrease with increases in the cost of the service being provided. Thus, banks providing e-banking services should ensure that the cost of the services is affordable to an average income earner in Cameroon.

In addition, customers' demographic characteristic such as age was found to have a negative effect on customers' attitude towards e-banking adoption. This result implies that older customers have a negative attitude towards technology innovation as a whole and e-banking in particular as compared to younger adults who are more interested in using this new technology. This view is consistent with Alagheband (2006) who also asserts that young individuals are more likely to adopt internet banking. The result for marital status shows that the customer's attitude towards e-banking adoption is higher for singles. A result that potential shows that singles are more likely to adopt and use e-banking services than couples. It may simply indicate that it is more convenient for singles to use e-banking than couples. Education also proves to be a very important determinant of customer's attitude towards e-banking adoption. This implies that the more educated a customer is, the more likely they are to adopt e-banking services. Specifically, being educated will facilitate the learning process and

will influence the ability of the customer to adopt e - banking as compared to an uneducated customer. However, other demographic characteristics of customers such as income level and gender were statistically insignificant in influencing customer's attitude towards adoption.

The results also provide statistical evidence to show that reliability, trust, accessibility, ease of use and security will significantly influence customer's perception of the usefulness of e-banking services. The results illustrate that banks should ensure that e-banking distribution channels are always reliable; secured, accessible, easy to use and trustworthy. These results put together imply that banks should provide more security measures such as firewalls that can be used to protect the internal network of banks. For if banks can ensure these security measures, customers will turn to have confidence in adopting and using these e-banking services without any hesitations.

5. Conclusion and Policy Implications

The challenge of the 21st century is enormous in the financial markets. The quest for efficiency amidst global competition has changed the entire platform of financial services and face to face financial services are fast declining, as more financial institutions open their doors to technological transformation aimed at implementing e-banking services. It is therefore of supreme importance for these institutions to identify factors that would influence customers' perception and attitude towards e-banking adoption and usage. The primary objective of this study was to understand those drivers and barriers that influence customer's attitudes and perception towards e-banking adoption in Cameroon in the light of the extended TAM. By extending TAM, this study reveals results that support arguments made by other researchers claiming that perceived usefulness and perceived ease of use were not sufficient to determine the consumers' behavioural intention to use information technology systems.

Accordingly, the study proposed that the adoption of electronic banking could be modelled in terms of the TAM by selecting other control constructs namely; perceived accessibility, perceived trust, perceived security, perceived reliability, perceived cost of services, perceived awareness, perceived ease of use and demographic characteristics, such as age, income level, gender and marital status. Moreover, the results of the statistical analysis revealed that the above mentioned constructs employed prove to have a significant influence on customers' attitude towards e-banking adoption, though variables such as; age, income, and cost of service have a negative relation with customers' attitude towards e-banking adoption.

In conclusion, this study provides evidence that clearly reflect that customers perceive e-banking in terms of its usefulness, ease of use, trustworthiness, cost effectiveness, reliability, convenient, and accessibility. Electronic banking is seemingly becoming a matter of need and holds the key that will help the banking industry to formulate their marketing strategy as well as continue to compete in the globalized network and gain market competitive advantage in the 21st century. Cameroon is at its infancy stage of e-banking adoption and usage, thus there is need for bankers to adopt strategies that will encourage customers' attitudes towards e-banking adoption, such as emphasizing the positive safety features in any marketing campaign. It is also important to improve on the security features of the system being used, since this could re-assure the customers that e-banking is a safe mode to perform transactions. There is need to promote trust, reliability, accessibility and awareness of e-banking services. Banks should also offer proper education and training to the customers emphasizing the relative ease and safety in using e-banking services so as enhance their overall confidence in the use of electronic banking services in the long term. Finally, the results provide evidence that there is need to make e-banking in Cameroon user friendly since many users in Cameroon are yet to become technically equipped in using these services.

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A Family of Stochastic Unit GARCH Models

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Abstract

A class of Asymmetric GARCH models is presented. It shares the same unconditional variance and volatility forecast formula as the standard GARCH(P,Q) model under the assumption of a symmetric conditional distribution for innovations. use three models of this class to assess their ability to forecast S&P 500 market volatility and to make better decisions for the purpose of risk management and investment. Subsequently, a comparison is made with respect to competing models (GARCH, EGARCH, GJR). It was found that for the in-sample evaluation, the best model is obtained from the Stochastic Unit GARCH (SUGARCH) model where leverage effects are introduced through the GARCH (i.e β_1) parameter. For the out-of-sample evaluation (QLIKE loss function), it is better to use the SUGARCH class where the asymmetry appears on the ARCH (i.e α_1) parameter.

Keywords: time-varying coefficients, GARCH models, market volatility, forecasting

1. Introduction

Understanding how the market volatility evolves is challenging for financial investors. This information can be used for many purposes among which risk management activities, trading strategies and option pricing. A common stylized fact of financial time series is that large absolute returns are more likely to be followed by large absolute returns. The same remark also applies for small returns. This stylized fact, known as volatility clustering, had motivated the work of Engle (1982) who proposes the ARCH(P) model where the conditional variance depends linearly on lagged squared innovations. In financial applications, to obtain a good fit, one needs a big integer for the parameter *P* and therefore more parameters to be estimated. In order to achieve a parsimonious parametrization, Bollerslev (1986) introduced the Generalized ARCH(P) model denoted by GARCH(P,Q). This model has the ability to sufficiently fit well asset prices even with small integers *P* and *Q*. During 1990s, another extension appears that integrates the fact that negative and positive return innovations impact differently future volatilities. Namely, the empirical evidence shows that impact of negative returns are more important than the positive ones (leverage effects). There are nowadays many GARCHs models that take into account this asymmetric effect, see Nelson (1991), Glosten, Jagannathan, and Runkle (1993), (GJR for short). Brownlees et al. (2011) provide also a good reference on this issue by make a forecasting comparative study.

A third extension is to consider many regimes of univariate GARCH models instead of one to generate enough skewness and kurtosis to match those of financial asset returns. The regimes may be independent or chosen through a Markov chain and the corresponding models are known as Markov regime switching GARCH models. Some papers related to this issue are Klaassen (2002), Marcucci (2005) and references therein. Switching GARCH models aim to capture the fact that volatility shocks are not persistent inside a regime (low or high volatility). Also, in these models, a small shock may be followed by a big shock and conversely a big shock may be followed by a small one. However, it is known that models with many parameters may have some problems of convergence in the estimation process or a lack of robustness in the out-of-sample evaluation because of the over-fitting phenomenon. For example, Marcucci (2005) demonstrates that Markov regime switching GARCH models do not dominate the single GARCH models with respect to VaR-based loss functions. He also finds the same results for volatility forecast accuracyfor which no model clearly outperforms the others if short and long run time period are considered. Christoffersen and Jacobs (2004), for option pricing purpose, consider several single GARCH models. They find that the leverage GARCH model is not dominated with respect to other asymmetric models having more parameters in their formulation. All these results motivate us to provide a mathematical model that is based on a single Asymmetric GARCH framework. The first contribution of the paper is to propose a stochastic unit GARCH (SUGARCH hereafter) model defined by a standard GARCH model where some coefficients are multiplied by a

predictable stochastic factor having an expected value of one. In other words, the model may be seen as a GARCH model in "mean". In contrast to other asymmetric models, the SUGARCH(P,Q,O) class cannot include an integer which is greater than one for its third parameter *O*. If not, the GARCH model in "mean" property will be lost and the latter is the main difference with respect to other asymmetric models. Therefore, the class is always SUGARCH(P,Q,1) and may be denoted simply by SUGARCH(P,Q) where *P*, *Q* are strictly positive integers. Consequently, the model may be reliable for investors/market participants who want to use a model capturing both complexity (time-varying parameter) and simplicity (standard GARCH) for their investment or risk management purpose. The second contribution of the paper is empirical. It is found that asymmetric models perform well in the in-sample data if leverage effects are introduced on the GARCH parameter β. However, for the out-of-sample data, the relative performance is not too good and it is preferable to introduce leverage effects on the ARCH parameter α as usually done in the literature.

The remaining in this paper is organized around four sections. Section 2 presents the SUGARCH(P,Q) class and its competing asymmetric models. Section 3 describes the data and the methodology used in the empirical application. Section 4 presents the empirical results and the last section concludes.

2. Some AGARCH Models

2.1 The SUGARCH Class

The idea of SUGARCH class is to capture some properties of the standard GARCH model by taking into account the leverage effects. Specifically, I define it as a standard GARCH model with some coefficients multiplied by a predictable factor say v_t. The latter is such as $E(v_t)=1$. In the next step, to share some properties with GARCH models, some additional constraints are introduced on the conditional distribution of innovations which must belong to the class of symmetric distributions. This condition is not too restrictive since we may find some of them with more kurtosis than the normal distribution (i.e Student Law,).

In this study, I am interested on forecasting conditional volatility on short horizon using daily data. So the conditional mean is supposed to be constant as in Klaassen (2002) or Marcucci (2005). Let S_t and r_t be respectively the security prices and security logarithmic returns, μ the conditional mean, then the SUGARCH(P,Q) class is defined by

$$r_t = \mu + \varepsilon_t = \mu + \sigma_t \eta_t, \quad (\varepsilon_t = \sigma_t \eta_t) \tag{1a}$$

$$\sigma_t^2 = \alpha_{0,t} + \sum_{i=1}^{P} \alpha_{i,t} \varepsilon_{t-i}^2 + \sum_{j=1}^{Q} \beta_{j,t} \sigma_{t-j}^2, \tag{1b}$$

$$\eta_t \sim IID\ f(0,1), \tag{1c}$$

where $\alpha_{0,t}$, $\alpha_{i,t}$, $\beta_{j,t}$ may be either constant ($\alpha_{0,t} = \alpha_0$, $\alpha_{i,t} = \alpha_i$, $\beta_{j,t} = \beta_j$) or stochastic. In the latter case, their expression is given by

$$\alpha_{0,t} = \alpha_0 v_t, \quad \alpha_{i,t} = \alpha_i v_t; \quad \beta_{j,t} = \beta_j v_t; \quad with \ \ v_t = 1 - \gamma \varepsilon_{t-1}. \tag{2}$$

The term $f(0,1)$ represents a (generic) symmetric density function with zero mean and unit variance and γ is the parameter that models asymmetry between negative and positive shocks. Note that, from Eq. (2), $E(v_t) = 1$ by using Eq. (1c) and a SUGARCH(P,Q) class has $2^{P+Q+1} - 1$ asymmetric models (Note 1). Hereafter, I will work only with the general SUGARCH model where each parameter is stochastic since the other special cases may be obtained from the same methodology. In this case, the conditional variance (1b) may be rewritten as

$$\sigma_t^2 = \left(\alpha_0 + \sum_{i=1}^{P} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{Q} \beta_j \sigma_{t-j}^2 \right) - \gamma \varepsilon_{t-1} \left(\alpha_0 + \sum_{i=1}^{P} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{Q} \beta_j \sigma_{t-j}^2 \right). \tag{3}$$

So to obtain an unconditional variance which is equal to the standard GARCH model, we need the expected value of the second term of Eq. (3) to be zero. For this, I assume the distribution of η_t to be symmetric with mean 0 which is a sufficient condition. In the appendix, it is then shown:

$$E(\sigma_t^2) = \overline{\sigma} = \frac{\alpha_0}{1 - \sum_{i=1}^{P} \alpha_i - \sum_{i=1}^{Q} \beta_i}. \tag{4}$$

Since the conditional volatility must be always positive and to obtain a covariance stationary model, the following constraints are made:

$$\alpha_0 > 0,\ \ \alpha_i \geq 0,\ \ i = 1,\cdots,P;\ \ \beta_j \geq 0,\ \ j = 1\cdots,Q;\ \ \sum_{i=1}^{P}\alpha_i + \sum_{j=1}^{Q}\beta_j < 1 \tag{5a}$$

$$|\gamma| < \frac{1}{\max\{|\varepsilon_t|, t = 1,\cdots,N\}},\ \ \varepsilon_t = r_t - \mu, \tag{5b}$$

where N is the number of observation returns.

Eq. (5a) gives the same GARCH constraints. Eq. (5b) handles the positivity of the stochastic factor $v_t = 1 - \gamma\varepsilon_{t-1}$ to ensure the positivity of the conditional variance, see (2). A general bound may be taken for the innovations and then for the parameter γ. Here, I let the bound to depend on the data. The idea is to allow a big range of γ since the leverage effects are introduced by this parameter. In practice, since investors generally work with high frequency (intra or daily) observations, the conditional mean μ in Eq (1a) is often small and so the innovations may be approximated by asset returns in Eq. (5b) (Note 2). It is also expected that γ will be positive to integrate the fact that negative shocks impact more future volatilities than positive shocks.

On the other hand, when a big shock appears in the innovations, the volatility cannot persist for a long time. This is due to the multiplicative factor v_t that alternatively allows large and small volatility movements in a symmetric way since (ε_t) behaves as a fair game. Namely, we may have a small shock in a period of high volatility or a big shock in a period of low volatility. This feature is also shared by switching GARCH models that allow the volatility process to be in different levels. To see formally the link, note that if we have two regimes, as it is often the case in financial applications, the standard GARCH coefficients take two different values. Here, for more flexibility, the SUGARCH class allows stochastic coefficients v_t valued in $\mathbb{R}$ (Note 3)

Even if the coefficients are random, the framework is still similar to the standard GARCH model; which is an an interesting result. We have seen that both models share the same unconditional variance. The difference only appears *locally* where the stochastic factor v_t generates asymmetry effects and extreme movements for the conditional variance. This is the main feature that differentiates our model to other Asymmetric GARCH models which have also time-varying parameters but with an expected value different from 1. Consequently of these oscillations, the kurtosis of the distribution increases. Specifically, if the sixth moment of the asset return exists, it can be shown, see the appendix, that

$$E(\sigma_t^4) = \frac{\alpha_0^2 + E(\sigma_t^2)\left[2\alpha_0\alpha_1 + 2\alpha_0\beta_1 + \gamma^2\alpha_0^2\right] + \gamma^2 E(\sigma_t^6)\left[15\alpha_1^2 + \beta_1^2 + 6\alpha_1\beta_1\right]}{1 - 3\alpha_1^2 - \beta_1^2 - 2\beta_1\alpha_1 - 2\gamma^2(3\alpha_0\alpha_1 + \alpha_0\beta_1)}. \tag{6}$$

For the forecast purpose, I use the simplest SUGARCH (1,1) class corresponding to P = Q =1. In this case, a closed formula for any multi-step-ahead volatility forecasts exists. Its form is similar to the standard GARCH(1,1) model where the difference appears only on the initial condition. Namely, we have for any integer $h \in \mathbb{N}^*$,

$$E_t(\sigma_{t+h}^2) = \frac{\alpha_0\left[1 - (\alpha_1 + \beta_1)^{h-1}\right]}{1 - \alpha_1 - \beta_1} + (\alpha_1 + \beta_1)^{h-1}\sigma_{t+1}^2, \tag{7}$$

where σ_{t+1}^2 is the conditional volatility defined from (1b) i.e

$$\sigma_{t+1}^2 = \alpha_{0,t} + \alpha_{1,t}\varepsilon_t^2 + \beta_{1,t}\sigma_t^2$$

In this study, I only consider three of the seven asymmetric models of the SUGARCH(1,1) class given by the following conditional volatilities:

$$\sigma_{t+1}^2 = \alpha_0(1 - \gamma\varepsilon_t) + \alpha_1\varepsilon_t^2 + \beta_1\sigma_t^2 \tag{8a}$$

$$\sigma_{t+1}^2 = \alpha_0 + \alpha_1(1 - \gamma\varepsilon_t)\varepsilon_t^2 + \beta_1\sigma_t^2 \tag{8b}$$

$$\sigma_{t+1}^2 = \alpha_0 + \alpha_1\varepsilon_t^2 + \beta_1(1 - \gamma\varepsilon_t)\sigma_t^2 \tag{8c}$$

The four remaining asymmetric formulations use at least two stochastic parameters and I find that they do not produce any significant difference with respect to formulations (8a), (8b), (8c). Another reason for choosing these

three conditional volatilities is that they integrate leverage effects respectively on the constant α_0, ARCH α_1 and GARCH β_1 parameter of the standard GARCH model. Therefore, it allows seeing which is the best way to capture asymmetry shocks on financial time series. The intuition of these three formulations is to model the negative correlation between past shocks (or returns) and future volatility. To the best of my knowledge, this problem is not studied in the literature and authors generally use a formulation similar to (8b) i.e asymmetry introduced through the ARCH parameter.

In the next section, I present two competing models (EGARCH, GJR), belonging to the class of asymmetric GARCH models. Additionally, I include the symmetric GARCH model which may give good results in the out-of-sample evaluation of volatility forecasts. Since the true conditional variance is not observable, square returns are used as a conditionally unbiased volatility proxy. The advantage of this proxy is that it ensures the correct ranking of predictive models in terms of the QLIKE loss functions, see Eq. (12). The other loss functions such that Mean Absolute Error, the Mean Square Errors on standard deviations may give some biases, see A. Patton (2011) for more information.

2.2 Competing Models

The EGARCH model: The Exponential GARCH (EGARCH) model is proposed by Nelson (1991). As its name indicates, the variable of interest is the logarithm of the conditional variance. It is defined as follows:

$$r_t = \mu + \varepsilon_t; \quad \varepsilon_t = \sigma_t \eta_t \tag{9a}$$

$$\ln \sigma_t^2 = \alpha_0 + \sum_{i=1}^{P} g(\eta_{t-i}) + \sum_{j=1}^{Q} \beta_j \ln \sigma_{t-j}^2 \tag{9b}$$

$$g(\eta_{t-i}) = \alpha_i \left[|\eta_{t-i}| - E(|\eta_{t-i}|) \right] + \gamma_i \eta_{t-i}, \tag{9c}$$

where η_t was defined in Eq. (1c). The asymmetry between negative and positive shocks is modeled by the parameters (α_i, γ_i), $i = 1, \cdots, P$. Note that, if we are interested in forecasting, the conditional variance of EGARCH must depend on the distribution of η_t through $E(|\eta_{t-i}|)$. Since η_t has a generic symmetric density f(0,1), I consider in this study two normalized distributions. The first is the Normal distribution:

$$f_{\eta_t}(x) = \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{x^2}{2}\right), \quad E(|\eta_t|) = \sqrt{\frac{2}{\pi}}.$$

The Student's t is the second distribution which has more kurtosis than the normal. Its density is given by

$$f_{\eta_t}(x, \nu) = \frac{\Gamma(\frac{\nu+1}{2})}{\Gamma(\nu/2)} \frac{1}{\sqrt{\pi(\nu-2)}} \left(1 + \frac{z^2}{\nu-2}\right)^{-\frac{\nu+1}{2}}, \quad E(|\eta_t|) = \sqrt{\frac{\nu-2}{\pi}} \frac{\Gamma(\frac{\nu-1}{2})}{\Gamma(\nu/2)}.$$

At time t, the conditional expectation of Eq. (9b) is given for P = Q = 1 by

$$E_t(\ln \sigma_{t+1}^2) = \ln \sigma_{t+1}^2 = \alpha_0 + \gamma_1 \eta_t + \alpha_1 \left(|\eta_t| - E(|\eta_t|) \right) + \beta_1 \ln \sigma_t^2.$$

So, the one-step ahead volatility forecast is obtained by

$$\ln \hat{\sigma}_{t+1}^2 = \hat{\alpha}_0 + \hat{\gamma}_1 \eta_t + \hat{\alpha}_1 \left(|\eta_t| - E(|\eta_t|) \right) + \hat{\beta}_1 \ln \sigma_t^2. \tag{10}$$

The multi-step-ahead volatility is derived recursively from $E_t(\ln \sigma_{t+h+1}^2) = \alpha_0 + \beta_1 E_t(\ln \sigma_{t+h}^2)$, due to Eq. (9c). Therefore, we have

$$\hat{\sigma}_{t+h+1}^2 = \exp\left[\hat{\alpha}_0 + \hat{\beta}_1 \ln \hat{\sigma}_{t+h}^2 \right],$$

where the initial condition is given by (10) and all parameters are estimated by the Maximum Likelihood method.

The GJR GARCH model: It is proposed by Glosten, Jagannathan and Runkle (1993), for short GJR model. The conditional variance of the asset return is defined by

$$r_t = \mu + \varepsilon_t; \quad \varepsilon_t = \sigma_t \eta_t$$

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{P} \alpha_i \varepsilon_{t-i}^2 + \sum_{k=1}^{O} \gamma_k \varepsilon_{t-k}^2 I_{\{\varepsilon_{t-k}<0\}} + \sum_{j=1}^{Q} \beta_j \sigma_{t-j}^2$$

where $I_{\{\varepsilon_{t-k}<0\}}$ is an indicator function that takes the value 1 if $\varepsilon_{t-k} < 0$ and 0 otherwise. Some constraints need to be made to insure strict positivity of the volatility. For the simplest model GJR GARCH (1,1,1), we have $\alpha_0 > 0$, $\alpha_1 \geq 0$, $\beta_1 \geq 0$, $\alpha_1 + \gamma_1 \geq 0$.

Since η_t is symmetric, the multi-step-ahead volatility forecast is recursively obtained from

$$E_t(\sigma_{t+h+1}^2) = \alpha_0 + (\alpha_1 + \tfrac{\gamma_1}{2} + \beta_1) E_t(\sigma_{t+h}^2).$$

Therefore, we have at time t

$$\hat{\sigma}_{t+h+1}^2 = \hat{\alpha}_0 + (\hat{\alpha}_1 + \frac{\hat{\gamma}_1}{2} + \hat{\beta}_1)\hat{\sigma}_{t+h}^2; \tag{11a}$$

$$\hat{\sigma}_{t+1}^2 = \hat{\alpha}_0 + \hat{\alpha}_1 \varepsilon_t^2 + \hat{\gamma}_1 \varepsilon_t^2 I_{\{\varepsilon_t<0\}} + \hat{\beta}_1 \sigma_t^2. \tag{11b}$$

The GARCH model: The model is proposed by Bollerslev (1986) as an extension of the ARCH model of Engle (1982). It is a special case of SUGARCH (set for any t $\alpha_{0,t} = \alpha_0$, $\alpha_{i,t} = \alpha_i$, $\beta_{j,t} = \beta_j$) and GJR-GARCH models. Its unconditional variance is given by Eq. (4) and the multi-step-ahead formula may be obtained from Eqs. (7) and (8a) by setting $\gamma = 0$.

Note that the literature of asymmetric GARCH models allows more than one parameter for the leverage effects without significantly affecting the structure of the model. This is not the case of SUGARCH class where the parameter O is restricted to be always one. The reason is that if the stochastic factor v_t contains more parameters ε_{t-2}, ε_{t-3},$\cdots$, the explicit formula for the unconditional variance is lost for some formulations. In this case, the second term of Eq. (3) may involve expressions such that $E(\varepsilon_{t-i}\varepsilon_{t-j}^2)$, $E(\varepsilon_{t-i}\sigma_{t-j}^2)$ with j < i and those terms will be different from zero. Therefore, the acronym SUGARCH will be lost. On the other hand, if a symmetric distribution for η_t is considered as a strong requirement for financial returns, we can avoid the distributional assumptions and estimate the model by using Quasi Maximum Likelihood method.

3. Data and Methodology

I consider the S&P 500 daily time series, adjusted for dividends, to evaluate the performance of the different models presented above. The sample period is from January 2, 2002 to December 31, 2010 corresponding to *N*=2267 daily observations. Table 1 gives the descriptive statistics of the index with respect to its asset returns $r_t = \ln S_t - \ln S_{t-1}$ where S_t represents the spot price at time *t*.

Table 1. Descriptive statistics of S & P 500 returns

Mean	Std. deviation	Min	Max	Skewness
0.0038	1.3791	-9.469	10.957	-0.139
Kurtosis	JB-stat	LB(20)-stat	LM(10)-stat	
11.854	7.410	97.171	666	
	(< 0.001)	(4.0210^{-12})	(0)	

JB-stat represents the Jarque-Bera statistic for normality test. LB(20)-stat corresponds to the residual autocorrelation test of Ljung-Box including up to 20 lags. LM(10)-stat is a statistic which examines for the presence of ARCH effects where 10 lags are used for the squared sample residuals. I give in brackets the corresponding p-values of the different statistics.

The table shows that the mean return of the S&P 500 index is positive and small. The standard deviation is also small (1.38%). The maximum (minimum) return is given by 10.957 % (-9.469 %). Extreme movements appear more frequently since the null hypothesis of normal distribution for the unconditional return is highly rejected even at the 1% significance level. The same thing appears for the null hypotheses of no serial correlation as well as the null of no ARCH effects. Both hypotheses are rejected with p-values close to zero. These results from Table 1

suggest to use GARCH models to take into account the excess of kurtosis and the presence of heteroskedasticity. In the previous section, I reviewed some of them. To make forecast, I estimate the parameters of each model by using the Maximum Likelihood method where the conditional distribution for innovations is either normal or Student-t. Then, the future volatilities are forecast and some quantiles (Value-at-Risk) are also determined. The time horizon h belongs to {1,2,5,10}, corresponding to 1 day, 2 days, one week and two weeks, respectiveley. The literature usually compares the relative performance of volatility models around a statistical loss function or an economic loss function. Only the former is considered with the Quasi-Likelihood loss function, as a criterion, defined as follows

$$QLIKE = \frac{1}{N-h-T+1}\sum_{t=T}^{N-h}\left(\log\hat{\sigma}^2_{t+h|t}+\frac{\varepsilon^2_{t+h}}{\hat{\sigma}^2_{t+h|t}}\right), \tag{12}$$

where T and N are length of the in-sample data and total sample, respectively.

QLIKE function shares robustness on ranking the models with respect to an unbiased estimator of the unkown conditional variance, see for example Patton (2011) .

The in-sample data spans the period January 2, 2002 to October 2, 2008 corresponding to T = 1699 (0.75*N) and the remaining (25% of the data) is used as the out-of-sample data. The parameter h gives the horizon forecast used to compare models. In this study, I focus only on the QLIKE loss metric for some reasons given by Brownlees et al. (2011). The authors note that QLIKE may be rewritten without loss of generality by

$$QLIKE = \frac{1}{N-h-T+1}\sum_{t=T}^{N-h}\left(-\log\frac{\varepsilon^2_{t+h}}{\hat{\sigma}^2_{t+h|t}}+\frac{\varepsilon^2_{t+h}}{\hat{\sigma}^2_{t+h|t}}\right)$$

and so is a combination of i.i.d terms (η_t). Another reason is that QLIKE penalizes small volatility forecast (close to zero).

Even if metric criteria are important, it is useful to have statistical tests that assess if the difference between loss functions of two competing models is significant or not. For this, I consider the test of equal predictive ability (EPA) of Diebold and Mariano (1995) (DM hereafter). Let d_t be the loss differential between the two competing forecasts i.e:

$$d_t = g(\sigma_t,\hat{\sigma}^i_{t|t-h}) - g(\sigma_t,\hat{\sigma}^j_{t|t-h}),$$

where g is given by (12). The above terms $\hat{\sigma}^i_{t|t-h}$, $\hat{\sigma}^j_{t|t-h}$ represent the multi-step-ahead volatility forecasts (horizon h) of σ_t from model i and j, made at time $t-h$. The asymptotic DM test is based on the mean of loss differential series (d_t), $t = T+h,\cdots,N$. If the latter is covariance stationary and short memory, the authors show that

$$\sqrt{n_h}(\bar{d}-\mu)\xrightarrow{d}\mathbf{N}(0,V(\bar{d})),\quad \bar{d}=\frac{1}{n_h}\sum_{t=T+h}^{N}d_t,\qquad n_h = N-h-T+1,$$

where μ represents the population mean loss differential. The variance is estimated by $\hat{V}(\bar{d}) = \frac{1}{n_h}(\hat{\gamma}_0 + 2\sum_{k=1}^{q}\omega_k\hat{\gamma}_k)$. Here, $\hat{\gamma}_k$ represents an estimate of the k-th order auto-covariance of the series (d_t), q the truncation lag and ω_k the lag windows. I follow Marcucci (2005) by taking $q = 4*(\frac{N}{100})^{2/9}$ and $w_k = 1-\frac{k}{q+1}$. So the DM test of equal predictive accuracy ($\mu = 0$) is given asymptotically by

$$\frac{\bar{d}}{\sqrt{\hat{V}(\bar{d})/n_h}}\sim\mathbf{N}(0,1). \tag{13}$$

After assessing the loss functions of competing models and analyzing their statistical significance, I evaluate volatility forecasting performance in a financial risk management setting. For this, I calculate the Value-at-Risk which is the money-loss in a portfolio that is expected to occur over a pre-determined horizon (h) and with a pre-determined degree of confidence (α). It may be seen also as a quantile of the portfolio (conditional) distribution. Precisely, consider equation (1a) and let $F_{t,h} = P(r_t \le r \mid \mathbf{F}_{t-h})$, $G_{t,h} = P(\eta_t \le \eta \mid \mathbf{F}_{t-h})$ be

the cumulative distribution of r_t and η_t, respectively, given the information set $\mathbf{F}_{t-h}$. The VaR with a tail probability $\alpha \in]0,1[$ and horizon h, denoted $VaR_t(\alpha,h)$, is calculated at time $t-h$, by

$$VaR_t(\alpha,h) = F_{t,h}^{-1}(\alpha) = \mu + \sigma_t G_{t,h}^{-1} = \mu + \sigma_t G^{-1}(\alpha).$$

The last equality is explained by the fact that (η_t) is i.i.d, see (1c) and so $G_{t,h}^{-1} = G^{-1}$. The difference between models appears on how σ_t is forecast from $t-h$. After getting estimates of $VaR_t(\alpha,h)$, $t = T+h,\cdots,N$ for each model, I define the following two loss functions for investors with long positions

$$\hat{\alpha} = \frac{1}{N-T-h+1}\sum_{t=T+h}^{N} 1_{\left(r_t < VaR_t(\alpha,h)\right)} \tag{14a}$$

$$\hat{Q}(\alpha) = \frac{1}{N-h-T+1}\sum_{t=T+h}^{N}\left(\alpha - 1_{\{r_t < VaR_t(\alpha,h)\}}\right)\left(r_t - VaR_t(\alpha,h)\right). \tag{14b}$$

The best model with respect to the loss function (14a) is the one that minimizes the function $d(\hat{\alpha}) = |\hat{\alpha} - \alpha|$ even if it is preferable to have low values $\hat{\alpha} \le \alpha$. I refer to Christoffersen (1998) for some statistical tests based on the coverage probability. The second loss function was proposed by Koenker and Bassett (1978), hereafter KB. It penalizes more heavily the observations for which there is a violation of VaR constraints. I also evaluate the performance of the competing models with respect to investors having short positions (Note 4).

4. Empirical Results

The results are based on the S& P 500 daily data adjusted for dividends. The data is extracted from yahoo finance web site (Note 5). I recall that all parameters are estimated by the Maximum Likelihood method with a Gaussian and a Student's t distribution for η_t and also the in-sample data ranges from January 2, 2002 to October 2, 2008 corresponding to 1699 daily observations. The labels ASUG, BSUG and CSUG in the Table 2 correspond to the conditional variance given by Eqs. (8a), (8b), (8c) respectively.

As expected, the estimated value of γ (leverage parameter) is such that negative shocks impact more future volatilities than positive ones. Accordingly, it is positive for SUGARCH and GJR models and negative for the EGARCH model. Also, the persistence of shocks on volatility ($\alpha_1 + \beta_1$) is high (> 0.990) for all models as it is usual in the financial time series. It is noted that introducing leverage effects on the constant of GARCH model (ASUG) or on the ARCH parameter (BSUG) does not give significant difference on the estimated parameters with respect to a standard GARCH model. However, if the asymmetry between negative and positive shocks is modeled through the GARCH parameter (CSUG model), the difference becomes clear since $\hat{\beta}_1 > 0.96$, (see Figure 1 for illustration). Figure 1 shows also the necessity to have time varying parameters for the standard GARCH model since its parameters have big oscillations through the time evolution. The use of SUGARCH class solves this problem due to its stochastic parameters.

Table 2. Estimated parameters of the different models

Models	mu	Alpha0	Alpha1	Beta1	Leverage	Dof
ASUG_N	0.033	0.008	0.062	0.931	0.097	–
	(0.021)	(0.005)	(0.011)	(0.014)	(0.014)	–
ASUG_T	0.044	0.005	0.061	0.935	0.097	10.09
	(0.022)	(0.003)	(0.011)	(0.013)	(0.006)	(0.01)
BSUG_N	0.028	0.008	0.060	0.933	0.097	–
	(0.029)	(0.005)	(0.009)	(0.012)	(0.11)	–
BSUG_T	0.041	0.005	0.060	0.936	0.097	10.69
	(0.03)	(0.005)	(0.024)	(0.026)	(0.74)	(0.71)
CSUG_N	0.022	0.005	0.035	0.962	0.089	–
	(0.023)	(0.003)	(0.009)	(0.010)	(0.010)	–
CSUG_T	0.044	0.003	0.031	0.966	0.092	11.47
	(0.017)	(0.002)	(0.009)	(0.010)	(0.011)	(0.010)
EGARCH_N	0.007	0.0003	0.078	0.986	-0.113	–
	(0.020)	(0.003)	(0.015)	(0.002)	(0.012)	–
EGARCH_T	0.017	-0.003	0.071	0.990	-0.111	13.461
	(0.019)	(0.003)	(0.017)	(0.003)	(0.013)	(2.409)
GJR_N	0.002	0.009	0.000	0.938	0.107	–
	(0.020)	(0.002)	(0.011)	(0.011)	(0.017)	–
GJR_T	0.018	0.006	0.000	0.941	0.108	11.716
	(0.019)	(0.002)	(0.014)	(0.012)	(0.020)	(2.236)
GARCH_N	0.034	0.008	0.063	0.932	–	–
	(0.020)	(0.002)	(0.009)	(0.010)	–	–
GARCH_T	0.044	0.004	0.063	0.937	–	9.623
	(0.019)	(0.003)	(0.011)	(0.011)	–	(1.753)

Note: Each model has been estimated by Maximum likelihood method with a Normal (_N) and a Student's t(_T) distribution for η_t. Asymptotic standard errors are in parentheses. Dof stands for degree of freedom.

Next, I give in-sample evaluation of the different models with respect to the QLIKE loss function as well as for the log likelihood function (LLF), $AIC = -2\log(LLF)/T + 2k/T$ and $BIC = -2\log(LLF)/T + (k/T)\log(T)$ criteria where T represents the in-sample size and k the number of model's parameters. The results are shown in Table 3.

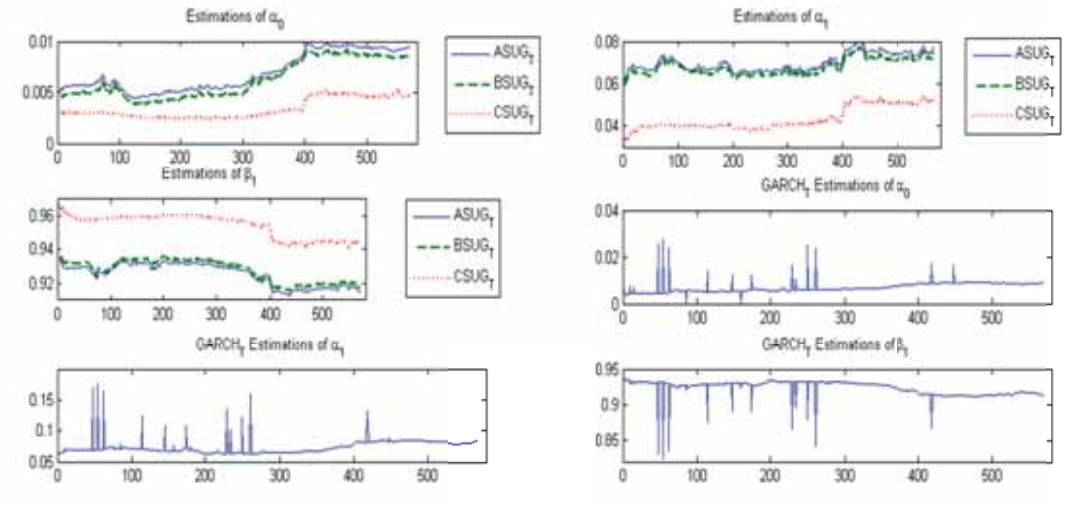

Figure 1. Comparison of recursive estimated parameters for some models ($SUGARH_T$ vs $GARCH_T$). The number of observations is 568 beginning from T=1699 to N=2266.

Table 3. In-sample diagnostic for the different models

Models	LLF	AIC	BIC	QLIKE
ASUG_N	-2286.88	2.698	2.714	24656043.71
ASUG_T	-2267.54	2.676	2.695	2469815.15
BSUG_N	-2277.87	2.687	2.703	2434990.48
BSUG_T	-2259.692	2.667	2.686	2440255.29
CSUG_N	-2256.51	2.662	2.678	2362420.94
CSUG_T	**-2238.72**	**2.642**	**2.661**	2368878.219
EGARCH_N	-2258.825	2.665	2.681	2370270.553
EGARCH_T	-2240.275	2.644	2.663	2375141.984
GJR_N	-2256.050	2.662	2.678	**2360839.063**
GJR_T	-2240.896	2.645	2.664	2367111.968
GARCH_N	-2287.273	2.697	2.710	2466936.088
GARCH_T	-2267.389	2.675	2.691	2473089.834

Note: This table presents the Log likelihood function(LLF), the Akaike information criterion(AIC) and the Schwarz criterion (BIC). QLIKE is the loss function defined in Eq. (12). Numbers in boldface indicate the best values.

The student's t distribution for η_t gives better fitting than normal distributions. The three best models are given respectively by CSUG_T, EGARCH_T, GJR _T for LLF criterion. The ranking order is also the same for AIC and BIC criteria. This point highlights the finding that normalized financial returns $\eta_t = (r_t - \mu)/\sigma_t$ still have a heavy tail distribution, however with less kurtosis than the unconditional return ($r_t - \mu$) distribution. If QLIKE is considered as a measure, the normal distribution for η_t is better than the Student distribution. The three best models are given respectively by GJR_N, CSUG_N, GJR_T. Overall, I note that introducing asymmetry through β_1 (CSUG model) instead of α_0 or α_1 (ASUG, BSUG model) improves accuracy in the in-sample fitting. Since the model structure has similarities with other (A) GARCH models in the sense that current volatility depends on past volatilities (GARCH parameters) and past innovations (ARCH parameters), we may expect that the same technique to work also for those models to better approximate financial data. The next step is to see the out-of-sample performance of the different models, part that interests more investors and market participants.

For this purpose, I compare the relative performance of the different volatility models in three ways. The first uses a metric loss function, the second is based on directional accuracy tests whereas the third focuses on risk management purpose. The out-of-sample data ranges from October 3, 2008 to December 31, 2010 and represents twenty six months of data (567 observations).

Table 4 shows the comparison between competing models for the QLIKE loss function (metric criterion) for all horizons $h = 1,\ 2,\ 5,\ 10$. The true m-step-ahead variance is approximated by the squared return of the forecast horizon that means $(\ln S_{t+h} - \ln S_t)^2$.

It is seen that no model outperforms the others. For example, for daily volatility forecasts ($h = 1$), GJR_T model gives the best results while for the remaining step-ahead volatility forecasts ($h = 2, 5, 10$), the best model is $BSUG\_T$. Another point is that the assumption of normal distribution for innovations generates satisfactory results specifically for daily volatility forecasts. However, for longer horizon, minimal values for the QLIKE loss function are obtained with a Student's t distribution. Also, a good in-sample performance does not imply a good out-of-sample performance. We see previously that CSUG_T was the best model from in-sample performance while it gives here no satisfactory results on the out-of-sample evaluation when multi-step-ahead volatility forecasts are considered. Overall, the best model is now BSUG_T.

Table 4. Out-of-sample evaluation of volatility forecasts for h=1, 2, 5, 10

Models	H	QLIKE	h	QLIKE	h	QLIKE	h	QLIKE
ASUG_N	1	557978.6	2	835203.8	5	1627324.9	10	2911320.9
ASUG_T	1	558362.5	2	831520.9	5	1606663.9	10	2863105.6
BSUG_N	1	553845.2	2	826436.8	5	1599190	10	2878972.9
BSUG_T	1	554372.2	2	**820814.5**	5	**1569805.8**	10	**2807348.9**
CSUG_N	1	547919.9	2	863287.7	5	1744494.3	10	3171634.2
CSUG_T	1	549464	2	865474.9	5	1746438	10	3185808.7
EGARCH_N	1	560398.8	2	836046.7	5	1616423.3	10	2887507.8
EGARCH_T	1	563255.8	2	843229.9	5	1675784.8	10	3124184.1
GJR_N	1	544429.1	2	837609	5	1648441.4	10	3034470.1
GJR_T	1	**543582.2**	2	824712.4	5	1607949.9	10	2924896.5
GARCH_N	1	556372.8	2	835519.6	5	1641501.4	10	2951462
GARCH_T	1	557947.8	2	829282.1	5	1594605.2	10	2821015

Note: This table presents the Quasi likelihood (QLIKE) loss function, see, (12). Numbers in boldface give the minimal (best) value for each group.

The Diebold and Mariano test, see Eq. (13) is now adopted to further examine the statistical significance from two competing models i and j. The findings from the DM-test statistics across all models and forecast horizons are available. Table 5 presents the results obtained from $BSUG\_T$ and GJR_T taken as benchmarks where forecast horizons are given respectively by $h = 5,\ 10$ (Note 6).

Table 5. Diebold-Mariano Test with BSUG_T and GJR_T as benchmarks

Bench. BSUG_T	horizon	QLIKE	Bench. GJR_T	horizon	QLIKE
ASUG_N	5	-2.87**	ASUG_N	1	-2.37*
P-values		(0.004)	P-values		(0.018)
ASUG_T	5	-1.73	ASUG_T	1	-2.54*
P-values		(0.08)	P-values		(0.011)
BSUG_N	5	-5.50**	BSUG_N	1	-2.30*
P-values		(0.00)	P-values		(0.021)
CSUG_N	5	-4.85**	BSUG_T	1	-2.59**
P-values		(0.00)	P-values		(0.009)
CSUG_T	5	-4.40**	CSUG_N	1	-0.689
P-values		(0.00)	P-values		(0.49)
EGARCH_N	5	-0.67	CSUG_T	1	-0.843
P-values		(0.49)	P-values		(0.40)
EGARCH_T	5	-1.21	EGARCH_N	1	-1.84
P-values		(0.22)	P-values		(0.06)
GJR_N	5	-4.78**	EGARCH_T	1	-1.57
P-values		(0.00)	P-values		(0.11)
GJR_T	5	-2.72**	GJR_N	1	-0.13
P-values		(0.006)	P-values		(0.84)
GARCH_N	5	-3.36**	GJR_T	1	-2.09*
P-values		(0.00)	P-values		(0.03)
GARCH_T	5	-0.16	GARCH_N	1	-2.63**
P-values		(0.86)	P-values		(0.008)

Note: Bench. stands for Benchmark. * and ** represent the DM statistics for which one can reject the null hypothesis of equal predictive accuracy at 5% and 1%, respectively.

As expected, the Diebold and Mariano (DM) test confirms results obtained from the previous table. For the benchmark model GJR_T, it is seen that all DM statistic values are negative showing that its loss function is the smallest for $h = 1$. On the other hand, the table shows that the null hypothesis of equal predictive ability is rejected for the following competing models ASUG, BSUG, GARCH. For the remaining, the difference between loss functions is not significant at the 5% level. When BSUG_T is now the benchmark, similar results are

obtained. It performs well in terms of volatility forecasts with respect to other models for the horizons $h = 2,5,10$. For example, for $h = 5$, the DM test is negative and the test is statistically significant at 1% level when a comparison is made with respect to $GJR, GARCH\_N$, $ASUG\_N$, $BSUG\_N$, $CSUG$ models. I have also the same conclusion for the other horizons $h = 2,10$. Finally, it is noticed that all the best models for a given horizon do not give significant difference with respect to EGARCH model. So even if the latter does not outperform the others, it gives satisfactory results.

Finally, I compare the performance of the different models with respect to the two loss functions defined in (14a), (14b). The coverage rate of the VaR is $\alpha = 0.01$ and the distribution of η_t is assumed to be either Normal or a Student. A general finding is that all the models have problems to give good realized VaR forecasts when the horizon step is a week or two weeks. If the horizon is however 1 or 2 days, results are satisfactory. For the risk management purpose, I only analyze one side of the conditional return distribution since if an investor takes a long (short) position, only extreme negative (positive) returns would matter for him.

Table 6. Out-of-sample Evaluation: 99 % VaR, Long Position

Models	horizon	PF	KB	horizon	PF	KB
ASUG_N	1	2.991E-02	4.6927E-02	2	5.300E-02	9.359E-02
ASUG_T	1	5.2910E-03	4.9117E-02	2	3.003E-02	6.854E-02
BSUG_N	1	2.64E-02	**4.670E-02**	2	4.77E-02	8.860E-02
BSUG_T	1	3.5273E-03	4.927E-02	2	2.826 E-02	**6.694E-02**
CSUG_N	1	3.5273E-02	5.8116E-02	2	6.360E-02	1.165E-01
CSUG_T	1	**1.23409E-02**	5.24609E-02	2	4.5930E-02	9.255E-02
EGARCH_N	1	3.1746E-02	5.810E-02	2	6.183E-02	9.99E-02
EGARCH_T	1	7.0547E-03	5.8360E-02	2	**2.120E-02**	7.281E-02
GJR_N	1	2.2465E-02	4.6826E-02	2	5.477E-02	9.02E-02
GJR_T	1	7.054 3E-03	4.860E-02	2	3.180E-02	6.76E-02
GARCH_N	1	2.6452E-02	4.671E-02	2	5.477E-02	9.306E-02
GARCH_T	1	5.2910E-03	4.971E-02	2	3.00E-02	6.695E-02

Note: This table presents the percentage proportion of failures (PF) and Koenker and Bassett (KB) loss function for the 99 % VaR failure processes at one and two-step-ahead. Numbers in boldface show the best values.

Table 6 shows that for long position and $h=1$, CSUG_T gives the best estimation of the theoretical value $\alpha = 1\%$. It is followed by GJR_T and EGARCH_T models. The latter becomes the best model for the two day-horizons followed by the BSUG_T model. Since, the PF loss function does not take into account the magnitude of VaR violations (same weight), I add Koenker and Basset (KB) loss function to remedy this disadvantage. In this case, VaR violations (no VaR violations) are weighted by $1-\alpha$ (α). So the Koenker and Basset (KB) loss function penalizes heavily prediction with VaR violations since α is equal in practice to 1% or 5%. It is found that the outperforming model is now BSUG_N followed by GARCH_N for $h=1$ as well as for $h=2$. It is also noted that for $h=2$, all models have more VaR violations than the theoretical value 1%. In other words, it is preferable to work only on daily observations for the long position.

Table 7. Out-of-sample Evaluation: 99 % VaR, Short Position

Models	horizon	PF	KB	horizon	PF	KB
ASUG_N	1	**1.05E-02**	4.77E-02	2	3.00E-02	5.97E-02
ASUG_T	1	3.52E-03	4.96E-02	2	**7.06E-03**	5.10E-02
BSUG_N	1	**1.05E-02**	4.44E-02	2	2.47E-02	5.29E-02
BSUG_T	1	0	4.88E-02	2	**7.06E-03**	5.13E-02
CSUG_N	1	5.29E-03	**4.03E-02**	2	2.65E-02	4.59E-02
CSUG_T	1	3.52E-03	4.35E-02	2	**7.06E-03**	**4.46E-02**
EGARCH_N	1	1.41E-02	4.60E-02	2	2.65E-02	5.52E-02
EGARCH_T	1	3.52E-03	5.41E-02	2	5.30E-03	5.53E-02
GJR_N	1	1.41E-02	4.37E-02	2	2.47E-02	4.97E-02
GJR_T	1	3.53E-03	4.86E-02	2	5.30E-03	4.86E-02
GARCH_N	1	**1.05E-02**	4.79E-02	2	3.18E-02	5.95E-02
GARCH_T	1	1.76E-03	4.99E-02	2	**7.06E-03**	5.10E-02

Note: This table presents the percentage proportion of failures (PF) and Koenker and Bassett (KB) loss function for the 99 % VaR failure processes at one and two-step-ahead. Numbers in boldface give the best value.

Table 7 shows results for a short position. For daily VaR predictions, there are three best models for the PF criterion given by ASUG_N, BSUG_N and GARCH_N models. For the same horizon, the best accuracy for KB loss function is obtained from CSUG_N. For the horizon $h=2$, CSUG_T is the model that minimizes also the loss function KB. For the PF loss criterion, the best models are a group given by ASUG_T, BSUG_T, CSUG_T and GARCH_T model. Overall, BSUG and CSUG models give satisfactory results with respect to VaR-based loss functions.

5. Conclusion

This paper has sought to re-examine the volatility forecasting literature by improving the standard GARCH model. The latter is extended by introducing asymmetry between negative and positive shocks. This extension, in contrast to other AGARCH models, does not change significantly the structure of the standard GARCH models. Also, I analyze what is the good way to capture leverage effects in financial time series. Our findings are summarized as follows. For in-sample fitting, the best model comes from SUGARCH class and it is the one obtained by modifying β_1 instead of α_1 parameter for asymmetric effects. Consequently, the GARCH parameter is more flexible than the ARCH parameter and is more suitable for financial asset prices. *CSUG* model is also the one inside the SUGARCH class that gives estimates significantly different from GARCH model.

For the out-of-sample evaluation, good results usually come from the SUGARCH class. For example, for the loss function QLIKE as a criterion, it is found that GJR is the best model for daily horizon but for $h=2$, $h=5$ and $h=10$, it is better to work with the BSUG model.

These findings are also confirmed by the second criterion which is the statistical test defined by Diebold and Mariano. The latter test additionally shows that, all best models, in terms of loss ranking, do not give significant difference with respect to the EGARCH model.

Finally, I investigate performance of the different models with respect to loss functions based on Value at Risk predictions. The first criterion is based on the coverage probability or the number of VaR violations. The obtained results depend on the investor's position. If long positions are considered, CSUG_T and EGARCH_T models gives respectively the best results for $h=1$ and $h=2$. However, for short position it is preferable to work with the SUGARCH class (ASUG, BSUG, CSUG). The second measure (KB loss function) integrates both the number and size of VaR violations. So it is more relevant than the coverage probability. For this criterion, the best models belong to the SUGARCH class (CSUG or BSUG model) independently on the investor position (long or short). These good results from SUGARCH class may be explained by inheritance of the standard GARCH model since they almost share the same formula for forecasting volatility where the difference only appears on the initial condition that integrates asymmetry. Another explanation is to see that SUGARCH class has some similarities with Mixture or Markov regime switching GARCH models and the literature has demonstrated that those models may give interesting results especially when economic changes appear on the interval of study as in our case (subprime crisis).

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Notes

Note 1. Since each parameter may take two forms, the cardinal is 2^{P+Q+1}. The minus 1 corresponds to the standard GARCH model where there is no stochastic parameter and so no asymmetry.

Note 2. In the implementation, I use $|\gamma| < \frac{0.9}{\max\{|r_t|, t=1,\cdots,T\}}$.

Note 3. I also tried other formulations of SUGARCH models that are close to regime switching models. Namely, I define v_t by $v_t = 1-\gamma * sign(\varepsilon_{t-1})$, so giving two values for v_t. The corresponding models give also the same unconditional variance than the standard GARCH model and have closed formula for the kurtosis.

Note 4. The loss function becomes in this case $\frac{1}{N-h-T+1}\sum_{t=T+h}^{N}\left(1_{\{r_t > VaR_t(1-\alpha,h)\}} - \alpha\right)\left(r_t - VaR_t(1-\alpha,h)\right)$

Note 5. For robustness, the same treatment is also made for CAC 40 index with similar conclusions.

Note 6. Due to space constraints, all results have not been included. The other ones can be downloaded from http://sites.google.com/site/makonte/

Appendix

Unconditional variance of SUGARCH (P,Q)

I have due to the hypothesis $\eta_t \sim f(0,1)$ and the law of iterated expectations

$$E(\varepsilon_{t-1}) = E[(\varepsilon_{t-1}\cdot\varepsilon_{t-i}^2] = E[(\varepsilon_{t-1}\cdot\sigma_{t-j}^2] = 0, \quad \forall i \geq 2, \quad j \geq 1.$$

Since the η_t distribution is supposed to be symmetric, I also have $E\left[(\varepsilon_{t-1})^{2n+1}\right] = 0 \quad \forall n \in \mathbb{N}$. These equations imply then

$$E\left[\gamma\varepsilon_{t-1}\left(\alpha_0 + \sum_{i=1}^{P}\alpha_i\varepsilon_{t-i}^2 + \sum_{j=1}^{Q}\beta_j\sigma_{t-j}^2\right)\right] = 0.$$

So, equation (3) gives

$$E(\sigma_t^2) = \alpha_0 + \sum_{i=1}^{P}\alpha_i E(\varepsilon_{t-i}^2) + \sum_{j=1}^{Q}\beta_j E(\sigma_{t-j}^2),$$

and equation (4) is obtained by using the fact that $E(\sigma_{t-j}^2) = E(\varepsilon_{t-i}^2)$ for any integers i, j.

Kurtosis of SUGARCH(1,1) class

For $P=1$, $Q=1$, I consider the model of SUGARCH(1,1) class defined by the following conditional volatility

$$\sigma_t^2 = \alpha_0 v_t + \alpha_1 v_t \varepsilon_{t-1}^2 + \beta_1 v_t \sigma_{t-1}^2 = \left(\alpha_0 + \alpha_1\varepsilon_{t-1}^2 + \beta_1\sigma_{t-1}^2\right)v_t, \quad v_t = 1-\gamma\varepsilon_{t-1}.$$

$$\begin{aligned} E(\sigma_t^4) &= E\left[(\alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2)^2 (1 - \gamma \varepsilon_{t-1})^2 \right] \\ &= E\left[(\alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2)^2 (1 - 2\gamma \varepsilon_{t-1} + \gamma^2 \varepsilon_{t-1}^2) \right] \\ &= E\left[(\alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2)^2 (1 + \gamma^2 \varepsilon_{t-1}^2) \right]. \end{aligned}$$

The last equation is obtained by the fact that $E\left[\varepsilon_{t-1} (\alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2)^2 \right] = 0$ which comes from

$$E(\varepsilon_{t-1}) = E(\varepsilon_{t-1}^3) = E(\varepsilon_{t-1}^5) = E(\varepsilon_{t-1}\sigma_{t-1}^2) = E(\varepsilon_{t-1}\sigma_{t-1}^4) = E(\varepsilon_{t-1}^3\sigma_{t-1}^2) = 0.$$

Therefore,

$$E(\sigma_t^4) = E\left(\alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2\right)^2 + \gamma^2 E\left[\varepsilon_{t-1}^2 (\alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2)^2 \right].$$

It remains to develop the last equality and then to use the following points coming from $\eta_t \sim N(0,1)$

$$\begin{aligned} &E(\varepsilon_{t-1}^2) = E(\sigma_{t-1}^2), \quad E(\varepsilon_{t-1}^4) = 3E(\sigma_{t-1}^4), \quad E(\varepsilon_{t-1}^2\sigma_{t-1}^2) = E(\sigma_{t-1}^4) \\ &E(\varepsilon_{t-1}^6) = 15E(\sigma_{t-1}^6), \quad E(\varepsilon_{t-1}^2\sigma_{t-1}^4) = E(\sigma_{t-1}^6), \quad E(\varepsilon_{t-1}^4\sigma_{t-1}^2) = 3E(\sigma_{t-1}^6), \end{aligned}$$

To obtain (6). The kurtosis is then deduced by the following formula

$$\kappa_{SUGARH} = \frac{E(r_t^4)}{E(r_t^2)^2} = \frac{3E(\sigma_t^4)}{E(\sigma_t^2)^2}.$$

The expression of the kurtosis is not explicit. The unconditional variance $E(\sigma_t^2)$ is known, see (4), but not the term $E(\sigma_t^4)$, see (6), which depends on the unknown moment $E(\sigma_t^6)$. Anyway, for $\gamma \neq 0$, I can assert that the SUGARCH kurtosis is bigger than the standard GARCH(1,1) model corresponding to $\gamma = 0$ since they share the same denominator while $E(\sigma_t^4)$ of Eq. (6) is an increasing function of γ^2.

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The Competitiveness of Jordan Phosphate Mines Company (JPMC) Using Porter Five Forces Analysis

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Abstract

The area of changing international mineral competitiveness has attracted growing attention among mineral economists. The main purpose of this paper is to examine the competitiveness of the Jordan Phosphate Mines Company (JPMC) using porter analysis. A questionnaire survey was undertaken with JPMC experts and findings showed that JPMC has a favorable advantage on the bargaining power of suppliers, threat of substitutes and threat of local entry. However, it doesn't have a favorable advantage on the bargaining power of buyers, rivalry among competitors and threat of global entry. Depending on the literature and the questionnaire findings, a number of strategies were recommended to JPMC, which can also be adopted by the companies in other developing countries.

Keywords: competitiveness, porter five forces, market concentration, rivalry, bargaining power

1. Introduction

Jordan is a small Middle Eastern developing economy, which the United Nations Development Program classifies as a "medium human development". Its mining industry is dominated by the production of phosphate and potash. Since Jordan's independence in 1946, these minerals have been a significant generator of national income and economic growth. As the major producer of phosphates in the Middle East, Jordan is a significant exporter into world markets. Jordan recently ranked as the sixth largest producer and the second largest exporter of phosphate (Jordan Phosphate Mines Company, 2008) which is exported to more than thirty countries.

While the first discovery of phosphate deposits in Jordan took place as early as 1894, the current monopoly producer is the Jordan Phosphate Mining Company (JPMC). The JPMC was established as a public shareholding company in 1953 and commenced its operations in 1962. It has operated in the international market since that time and has established itself as a prime source for the international fertilizer industry. It currently operates three mines – the Hassa, Abyiad, and Eshidiya mines – all in Jordan's Southern region, the nation's poorest.

Although the mining sector contributes only around one per cent of the employment, the Jordan Phosphate Mining Company (JPMC) remains one of the largest employers in the nation with 3870 workers in 2007. In March 2006 the Jordanian government sold 37 per cent of JPMC to the Brunei government. The Jordanian government currently owns around 26 per cent of the company's capital and owners now operate the company. Besides phosphate rock production, JPMC produces several downstream products such as phosphoric acid, Di-ammonium phosphate and Aluminium fluoride. Its main competitors are Syria, Morocco, Tunisia, Egypt, USSR and Togo. Phosphate is an important source of income for Jordan. Together with potash its products are the major outputs of the nation's mining sector. The collective revenue contribution of mining to the national economy in 2008 was three per cent of Gross Domestic Product and fourteen per cent of merchandise exports (Central Bank of Jordan, 2008).

The ability of companies and countries to mine phosphate and other mineral commodities competitively and in the process to generate new wealth depends on their mineral endowment. Jordan for example produces and exports phosphate because it is well endowed with high quality and low cost deposits. This production creates wealth that benefits mining companies and their stockholders, the government, local communities as well as phosphate consumers around the world.

Michael Porter's famous Five Forces of Competitive Position model provides a simple perspective for assessing and analysing the competitive strength and position of the JPMC. The Five Forces tool is used in this paper as a

simple and powerful tool for understanding where power lies in JPMC. This is important, as it helps it to understand both the strength of its current competitive position, and the strength of a position it is looking to move into. With a clear understanding of where power lies, it can take fair advantage of a situation of strength, improve a situation of weakness, and avoid taking wrong steps. This makes it an important part of its business planning toolkit.

2. Literatures Review: Competitiveness and Mining View

The concept of competitiveness is best understood at the firm level. In the simplest terms, an unprofitable firm is uncompetitive. In the textbook model of perfect competition, an uncompetitive firm is one with an average cost that exceeds the market price of its product offering. A firm may be unprofitable because its average cost is higher than the average costs of its competitors. Its average cost may be higher than its competitors because its productivity is lower; it pays more for its inputs, or both.

Tilton (1992, 2000 and 2003) suggests two schools of thought concerning national and company mineral competitiveness. These are “the traditional view” and the “alternative view”. The traditional view states that competitiveness and wealth creation in mining is largely a transitory gift of nature. Companies and countries with the best deposits are the most competitive and generate the most wealth. Once their deposits are exhausted, however, competitiveness will shift to those companies and countries with the next best set of deposits. In this view, resource endowment is the overriding determinant of competitiveness in mining.

The traditional view of competitiveness which stresses the overriding importance of abundant, high quality mineral resources and deposits is only partially correct. There is no doubt that mineral endowment is important; it is, however, not the only significant determinant of competitiveness. Other factors of production - low cost electricity, a skilled labor force, a well developed infrastructure also play a role, along with a multitude of public policies.

Tilton’s “alternative view” sees a key role for technology and innovation in reversing mining’s otherwise declining fortunes by maintaining and enhancing the competitiveness of the industry. Here government plays a role in providing an economic climate that encourages innovative activities. In this view of the world, the role of government shifts from ensuring that society gets its fair share of wealth created by mining and that it is used in a manner that achieves intergenerational equity, to creating an economic climate conductive to the innovative activities of firms and individuals. In short, public policy focuses more on how to increase the benefits flowing from mining and less on how best to divide them.

Tilton (2003) reported that while every mine eventually runs out of reserves, innovation and new technology may extend by decades the path to extinction. The possibilities for government policies to affect natural competitiveness in mining and mineral processing certainly exist, particularly by encouraging the development and diffusion of new technology. While it is true that new innovations today tend to spread quickly around the globe, in the mineral sector they often affect producers differently. Vogt (2006) reported that technology can enable mining in South Africa to remain competitive and to remain an important contributor to the economy.

The introduction of new leaching techniques, much more suitable for gold deposits in the USA than in South Africa or Russia, has greatly increased the competitiveness of US producers. The more widespread use of column flotation is another example of technology change in the phosphate industry. This has been the most dramatic development in the area of fine particle separation in mineral processing since the invention of froth flotation. A flotation column is a bubble column device that achieves separation between solid particles by using differences in their affinity for air bubbles. While the concept of bubble column flotation was first developed and patented after 1910 - see Clifford, Lloyd & Zhang (1998) - industrial acceptance of flotation column cells did not take place until the early 1980s. Producers now use columns widely for the separation of phosphate/gangue.

Besides technology, government policies can also play an important role in increasing competitiveness. For example, the specific type of fiscal regime that a country adopts is of paramount importance both to the government of that country and the investor, because this directly impacts on each party's share of benefits from the exploitation of the mineral resource. The major taxes that are applied to mining operations are classified under three broad categories: they are either profit related, output related, or input related.

Rodriguez (2004) reported that profit-related taxes are usually in the form of corporate income tax, dividend withholding tax and additional profits tax. Output taxes (commonly referred to as royalties) are related to the sales value of the mineral resource, while input taxes are imposed on the inputs of mining operations, such as sales, transaction and withholding taxes, import duties and labour and wage related tax payments. For companies to invest in the mineral sector the right balance has to be struck between the interests of the investor and the

government, and essentially the fiscal regime must be competitive and stable when compared to others in existence throughout the world.

Some other authors looked at factors of production as the major determinant of competitiveness in mining. Bosmel (1992) reported that competitiveness in mining e.g., the capacity to sell ores and metals on the world market at a profit, relies on the capacity of the producer to mix adequately the three basic production factors: the mineral deposit, capital and labor.

Mining Association of Canada (2008) set several variables that affect the competitiveness of an investment regime in Canada. These include a present and projected shortage of labor – skilled and unskilled, increasing Project approval times and costs, declining levels of domestic reserves of key minerals such as copper, zinc, silver and lead reserves. The sustained growth of the value of the Canadian currency can also serve to reduce the profitability/feasibility of mining and metals operations that receive revenues in U.S.

In considering the contribution of copper to the economic development of Chile, Maxwell (2004) suggested that mining competitiveness is related to policy environment, size of mineral endowment, cultural homogeneity and political harmony, human capital and distance from major markets. Maxwell framework provided a useful broad view of the factors that will influence country‘s mineral sector competitiveness.

Large-scale and long-term mining operations inevitably produce a significant amount of waste which depends on geological and technological characteristics such as: geological settings, reserve characteristics, the type of mining operation (surface or underground mine), tailing dump closure design and post-closure cost, and so Kulczycka, Goralczyk and Włodarczyk (2003) considered the volume and cost of mining waste produced as an important determinant of competitiveness. The lower the cost, the higher the firm profitability and competitiveness in the market.

Porter’s five forces model is widely considered to be one of the core ideas in modern corporate strategy. The model is a framework that defines the rules of competition in an industry and highlights what is important in order to have a long-term competitive advantage. According to the model, the competitiveness of an industry is influenced by five forces and the collective strength of these forces determines the ultimate profit potential of an industry. Five forces which are: threat of entrants, intensity of competitive rivalry, power of suppliers, power o buyers and the threat of substitutes (Porter, 1980). Porter, additionally, emphasized the role of the government on the competitiveness of the industry through its influence on five forces.

Slator and Olson (2002) stated that Porter’s basic premises are indeed valid. They stressed that the vast majority of Porter’s conclusions are as valid today as they were 20 years ago. Slator and Olson didn’t challenge the points porter has made so effectively in his model. Instead, they believed that the five forces model is an incomplete representation of the market factors that influence an industry and business performance. They concentrated on forces that were not elements in the Five Forces Model, as well as on new ways of thinking about the original forces.

Porter model could be used to analyze the factors that affect the mining and manufacturing industries. For example, Orala and Mıstıkoglu (2007) used porter model to analyze the brick industry in Turkey. Their results showed that competition between the existing companies in Turkish brick industry was fierce with many similar-sized companies and there was low entry and exit barriers, increasing threat from the substitute products, and increasing bargaining power of buyers.

Pines (2006) has analysed the industry of emergency care using Porter’s five forces model. He found that the suppliers to Emergency departments (ED), particularly the pharmaceutical companies and nurse staffing companies, exert a significant level of power over the individual ED. The industry does have significant barriers to entry, both in education and cost of starting an emergency care centre. The buyers of ED care also have significant power over the individual ED and there is also a high threat of substitution and a high degree of internal rivalry

3. Assessing the Competitiveness of JPMC Using Porter’s Five Forces

3.1 Methodology

A questionnaire survey has been distributed by hand to 35 experts working in the marketing; financial and research and development departments within the Jordanian Phosphate Mines Company. The experts sample included 27 men and 7 women whereas ninety percent of them ranged in age from 31 to 50 years old. Among them 13 experts has 11 to 15 years experience , 19 experts have 16 to 20 years experience and only 3 experts have more than 21 years experience. The experts are also educated and 25 of them have bachelor degree and 10 of them have master. The questionnaire consisted of five main sections with a total number of 29 questions.

These sections included questions related to the bargaining power of suppliers (6 questions), the bargaining power of buyers (6 questions), the threat of substitutes (7 questions), the threat of substitutes (3 questions) and the rivalry among competitors (7 questions) (see Tables 1, 2).

This section adopts an original survey-based qualitative approach (primary data) to examine JPMC global competitiveness. Taking into account that the paper depends on the opinion of "JPMC experts" instead of admittedly scarce independent "industry experts", however, the response bias is minimized and the objectivity and neutrality are not compromised (e.g. through omitting the name of the consulted experts).

One of the known limitations of the five forces model is that it focuses on the whole industry, rather than on that industry's individual firms. As such, the model is useful for assessing the likely competitiveness of an average company in the industry not Just JPMC alone. To put this note into context, it is clear that the threat of substitutes, power of suppliers and threat of entry do apply partially at least to many regional phosphate companies of comparable technological capability.

Table 1. Frequency and percentages of sample gender and age

Gender	*Frequency*	*Percent*	*AGE*	*Frequency*	*Percent*
Male	27	77.1	31-40 years	16	45.7
Female	8	22.9	41-50years	16	45.7
Total	35	100.0	51-60 years	3	8.6
			Total	35	100.0

Table 2. Frequency and percentage of sample experience and education

Experience	*Frequency*	*Percent*	*Education*	*Frequency*	*Percent*
11-15	13	37.1	Bachelor degree	25	71.4
16-20	19	54.3	Master degree	10	28.6
21	3	8.6	Total	35	100.0
Total	35	100.0			

3.2 Results and Discussion

3.2.1 Bargaining Power of Suppliers

Suppliers of raw materials, components, and services (such as expertise) to the firm can be a source of power over the firm. How easy it is for suppliers to drive up prices is driven by the number of suppliers of each key input, the uniqueness of their product or service, their strength and control over their customers, the cost of switching from one to another, and so on. The fewer the supplier choices one company has, and the more it needs suppliers' help, the more powerful its suppliers are.

In analyzing the bargaining power of suppliers, Sulfur and ammonia are the main input products used by JPMC to manufacture phosphatic fertilizers. There are more than 15 international suppliers for ammonia (US, China, Canada, Egypt, Germany, Qatar, India, Indonesia, Netherlands, Pakistan, Poland, Russia, Saudi Arabia, Trinidad and Tobago, Ukraine) and there are around 26 main suppliers for sulfur (US, Australia, Canada, Chile, China, Finland, France, Germany ,India, Iran, Italy, Japan, Korea, Kazakhstan, Kuwait, Mexico, Netherlands, Russia, Saudi Arabia, South Africa, Spain, United Arab Emirates, Uzbekistan, Venezuela). JPMC imports around 170,000 tonnes of ammonia from neighboring gulf countries (mainly Qatar). It also imports around 350,000 tonnes of sulfur for sulfuric acid manufacturing from Russia, Iran and Ukraine. The government is also an important supplier of the industry through supplying important local services needs such as electricity, fuel, water and natural gas.

Through the results of the questionnaire in Table 3, respondents agreed that JPMC has large number of input suppliers**,** and the company has been well informed about the supplier's products and markets and it can easily switch to substitute products from other suppliers. Respondents also agreed that input products purchased by the company from suppliers are unique (not ordinary), and they don't constitute a high proportion of their business. The easier it is to start a new business, the more likely it is that JPMC will have competitors and so it seems that there is no difficulty for JPMC suppliers to enter the company's business, sell directly to the company customers, and become a direct competitor for JPMC. Overall, 56 per cent of respondents agreed that JPMC has a credit and a favorable competitive advantage in the bargaining power of suppliers. The question of bargaining power of

local suppliers, yet, is not relevant for JPMC as the government, which provides electricity, fuel and water, for JPMC, owns around 26 per cent of the company assets.

Table 3. Bargaining power of suppliers' results

		Yes	*Percentage (%)*	*No*	*Percentage (%)*	*Power of suppliers*
1-	There are a large number of potential input suppliers?	34	97.1	1	2.9	Low
2-	Are the products that you need to purchase for your business ordinary?	6	17.1	29	82.9	High
3-	Do your purchases from suppliers represent a large portion of their business?	3	8.6	32	91.4	High
4-	Would it be difficult for your suppliers to enter your business, sell directly to your customers, and become your direct competitor?	13	37.1	22	62.9	High
5-	Can you easily switch to substitute products from other suppliers?	29	82.9	6	17.1	Low
6-	Are you well informed about your supplier's product and market?	33	94.3	2	5.7	low
	Total	118	56.2	92	43.8	Low

3.2.2 Bargaining Power of Customers

This force describes the ability of customers to put the firm under pressure. How easy for buyers to drive prices down, this is driven by the number of buyers, the importance of each individual buyer to the business, the cost to them of switching from one product to another, and so on. If the industry has few, powerful buyers, they are often able to dictate terms to suppliers. Bargaining power of buyers also increases with the buyers buying from the same supplier in large amounts. It also increases if there are undifferentiated products, low switching costs, a threat of backward integration, purchase being not important for the buyer, buyers having all the relevant information about the product or production.

In analyzing the bargaining power of customers, JPMC exports are focused on Asian customers. More specifically, ninety per cent of Jordanian phosphate exports are directed to Asian markets and around sixty per cent of which is directed towards one market; the Indian market, the largest phosphate consumer in the world, and a market in which Jordan maintains excellent prices for the phosphate exports (Jordan Phosphate Mines Company, 2008). Nevertheless, focusing exports towards one market exposes JPMC to the added risk of that market closing for one reason or another.

Table 4 shows that most respondents agreed that JPMC's products (e.g. phosphate rock, phosphoric acid, di-ammonium phosphate) are unique and they represent high expense for the company's customers who are well informed about these products and their markets. Respondents have also stated that JPMC doesn't have enough customers and losing one would be critical to its business success. Nevertheless, it would be difficult for buyers to integrate backward in the supply chain and compete directly with the company's customers. It would be also difficult for customers to switch from the company's product to its competitors' products and so overall majority of results by respondents (around 53 per cent), stated that JPMC doesn't have a favourable advantage on the bargaining power of customers.

The phosphate producers which have the most to gain or lose from the Indian buying decisions are undoubtedly those in Jordan, the US and Morocco. For example, in 1990, Morocco has been very hard hit by India's refusal to purchase acid at the price originally dictated by Morocco. At that time, India successfully managed to lower the price from a high of $480 per tonne in 1989 to a much lower level of $376 per tonne.

Table 4. Bargaining power of buyers' results

		Yes	*Percentage (%)*	*No*	*Percentage (%)*	*Power of buyers*
1-	Do you have enough customers such that losing one isn't critical to your success?	8	22.9	27	77.1	High
2-	Does your product represent a small expense for your customers?	15	42.9	20	57.1	High
3-	Are customers uninformed about your product and market?	10	28.6	25	71.4	High
4-	Is your product unique?	15	42.9	20	57.1	High
5-	Would it be difficult for buyers to integrate backward in the supply chain, purchase a competitor providing the products you provide, and compete directly with you?	29	82.9	6	17.1	Low
6-	Is it difficult for customers to switch from your product to your competitors' products?	21	60	14	40	Low
	Total	98	46.7	112	53.3	High

3.2.3 Threat of Entry

Profitable markets that yield high returns will draw firms. The results are many new entrants, which will effectively decrease profitability. Unless the entry of new firms can be blocked by incumbents, the profit rate will fall towards a competitive level. Some common factors that raise barriers of entry are: economies of scale, differentiation, long-term relationships with the customers, capital requirements, switching costs, access to distribution channels, and government policies.

The high start up costs and the regulations set by the Jordanian government to open a new mine represent a high barrier of entry to the local industry. JPMC has a monopoly over the extraction of the phosphate resources in the country and its customers are loyal to its products brands and it will be difficult for a new local competitor to enter the industry or to obtain new customers. Results in Table 5 showed that inputs required for production pose high threat of entry. Ortiz (2004) stated that the machinery and equipment of the fertilizer plant in Aqaba (located south of Jordan) will cost over $US114 million. The US share of the machinery and equipment accounted for 70 per cent of this cost.

Overall results on threat of local entry factor showed that JPMC has a favourable advantage. The respondents agreed that the uniqueness of the assets needed to run the three phosphate mines in the southern part of Jordan (Al-Abyad, Eshidyah, and Al-Hassa) and the processing plant in Aqaba represent a big threat of entry to the phosphate industry. However, the threat of global entry is low. Through analysing the market concentration, e.g. percentage share of sales, there has been a decline in the market concentration of the largest company, largest three companies and largest five companies from 1975 to 2008 which may indicate that there have been new entrants in the market in the last thirty years, see Table 6.

The arrival or the entry of new producers in markets close to Jordan's competitive location could affect the future market share of the JPMC. The large Saudi Arabian Al-Jalamid phosphate project, located close to its border with both Jordan and Iraq, has a new capital investment of $US 2 billion. It commenced operations in 2010, this may have a significant impact on the downstream market for Di-ammonium phosphate (DAP) and it seems likely to position Saudi Arabia as the third or fourth largest phosphate producing nation. It is a potential threat to Jordan's future mining capacity expansions to feed integrated downstream capacity targeted at the export market.

Table 5. Threat of entry results

	Yes	*Percentage*	*No*	*Percentage*	*Threat of entry*
1- Are customers loyal to your brand?	29	82.9	6	17.1	Low
2- Are there high start-up costs for your business?	35	100	0	0	Low
3- Are the assets needed to run your business unique?	33	94.3	2	5.7	Low
4- Is there a process or procedure critical to your business?	31	88.6	4	11.4	Low
5- Will a new competitor have any difficulty acquiring/obtaining customers?	27	77.1	8	22.9	Low
6- Do you need a license to open a new mine / project	35	100	0	0	Low
7- Will a new competitor have difficulty acquiring/obtaining needed inputs to compete efficiently	10	28.6	25	71.4	High
Total	200	81.6	18.4	18.4	Low

Table 6. Market concentration of the phosphate market from 1975 to 2008 (percentage share of sales)

Year	*Largest company*	*Largest three companies*	*Largest five companies*
1975	41.8	77.3	85
1990	33	66	85
1995	34	64	80
2000	30	60	75
2008	24	62	75

Source: US Geological Survey (various years)

The existence of close substitute products increases the propensity of customers to switch to alternatives in response to price. If substitution is easy and viable, then this will weaken the producers' power. According to Porter's analysis substitute products refer to the products offered by other industries. When switching costs to new products are low, the threat of substitutes is high.

3.2.4 Threat of Substitutes

Because phosphate is an essential nutrient for plant growth, there is no substitute for it (US Geological Survey, 2008). Jordan phosphate products compare favorably to the other possible substitutes. Potassium, Urea and Nitrogen fertilizers are sometimes considered as close substitutes for phosphate and so it is costly for Jordan Phosphate Mines Company customers to switch to other products since they might experience a loss of productivity. Even if switching costs are low, customers may have allegiance to a particular brand and this seems true for the JPMC's customers. Overall results in Table 7 suggest that 76.2 per cent agreed that JPMC has a favorable competitive advantage over the substitute's threats.

Phosphate rock used in agriculture has no substitutes. However, zeolite is considered to be a substitute for phosphate in the detergent industry. Demand for detergent zeolite grew during the late-1980s and early-1990s because of concerns about the possible effects of sodium phosphates on freshwater bodies (Lerner, 2000).

3.2.5 Rivalry among Competitors

For most industries, this is the major determinant of the competitiveness of the industry. Often the greater the number of players, the more intense the rivalry, however, rivalry can occasionally be intense when one or more firms struggle for market leader position. Rivalry also intensifies if companies have similar shares of the market, leading to a race for market leadership. In a growing market, firms are able to grow revenues simply because of the expanding market whereas, in a stagnant or declining market, companies often fight intensely for a smaller market.

With high fixed costs, companies must sell more products to cover these high costs. High storage costs or perishable products result in a situation where firms must sell product as soon as possible resulting in increasing rivalry among firms. Firms that produce products that are very similar will compete mostly on price, so rivalry is

expected to be high. If exit costs are high, a company may remain in business even if it is not profitable. If customers can easily switch, the market will be more competitive and rivalry is expected to be high.

Rivalry is intense among competitors in the phosphate industry. There has been considerable tendency to cheat on price agreements to increase their market share. For example, Azhar (2000) reported that in the late 1980s, Jordan made a market share agreement with Morocco. Morocco paid lip service to the agreement, but in practice acted unilaterally in selling phosphate in some of Jordan's South East Asian markets by undercutting Jordanian prices.

In the past, US phosphate prices have benefited from tighter North American supply and production problems in Jordan. Some of Jordan's competitors have also received government assistance, which has given them a competitive edge. In the USA for example producers get sales tax exemptions for new machinery and equipment.

Results in Table 8 showed that there are high numbers of competitors, and there is no clear leader in the market. The market is growing fast, and JPMC has a high fixed costs and it can store its products to sell at the best times. Respondents also agreed that JPMC products are not unique and it is not easy for its competitors to abandon their products. Overall results (63 per cent of respondents) confirm that JPMC doesn't have a favourable advantage over the rivalry among competitors. This is because other producers have a very strong influence in the market and rivalry among competitive companies is fierce as there are quite a number of equally balanced companies with low differentiation.

Table 7. Threat of substitute's results

	Yes	Percentage(%)	No	Percentage (%)	Threat of Substitutes
1. Does your product compare favourably to possible substitutes?	20	57.1	15	42.9	Low
2. Is it costly for your customers to switch to another product?	31	88.6	4	11.4	Low
3. Are customers loyal to existing products?	29	82.9	6	17.1	Low
Total	80	76.2	25	23.8	Low

Table 8. Rivalry among competitors' results

	Yes	Percentage (%)	No	Percentage(%)	Rivalry power
1. Is there a small number of competitors?	4	11.4	31	88.6	High
2. Is there a clear leader in your market?	9	25.7	26	74.3	High
3. Is the market growing fast?	26	74.3	9	25.7	Low
4. Do you have low fixed costs?	5	14.3	30	85.7	High
5. Can you store your product to sell at the best times?	28	80	7	20	Low
6. Is your product unique?	11	31.4	24	68.6	High
7. Is it easy for competitors to abandon their product?	7	20	28	80	High
Total	90	37	155	63	High

4. Conclusion and Recommendations

JPMC was analyzed as a case study within the frame of Porter's five forces model. Results showed that JPMC has a favorable advantage on the bargaining power of suppliers, threat of substitutes and threat of entry. However, it doesn't have a favorable advantage on the bargaining power of buyers and rivalry among competitors.

Barriers to entry in the local phosphate market are high because JPMC has a monopoly over the extraction and exploration of phosphate deposits in Jordan. However global threat of entry is low and new exploration and discovery of new phosphate reserves and deposits in the world may encourage new entrants to enter the global market and be a strong competitor, e.g. Saudi Arabia. Where preferential borrowing privileges and overgenerous fiscal incentives exist, capital would then be relatively inexpensive, encouraging new phosphate enterprises in the world to invest more heavily in plant and equipment in order to reduce operating costs.

Threat of substitute products has not been experienced throughout the industry widely yet. However, the threat of incoming substitute products should not be ignored and product developments should be one of the main strategies of JPMC in order to stay competitive. Additionally, marketing strategies should focus on the promotion of the advantages of phosphate products against the substitutes in order to satisfy the buyers' concerns related with the product specifications in terms of cost, quality, reactivity and smell.

The future changing of technological requirements suggests that suppliers of the new technologies will have a strong bargaining power in the near future. While current production technologies used by the JPMC is good enough to satisfy customers, however, the quality of phosphate deposits is declining and the levels of certain impurities may pose problems in processing or in their application to crops and so JPMC may have to adopt new technologies in the future.

Rivalry among competitive companies is fierce as there are quite a number of equally balanced companies with low differentiation. However, in order to survive against the global competition, low cost with high quality should be targeted by JPMC .Yet, the size; the location and the technical know-how are important parameters that would affect JPMC in choosing their strategies.

Since JPMC exports are focused on Asian customers and around 60 per cent of which, is directed towards the Indian market, in order to reduce bargaining power of buyers, a good export strategy is to diversify and spread exports as much as possible because higher concentration and lower spread of the exports strengthen bargaining power of buyers and makes the exporter more vulnerable to market disturbances whereas, a lower concentration and higher spread makes the exporter less vulnerable to market disturbances.

The key to growth -- even survival -- is to stake out a position that is less vulnerable to attack from head-to-head opponents, whether established or new, and less vulnerable to erosion from the direction of buyers, suppliers, and substitute goods. Establishing such a position can take many forms:

- solidifying relationships with favorable customers,
- differentiating the product either substantively or psychologically through marketing, integrating forward or backward, or
- establishing technological leadership

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Does Female Education Promote Economic Performance? Evidence from Nigeria

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Abstract

The paper examines whether female education promotes economic performance in Nigeria, using the co-integration and error correction techniques for the period 1975-2008. The augmented Solow model is used to incorporate the gender dimension. The unit root tests conducted indicated that all variables are stationary at first difference and are also co-integrated. This shows that a long-run equilibrium relationship exists among them. Furthermore, it was revealed that the male education has a significant and positive impact on the Nigerian economy, while female education does not. Contrary to expectations, the results also revealed that investment to GDP ratio and government investment on social and community services have no significant effect on real GDP when lagged by one year. It is implied that instead of promoting growth, investment efforts have not been beneficial to the economy. The result shows that trade openness is an effective policy for promoting economic performance in Nigeria. The policy implication of the study is that if the country wants to achieve sustainable growth which would engender structural transformation of the Nigerian economy, the issue of gender equality in access to education should be taken seriously. Thus, government should pay more attention to educational policies that enhance female enrolment rates, participation in educational institutions and literacy in order to enhance women contribution to growth and economic transformation in Nigeria. This should be done in a stable macroeconomic environment which has a tendency to enhance domestic investment in Nigeria.

Keywords: female education, gender, economic growth, human capital, Nigeria

1. Introduction

Education is considered as a major contributing factor to sustainable development and poverty alleviation in developing countries, including Nigeria. Thus, the need for the promotion of gender equality in education is highly essential for growth and structural transformation of an economy and the attainment of economic development. The education of women is instrumental to the reduction of fertility rates and population growth rates. It also enables them to engage in healthier habits and bring their children up in healthy ways. Female education is highly important in reducing both maternal and child mortalities, which increases life expectancy (World Bank, 2001; Herz and Sperling, 2004).

Nigeria's economic performance in the last four decades leaves much to be desired. The country's economic performance is dependent on the performance of oil in the world oil market. This has culminated in a series of booms and depressions over the years. Since the introduction of democracy 1999, Nigeria has been experiencing modest economic growth, driven mainly by the non-oil sector. However, the oil boom and associated income derived from oil exports have not translated into sustainable development and wealth for its citizens. The major challenges facing the country's social and economic development are the weak infrastructure base, especially power and transport infrastructure, corruption, macro-economic instability, over-dependence on oil revenues, poor governance and educational gender gap. The need to bridge the gender inequality in access to productive resources has been a major concern in Nigeria, especially, since the 1985 Nairobi Declaration and World Declaration on Education for All. Gender mainstreaming in all policies, programmes and organizational cultures through the incorporation of the principles of Convention on the Elimination of all forms of Discrimination against Women (CEDAW) has become a central principle of development programmes and strategies.

In recent times, Nigerian women have been contributing significantly to the development of the various sectors of the economy. Many women have been able to distinguish themselves in major corporations, such as Nigerian Stock Exchange (NSE), the National Agency for Food Drugs Administration and Control (NAFDAC), Economic

and Financial Crimes Commission (EFCC) and in ministerial positions at the federal and state levels. This new development has given rise to calls for the education of women in the country.

Consequently, increasing attention is now being paid to the promotion of women education. It has been acclaimed that improving the education of women alongside that of men may be the most efficient way to reduce poverty and ensure rapid growth and structural transformation. Although, there have been quite a number of empirical studies on the relationship between educational human capital and economic growth in Nigeria, very few of them focus on the growth impact of female education. This is clearly the motivation behind this study. The paper is also important for Nigeria because it tends to broaden our understanding of this important issue and provides guidance on how to make progress.

Against this background, the main objective of this paper, therefore, is to provide quantitative evidence on the relationship between female education and Nigeria's economic performance. Specifically, it sheds light on the role of female education in the growth and transformation process in Nigeria. The rest of the paper is structured as follows: Section two provides a review of literature. This is followed by a presentation of the stylized facts on female education in Nigeria's development. Section three outlines the analytical framework and the model while section four contains the empirical results. Section five concludes the paper.

2. Literature Review

There have been a number of theoretical and empirical studies which suggest that female education has enormous economic and social benefits. Herz and Sperling (2004) provide extensive evidence from developing countries in widely different circumstances on the returns to girls' education and these were subdivided into four broad categories. They are briefly summarized. Regarding the nexus between female education and women empowerment**,** a strong and extensive body of evidence suggests that education enhances women's bargaining position in both the family and society (Barro 1999; Sen, 2000). The second benefit is that female education encourages smaller, healthier, better-educated families (World bank, 2001; Hill and King, 1995). The third benefit shows that education can be one of the best defenses against HIV/AIDS, both because of education's impact on women's earning capacity, empowerment, and family well-being, and because school-based HIV education programs discourage risky behavior among young girls in particular (UNESCO, 2002). The fourth relates to the growth impact of female education. It is widely believed that education generally leads to increased income and productivity, for individuals and for nations as a whole.

A number of empirical growth studies incorporating female education yield mixed results (Barro and Lee 1996; Knowles, Lorgelly and Owen 2002; Galor and Weil 1996; Hill and King 1995; among others). These studies found that both male and female schooling have differential impact on GDP per capita. Dollar and Gatti (1999), in a 100-country World Bank study also found that the gender gap in education disappears with development, while efforts to educate girls boost the pace of development and in turn promote education. The study revealed that increasing the share of women with secondary education by 1 percentage point boosts annual per capita income growth by 0.3 percentage points.

Klasen (2002) investigated the nexus between gender inequality in education and long-term economic growth by using cross-country and panel regressions during 1960-1992. The author found that gender inequality in education directly affects economic growth lowering the average level of human capital and indirectly through its impact on investment and population growth. The results however differ by regions. Klasen and Lamanna (2008) also lend credence to this fact. In a study carried out by Cooray and Mallick (2011), it was found that the impact of human capital disaggregated by gender has a differential impact on economic growth. Male human capital showed a positive and significant effect on growth while female human capital has no significant effect when the openness variables are considered. Zaman (2010) seeks to establish whether there is any causal relationship between female enrolment rates and economic growth in Pakistan using co-integration and Granger causality test during the period 1966-2008. The study supports the unidirectional causality relationship between the GDP and female enrolment within the specific context of Pakistan.

There are many studies on the growth impact of human capital in Nigeria, but the specific relationship between female education and the performance of the Nigerian economy has not been adequately analyzed. However, it is noteworthy that some studies have demonstrated the importance of female education in poverty reduction. For instance, Anyanwu cited in Odusola (1998) showed that good health status and educational attainment of Nigerian women positively influenced their income in six Nigerian states, namely, Anambra, Borno, Cross River, Ogun, Plateau and Sokoto. The coefficients of primary, secondary and technical school attainment were statistically significant at 5 percent level while that of excellent health conditions was significant at 1 percent.

Okojie (1995) also demonstrated the positive effects of female educational advancement on poverty reduction which invariably translate into economic growth and development.

A major conclusion that has emerged from the review of literature is that diverse opinions exist concerning the impact of female education on growth. While some studies lean towards a positive effect of female education on growth, others have shown negative effect. But most studies lend credence to the fact that promotion of female education pays off substantially.

2.1 Stylized Facts on Female Education in Nigerian Development

Education in Nigeria is provided by both the public and private sector with planning, administration and funding from the three tiers of government, federal, state and local. The Nigerian government accords high priority to female education. Towards this end, a great number of policies, programmes and strategies for enhancing female education were put in place. These among others include, the Blueprint on Women Education launched in 1986 to re-orientate the attitude of all females irrespective of age towards education in the fields of science, technology and mathematics. Family Support Basic Education Programme launched in 1994 to encourage girl-child education, The Universal Basic Education (UBE) scheme designed to ensure the access of all children in Nigeria to primary and junior secondary school level of education was launched in 1999. The UBE was meant to overcome geographical and gender disparities as well as address the issue of capacity building of teachers, structural state of schools and availability of instructional materials.

Furthermore, the Girls' Education Project was launched by the Federal Government of Nigeria, Department for International Development (DFID) and United Nations Children's Fund (UNICEF) in 2004 and currently under implementation. Its main goal is to achieve significant progress in Nigeria towards Millennium Development Goal 3: 'to eliminate gender disparity in primary and secondary education preferably by 2005 and to all levels of education no later than 2015'. The introduction of these programmes has made a major impact on enrolment and the number of schools. Figures 1-3 presented in the appendix show phenomenal growth in the number of students in Nigerian educational institutions during the period 1979-2008. Figure 1 shows the predominance of male enrolment at primary school. In the same vein, female secondary school and tertiary institutions enrolment increased dramatically during the same period. The general trend at secondary and tertiary levels of education also shows a lower enrolment rate for girls than boys.

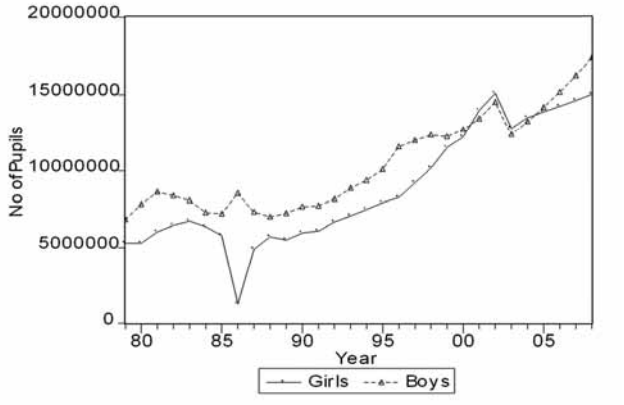

Figure 1. Primary School Enrolment, 1979-2008

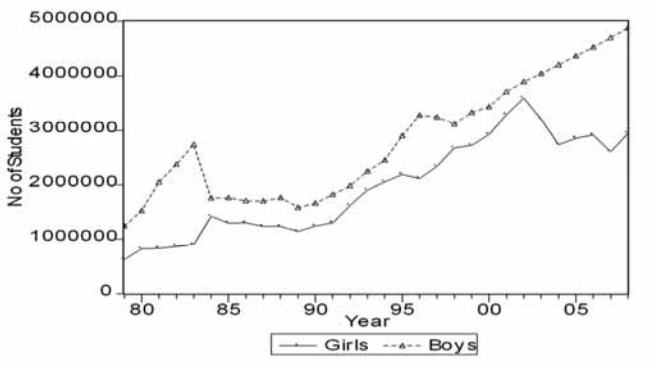

Figure 2. Secondary school Enrolment, 1979-2008

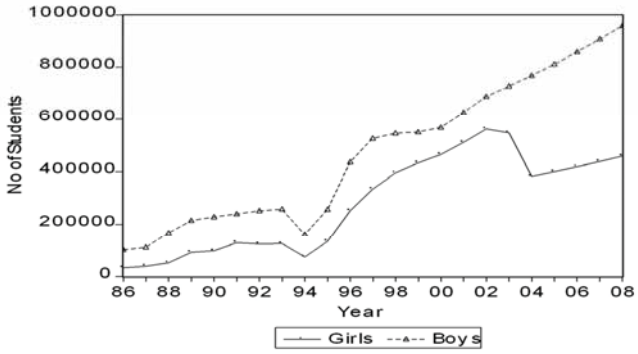

Figure 3. Total Enrolment in Nigerian Universities, 1986-2008

Another glaring fact from available statistics is the fact that women have much lower literacy rate than men. This is evident in Table 1 which displays gender inequality in education indicators for Nigeria and some selected countries.

Table 1. Gender Inequality in Education Indicators for SANE Countries, 2004-2009

S/N	Indicators	Nigeria	Algeria	Egypt	South Africa
1	Adult literacy rate, females as a % of males, 2005-2008	68	79	77	98
2.	Youth (15-24) literacy rate, 2004-2008, (%):				
	- Male	78	94	88	96
	- Female	65	89	82	98
3.	Gross primary school enrolment ratio, 2005-2009, (%):				
	- Male	99	111	102	106
	- Female	87	104	97	103
4	Net primary school enrolment ratio, 2005-2009, (%):				
	-Male	64	96	95	87
	-Female	58	94	92	88
5.	Net primary school attendance ratio, 2005-2009, (%):				
	-Male	65	97	96	80
	-Female	60	96	94	83
6.	Gross secondary school enrolment ratio, 2005-2009, (%):				
	-Male	34	80	82	93
	-Female	27	86	77	97
7.	Net secondary school enrolment ratio, 2005-2009, (%):				
	-Male	29	65	73	70
	-Female	22	68	69	74
8.	Net secondary school attendance ratio, 2005-2009, (%):				
	-Male	45	57	72	41
	-Female	43	65	67	48

Source: www.unicef.org/infobycountry/index.html. Accessed on 09/06/2011

As shown in Table 1, a comparison of indicators measuring gender inequality in education in Nigeria with that of other "Africa's G-4" or the SANE (South Africa, Algeria, Nigeria and Egypt) countries that have recently been designated African "growth poles" akin to what the BRIC (Brazil, Russia, India and China) are to the developing world supports the fact that girls lagged behind in school enrolment and attendance. Nigeria has a proportion less than the other African 'growth poles' in all the education indicators during the 2004-2009 study periods. Also, women face discrimination in access to education. For instance, net secondary school enrolment ratio for female in Nigeria stood at 22% while it was 68%, 69%, 74% respectively for Algeria, Egypt and South Africa. Similarly, net secondary school attendance ratio for female was low in Nigeria. Several reasons culminate in low literacy rate among women. One of these is that most parents are biased in favour of the education of the sons at the expense of that of their daughters. These parents are often more willing to make financial sacrifices for their son's than for their daughters' education. Other factors impeding women education in Nigeria include poverty and economic issues, early marriage, teenage pregnancy, inadequate school infrastructure and cultural and religious misinterpretation. Overall, one can conclude from the trend analysis that the goal of achieving gender equality in education remains elusive and sustainable development outlook appears to be precarious.

3. The Model, Data and Estimation Techniques

3.1 The Model

The econometric approach for this study follows Cooray and Mallick (2011). It employs an extended version of the Solow growth model with real GDP being a function of investment to GDP ratio, human capital accumulation (disaggregated by gender), labour force, openness to trade and government spending on community services. This takes the following form:

$$\ln RGDP_t = \beta_0 + \beta_1 \ln INVG_t + \beta_2 \ln IOP_t + \beta_3 \ln LBF + \beta_4 \ln MES_t + \beta_5 \ln FES_t + \beta_6 \ln GCSP + \varepsilon_t \quad (1)$$

where RGDP is the real GDP, INVG represents investment/GDP ratio, IOP represents index of openness, MES is male human capital proxied by male enrolment at the secondary school level, FES is male human capital proxied by female enrolment at the secondary school level, LBF is labour force, GCSP is government spending on social and community services and ε is a random error term. *ln* is logarithmic transformation.

The a priori expectations are: $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6 > 0$; this implies that all the explanatory variables are expected to have positive effects on real GDP. This study provides empirical evidence on the relationship between female education and Nigeria's economic performance using the error correction methodolgy. It is a clear departure from Cooray and Mallick (2011) because instead of trying to account for per capita GDP growth rate, this study relates female education to real GDP levels.

3.2 Data Sources

Data were obtained from several secondary sources and covered the period 1975-2008. Data were obtained from various volumes of *Annual Reports and Statement of Accounts, Statistical Bulletin* published by the Central Bank of Nigeria, Annual Abstract of Statistics and Social Statistics Report of the Nigerian National Bureau of Statistics and publications of the Federal Ministry of Education, Nigeria, The World Bank, World Development Indicators and enrolment figures in Anyanwu, Oyefusi, Oaikhenan and Dimowo (1997).

3.3 Estimation Techniques

For the purpose of analysis, the error correction technique will be employed to analyze the relationship among the variables in our model. Estimating equation 8 by the ordinary least squares (OLS) may lead to spurious results and inferences if some of the explanatory variables and the dependent variable are non-stationary. Thus, the Augmented Dickey-Fuller unit root test is used to ascertain the characteristics of the data in order to determine whether the variables have unit roots i.e, whether it is stationary and the order of integration. Next, the Johansen Cointegration technique is used to test for the existence of a long-run relationship among variables in the equation. Mainly, it is used to check if the independent variables can predict the dependent variable both now (short-run) or in the future (long-run). Although long-run equilibrium relationship may occur among variables in the regression model, short-run equilibrium may not occur. The short-run dynamic adjustment is modeled using error correction mechanism i.e it is used to correct or eliminate the discrepancy that occurs in the short-run. The coefficient of error-correction variable gives the percentage of the discrepancy between the variables that can be eliminated in the next time period. This methodology is employed because it adds richness, flexibility and versatility to the econometric modeling and integrates short-run dynamics with long-run equilibrium relationships between the variables, while at the same time correcting for short-term disequilibrium. This facilitates accurate predictions of the economic relationships between the variables.

4. Empirical Results and Discussion

Table 2, shows the results of the unit root test. These results depict that some of the variables were non-stationary in their level, but after first differencing, all variables attained stationarity. This can be seen by comparing the observed values (in absolute terms) of the ADF tests with the critical values (in absolute terms) of the test statistics. By implication, this suggests the acceptance of the null hypothesis and it is necessary to conclude that there is the presence of a unit root in the series.

Table 2. Results of Unit-Root Test

Augmented Dickey-Fuller Test					**Order of Integration**
	Level		**First Difference**		
Variables	**Intercept**	**Intercept and Trend**	**Intercept**	**Intercept and Trend**	
LNRGDP	1.2097	-1.2903	-3.7502*	-4.3491*	I(1)
INVG	-2.1387	-2.2577	-4.5028*	-4.5909*	I(1)
IOP	-2.1234	-2.3573	-4.2624*	-4.2084*	I(1)
LNFES	-4.4223*	-3.7989*	-2.2843	-2.6924	I(0)
LNMES	-1.7014	-2.7605	-3.2586*	-3.1447	I(1)
LNLBF	0.0983	-2.6005	-2.1976	-3.5755*	I(1)
LNGCSP	0.7039	-3.4435***	-5.4957*	-4.59443*	I(0)

Note: (*), (**), (***) indicates significant at 1%, 5% and 10% level respectively.

MacKinnon (1996) critical value for rejection of hypothesis of unit root test was applied.

Source: Author's Estimation Using E-view 5.0

The Johansen maximum likelihood test for co-integration was used to carry out the co-integration test. The Max-Eigen value test was employed in determining the number of co-integrating relations in the series. The result is contained in Table 3. From the table, there was an evidence of at most three co-integrating equations at 5%. By implication, this means that there is co-integration among the variables in the long-run. This is an evidence of a long-run relationship among the variables in the model.

Table 3. Results of the Johansen Cointegration Test

Hypothesized	Eigenvalue	Trace Statisics	0.05	Prob**
	No. Of CE(s)		Critical Value	
None *	0.933801	212.7789	125.6154	0.0000
At most 1 *	0.768815	125.8962	95.75366	0.0001
At most 2 *	0.636088	79.03101	69.81889	0.0077
At most 3	0.411330	46.68405	47.85613	0.0641
At most 4	0.375789	29.72758	29.79707	0.0509
At most 5	0.365173	14.64702	15.49471	0.0668
At most 6	0.003311	0.106138	3.841466	0.7446

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at 5% level

**Mac Kinnon-Haug-Michelis (1999) p-values

Source: Author's Estimation Using E-view 5.0

The main focus of this paper is to empirically determine the impact of female education on economic growth in Nigeria. The empirical results of estimating equation (1) are presented in Table 4. The standard error of the regression, the t-values, the coefficient of multiple determination (R^2), F-ratio, Schwarz criterion and the Durbin-Watson statistics are shown in the table.

Table 4. Error Correction Model Estimates
Dependent Variable: D (LNRGDP)

Variables	Coefficient	Std. Error	t-Statistic	Prob.
D(INVG(-1))	-0.005171	0.003587	-1.441301	0.1630
D(IOP)	0.254332	0.106172	2.395464**	0.0251
D(IOP(-1))	0.333610	0.125193	2.664764**	0.0138
LNFES(-1)	0.029282	0.020979	1.395795	0.1761
LNGSCP	0.007622	0.009587	0.795006	0.4347
D(LNLBF)	-8.382009	4.113438	-2.037714**	0.0532
D(LNMES)	0.231579	0.106709	2.170190**	0.0406
ECM(-1)	-0.275004	0.140595	-1.955998**	0.0627
C	-0.238928	0.286172	-0.834909	0.4124
Adjusted R-squared	0.537855			
Schwarz criterion	-2.310187			
Durbin-Watson stat	1.813552			
F-statistic	3.345994**			

*, **, means 1%, 5% level of significance

Source: Author's Estimation Using E-view 5.0

The empirical analysis shows that female education has no significant impact on real GDP in Nigeria. The findings are consistent with the findings of Barro (2001) and Cooray and Mallick (2011). This result suggests the need for investment in female human capital. The male human capital has a significant and positive effect on the Nigerian economy. This implies that the theoretical expectations that male human capital education promotes growth are valid in the Nigerian case. The coefficient of the error correction variable (ECM (-1)) is, as expected, negatively signed, statistically significant at 5 percent level and its absolute value lies between zero and unity. Consequently, it will act to correct any deviations from long-run equilibrium. The size of the absolute value of the error-correction coefficient shows that the speed of restoration to equilibrium in the event of any temporary displacement is slow.

Contrary to expectations, the results also revealed that investment to GDP ratio has a negative but not significant effect on real GDP when lagged by one year. It is implied that instead of promoting growth, investment efforts have not been beneficial to the economy. Nigeria's investment climate has not enhanced the country's purchasing power. This implied that there were severe infrastructural bottlenecks that hindered private sector initiatives. Government investment on social and community services has no significant effect on the Nigerian economy. This is not surprising because of the high level of corruption in the country. Most of the government spending on social services tends to end in private pockets. Moreover, the projects embarked upon by the government are not aimed at alleviating the suffering of the people but to score political points. The result shows that trade openness is an effective policy for promoting economic performance in Nigeria. The findings suggest that creation of a stable macroeconomic environment has a tendency to enhance domestic investment in Nigeria.

5. Conclusion and Policy Implications

This study has examined whether female education promotes Nigeria's economic performance using the Johansen co-integration and error correction techniques. The augmented Solow model is used to incorporate the gender dimension. In the course of this study, the relationships among some key socio and macroeconomic variables such as investment to GDP ratio, human capital accumulation (disaggregated by gender), labour force, openness to trade and government spending on social and community services and real GDP have been investigated. The Johansen maximum likelihood test for co-integration shows that there is an evidence of a long-run relationship among the variables in the model. The results of this study reveal that female education does not have any significant impact on real GDP in Nigeria. This finding brings to the fore the need for adequate investment in female education. The fact that male education has a positive and statistically significant impact on the growth of the Nigerian economy may be attributed, in part, to the biased nature of child development in many parts of Nigeria which favours the education of the male children at the expense of female children. The policy implication of the study is that if the country wants to achieve sustainable growth which would engender structural transformation of the Nigerian economy, the issue of gender equality in access to education should be taken seriously. Thus, government should reappraise, existing development policies and strategies and pay more attention to educational policies that enhance female enrolment rates, participation in

educational institutions and literacy to enhance women contribution to growth and economic transformation in Nigeria.

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An Empirical Study on the Impacts of the Chinese Banking Industry by Foreign Banks' Entry

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Abstract

Foreign banks entering into the Chinese banking industry have significant influence in its profitability sources including non-interest income while foreign banks bring competitions to the domestic banking sector resulting in declined profitability of the Chinese banking industry. In addition, foreign banks' entry makes a promoting efficiency in China's banking sector. Overall foreign banks' assets become an integral part of China's financial institutions, and they may have more significant impacts on the non-traditional businesses and operational efficiency of Chinese banking which helps the formation of healthy competition.

Keywords: foreign banks' entry, Chinese banking industry, profitability

JEL Classification: G21

1. Introduction

In 1979, China approved the first foreign banks to set up offices in China. The number of foreign banks in China has begun to sprout since then. Since 1992, China has opened Xiamen, Zhuhai, Shantou, Hainan, Shanghai, for foreign banks to enter and the rapid development stage has come. The new century, China's access to the WTO, the Chinese banking industry is facing unprecedented opportunities and challenges. As the financial industry is one of the first opening areas, the rapid development of foreign banks will have a profound impact on the Chinese banking sector. Specifically, during this past decade, those aspects that whether business development by foreign banks in China has impacts on the Chinese banking industry's profitability and the operating level, and that how much are the following impacts, are our main concern. In this paper, we conduct multiple regression analysis, using the data included in the China representative four state-owned commercial banks and the related financial data about seven joint-stock banks.

2. Research Literature Review

In recent years, banks have to cope with foreign banks' entry into their countries. Entering other country is a new investment for foreign banks.

(1) The positive effects of foreign banks' entering into host county

In terms of the positive impact of foreign banks' entry, Gelb and Sagari (1990), Levine (1996) consider that the foreign banks entry will benefit the host county as following aspects: improving the efficiency of resource allocation; increasing the competition among banks, thereby enhancing the domestic financial service quality; accelerating the establishment of the legal framework and the banking supervision; increasing the host country's capability to procure capital from the international capital market.

(2) Empirical analysis on the impacts of the entry of foreign capital entry into the host country's banking sector

The empirical studies for the impacts by foreign banks' entering into the host banking industry carried out earlier. Most studies confirm that the foreign banks' entry leads to a positive role in improving the efficiency of the host country's financial system. Claessens, Demirgus-Kunt, Huizinga (2000) conducted a study using cross-sectional date from 80 countries, and the results show that the efficiency of the foreign banks is usually lower than domestic banks, while in developing countries the results were reversed. The increasing number and degree of foreign banks entry will break the monopoly of local banks through the competition. That also will improve bank

profitability, reduce operating costs, improve efficient usage of resource, and promote efficiency and fairness of the entire banking industry. These results are often used as evidence that the foreign banks' entry has significant impacts in improving the overall efficiency of the banking system, and that the result is also used as a basis for developing countries to open up their financial sector. Terrel (1998) also has studied the impact of the banking industry's opening in some countries. After analyzing 14 developed countries' banking market data, he found that the countries which allow foreign banks entering usually get a lower pre-tax profit and operating costs than those do not allow to enter. In other words, the competitive effects which brought by the foreign banks will reduce the local banking market shares and profits, but it can improve the banking market functions and enhance the overall social economic level.

The representative scholars who have studies on the impacts of individual country's entry are Clarke (1999), Barajas (1999) and others. After the studies on Argentina, Colombia and Turkey and other countries, Clarke (1999) found that the foreign banks' entry will reduce the high level of the locals' operating costs, and have significant effects on improving the entire banking system efficiency. By studying how foreign banks impact on the Colombian banking industry, Barajas, Steiner (1999) found that foreign bank's entry shrinks the proliferation of intermediaries, reduces the intermediary business income and non-financial costs of the local bank at the same time, and it also lowered the cost of loans.

(3) The possible adverse effects of the foreign banks' entering

From the possible negative effects of the foreign banks' entry, Stiglitz (1993) summed up the potential risks of and costs to the domestic banking industry, enterprises and government as follow. Domestic banks will face strong technologically advanced competition from large foreign banks, thus domestic banks may suffer from the weakening of market forces and profits. Foreign banks with parent bank and subsidiaries equipped with global distribution channel will have a close business contacts with large multinational companies and provide more opportunities for the cross-sub-partnership, while the small and medium domestic enterprises may get less services for. The main purpose of foreign bank's entry is for profit. Marketing operation in the host country may weaken the role that banks do on the nation's industrial politics and the host government's macro-economic control capability. Foreign banks attract the best customer's with more advanced products and better services in the domestic market, while domestic banks may instead engage in potentially riskier businesses by the forcing competitive pressure. In addition, Agenor (2001) pointed out that once the host country faced economic difficulties, foreign banks could become a haven for social capital. Massive transferring of wealth will further exacerbate instability in the host country's financial market.

2.1 Domestic Research Literature

With the five-year transition period of financial opening process, foreign banks entering into China have rapidly increased from the quantity to the size. So it is increasingly important to study the impacts of foreign banks' entry into the Chinese banking industry, and proposing specific policy recommendations to face the situation is important as well. Although previous studies have accumulated wealthy experience in terms of foreign banks' entering into other countries, the most cases are for the developed countries. Because China is different from the other developed countries in some aspects, such as, the micro-economic conditions, the grades of bank opening, the financial development and so on, so the case of China should be studied with different approaches.

(1) Theoretical analysis on the impacts of foreign banks' entering into the Chinese banking industry

On the impacts of the foreign banks' entry, domestic scholars, such as, Xu Zhendong (2001), Ye Xin (2004), Guo Yan and Zhang Liguang (2005) concluded that the foreign banks' entry will help improve domestic banks' operational efficiency and financial stability. Those studies mainly reflected improving the Chinese banking efficiency by the competitive effect (Bai and Li Ya (2002) go far classification). It is undeniable that the foreign banks' entry is challenge to China, compels domestic banks to improve operational efficiency and competitiveness, and credit resources in private sector are expected to be improved. While competing and cooperating with foreign banks, the Chinese banking system, such as, risk assessment and customer credit evaluation system will be further improved. Improvement of customer credit evaluation system is expected to mend the private sector's credit resource distorted by the wrong information. The establishment of risk assessment can also reduce the risk of the entire financial system.

Also, the efficiency of resource allocation is expected to be improved (Gao Xiaohong (2000)). China has a lot of fields which hold great investment value; however, the domestic banks cannot provide financial supports to these industries, because of low level of the technology and the ability to spread the risks. So the entry of foreign banks is expected to improve the situation, digging out the huge potential and setting up competitive and effective industries.

Foreign banks' entry will have brought forth technology spillovers in the related fields. During the process of competition and cooperation with foreign banks, domestic banks have the opportunity to learn from the foreign banks plentiful experience both in the traditional banking businesses and in the new banking businesses. In terms of technology spillover effects, domestic banks can have the opportunities to quickly grasp the advanced technology. Furthermore, a large number of Chinese staffs who served for the foreign banking institutions can acquire foreign advanced management experiences and innovative capabilities. Guo Yan and Zhang Liguang (2005) found that market competition effect, technology demonstration effect, and financial stability effect by foreign banks' are kicked in China too.

(2) The empirical analysis of the stability impact by the foreign banks' entry into the Chinese banking industry

The empirical researches analyzing the effects of the foreign banks' entering were carried out relatively later. The representatively scholars on this field are Ye Xin and Feng Zongxian (2003). They have analyzed the date of foreign banks' actual entering degrees, macroeconomic variables and financial data, and pointed out that the expansion of foreign banks entry both in number and in size help strengthen the stability of domestic banking system.

(3) The impact of other areas by the foreign banks' entering into the Chinese banking industry

Mao Zesheng (2005), Guo Yan and Zhang Liguang (2005), Huang Xian and Xiong Fuping (2006), Liu Liwei and Wu Lina (2006), Chen Weiguang and Xiao Jing (2007), also did empirical research on the efficiency effects by foreign banks' entering into the Chinese banking industry. Sun Ming (2005) studied on the impacts by foreign banks on China's regulatory sector. Liu Liwei and Wu Lina (2006) pointed out his own views on the effects of cross-border acquisitions of banks and proposed China's international banking strategy. These studies showed that foreign banks' entry may have negative effects. That is, foreign banks' entry may force Chinese domestic banks to be engaged in higher risky activities; the fierce competition for good customers could force Chinese domestic banks to transact with potential higher risky customers; foreign banks may not follow the guidelines by the government authorities of China, and its business activities may not meet the China's development strategy.

In summary, foreign banks' entry can promote the formation of inter-bank competition, consummate the overall operating efficiency of the host country's banking industry, and promote the banking management level and formation of competition among banks. But it may also weaken the domestic banks' market power and profit, reduce small and medium domestic enterprises' access to financial services, and slow down the government's macro-economic control capability. However, there is no universal answer to what impacts are brought by the foreign banks' entry. On the process of opening the financial sector, China's government should strive to bring the possible positive effects into reality, to avoid the adverse effects by foreign banks.

3. Research Hypothesis

3.1 Hypothesis

We raise the following questions: "During this past decade, business development by foreign banks in China has impacts on the Chinese banking industry's profitability, the operating level, and how much is the impacts, if any". Assuming that Chinese banking industry's profitability and operational efficiency will be impacted by the foreign bank's entry, we will measure the profitability in two aspects, the non-interest income ratio, and operational efficiency. Then we make the following assumptions:

(1) With the foreign banks' increasing operation scale, Chinese banks' net profit margin will be shrank,

(2) With the foreign banks' increasing operation scale, Chinese banks' non-interest income ratio will be reduced.

(3) With the foreign banks' increasing operation scale, Chinese banks will improve the operational efficiency.

Corresponding to the above three assumptions, we separately establish net profit margin, non-interest income, the ratio of operating costs to total costs (operating efficiency), which are the explanatory variables for the three models. In the three models, an independent variable, foreign banks' business in China (the ratio of foreign banks' assets to China's financial institutions (FAP)), is included.

3.2 Variables

In order to answer whether foreign banks' entry has effects on profitability of China's banking industry, we first need to select proxy variables which represent the profitability of the banking industry. Here we consider two variables, net profit margin (NP) and non-interest income ratio (NNIR). Net profit margin is the net profit divided by total assets, while non-interest income ratio is non-interest operating income divided by the sum of net interest income and non-interest income. The reason we use net profit margin (NP) is because it mainly reflects the bank's overall profitability. Considering that the deposit and loan spreads are the major part of

Chinese banking income, we take the NNIR to measure the non-traditional income profitability of the Chinese banking industry. Similarly, to answer whether the foreign banks impact on the operation efficiency of China's banking, we select a proxy for the efficiency of banking operations. Before and after the foreign banks' entry, the sample banks' operating costs (OC) can be different, so the change in operating costs can be to some extent reflect the impacts by foreign banks' entry to the operating efficiency of sample banks. But each sample bank has different asset size and different operating cost size, so we choose the ratio of operating costs (OC) to the total cost (TC), OE (OE = OC/TC)), as a proxy variable, to eliminate the effect of the sample bank size.

In the current literature, there are two methods to measure the degrees of foreign banks' entry. The first is the number of foreign banks, the ratio of the number of foreign banks to the number of domestic banks. The second is the share of assets owned by foreign banks, the total foreign bank assets proportional to the total domestic banking assets. Although the total assets of China's banking industry is huge but highly concentrated in the market, that is, the number of banks in China is small, coupled with restrictions on foreign banks business scope, the foreign banks that have some market share can bring impacts on making prices and profits of domestic banks. According to the fact that Chinese actual conditions are more in line with the second measure, we choose the total assets of foreign banks proportional to those of Chinese financial institutions as the proxy variables of the degree of the foreign banks entry.

Here are the control variables. The rate of inflation (CPI) can affect the Chinese banking industry profitability and operational efficiency. And other variables included are total assets (TA), operating income (OR), and the total cost (TC).

3.3 Sample Selection

We selected four state-owned China's commercial banks, China Construction Bank, Agricultural Bank of China, Bank of China and Commercial Bank of China, and seven joint-stock banks, Merchants Bank, CITIC Bank, Bank of Communications, Shanghai Pudong Development Bank, Industrial Bank, Huaxia Bank and Minsheng Bank. The time period for the sample is the last decade, from 1999 to 2008. The data were collected from the "China Financial Yearbook"(Volume 2009 to Volume 2000) and "China Statistical Yearbook" (Volume 2009 to Volume 2000).

3.4 Sample Statistical Analysis

Here we will do the appropriate statistical description of the selected 11 banks on three selected variables: net profit margin (NP), ratio of non-interest income to operating income (NIOI), and ratio of operating costs to total cost OE (OE = OC / TC), to make understand further on their basic features.

Table 1. Sample bank's descriptive statistics on net interest (1999-2008)

bank	Mean value	Stand. deviation	Max. value	Min. value
Agricultural Bank of China	0.001818	0.002891	0.007357	-0.000155987
Bank of Communications	0.005078	0.003356	0.010589	0.000803594
Bank of China	0.006192	0.004022	0.012707	0.001111115
China Construction Bank	0.006886	0.004474	0.012542	0.001395955
Industrial Bank	0.005344	0.003225	0.011152	0.000934689
China Minsheng Bank	0.010241	0.015806	0.055081	0.003621879
China Merchants Bank	0.006726	0.003152	0.013326	0.004425543
China CITIC Bank	0.005366	0.002473	0.011214	0.003145847
Bank of China	0.004625	0.001918	0.008375	0.003249213
ICBC	0.00388	0.004061	0.011432	0.000407546
Pudong Development Bank	0.010374	0.014446	0.051186	0.004220376

We can see from the table 1, Minsheng Bank, Shanghai Pudong Development Bank have high total capital utilization, more than 1% net profit margin. Of course, the result has relationship with lesser total assets. In contrast, the Agricultural Bank of China and Commercial Bank of China's have relatively low total capital utilization, only 0.182% and 0.38806, respectively, which may have the relationship with their own enormous assets.

Table 2. The Descriptive statistics of sample banks' ratio of non-interest income to operating income (1999-2008)

bank	Mean value	Stand. deviation	Max. value	Min. value
Agricultural Bank of China	0.2982	0.21673	0.60037	0.08219
Bank of Communications	0.47364	0.31594	0.81006	0.08413
Bank of China	0.23697	0.06502	0.33897	0.13833
China Construction Bank	0.2732	0.22312	0.71983	0.06345
Industrial Bank	0.37949	0.28915	0.81797	0.02892
China Minsheng Bank	0.42821	0.29243	0.71798	0.04868
China Merchants Bank	0.425	0.19454	0.66209	0.15714
China CITIC Bank	0.49636	0.30173	0.78797	0.05992
Bank of China	0.4035	0.23746	0.70788	0.04416
ICBC	0.2373	0.29578	0.8236	0.05437
Pudong Development Bank	0.37889	0.29115	0.76324	0.0218

We can see from the Table 2 that different banks have different ratio of non-interest income to operating income. That indicates different banks have different non-traditional business development. For the ratio of non-interest income to operating income among banks of table, Merchants Bank, CITIC Bank, and China Minsheng Bank exceed 40%. While the four state-owned commercial banks, Agricultural Bank of China, Bank of China, China Construction Bank, China Industrial and Commercial Bank were only 29.82%, 23.6970%, 27.32% and 23.73%. This fact reveals that the four major commercial banks earn the main income from traditional deposits and loan businesses. But among the banks listed above, CITIC Bank, Huaxia Bank, and Minsheng Bank are actively expanding their non-traditional businesses, to be more flexible on the way of the operation.

Table 3. Descriptive statistics of the sample banks' ratio of the operating costs to the total cost (1999-2008)

Bank	Mean value	Stand. deviation	Max. value	Mini. value
Agricultural Bank of China	0.82871	0.2952	0.9201	0.42808
Bank of Communications	0.61343	0.3468	0.7406	0.3372
Bank of China	0.79392	0.3093	0.8816	0.41796
China Construction Bank	0.81888	0.2747	0.9186	0.46062
Industrial Bank	0.54031	0.3699	0.7308	0.32644
China Minsheng Bank	0.54794	0.3765	0.6414	0.31987
China Merchants Bank	0.66101	0.3495	0.8246	0.37526
China CITIC Bank	0.49359	0.3969	0.8399	0.33765
Bank of China	0.46225	0.4322	0.7663	0.31309
ICBC	0.83228	0.2606	0.8917	0.42522
Pudong Development Bank	0.41483	0.3882	0.7412	0.30728

We can see from the table 3, the four major commercial banks and the joint-stock banks have relatively larger operating costs ratio. The four major commercial banks have generally relatively high, while the joint-stock banks are low. We mainly want to examine the net profit rate (NP), the non-interest income ratio (NNIR) and the ratio of operating costs to the total cost (OE; OE = OC/TC) to see whether the three variables affected by the impact of foreign bank entry.

From the correlation analysis, we can see that net profit rate (NP), non-interest income accounted for the ratio of operating income (NNIR) and the operating costs of the total cost ratio OE have a significant correlation with the foreign banks entry. Pearson correlations are 0.4368, - 0.60585 and 0.25439, respectively, while P values of the three Pearson correlation coefficients are less than 5%. That is, the three research variables and the assets of foreign banks were significantly related.

3.5 Regression Models

According to the three hypotheses in section 3.1, we set up multiple regression models for the three variables.

We conduct multiple linear regressions on samples (11 banks) from the data of 2008 to 1999, using generalized linear least squares estimation method, model parameters screening methods using stepwise regression method.

(1) The final model parameter estimation and the final model equations are as follows:

From the perspective of the sample banks net profit margin, we examine the impacts by the foreign banks' entering on the profitability of China's banking industry. The model is:

$$NP = \alpha_0 + \alpha_1 FAP + \alpha_2 OR + \alpha_3 TA + \varepsilon \quad (1)$$

(2) For the analysis of the effects of non-interest income ratio, the model is:

$$NNIR = \alpha_0 + \alpha_1 FAP + \alpha_2 OR + \alpha_3 TA + \varepsilon \quad (2)$$

(3) For the analysis of the impacts on operating efficiency, the model is:

$$OE = \alpha_0 + \alpha_1 FAP + \alpha_2 TC + \varepsilon \quad (3)$$

The results are summarized as the following table.

Table 4. Empirical results of

	Model 1			Model 2			Model 3		
Variable	Parameter estimation	t value	p value	Parameter estimation	t value	p value	Parameter estimation	t value	p value
Intercept	-0.00842	-1.64	0.1066	1.16467	-.14	<.0001	-5.73658	-1.56	0.1243
FAP	-0.00791	-3.02	0.0037	-0.45089	-6.95	<.0001	5.47506	2.94	0.0046
OR	0.0000111	3.2	0.0021	0.0003093	3.61	0.0006	-		
TA	-3.15E-07	-3.19	0.0022	-1.01E-05	-4.13	0.0001	-		
TC	-			-			-0.00493	-3.83	0.0003
Adj. R-sqaure	0.2737			0.4912			0.2174		

5. Conclusion

We can conclude from the above results: We can see that the coefficient of the total foreign bank assets proportional to the total domestic banking assets is negative at 5% significance level. Negative coefficient indicates that foreign banks in China impact the banking industry's net profit margin negatively. As the assets of foreign banks expand, their impacts cause significant conflicts with domestic banking sector. As the foreign banks increase volume of business in the host country, the domestic bank's net profit rate decreased significantly. The coefficient of operating income is significantly positive, which is consistent with and relevant to the financial theories indicating that the more operating income, the greater net profit margin. But it is worth notifying that the total assets coefficient is significantly negative, which shows that the larger of the sample bank's total assets, the lower net profit rate is. And this is the same as we saw from the general statistical description before. It is shown that to some sample banks, the larger of the asset size, the more administrative costs, the more difficult to manage, even the net profit margin may decline with the increase of sample banks assets. We should pay attention to such phenomenon.

We can see if we divide the net profit into interest income and noninterest income, the non-interest income estimated coefficient is also significantly negative in the final model. Similarly, foreign banks' entry did insignificant impacts on Chinese non-traditional businesses. Because Chinese interest rates are not market-oriented interests, and Chinese bank deposits and lending rates are determined under the guidance of the government regulations, the ratio of interest income to operating income is very small due to the fact that the major part of Chinese major banks' income is their deposits and loans spread. Compared to domestic banks, foreign banks do not have advantages in the size of deposits but they have advantage in loan interest rates. That may lead to negative impacts on Chines banks' non-traditional businesses and financial services. With the increasing scale of foreign banks, domestic banking businesses for the income from non-traditional business will become lesser. The operating income coefficient is significantly positive, indicating that the more operating income, the greater ratio of non-interest income to operating income. The fact that the coefficient of total assets is significantly negative shows that the greater the total assets of sample banks, the smaller ratio of non-interest income ratio.

From the perspective of operational efficiency, the result that coefficient of the ratio of the total foreign banks' assets to those of Chinese financial institutions is positive indicates that there is significant improvement in operating efficiency by foreign banks' entry, which is the same to our theoretical analysis. In addition, the total

costs have significant effect on operating efficiency, that is, the lower total cost, the better operational efficiency.

On the whole, foreign banks entering into the Chinese banking industry have significant influence in its profitability including some non-interest income. In addition, foreign banks' entry impacts significantly on the bank's operational efficiency. On one hand, foreign banks bring competitions to the domestic banking sector resulting in declined profitability of the Chinese banking industry. On the other hand, due to competition, foreign banks' entry makes promoting efficiency in China's banking sector. Until foreign banks' overall assets become an integral part of China's financial system, it may bring more significant impacts on the non-traditional businesses and operational efficiency of the Chinese banking system which helps the formation of healthy competition.

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Bank Lending in Project Finance: The New Regulatory Capital Framework

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Abstract

The paper aims to examine the new regulatory framework of project finance in the economics of banking firms. In particular, the paper investigates the uniqueness of the project finance, the significant importance of the project finance in bank activity, and the role of the new bank capital requirements to promote the innovative financial scheme.

In the project finance business loans terms and characteristics are primarily based on the assets and quality of the project to be financed. It means that the usual bank rating models for lending business might not been implemented in the project finance lending. Quantitative estimates of credit risk could not be always possible in project finance lending. Consequently, the new regulatory capital requirements framework gives banks the option to implement a qualitative method – a supervisory slotting criteria approach – to evaluate credit risk in project finance lending business. The regulatory capital requirement recognizes project finance as specialized lending. The paper provides a summary of the treatment of the project finance in the New Basel Capital Accord.

The paper is organized as follows. Section 1 provides a general description of project finance. Section 2 identifies the economic and financial uniqueness of project finance loans and credit risk assessment process. Section 3 delineates the impact of the new regulatory capital requirements framework on project finance lending. Final sections concludes.

Keywords: project finance, specialized lending, bank capital requirements, credit risk

1. Introduction

Project finance is an innovative financial technique that aims to fund investment project based on the basis of economic and financial characteristic of the project itself, rather than on indebtedness capacity of the promoter of the project.

Usually, the birth of the project finance goes back to the previous century in the United States and, in particular, in the energy and oil extraction. At the international level project finance has been established especially after the Second World War. The application of project finance in the industry and infrastructure sector is more recent (ports, airports, railway works, high speed rail, hospitals, prisons, subways, bridges, roads, environment projects, telecommunication networks, alternative energy plants, power generations plants, chemical processing plants, mines, etc.). This success was due to the privatization process that affected the European countries and the increasingly constraints on public spending that has increased the need for private financial resources.

Project finance during the last decades has become not only an innovative financial instrument but also an instrument of economic policy that aims at encouraging the involvement of private parties in infrastructure financing and management of public utilities (Brealey, Cooper & Habib, 1996; Comana, 2003; Imperatori, 2003; Khan & Parra, 2003). The widening, over time, of project finance techniques to different kinds of projects has expanded the technical notion of the project finance. Today, it encompasses some cases that are different from the traditional concept of the project finance. It has mainly occurred in the public sector where public works are entirely financed with public funds. It becomes essential to define the concept of the project finance from a legal and management point of view, in order to better analyze the different configurations assumed by the project finance.

It is complex to give a legal definition of project finance because it is not suitable to frame the project finance within a typical contract. It represents rather a sum of typical contracts, such as supply, sale, procurement,

financing, etc. In addition, there are agreements with local governments and administrative measures (licenses, permits, concessions, etc). Project finance can not therefore be regarded as a single multilateral contract but as a set of typical contracts which are closely linked (Figure 1). Even though project finance has certain common elements, every project finance operation has unique characteristics that distinguish one from each other. So, it is very difficult to give a general definition, since it has been adapting not only to the objectives of parties involved but also to technical, financial, and economic aspects of the investment projects.

A special purpose vehicle (e.g. a corporation, limited partnership, or other legal form) usually builds and operates a project. The project finance represents a multidisciplinary way to finance specific investments. It is characterized by complexity and a high involvement of bank loans. The main guarantee for the repayment of funds is represented by cash flows of the project. Project finance can be defined as a financing technique in which the main point of reference is the project. The single project has a distinct legal entity. Lenders loan money for a project solely based on the specific project's risks and future cash flows (Altug, Ozler & Usman, 2002; Beidleman, Fletcher & Veshosky, 1990; Finnerty, 2007; Wynant, 1980). The project should be able to generate cash flows over time in a sufficient way to repay loans and offer adequate returns on equity. Nevitt (1988) has defined the project finance as a financing technique in which a lender relies on cash flows of the project as the source of funds that will allow the repayment of loans and the return on equity capital. This is the main difference between project finance and corporate finance.

In the project finance the procedure for granting a loan is reversed. In the corporate finance a bank evaluates the possibility to loan money based on the credit standing of the firm. In the project finance a bank decides to fund a project by agreeing that cash flows to service debts are associated with revenues generated from the project, and the guarantees are only represented by the assets of the project and not by all firm's assets. The project lies at the center of all the contractual and financial relationships in the financing scheme. The project is evaluated mainly by private lenders for its ability to generate cash flows.

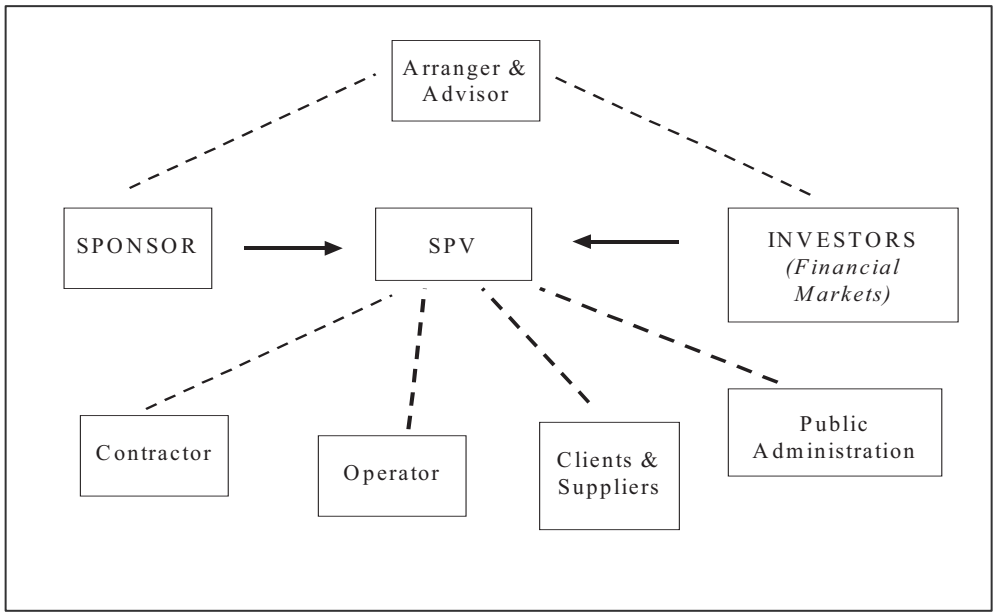

Figure 1. Project Finance: a Comprehensive Scheme

Using project finance involves making a detailed business plan. The plan should quantify cash flows that the investment will generate in the future in order to assess the project's ability to repay debts and equity. In order to do so is necessary to define a credible set of assumptions that should be used as an information base for the estimations of future income statements and balance sheets as well as for the calculations of the expected cash flows generated by the investment project (Figure 2). A set of cash flows scenarios is a basic starting point of every project finance transaction. It has a macroeconomic, industry, and asset specificity. Ideal projects for project financing are those that have relatively predictable and stabile cash flows.

Project finance has proven to be a useful financing technique throughout the world and across many industry sectors (Buljevich & Park, 1999; Esty, 2002, 2003; Fabozzi & Nevitt, 2000; Gatti, 2008). As argued before,

project finance is an innovative model of financing projects. This leads to emphasize the unique attributes of project finance:

a. cash flows of the project must be legally isolated by other activities (*ring-fence*). It usually is, but not necessarily, realized through the establishment of a corporate vehicle (special purpose vehicle-SPV) to isolate assets in a separate entity;

b. financing decisions are based on the cash flows that the project is expected to generate. The project is financed as a stand-alone entity rather than as part of a corporate balance sheet;

c. expected cash flows must be sufficient to meet debt service (appropriate *cover ratios* are identified);

d. the risks of the project, that are reflected in a more or less variability of costs and revenues of the project, must be identified, analyzed, evaluated, and distributed among various parties involved in the project. The *risk sharing* should be realized through a complex system of contracts which reflects a process of negotiation between different stakeholders.

e. projects usually have two main distinct phases (construction and operation) characterized by different risks and cash flows structures.

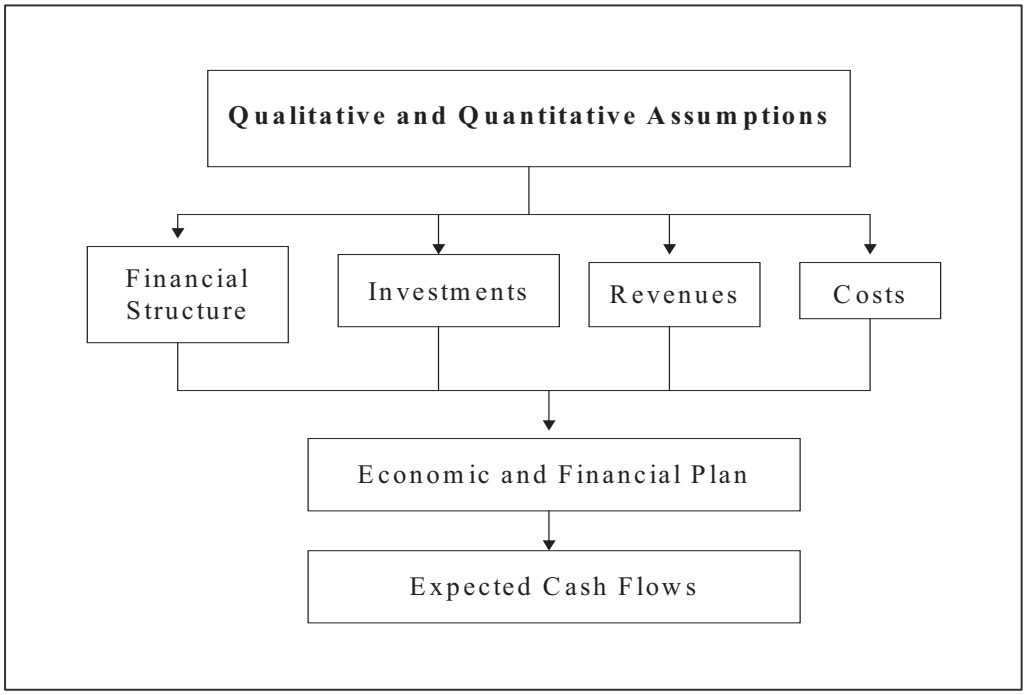

Figure 2. Project Finance: a Flow Structure of Expected Cash Flows

2. Bank Lending and Credit Risk Assessment in Project Finance

The de-specialization of banks has led to a greater integration between different segments of financial intermediation: loans, securities and insurance. This was possible thanks to the development of "universal" banks which are able to offer many kinds of services. In the project finance business banks may offer two kind of services: advisory services and financing services.

As regards the role of financial advisor banks may assist public or private parties to promote projects. The following financial services might be provided by banks in the project finance business:

- analysis of technical aspects of the project (product, target market, competition, risks, etc.);
- analysis of regulatory and legal aspects;
- due diligence;
- risk sharing package;
- preparation of business plan and sensitivity analysis;

- quantification of financial supports and identification of fund providers;
- evaluation of debt capital and equity capital in the project;
- organization and negotiation of financing terms (arranging).

As regards the role of financing services provider banks may mainly offer debt capital. They rarely offer equity capital. The activities concern mainly:

- underwriting debt capital;
- provision of syndicated loans;
- provision of equity capital;
- provision of guarantees;
- provision of financial support to issue project bonds and raise equity capital in the financial markets.

The project finance has two sources of funds: debt and equity. Debt capital is usually provided by commercial banks and international investment banks. Equity capital is usually provided by project sponsors and outside equity investors, such as commercial banks, investment funds specializing in project finance equity, venture capital and private equity vehicles. Banks are the largest providers of debt capital in project finance and the financial structure of the project (leverage ratio) is very important in convincing bankers to provide capital. It implies that banks must pay particular attention to the evaluation of the credit risk of the project. The failure of the project, and the subsequent borrowers' insolvency, may damage lenders heavily.

Project finance is characterized by an *high leverage financing* scheme. It is possible to achieve much higher leverage ratios than sponsors could sustain on their own balance sheets. In addition, project finance loans on average have a longer term than corporate loans. The traditional debt-based financing model is the bank loan. It is the traditional way to raise long-term funding for long-term projects. A new debt-based financing model is the issue of project bonds (Scannella, 2012). Using financial techniques and financial market conventions for project appraisal, design, and financial structure, project bonds might represent an innovative way to perform the function of financial intermediation instrument and long-term project financing instrument.

The assessment of economic and financial feasibility of the project made by the banks should primarily evaluate the expected economic return of the project on medium and long term, rather than focusing on collaterals provided by sponsors or third parties. To assess the "bankability" of a project is necessary to carry out a feasibility study. A bank, before starting the assessment process, has to evaluate the existence of key (base) elements to participate in a project finance. Banks have to differentiate bankable projects from not bankable ones.

Preliminary test of project practicability (*viability test*) is the first step for banks. The project should be technically feasible and economically viable (Esty, 2003; Fabozzi & Nevitt, 2000; Yescombe, 2002). A "static" analysis of the project focuses on assets characteristics, tangibility and marketability of corporate assets, as well as firm's solvency ratios. In the standard corporate lending the lender has security over tangible assets. A "dynamic" analysis is necessary in funding project finance because lender's primary security is the future revenue stream of the project. It is a different type of analysis that focuses on the expected economic and financial returns associated with the project. In particular, a lender should deeply evaluate the degree of innovation of the project, the professional skills of people who will execute and manage the project, the capabilities, competences, and knowledge of firms involved in the project, the reaction of the target market to the introduction of new services and products. The implementation of a dynamic perspective of analysis of projects to be finance implies a "paradigm shift" in the bank lending assessment process (standard corporate lending vs. project finance lending).

Lending to a project exposes banks to credit risk. It is the typical risk in lending business. It refers to the borrower's ability to service its debt. The borrower is usually a special purpose vehicle (SPV) that is not permitted to perform any function other than developing, owning, and operating the project. Such credit risk exposure involves every kind of loans in project finance. Credit risk is most simply defined as the potential that a bank borrower will fail to meet its obligations in accordance with agreed terms. In a limited meaning of the "credit risk", it affects the extreme case of insolvency, namely the fact that debtor does not meet his payments. Credit risk definition can be enlarged including the reduction of creditworthiness. Even this reduction does not automatically translate into insolvency, however, it could increase the probability of insolvency. The payment may ultimately be made, but credit risk is a concern because the delay in receiving payments is costly.

In a wider perspective, credit risk refers to the likelihood that the borrower will default or fail to make timely payments of principal and interest. Credit risk should be measured not with reference to a single binomial distribution ("default" vs. "no default") but with reference to a distribution of different levels of insolvency probability, in which the insolvency event is only the extreme event that could occur in the future.

Generally, the loan agreement in the project finance sets some possible "events of default" that allow lenders to take action against the project company. Once an event of default has occurred, the project company is no longer able to manage the project without lender involvement. These events do not put the project in default automatically. A decision has to be made by the lender after the event of default has occurred. As correctly argued by Yescombe (2002, p. 319) typical events of default could be the followings:

- the project company fails to make any payment under the financing documentation on its due date;

- the project company does not fulfill any of its covenants or undertakings under the finance documentation;

- there is any change in the ownership or control of the project company prior to an agreed date;

- the project company is subject to a court judgment for more than a certain amount;

- insufficient funding remains to complete construction of the project;

- any permit or license is revoked;

- the project is abandoned;

- any party defaults under a project contract.

Over the last decade, banks have invested a lot of resources in modeling the credit risk arising from their loans to project finance business, thanks to the implementation of the New Basle Capital Accord (2006). The revised Capital framework is more risk sensitive than the 1988 Accord. The new supervisory regulation aims to strengthen the soundness and stability of banks by adopting more risk sensitive capital requirements. It imposes a strict control over the bank lending policies. A significant innovation is the greater use of risk assessments provided by bank's internal rating systems. It has promoted the adoption of stronger risk management practices by banks. These advanced risk management practices aim to produce quantified measures of risk and economic capital, allowing banks to use internal credit risk models for regulatory capital purposes.

Credit exposure to project finance business is classified as a form of "specialized lending" (Basle Committee on Banking Supervision, 2006, p. 53) for the assessment of bank regulatory capital requirements. Credit exposures have to be classified as a form of specialized lending when:

- the exposure is typically to an entity (often a special purpose vehicle) which was created specifically to finance and/or operate physical assets;

- the borrower has little or no other material assets or activities, and therefore little or no independent capacity to repay the obligation, apart from the income that it receives from the assets being financed;

- the lender has a substantial degree of control over the assets and the income that it generates in accordance with the terms of the obligation;

- the primary source of repayment of the obligation is the income generated by the assets.

In accordance with the economic literature and professional practice, the New Basle Capital Accord (2006, p. 53) defines project finance as a method of funding in which the lender looks primarily to the revenues generated by a single project, both as the source of repayment and as security for the exposure. The lender is usually paid solely or almost exclusively out of the money generated by the contracts for the facility's output. The borrower is usually a special purpose vehicle that is not permitted to perform any function other than developing, owning, and operating the project.

Due to its unique financial characteristic, the credit risk assessment in project finance lending is particularly complex. Basically, the credit risk of project finance loans is affected by the timing and uncertainty of project cash flows. The main components of credit risk (probability of default, loss given default, and exposure at default) are closely connected with the nature and characteristics of the project, the economic sector of the project, the guarantees afforded to creditors, the potential alternative use of the assets that belong to the special purpose vehicle.

Project finance loans are structured in such a way that repayment of the loan depends principally on the cash flow generated by the asset rather than the credit quality of the borrower (Basle Committee on Banking Supervision, 2001). For this reason loans possess unique loss distribution and risk characteristics. Such credit

exposures are treated separately from the corporate exposure. Basle Committee on Banking Supervision has proposed a specific regulatory treatment for these exposures (*specialized lending*).

In contrast with corporate exposures, there is no common industry standard for the estimation of credit risk in project finance lending. Every project has unique characteristics, unique financing schemes, and different risk sharing mechanisms that allocate risks among different parties involved (Esty, 2004). In addition, to calculate rigorous probability of defaults is necessary to base such calculations on valuable databases. Nevertheless, historical loan performance data for project finance exposures are scarce. Furthermore, defaults in project finance are quite rare because the failure of the project company generally involves a debt restructuring or a takeover by a new project company. Project finance exposures are characterized by few time series of defaults and losses. So, it is unlikely that a bank may rely on historic estimates of probability of defaults (PD) and loss given defaults (LGD) for the portfolio of project finance loans. Project finance operations usually have a complex structure. It implies that project finance rating is primarily based on future cash flows expectations rather than on historical data.

Under the previous Capital Accord (1988) there was no difference between corporate finance and project finance in measuring bank capital requirements. On the contrary, the New Capital Accord (2006) has recognized such differences. Project finance loans are classified as "specialized lending", an asset class different from the "corporate lending". The Basle Committee has proposed different methodologies for the estimation of the risk components: standardized approach, internal rating-based (IRB) approach, and supervisory slotting criteria approach (SSCA).

3. Credit Risk in Project Finance: The New Regulatory Capital Requirements Framework

The first operation that a bank must take to implement the New Basel Capital Accord is the classification of the credit exposure. In the project finance class, the main determinant of the credit risk is the variability of cash flows. The PD and LGD are therefore interconnected and depend on the revenues generated by the financed assets (Gatti, 2008; Marchetti, 2009; Sorge, 2004). The character of project finance is primarily related to the future revenues of the project.

In the "standardized approach" banks must continue to assimilate project finance exposures to corporate exposures: project finance is considered as a normal financing transaction. Banks must use a coefficient related to the external rating assigned to the SPV, otherwise a coefficient equal to 100%. It means that when project finance loans are unrated banks have to use 100% risk weight. The bank's supervisory authority, however, can classify the project finance loans as "category at higher risk", for which is defined a coefficient higher than that required for corporate finance. It assumes that in some cases project finance loans could be riskier than corporate loans. This implies an higher capital requirement in the project finance lending business.

Within the internal rating-based approach (IRB), however, project finance exposures must be classified in specialized lending portfolio and partly within the corporate portfolio. Banks may classify their loans into risk categories using their own internal data. In general, to calculate capital requirements to cover expected and unexpected losses for specialized lending exposures, banks must apply the same rules established for corporate exposures. The derivation of risk-weighted assets depends on estimates of PD, LGD, EAD and, in some cases, effective maturity (M), for a given exposure. With the IRB approach for project finance loans banks may incorporate specific risk profiles into capital requirements standards.

Banks that meet the requirements for the estimation of PD are able to use the foundation approach to corporate exposures to derive risk weights for all classes of project finance exposures. LGD is set by the Authority equal to 45%, as corporate exposures. Within the IRB advanced approach, banks that meet the requirements for the estimation of PD, LGD, and EAD are able to use the advanced approach to corporate exposures to derive risk weights for project finance exposures. Consequently, banks must determine the project rating as corporate exposures, using its own rating system procedure to estimate credit risk components. Within IRB approaches, therefore, the rules relating to corporate exposures were extended, without any change, even to the project finance loans without considering the peculiarity of this type of transaction, which would influence the default definition and estimation of risk factors: PD, LGD, and EAD (Sorge & Gadanecz, 2004). In both cases, the capital requirements would be based on a framework established by the banking authority, which would define the relationship between PD, LGD, and risk weights. As argued by Esty (2004, p. 3), in most cases, banks using the IRB approaches would have equal or lower capital requirements than banks using the standardized approach.

Banks have to overcome many difficulties in estimating the risk factors of a project finance transaction. They have to take into account different aspects and risks of the transaction, such as financial structure of the project, operating and constructing risks, legal and regulatory issues, political and administrative constraints,

environmental and technological implications, etc. The risk implications of project finance lending are determined by the application of complex mathematical models that are highly affected by the ability to predict the future cash flow expectations of the project. These models have to be appreciated by banks and supervisors. Furthermore, it might be difficult to calibrate them in practice. This problem has caused severe difficulties for some banking institutions. Complex valuation and implementation problems may arise particularly with reference to small and medium banking firms. Consequently, only banks that have good databases and good historical data, and a good organizational structure, implement the internal rating-based approach in the project finance lending business.

Finally, banks that do not meet the requirements for the estimation of PD under the corporate foundation approach for their specialized lending assets are required to map their internal risk grades into five supervisory categories. Each category has a specific risk weight. This version is termed the "supervisory slotting criteria approach".

The supervisory slotting criteria approach (SSCA) is a qualitative method. It is a simplified rating method. Banks must assign credit to one of the following levels: strong, good, satisfactory, weak and default. The supervisory authority provides a scheme through which banks can analyze risk factors of the project, and then classify exposures into 5 levels (a specific risk weight is associated to each level). Risk weights for unexpected losses that are associated with each supervisory category are described in table 1. Each supervisory category broadly corresponds to a range of external credit assessments, as outlined in table 2.

At national level, supervisors may allow banks to assign preferential risk weights of 50% to "strong" exposures, and 70% to "good" exposures, when they have a remaining maturity of less than 2.5 years or the supervisor determines that banks' underwriting and other risk characteristics are substantially stronger than specified in the slotting criteria for the relevant supervisory risk category.

For project finance exposures subject to the supervisory slotting criteria, the expected losses amount are determined by multiplying 8%, the risk-weighted assets (using the appropriate risk weights), and the EAD. Risk weights for project finance are outlined in table 3. Banks must assign exposures to their internal rating grades based on their own criteria, systems and processes, subject to compliance with minimum requirements. Banks must then map the internal rating grades into five supervisory rating categories. In other words, the outcome of the slotting approach (expected loss) is mapped into a slotting category. The general assessment factors and characteristics exhibited by exposures in every supervisory category are provided by the Basle Committee on Banking Supervision (2006).

The Committee recognizes that the criteria that banks use to assign exposures to internal grades will not perfectly align with criteria that define supervisory categories. However, banks must demonstrate that their mapping process has resulted in an alignment of grades consistent with the characteristics of supervisory categories. Banks should take special care to ensure that any overrides of their internal criteria do not render the mapping process ineffective.

Table 1. Supervisory categories and unexpected losses risk weights for specialized lending exposures

Strong	Good	Satisfactory	Weak	Default
70%	**90%**	**115%**	**250%**	**0%**

Source: Basle Committee on Banking Supervision (2006).

Table 2. Correspondence between each supervisory category and a range of external credit assessments

Strong	Good	Satisfactory	Weak	Default
BBB- or better	**BB+ or BB**	**BB- or B+**	**B to C-**	**Not applicable**

Source: Basle Committee on Banking Supervision (2006).

Table 3. Risk weights for specialized lending

Strong	Good	Satisfactory	Weak	Default
5%	**10%**	**35%**	**100%**	**625%**

Source: Basle Committee on Banking Supervision (2006).

The criteria provided by the Committee are linked to practices already in use by intermediaries and rating agencies with regard to asset-backed lending programs (Gatti 2008; Marchetti, 2009). For example, Standard & Poor's has developed 5 levels of analysis and the first project finance industry database: project level risks, sovereign risk, institutional risk, force majeure risk, credit enhancements. The first level corresponds to financial strength criteria and transaction characteristics of the New Bank Capital Accord, while the second and third level correspond to political and legal environment of the New Bank Capital Accord.

Table 2 makes a comparison between risk weights useful to calculate the unexpected losses for project finance exposures with the SSCA and those useful to calculate the unexpected losses for corporate exposures in the standardized approach. It means that the two rating methods deliver comparable results.

In brief, the treatment of project finance exposures under the New Basle Capital Accord has boosted banks to implement sophisticated credit risk analysis models into the credit assessment value chain, and develop in-house technical experts. Banks may develop their own models for specialized lending exposures in accordance with minimum standards for estimating PD and LGD. In this sense, a bank is able to shift from elementary approaches to sophisticated ones (as, for example, Monte Carlo simulations). Slotting approaches in project finance exposures are required when it is not possible to meet the above minimum criteria.

Over the time, based on economic literature, operating experience, and regulatory standards, major banks have developed their own project finance credit risk models. Instruments and approaches for the evaluation of credit risk in the project finance lending are a recent development and raise particular issues, both at theoretical and practical level. This paper has contributed to shed light on both levels.

4. Conclusion

Project finance is an innovative model of financing projects. It is a useful technique for financing large and long-term projects with relatively predictable cash flows. Project finance has typically an high leveraged financial scheme. Cash flow and risk analysis are the two main crucial aspects of every project finance transaction. Banks have increased the use of quantitative models to analyze default risks and loan losses in project finance lending. Banks must be able of evaluating risk factors of the project, and the assumptions used in the prediction of the future cash flows. In the project finance lending practices look primarily to the expected income stream of the project.

The paper highlights the features of credit risk assessment in project finance lending, and how the bank regulatory framework affects it. Project finance involves a higher degree of sophistication in credit risk analysis than normal loans. This consideration suggested a tentative conclusion regarding the regulatory implications of the project finance in the banking business. The new bank regulatory capital requirement framework recognizes such important differences between corporate and project finance lending.

The appreciation of the risk factors and, in a wider view, the credit risk evaluation process of the project finance package, are fundamental elements not only for the success of project finance loans market, but also for the bank capital adequacy, soundness, safety, and stability. A deeper understanding of the credit risk in project finance lending affects the allocation of financial resources across asset classes in a bank portfolio.

In the capital adequacy framework, project finance is defined as a form of specialized lending. Cash flows generated by the project are the main sources of repayment. The regulatory treatment of the project finance is investigated in the paper. Current bank approaches to estimate rating in project finance are put under substantial pressures. A qualitative method, named the supervisory slotting criteria approach, might support banks to implement a cash flow oriented model to appreciate credit risk in the project finance business.

Table 4. A comparison between risk weights for unexpected losses in the New Bank Capital Accord

STANDARDISED APPROACH-CORPORATE EXPOSURES		SUPERVISORY SLOTTING CRITERIA APPROACH - SL EXPOSURES	
RATING	Risk weights	CATEGORY	Risk weights
AAA	20%	Strong	70%
AA+	20%	Strong	70%
AA	20%	Strong	70%
AA-	20%	Strong	70%
A+	50%	Strong	70%
A	50%	Strong	70%
A-	50%	Strong	70%
BBB+	100%	Strong	70%
BBB	100%	Strong	70%
BBB-	100%	Strong	70%
BB+	100%	Good	90%
BB	100%	Good	90%
BB-	100%	Satisfactory	115%
B+	150%	Satisfactory	115%
Da B a C-	150%	Weak	250%
D	Not applicabile	Default	0

Marchetti (2009) based on Basel Committee on Banking Supervision (2006).

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The Determinants of Agricultural Export: Cocoa and Rubber in Cote d'Ivoire

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Abstract

As a large lake of natural endowment, most of African countries still have small and poorly developed domestic markets and must rely on foreign markets for the sale of their excess production. This study examined the factors that influence agricultural exports with specific reference to Cocoa and rubber. Secondary data was used for this study. Ordinary Least Squares regression (OLS) was used in analyzing the relevant data. The OLS findings revealed that rubber export is influenced significantly ($p < 0.05$) by domestic rubber production (β= 68124.857), producer price (β= 10741.503), exchange rate (β= -17078.957), domestic consumption (β= -27094.147) and interest rate (β= 14991.565). For cocoa, the OLS shows that cocoa output (β=0.847), domestic consumption (β=-0.850) and rainfall (β=44.074) significantly ($p <0.05$) influence cocoa export. It is recommended that there should be value addition in respect of the cocoa being exported.

Keywords: Cote d'Ivoire, ordinary, Least Squares Regression (OLS), Structural Adjustment Programme (SAPS)

1. Introduction

As suppliers of raw materials to western economies, since independence, Africans countries' economies have continued to produce primarily crop for export .Thus agriculture still the most important single activity for the Africans peoples. In Cote d'Ivoire, about70% of the total working population engaged in agricultural sector. Situated between Liberia and Ghana on the west coast of Africa, Côte d'Ivoire is first and foremost an agricultural country with agriculture one of the key pillars of the economy. The country is a great asset on the production and export of tropical products. Agriculture, forestry, and fisheries account for a substantial part of GDP and exports. Cote d'Ivoire produces 40% of the world's cocoa crop and is a major exporter of bananas, coffee, cotton, palm oil, pineapples, rubber, tropical wood products, and tuna. Consequently, the economy is highly sensitive to fluctuations in international prices for these products and to weather conditions. One of the most events in Cote d'Ivoire over the past decade was the devaluation of the currency in 1994 with the adoption of a Structural Adjustment Programme (SAP), supported by IMF and World Bank which was focused on export development regardless of their sectoral features, which reinforced the traditional exports of Côte d'Ivoire. However Cote d'Ivoire has been on crisis since 1999 which led to the destruction of economic infrastructure and the breakdown of government administration. The crisis brought a drastic fall in output, a substantial drop in employment, resulting in the loss of foreign investment and slow economic growth. In 2007, however undeniable progress was made in re-establishing the country's institutions, the recovery of the economy, as real GDP grew by 1.6 as compared to 0.9% in 2006(see figure 1). In 2011 the crisis found a solution by the contested election won by the current president ALassane Ouattara.Although the country remained highly vulnerable it is better to notice that the agricultural sector still the pillar of the Economic, with contribution of 35 percent of the country's GDP and 66 percent of its export revenues, provided employment for about two-thirds of the national workforce. Cash crops, mainly cocoa and coffee account for nearly 50 percent of agricultural value added. Apart from cocoa and coffee it is critical to mention the rubber planting, which ranked at the fourth as exporter produce with the global revenue estimated at 162 billionsFCFA for 221000 tons. In 2009 Cote d'Ivoire ranked the first place in Africa and seventh in the world. The country is the first exporter of natural rubber. In 1999 the total superficies was 84 000 hecters.The rubber processed transformation is doing by some companies such as SAPH,SOCB and TRCI.Howver the country export the intermediaries' products in Foreign country .This Study therefore aims to examine the factors that can influence the export of cocoa and rubber with the following

specific objectives: estimate net trade balance in agricultural trade, determine the possible factors influencing the rubber and cocoa export trade and finally profer some policy recommendations based on the findings of this investigation.

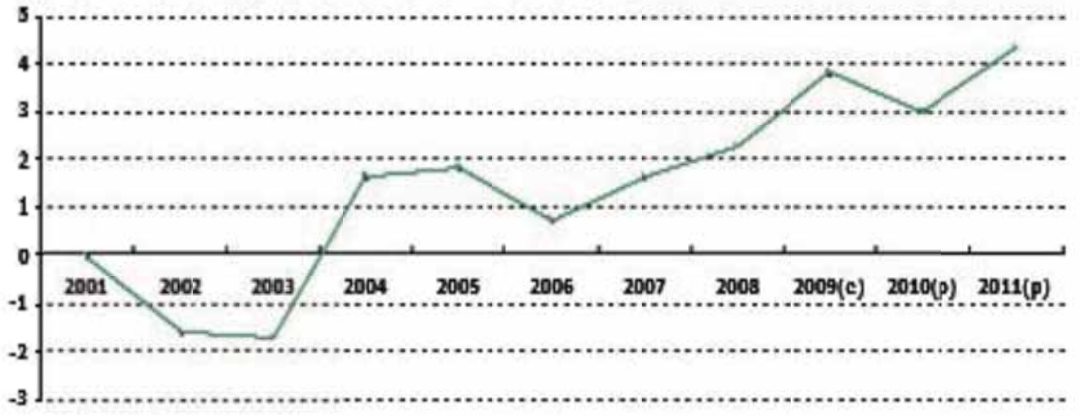

Figure 1. Recent Evolution of GDP growth rate in real terms

Source: IMF data and national sources; estimates (e) projections (p).

2. Literature Review on the Determinants of Export

According to Fleming and Blowes (2003), the Geographical factor can be identified as one the factors which influence export activities. Natural resources endowment is one of the variables that determine the export of country. The influence of this factor is well explained under the Heckser-Ohlin model that was used to determine International trade patterns. As a variable, the rainfall and climate condition enable Cote d'Ivoire to specialize in the tropical products exportation in which it has a comparative advantage. Thus the country benefit of many sources of water and rich soil, which favors primary crops, that economy is either not suited for huge local demand, due to the small and poorly developed domestic markets. Therefore the country rely on foreign markets entry for the sale of its products, which foreign market access is one the most critical determinants of exports according to Redding and Venable (2002), Fugaza (2004) and UNCTAD (2005).Market access refers to conditions determined by the legal and administrative framework imposed by the importing countries under internationally agreed trade rule that create the possibility of selling on foreign markets UNCTAD, (2006).

In contrast to foreign demand, a huge domestic demand impede an increase of the export related by ADB (2005),which reported a negative association between exports and growth rate of domestic demand in the Southeast Asian countries. Thus a variation in domestic demand pressure will affect the supply-side or availability for exports. Ball et.al (1966) also argued that at relatively high level of domestic demand, ceterus paribus, the quantity of resources devoted to export is lower. So, at lower domestic demand the surplus production leads to increased export volume. He further said that higher level of production is the main cause of export expansion since surplus output can be exhausted in international markets. Ngeno (1990) carried out a study on determinants of export and one of his findings was that export is positively related to output level since higher production leads to increased volume of exports. Musila (2004) analyzes the impact of the common market for Eastern and Southern Africa on Kenya export, and finds that export is associated with high volume exported and not high price for the product.

In the early 1970s, when Brazilian exports increased greatly, scholars and practitioners have investigated the country's export experience. In one of the pioneering studies on the topic, "Manufactured Export Promotion in a Semi-Industrialized Economy: The Brazilian case," Tyler (1973) suggested that the success of Brazilian industrial exports was a function of several independent variables such as real exchange rate, tax incentives, etc.Various studies have also shown that a fall in domestic prices due to exchange rate depreciation makes exports cheaper in the international market resulting into their increased demand. This mean the depreciation or devaluation of one country currency enables an increase demand of its exportation products. In Tanzania, a time series study on Non Traditional Exports (NTE) found a statistically significant relationship between real devaluation and export growth of (NTE).Studies in Ghana and India by Fosu(1992) and Sharma(2001)

respectively have show that real exchange rate has a significative negative relationship with export. However a good producer price matching with export price has a positive significance on the export. Tijani *et al (*1999) employed cointegration and error correction model to estimate export supply function in Nigeria using time series data that span more than three quarters of the 20th century. The results indicate that weather effect is stationary while producer price and hectare planted to cocoa have a long run equilibrium relationship with cocoa export. This findings is significant to the present study as the results established it that producer price has a long run equilibrium relationship with the rubber export. The economic justification is that ,high producer price lead to accumulation of ample revenue to producers as a result resources are diverted from sectors that have low return to sector that promise high payment at that time consequently, high price induced producers to increase production of the given product and thus assured the supply and availability of products to export.

Regarding to the rainfall which has a positive significance effect on the yield of cocoa crop, this research find its significance to the previous finding where Akintola (1983), studying the effects of agro climatic factors on some selected crops in Ibadan. Following his correlation and regression analysis, the responsiveness of each crop yield to specific agro climatic variables (rainfall, temperature, sunshine and humidity) was determined. Based on his findings, it was known that rainfall has statistically significant effect on yields of rice, cowpea, yam, cocoa and rubber crops.

3. Methodology

The data for this study were obtained from secondary sources. They include the following; Food and agricultural organization (FAO), reputable journals and the Internet; and supplemented with primary data as Collected by the National Research center of Agronomy (CNRA) and Ministry of Agriculture (MINAGRI). The observation of this study is categorized as follow The pre-1970 period(1961-1969), pre-SAP period (1970-1985), SAP period (1986-1994) and the post-SAP period (1995-2005).The pre-1970 period witnessed a minimum direct government intervention in agricultural development. The pre-Structural Adjustment Programme (SAP) era witnessed an increasing migration of able-bodied youths from the rural to urban areas. The Structural Adjustment Programme period was the era SAP was introduced in Cote d'Ivoire. The post- Structural Adjustment Programme era is a period that witnessed activities in the agricultural sector after the Structural Adjustment Programme .Ordinary least squares (OLS) method was used to determine variables affecting export of cocoa and natural rubber. The function is stated as:

$$LnXt = \beta_0 + \beta_1 lnQt + \beta_2 lnPt + \beta_3 lnWt + \beta_4 lnEXt + \beta_5 lnDct + \beta_6 lnRt + \beta_7 lnInt + \mu_t$$

With Qt>0; Pt>0; Wt>0; EXt<0; Dct<0; Int>0 or Int<0

Xt = natural rubber\cocoa export quantity

(Tons) between 1970 and 2005

Qt=quantity of natural rubber\cocoa output

(Tons) between 1970 and 2005

Pt=average producer price of natural rubber

Or cocoa (F\tons) between 1970 and 2005

Wt=average world market price of natural

rubber\cocoa (F\tons) between 1970 and 2005

EXt =exchange rate (FCFA to 1 U.S. dollar)

Between 1970 and 2005

Dct =domestic consumption (tons) of cocoa

Rt =average total rainfall (mm/year) in major producing

Region between 1970 and 2005

Int=Interest rate (%) between 1970 and 2005

3.1 Hypothesis to Be Tested

This study is testing the hypothesis zero influence of independent variables to dependent variable. It attempt to find out whether the independent variables have significant impact on dependent variable or not, that is β_j is significantly equal to zero or not. This hypothesis can be written as;

H_0: $\beta_j=0$

H_i: $\beta_j \neq 0$

4. Results

Average Net Trade Balance during Different Periods in Cote d'Ivoire

Table 1 shows the average net trade balance during the 4 different periods. The average net trade balance for total agricultural products on value at base year price (1000 US $) from 1970 to 2004 range from –178,149.11 to 764,819.73.

Table 1. Average net trade balance during different Periods in Cote d'ivoire

Period Net ('000 US$)	trade balance
1961-1969 (pre-1970)	842,767.59
1970-1985 (pre-SAP)	-178,149.11
1986-1994 (SAP)	-265,614.67
1995-2004 (post-SAP)	-764,819.73

Source: Computed from FAO Database, 2006.

4.1 Determinants of Cocoa Export

The result of the OLS regression is presented in Table 2.Regression analysis was carried out using log linear function. Log Linear function was used as it fits the model based on having the highest number of significant variables affecting cocoa export and the highest adjusted R^2 value. The adjusted R^2 was 0.789, implying that the independent variables explain 78.90% of the total variation in cocoa export. The value was significant at 1% for cocoa production (mt) (β=0.847) and domestic consumption (mt) (β=-0.850). The F-value (18.634; P <0.05) is significant at 1%, implying that the model is significant.

Table 2. Ordinary least square estimates for cocoa export

Variable	Coefficients	t-statics	Prob.
Constant	-32424.547	- 0.870	0.392
Cocoa output (mt)	0.847	6.87	0.000
Producer price of cocoa (F/mt)	0.175	0.639	0.529
World Price of cocoa (F/MT)	- 1.253	- 0.341	0.736
Exchange Rate	- 76.819	- 0.343	0.735
Domestic consumption (mt)	- 0.850*	- 8.019	0.000
Interest rate (%)	- 418.779	-0.634	0.532

Source: Computed from data

F = 18.634;

Adjusted R^2=0.789

*Significant at 1 percent

4.2 Determinants of Rubber Export

The result of the OLS method is presented in table 3. The log function best fit the model as it has the highest number of significant variables affecting rubber export and high-adjusted R^2 value. The adjusted R^2 was 0.838; Implying that the independent variables explain 83.80% of the total variation in the rubber export. The value was significant at 1% for rubber production (mt)(β=68124.857), producer price (F/mt) (β=10741.503), exchange rate (β=-17078.957),domestic consumption (mt) (β=-27094.147) and interest rate (%) (β=14991.565). The F value (30.085; P<0.05) is significant at 1%, implying that the model was significant.

Table 3. Ordinary least squares estimates for rubber export

Variable	Coefficients	T-statistics	Prob
Constant	-731123.324	- 1.721	0.094
Rubber Production (mt)	68124.857*	8.647	0.000
Price of Rubber (F/mt)	10741.503*	2.745	0.009
World Price of Rubber (F/mt)	1798.804	0.322	0.749
Exchange Rate	- 17078.957*	- 2.71	0.010
Domestic consumption(mt)	- 27094.147*	- 10.36	0.000
Interest rate (percent)*	14991.565*	4.578	0.000

Source: Computed from data

F value 30.085

Adjusted R2 = 0.838

*Significant at 1 percent.

5. Discussion

The net trade balance value shows that agriculture remains a deficit trade balance. During the pre-1970 era, Cote d'Ivoire was involved in the exports of its agricultural products notably cocoa, natural rubber and palm oil. This contributed immensely to foreign earnings for the country. The implication of net exports shows that agricultural exports can adequately finance agricultural imports. Generally, the net trade balance value shows that Cote d'Ivoire remains a net importer with regards to agriculture. In summary, based on the results of table 1, in which net export values for the different period studied had negative values, it can be concluded that agricultural exports cannot finance agricultural imports. The positive sign for the cocoa production implies that an increase in production will lead to an increase in export. Conversely, a reduction in domestic consumption of cocoa will lead to an increase in the export of cocoa. The appropriate sign on rubber production is positive; it implies that an increase in production will stimulate an increase in export. The producer's price was also significant and has a positive sign, which is similar to the prediction above that an increase in farm gate price will result in an increase in export. This is in agreement with Okoruwa et al. (2003), who reported that an increase in producer's price of rubber will lead to an increase in export of rubber. The implication is that an increase in the producer's price of rubber to match world price will encourage maintenance of rubber farms and increased output. However a gap between export price and farm gate price discourage the rubber farmers from fully participating in rubber or cocoa production.

The official exchange rate was significant but has a negative sign. This finding is in agreement with Mesike (2005) who also reported a negative relationship between rubber export and exchange rate. This implies that the lower exchange rate that occurred during the devaluation of domestic currencies led to increased exports. Domestic consumption has a negative relationship with rubber export. This implies that a reduction in domestic consumption will lead to an increase in export supply and vice-versa

6. Conclusion

The African countries exports of agricultural products continue to be vital for the overseas population and their economies. And however although African countries earned substantial foreign exchange from their exports, major fluctuations in the export earnings have raised concern about their country's future growth potentials and self-sustainability. This study has established the major or significant determinants of cocoa and natural rubber exports in cote d'Ivoire,where export volume of Cocoa is crucial, estimated at 1.334000 million, while rubber export quantity account for 200652 tons in 2006.

7. Recommendations

The result of the study showed that output domestic consumption, interest rate, producer price and exchange rate have key roles to play in the export of cocoa and natural rubber in Cote d'Ivoire. In order to improve the export supply of the two cash crops, the following steps are necessary. Firstly as a small open economy in relation to the rest of the world, Cote d'Ivoire economic performance is sensitive to international market shocks. Consequently, stabilization policies that will enhance export promotion and productivity be implemented and sustained. Government policies will be canvassed to transform the composition of Ivoirian's export. Thus to achieve that goal, the country should re-invest its exports revenues in agro processing equipment & technologies and human capital. This will attract more revenue than raw cocoa. This will also stimulate local consumption.

Conservation and rehabilitation programmes for rubber should be organized in areas where degradative processes are about to set in. Also, uncontrolled felling of rubber trees should be checked and farmers encouraged through appropriate pricing mechanisms, to replant the cleared and rehabilitate the old rubber plantations. Cote d'Ivoire should ensure that there is only a small margin between the producer prices and world price of rubber and cocoa, so that the farmers can benefit substantially from international market.

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An Examination of Herd Behavior in the Jordanian Equity Market

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Abstract

The paper aims at examining the herd behavior in the Jordanian equity market before and after the 2008 global financial crisis. The most common approaches [Christie and Huang (1995) (CH) and Chang et al. (2000) (CCK)] are used to test for herding tendency of the financial and nonfinancial firms. By making use of the CH approach, estimated using the Ordinary Least Squares method (OLS), evidence of the absence of herding tendency is reported in extreme and normal market conditions. To investigate the tendency for herding further, the CCK approach is also implemented. The model of CCK is estimated using the OLS and the Quantile Regression (QR) methods. The results of CCK, using OLS, show evidence of the absence of linear herding for both types of firms before and after the crisis. But, only nonfinancial firms exhibit evidence of nonlinear herding in both sub-periods. In the extreme up and down market, evidence of linear herding is only found after the crisis for both types of firms when market is trending up. For all firms at the median level, the results of QR provide evidence of linear herding after the crisis while no evidence is reported for nonlinear herding. Financial firms exhibit only nonlinear herding at median level before the crisis when the market is trending up. Nonfinancial firms do not exhibit linear and nonlinear herding at the median level in both up and down markets. The results of OLS and QR are different for both types of firms. However, for linear herding the results of CH and CCK are similar. Jordanian investors exhibit a tendency for linear herding in extreme and normal market conditions but cannot have enough power to convert into nonlinear one.

Keywords: equities market, herding, quantile regression, behavioral finance, financial crises

1. Introduction

This paper examines whether herding behavior can be detected in the Jordanian equity market before and after the 2008 financial crisis. Herding is defined as the situation when a group of stock investors blindly follow other investors in either buying or selling stocks overtime (Bikhchandani and Sharma, 2000; Demirer and Kutan, 2006; Choi and Sias, 2009). Herding behavior is either rational or irrational as investors behave in different manners with regard to their tendency to mimic the actions of others. Rational herding means that investors mimic the actions of others by ignoring their own private information to keep their reputation in the market (Scharfstein and Stein, 1990; Bikhchandani et al., 1992; Lakonishok et al., 1992; Rajan, 1994; Wermers, 1999). In other words, they may rely on fundamental factors when herding, such as speculation, market volatility, the behavior of other investors, different techniques in measuring performance and the investment horizon (Chang, Chen and Khorana, 2000). However, irrational herding refers to investors who disregard their prior beliefs and blindly follow other investors' decisions (Christie and Huang, 1995; Devenow and Welch, 1996; Nofsinger and Sias, 1999).

Empirical literaure, focusing on investigating the existence of the herd behavior in equity markets, can be categorized in two main groups of studies. The first group of studies relies on detailed and unambiguous information on the trading activities as well as on the changes in their investment portfolios. Lakonishok, Shleifer and Vishny (1992) (LSV measure) and Wermers (1999) (PCM measure) are the best examples of such herd measures. The second group of studies examined herding by following the view that herding is the buying and the selling actions of the individual investors who follow the performance of specific factors or styles. In this context, herding was measured by taking the advantage of the information contained in the cross-sectional stock price movements. Following this view, three common measures are developed by Christie and Huang (1995) (CH), Chang, Cheng and Khorana (2000) (CCK), and Hwang and Salmon (2004) (HS). Empirical studies follow these three measures (e.g. Kim and Wei, 2002; Caparrelli et al., 2004; Henker et al., 2006; Demirer and Kutan,

2006; Tan et al., 2008; Chiang and Zheng, 2010; Fu and Lin, 2010; Chiang et al., 2010; Economou et al., 2011). These studies use different sets of data from well-developed stock markets such as the US, the UK, Japan, South Korea, Taiwan, Australia, China, the Germany, Italy, France, Spain, Greece and Portugal.

The Jordanian stock exchange (ASE) is considered one of the most active stock markets in the Middle East region. Recently, its trading volume has increased from 0.40 billion USD in 1978 to 9.4 billion USD in 2010. It follows that, over the last ten years, there has been an increase in the number of Jordanian listed firms. In fact, the number of listed firms has increased rapidly from 158 firms in 2002 to 277 firms in 2010 - an increase by 75% (ASE, 2003; 2011). The 2010 newsletter of ASE shows that the number of financial (nonfinancial) firms has risen from 43 (115) in 2003 to 123 (154) in 2010. The stock value traded in this market has increased rapidly (ASE, 2011). The total value traded by financial investors has risen from around 775 million USD in 2003 to nearly 9.16 billion USD in 2010 – an increase by 12 times. In addition, the total value traded by nonfinancial firms has increased from 3.52 billion USD in 2003 to nearly 4.65 billion USD in 2010 - an increase by 0.32 times. These substantial increases in the overall market capitalization and in the number of its listed firms indicate that Jordanian investors are more likely to engage into herding behavior more than before. Therefore, it is of interest to test for the tendency of herding in such a market and among these firms.

The recent new set of regulations adopted by the ASE is considered a strong motive for conducting such a study. One of these regulations is the comprehensive capital market reforming policy. The purpose of such a policy is to improve the regulation of the securities market to reach the international standards. For example, the government has endorsed the Temporary Securities Law (No. 23) in 1997. Such a temporary law is considered a turning point for regulating and completing the infrastructure of the Jordanian capital market. In addition, this endorsement is continued to adopt a new securities Law (No. 76) issued in 2002. This new Law is installed to set up other stock exchange issues, protect investor's fund, install ethical and professional codes, strengthening the application of the rule of law. Therefore, setting up these regulations would participate in increasing the probability of herding tendency among Jordanian investors because they would be more confident to perform more trading activities.

Motivated by the recent development, expansion and new regulations of the ASE, the tendency of herding in such a market is examined in this study. In this context, the present study contributes to the literature in many ways. Empirical studies in this field employ only the least squares estimation method to test for herding tendency without paying a strong attention to use the quantile regression method. Following Chian et al. (2010), this study uses both the least squares and the quantile regression methods to test for herding tendency. The use of quantile regression method under different quantiles would have the power to solve the statistical problems facing the least squares method to gain more fitting estimators of herding. Form methodological perspective, where the originality of this study is stemmed from, the two common approaches (CH and CCK) are used to test for herding. In addition, the asymmetric herding is also tested in this study by making use of a different regression specification technique. In this technique, one set of regressions is used to test for asymmetric herding for the up and the down market, instead of using two separate regressions that was used by CCK. The study also explores whether Jordanian investors do herd before and after the 2008 financial crisis for the daily stock returns of the financial and nonfinancial firms, as no study has been conducted using data representing such a market.

The study finds no evidence of the tendency of herding for both financial and nonfinancial firms before and after the crisis when using the CH approach. It reports also evidence for the absence of nonlinear herding for financial firms in normal and extreme market conditions (when applying the CCK method). But, nonfinancial firms present evidence of nonlinear herding in both market conditions. For herding in extreme conditions (the up and down market), evidence of the existence of herding is only found in the period before the crisis. Nonetheless, after the crisis, evidence of the absence of nonlinear herding is reported. Consistent with the results of the least squares, the results reported by the quantile regression signal no evidence of herding behavior. These results indicate that Jordanian equity investors (financial and nonfinancial) show a sign of herding tendency when using both approaches either in extreme or normal market conditions. Nevertheless, the results reported by QR and OLS are somewhat not similar across types of firms.

The remainder of this paper is as follows: the relevant literature on herding is reviewed in the next section. To give a better understanding of the examination setup, Section 3 introduces the methodology. Section 4 states the data of the study and Section 5 presents the empirical results. Section 6 summarizes the findings and concludes.

2. Literature Review

Herding is a hardly measurable concept, stemmed from the behaviors of humans, with difficult quantifiable parameters. Focusing on irrational herding, one of the common methods was developed by Christie and Huang

(1995) (so-called CH) (Note 1). This method examined the investment behavior of equity investors in the US market. It developed a measure to test for herding by using the cross-sectional standard deviation of returns (CSSD) (i.e. the dispersion of the average of individual stock returns from the average market returns) in normal and extreme market conditions. It argued that if market investors ignore their own beliefs and build their investment decisions merely on market consensus, stock returns will not deviate far from the overall market return. In periods of market stress in either up or down, stock investors tend to herd toward the market. Therefore, stock returns would cluster around the market return and the cross-sectional standard deviation of returns tends to decrease. Christie and Huang (1995) were unsuccessful in reporting evidence of herding in the United States, Hong Kong and Japan stock as returns dispersion increases instead of decreasing during periods of market stress in these markets.

Many empirical studies applied the CH method on data from emerging and developed equity markets. But, they produced mixed results. CH was unsuccessful in providing evidence of herding in the United States, Hong Kong and Japan. Proponents of the CH method found no evidence of the existence of herding in several worldwide stock markets. For example, Caparrelli et al. (2004) stated that the Italian stock investors do not herd, but herding was only present during extreme market conditions. Using a data set from the Chinese equity markets, Demirer and Kutan (2006) found no evidence of herding. Chiang and Zheng (2010) also reported no evidence of herding in Latin America stock markets during the 2008 crisis. Nevertheless, another group of recent studies were successful in reporting contradictory results to the findings of the CH approach. Chen et al. (2008), for instance, reported evidence of herding in the Italian stock market indicating that herding is present in extreme market conditions. Chiang and Zheng (2010) found evidence of herding in Latin America stock markets (except the US) and in Asian markets in normal market conditions.

But, most of studies, investigating the existence of the herding in developing markets, implemented datasets from different Asian countries. However, Baek (2006) documented that there are different factors affecting investments on Asia and Latin America. For example, investments in Asia are highly dependent on investors' preferences and the stock market volatility. In addition, in Latin America, investments are affected by the sensitivity of portfolio investments to the fundamental factors. Although it is difficult to generalize the conclusions that the presence of the herding behavior in the developing stock markets based on only evidence from Asian countries, these factors may also participate on pushing Jordanian investors to engage in the herd behavior. Most of these factors focus on fundamentals such as the high cost of information acquisition, lack of transparency, lack of financial reporting and information disclosures and lack of credibility and integrity to the public information (Zaharyeva, 2008). However, the low liquidity of the stock market may also prevent investors of being engaged in herd behavior (Devenow and Welch, 1996). Therefore, these factors can affect Jordanian investors. Jordanian investors who are willing to sell a particular asset may not succeed in finding buyers for this asset and therefore the possibility for engaging in the herd behavior would be significantly reduced.

Although the CH approach has been extensively used by many empirical studies, it has a number of failing points. First, the use of the cross-sectional deviations of returns, as a measure for herding, is considered a failing point. A decrease in the CSSD does not necessarily entail the existence of herding (see Hachicha et al., 2008). The reason of this failure is that herding might not be observable even if the CSSD is increased. Second, CH approach ignores to some extent the effects of changes in fundamentals (see Shiller and Pound, 1989; Chang et al., 2000). Therefore, the ability of this method to differentiate between rational and irrational herding might be feeble (Bikchandani and Sharma, 2001). In addition, there is no such rule that herding occurs only in extreme market periods. This is because the herd behavior is not necessarily observable only in these periods. But, it might be also identifiable in periods of normal market condition (Hwang and Salmon, 2004).

In light of these failing points, Chang et al. (2000) (so-called CCK) developed an alternative method to examine herding by relying on the Cross-sectional Absolute Deviation (CSAD). This method stated that herding can be detected by a nonlinear function between the CSAD and market return. The assumption of this method is that in periods of market stress the nonlinear relationship is more likely to be negative. This is because the CSAD would increase at decreasing rate. Chang et al. (2000) found evidence of the presence of herding in the stock markets of South Korea and Taiwan, whereas no evidence of herding was found in the US, Hong Kong, and Japan. Empirical studies adopted the CCK method to test for herding. The first group of these studies was unsuccessful in reporting evidence in favor of herding. Using an intraday data, Gleason et al. (2004) and Henker et al. (2006) reported no evidence of herd behavior of the Exchange Traded Funds sector in the U.S. stock market and of the Australian industry sectors, respectively. Finally, Fu and Lin (2010) failed in reporting evidence of herd behavior in the Chinese equity market. Khan et al. (2011) also suggested that herding in France, the UK, Germany and Italy is evident in normal market conditions, but herding was not found in periods of market stress.

Conversely, evidence of the existence of herding was reported by another group of studies. For instance, for both individual and institutional investors on the Shanghai and Shenzhen stock markets, Tan et al. (2008) found evidence of the herd behavior. For individual investors, evidence was found within both the Shanghai and Shenzhen A-share markets while for foreign institutional investors evidence of herding was also found within both markets for B-share. Zhou and Lai (2009) stated that herding is more likely to be observable for small stocks when selling rather than when buying stocks. Using data from the Polish stock market, Goodfellow et al. (2009) found evidence of herding for individual investors during market downswings, while during the upswing market there was a weak evidence of herding. They also argued that institutional investors do not show any sign of herd behavior. Using data from the Banja Luka stock market, Kallinterakis et al. (2010) examined herding behavior and argued that herding is insignificant during extreme market periods. In both the Shanghai and Shenzhen A-share markets, evidence of herding was found by Chiang et al. (2010). They argued that Chinese investors herd in both the up and the down markets. Economou et al. (2011) provided evidence of herding in the Portuguese, Italian, Spanish and Greece markets before and after the 2008 crisis.

To sum up, almost all the above studies relating to the two herding common approaches have used the OLS with no considerations for the other statistical estimation methods such as the QR, the Generalized Method of Moments, Seemingly Unrelated Method, and the Weighted Least Squares Method. Therefore, one can use one or more of these methods to test for herding tendency rather than the OLS. In addition, the majority empirical studies discussed previously did not take the most recent financial crisis into account. Therefore, the present study has taken a break point representing the financial crisis by testing for the tendency of herding between Jordanian investors before and after the 2008 financial crisis.

3. Methodology

3.1 Christie and Huang (1995) – CH Method

As mentioned in the introduction section, the Jordanian stock market, as other stock markets in the world, may exhibit herding tendency. Therefore following the CH method, herding phenomenon is measured by the following specification.

$$CSSD_t = \sqrt{\frac{\sum_{i=1}^{N}(R_{it} - R_{mt})^2}{N-1}} \tag{1}$$

where R_{it} is the stock return on a firm i at time t. R_{mt} refers to the return of the stock market index at time t. N is the number of firms in the sample study. The CH method argues that, when investors suppress their own beliefs in favor of herding to market consensus, security returns would not disperse far from the overall market return. In addition, it states that the security return is more volatile during periods of market stress, thus, herding is more likely to be present. The presence of herding is more likely to happen when there would be an increase in dispersion at a decreasing rate, or merely by a decrease in dispersion at an increasing rate. Therefore, the current study examines whether equity return dispersions are significantly lower than average during periods of extreme and normal market conditions as follows:

$$CSSD_t = \alpha_0 + \beta_1 D_{Lt} + \beta_2 D_{Ut} + \varepsilon_t \tag{2}$$

where D_{Lt} is a dummy variable taking a value of unity if the market returns on time t lies in the extreme lower tail of the distribution, or zero otherwise. D_{Ut} is a dummy variable taking a value of unity if the market returns on time t lies in the extreme upper tail of the distribution, or zero otherwise. If the estimated coefficients are negative and significant, herding will be detected. In other words, when the CSSD of stock returns is low under large price movements, herding is detected. This contradicts the CAPM theory which suggests that, in periods of market stress, large dispersions should be expected because individual securities may have a different degree of sensitivities to market return.

3.2 Chang, Cheng and Khorana (2000) – CCK Method

CCK generated a new technique to test for herding by using the CSAD. This technique relies on the CAPM specification to estimate the cross-sectional absolute deviation (CSAD) of stock return from market return. The cross-sectional absolute deviation (CSAD) is specified as follows:

$$CSAD_t = \frac{1}{N}\sum_{i=1}^{N} AVD_{it} = \frac{1}{N}\sum_{i=1}^{N}\left|\beta_{it} - \beta_{mt}\right| \times E(R_{mt} - R_{ft}) \tag{3}$$

where AVD is the absolute value of the cross-sectional deviation of stock's i at time t. $E(.)$ stands for the expected returns of stock's i at time t. R_{ft} refers to the risk-free return of interest rates at time t. R_{mt} is the excess

return on the stock market index at time *t*. R_{it} is the excess return of stock's *i* at time *t*. β_{it} is the time-invariant systematic risk measure of the stock's *i* at time *t*. *N* is the number of firms. β_{mt} is the systematic risk of stock market index which is generated by the average of betas of all firms.

CCK stated that the nonlinear relationship between CSAD and market return is more efficient to detect for herding compared with the linear one. However, the theory of finance proposes that a linear function is more likely to detect for herding in normal market condition. Therefore, this assumption of finance theory would be violated in periods of market stress because herding might not be detected by a linear function. Therefore, the nonlinear relationship is originated as follows:

$$CSAD_t = \alpha_0 + \delta_1 \left| R_{mt} \right| + \delta_2 (R_{mt})^2 + \varepsilon_t \tag{4}$$

If the nonlinear coefficient (δ_2) is negative and significant, herding would be detected and therefore the linear function would not have the power to capture herding tendency. The linear function may convert into a nonlinear function. This conversion occurs because of the increase in the number of market participants who intend to herd around the market consensus during periods of large price movements. Those market participants are more likely to suppress their own predictions in respect with asset prices in such periods, especially in the presence of moderate herding. Therefore, it is expected that return dispersions will decrease or increase at a decreasing rate.

In this study, the asymmetric herding is tested using a different specification from that used by the CCK. CCK generated two separate regressions for the up and the down market. These regressions did not consider the asymmetric effects when the market falls and rises. Therefore, the current study allows for the possibility of asymmetric herding using one regression without restriction. It does not restrict for the estimation of δ_1 and δ_2. A new specification, in Eq. (5), is created. It places both the up and down market proxies in one model to test whether linear herding shows an asymmetric reaction when the market goes down only if the nonlinear market return is included.

$$CSAD_t = \alpha_0 + \delta_1 (1 - D_t) R_{mt} + \delta_2 D_t * R_{mt} + \delta_3 (R_{mt})^2 + \varepsilon_t \tag{5}$$

where D_t is a dummy variable taking the value of unity at time t if $R_{mt} < 0$, or taking zero otherwise. In fact, some empirical studies provided evidence of the asymmetric behavior under different market conditions (Hong et al., 2007; Tan et al., 2008). Because of this evidence, it is of interest to examine whether nonlinear herding behavior presents an asymmetric reaction for both the up and down situations of market returns. Therefore, the specific expression is generalized by Eq. (6) as follows:

$$CSAD_t = \alpha_0 + \delta_1 (1 - D_t) R_{mt} + \delta_2 D_t * R_{mt} + \delta_3 (1 - D_t) * (R_{mt})^2 + \delta_4 D_t * (R_{mt})^2 + \varepsilon_t \tag{6}$$

CCK proposed that the rational asset-pricing model implies a linear relationship between the dispersion in individual security returns and market return. The model suggests that if the absolute value of the market return increases, the dispersion in individual asset returns should increase. During periods of extreme market movements, investors may exhibit herding behavior. This behavior is likely to increase the correlation between security returns and therefore individual security return dispersion will decrease or at least increase at a decreasing rate with the market return. For this reason, a non-linear market return, R^2_{mt} multiplied by its down and up dummy variables, is included in the equation to test whether nonlinear herding shows an asymmetric reaction when the market does down and up. A significantly negative coefficient would be consistent with the tendency of herding behavior.

Although the least squares method (OLS) is employed extensively in the herding literature, it might have some shortfalls. It would cause a loss of efficiency in reporting regression coefficients. The first reason of this loss of efficiency is that OLS is based on the mean function of the conditional of stock returns dispersions. Estimating the mean coefficients may not have the ability capture the extreme tail information in stressful periods. Therefore, the models specified by CH and CCK would not efficiently capture herding behavior. Passing the normality test is the other reason of losing efficiency. Financial data usually does not pass this test. The quantile regression (QR) as a non-parametric estimation method is more efficient because it may have the power to alleviate statistical problems. These problems are the normality, the measurement errors of variables, sensitive outliers, and non-Gaussian error distribution (Alexander, 2008). Because of market stress models are commonly used in finance literature, using QR would be a flexible method in analyzing extreme quantiles of return distribution. To resolve the so-called 'extreme' and observing herding only in market stress conditions, QR would capture the effects on the dependent variable over the entire distribution. The fourth reason is that the method based on CSSD would be sensitive to outliers. Given that QR is robust to the presence of outliers, it will not harm the reliability of results (Koenker and Hallock, 2001, p. 17).

In addition, QR would have the power to gain herding estimates in the tails of market return distribution in period of market stress without requiring a high-level of nonlinearity as in CH (see Chang et al., 2000). To obtain the quantile estimates for the extremely low returns, $\tau = 0.10$ and $\tau = 0.25$ are undertaken. Similarly, $\tau = 0.75$ and $\tau = 0.90$ are undertaken to get the quantile estimates for the extremely high returns. Eq. (6) is estimated to point out the quantile regression estimators that can be attained by minimizing a weighted sum of the absolute errors. This regression is not restricted only to the median regression ($\tau = 0.5$). But, it allows for estimating the interrelationship between a dependent variable and its explanatory variables at any specific quantile. Therefore, it provides a clearer estimation of the asymmetric relation between CSAD and R_{mt} is as:

$$CSAD_{\tau}(\tau \mid x) = \delta_{0\tau} + \delta_{1\tau}(1-D_t)R_{mt} + \delta_{2\tau}D_t * R_{mt} + \delta_{3\tau}(1-D_t)*(R_{mt})^2 + \delta_{4\tau}D_t*(R_{mt})^2 + \varepsilon_t \quad (7)$$

where D is a dummy variable which takes value of unity at time t if $R_{mt} < 0$, or zero otherwise. If the estimated coefficients are negative and significant, herding is present. In addition, the nonlinear herding exists in the up and down markets, respectively, if the coefficients, δ_3 and δ_4, are significant and negative for different quantiles.

4. Data

The daily stock returns of the Jordanian listed firms and the market returns are sourced from the Amman stock exchange (ASE) database. The sample study consists of 43 financial firms and 112 nonfinancial firms which have data availability for the whole period of 2003 until end of 2006. In addition, the number of firms with data available for the whole period from 2007 until 2010 is 105 for financial firms and 145 for nonfinancial firms. The study period was from the beginning of January 2003 to the end of December 2010. It is divided into two sub-periods before and during the 2008 financial crisis. The reason of dividing the sample into the two major sub-periods is that they would provide a greater insight into the nature of herding behavior in the Jordanian equity market before and after the 2008 financial crisis. Melvin and Taylor (2009) argued that the 2008 financial crisis started at the mid of 2007 and began to lose its effect at the end of 2008. Following this argument, the crisis period in this study starts at the beginning of 2007. The reason of this choice is that although the real crisis event was observed in the mid of 2008, it would have started before this date by a period of time. The risk-free rate of interest (6-months Jordanian Treasury-bill rate) is sourced from the monthly bulletins of the Central Bank of Jordan (CBJ). All data sets are stationary as the Dickey–Fuller (1979; 1981) (ADF) tests suggest.

5. Empirical Results

5.1 Univariate Statistics

Table 1 reports the univariate statistics of the average daily returns R_t, the CSSD, the CSAD and H_t for financial and nonfinancial firms. The data series of all these variables show no sign autocorrelation. But, they are stationary as the AR and ADF tests show. Before the crisis, the average daily returns of financial (nonfinancial) firms ranges between -0.143 (-0.024) and 0.132 (0.035). In fact, financial firms express higher range of daily returns more than nonfinancial firms but with low volatility (standard deviation of financial (nonfinancial) firms is 0.009 (0.006)). After the crisis, the average daily returns are reported for financial (nonfinancial) firms ranging between -0.027 (-0.024) and 0.032 (0.035). It also reports a low standard deviation of 0.007 (0.005) for financial (nonfinancial) firms, respectively. This low of average daily returns would indicate a sign of herding, although of the effect of the crisis.

Before the crisis, the daily average CSSD ranges are between 0.001 (0.026) and 0.806 (0.898) for financial (nonfinancial) firms. This means that both types of firms display a higher range, but a lower volatility. Therefore, there would be no tendency to herding as the dispersion of stock return from market returns would remain too high with no decrease. After the crisis, the daily average CSSD ranges are between 0.002 (0.046) and 0.29 (0.545) for financial (nonfinancial) firms. Daily CSSD of those firms present a lower range and a lower volatility compared to those in the period before crisis. However, although those firms show low ranges of CSSD after the crisis, these ranges are still considered too high. These higher ranges of stock dispersion from market portfolio suggest that stock returns diverge far from their average which might show no sign of herding.

Table 1. Summary statistics of herding measures for the Jordanian financial and nonfinancial firms

Period	Var.	Mean	StDev	Min.	Max.	Serial correlation (*rho value*)				ADF-test
						AR(1)	AR(5)	AR(10)	AR(20)	
2003-2010	**Financial firms**									
	R_t	0.001	0.009	-0.143	0.132	0.167	0.012	0.023	0.013	306.25***
	$CSSD_t$	0.026	0.032	0.001	0.806	0.006	0.005	0.015	0.006	317.39***
	$CSAD_t$	-0.002	0.019	-0.228	0.279	0.336	0.045	0.022	-0.010	229.51***
	H_t	0.963	0.507	0.086	1.962	0.885	0.004	-0.001	0.010	20.429***
	Nonfinancial firms									
	R_t	0.000	0.006	-0.024	0.035	0.199	0.002	0.012	-0.011	310.22***
	$CSSD_t$	0.022	0.015	0.002	0.343	0.059	0.023	0.020	0.024	311.83***
	$CSAD_t$	-0.002	0.014	-0.096	0.094	0.261	0.063	0.047	-0.004	238.83***
	H_t	0.496	0.362	0.009	1.113	1.334	-0.007	-0.021	0.017	119.39***
2003-2006	**Financial firms**									
	R_t	0.001	0.011	-0.143	0.132	0.135	0.019	0.036	0.006	160.00***
	$CSSD_t$	0.027	0.043	0.001	0.806	-0.001	0.002	0.009	0.003	157.90***
	$CSAD_t$	-0.004	0.021	-0.228	0.279	0.198	0.056	0.076	0.003	126.80***
	H_t	0.822	0.645	0.086	1.895	1.042	-0.006	-0.018	-0.000	60.44***
	Nonfinancial firms									
	R_t	0.000	0.006	-0.023	0.027	0.148	0.029	0.029	-0.035	168.92***
	$CSSD_t$	0.156	0.056	0.026	0.898	0.049	0.029	0.010	0.021	154.30***
	$CSAD_t$	-0.004	0.013	-0.096	0.040	0.308	0.056	0.052	-0.005	123.79***
	H_t	0.732	0.178	0.401	0.936	1.024	-0.034	-0.024	-0.011	51.30***
2007-2010	**Financial firms**									
	R_t	-0.001	0.007	-0.027	0.032	0.106	-0.004	0.007	0.004	133.29***
	$CSSD_t$	0.024	0.014	0.002	0.297	0.039	0.003	0.046	0.013	145.65***
	$CSAD_t$	-0.001	0.016	-0.04	0.06	0.213	0.017	-0.031	-0.004	99.960***
	H_t	1.101	0.252	0.775	1.962	0.567	0.032	0.049	-0.000	54.77***
	Nonfinancialfirms									
	R_t	0.000	0.005	-0.024	0.035	0.137	-0.028	-0.012	0.017	140.64***
	$CSSD_t$	0.153	0.027	0.046	0.545	0.074	0.007	0.030	0.025	154.27***
	$CSAD_t$	0.000	0.014	-0.027	0.059	0.225	0.007	-0.009	-0.003	101.79***
	H_t	0.264	0.347	0.009	1.113	1.448	0.222	-0.004	0.011	21.79***

This table reports the daily summary statistics of average stock returns R_t, $CSSD_t$, $CSAD_t$ and H_t over the sample periods. In addition, the serial correlations are reported for lags 1, 5, 10 and 20 together with test-statistics of the Augmented Dickey-Fuller test (includes constant and trend). The confidence level parentheses of (1%, 5%, and 10%) are (***, **, and *), respectively. For both types of firms, the daily data availability periods range from (1960) days for the whole period, (988) days for the sub-period before the crisis, and (972) days after the crisis.

The summary statistics of the daily average of the CSAD are also reported in Table 1. Before the crisis, the average daily of CSAD ranges between -0.228 (-0.096) and 0.279 (0.04) for financial (nonfinancial) firms. Financial firms exhibit a higher range and volatility (0.021 and 0.013, respectively) more than nonfinancial firms. This would indicate that financial sectors' investors might be involved in more traded values than nonfinancial investors. After the crisis, the average daily of CSSD ranges between -0.04 (-0.027) and 0.06 (0.059) for financial (nonfinancial) firms. Those firms present a low dispersion of stock returns with low volatility because of the effect of the crisis. CSAD does not show a sign of serial correlation but show a sign of stationary.

Table 1 also shows that, before the crisis, the averages of the daily variation of the betas for financial (nonfinancial) firms are 0.822 (0.732), respectively. These high variations suggest that the dispersion of stock returns diverge far from market portfolio. So, no sign of herding would present. However, the standard deviations of beta variations for financial firms equals to 0.645 which is higher than that for nonfinancial firms of 0.178. This suggests that the variability of stock dispersion of nonfinancial firms is less than the variability of stock dispersion of financial firms. Therefore, it is more likely to nonfinancial firms to display herding more than financial firms. After the crisis, the average of daily beta variation of financial firms rises to 1.101 (with standard deviation of 0.252). But, the average of daily beta variations of nonfinancial firms decreases to 0.264 (with standard deviation of 0.347). This confirms the presence of herding within nonfinancial firms, but financial

investors are more likely not to herd.

5.2 Multivariate Results

5.2.1 Dummy Variable Regression Results Using CSSD – The CH Method

The multivariate results are reported in the rest of tables in the following pages. Table 2 records the regression coefficients ofherding using the CH method. These coefficients shed the light on the extent of herd behavior across trading days with extreme upward or downward price movements (Note 2). Eq. (2) is estimated using the three criteria (1%, 10%, and 20%) of market returns to apply definition of extreme price movement. Findings of this study are consistent with earlier studies. The coefficients (β_1 and β_2) of the lower and upper extreme variables are positive and significant in periods before and after crisis. This suggests no evidence of herding since equity return dispersions tend to increase rather than to decrease. This evidence is consistent with CH approach but inconsistent with Zhou and Lai (2009), Chiang et al. (2010) and Economou et al. (2011).

Table 2. The coefficients of herding using the cross-sectional standard deviation– The CH approach

	ALL period (2003-2010) 1960 = (-) 894 and (+) 1067			**Before (2003 – 2006)** 972 = (-) 414 and (+) 558			**After (2007 – 2010)** 988 = (-) 480 and (+) 508		
	Criterion 5%	***Criterion 10%***	***Criterion 20%***	***Criterion 5%***	***Criterion 10%***	***Criterion 20%***	***Criterion 5%***	***Criterion 10%***	***Criterion 20%***
Panel A: All Firms									
β_1	0.006***	0.004***	0.003***	0.007*	0.005*	0.003	0.006***	0.004***	0.003***
	(3.234)	(3.061)	(2.501)	(1.862)	(1.899)	(1.391)	(3.899)	(3.325)	(3.086)
β_2	0.019***	0.011***	0.007***	0.030***	0.016***	0.010***	0.008***	0.005***	0.004***
	(9.441)	(7.231)	(6.112)	(8.270)	(6.147)	(4.600)	(4.860)	(3.959)	(4.765)
R^2	0.05	0.04	0.03	0.07	0.05	0.02	0.04	0.02	0.03
F(p-val)	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Panel B: Financial firms									
β_1	0.004	0.003	0.001	0.005***	0.005***	0.001	0.009***	0.007***	0.005***
	(1.454)	(1.269)	(0.796)	(2.517)	(2.517)	(0.292)	(3.849)	(4.079)	(3.499)
β_2	0.020***	0.011***	0.006***	0.006***	0.006***	0.009***	0.026***	0.015***	0.010***
	(6.120)	(4.606)	(3.201)	(2.951)	(2.951)	(2.603)	(11.160)	(8.469)	(7.406)
Adj. R^2	0.10	0.13	0.15	0.17	0.17	0.15	0.12	0.17	0.20
F(p-val)	0.000***	0.000***	0.006***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Panel C: Nonfinancial firms									
β_1	0.008***	0.006***	0.004***	0.009***	0.007***	0.005***	0.007***	0.005***	0.004***
	(5.390)	(5.322)	(4.871)	(3.849)	(4.079)	(3.499)	(3.866)	(3.458)	(3.450)
β_2	0.018***	0.010***	0.008***	0.026***	0.015***	0.010***	0.009***	0.006***	0.006***
	(11.740)	(9.180)	(9.252)	(11.160)	(8.469)	(7.406)	(5.012)	(4.103)	(5.560)
R^2	0.15	0.19	0.17	0.12	0.17	0.20	0.22	0.15	0.20
F(p-val)	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***

The table reports the estimated coefficients of the relationship between the Cross-sectional standard deviation (*CSSD*) and the up (down) market returns. Eq. (2) is estimated to provide the results in this table. Recall, $\beta_1(\beta_2)$ are the coefficients of D_{Lt} (D_{Ut}), respectively. They are equals 1 if the market return on day *t* lies in the extreme lower (upper) tail of the return distribution, otherwise D_{Lt} (D_{Ut}) equals zero. The 1%, 2% and 5% criterion refers to the percentage of observations in the upper and lower tail of the market return distribution used to define extreme price movement days. Before the crisis period, the number of financial (nonfinancial) firms is 43 (112). After the crisis, In addition, the number of financial (nonfinancial) firms is 105 (145). The levels of confidence (1%, 5%, and 10%) are signed by ***, **, and *, respectively.

5.2.2 The Non-linear Function of Market Return and CSAD – The CCK Approach

Table 3 shows the estimated coefficients of the nonlinear herding (Eq. 4), as designed in the CCK method. In general, Jordanian firms display evidence of herding only before the crisis (normal market conditions). For financial firms, the coefficients (δ_1 and δ_2) are positively significant. This suggests no evidence of linear and nonlinear herding in periods before and after the crisis. This is consistent with CH findings and Kallinterakis et al. (2010) while contradicts the results of Economou et al. (2011). However, nonfinancial firms display a tendency of nonlinear herding. This means that evidence of the nonlinear function of CSAD on market returns is captured before and after the crisis. To explain, let us apply the general quadratic function (Eq. 4) between

CSAD and market returns, for nonfinancial firms before the crisis. The presence of a negative parameter, α_2, is a signal of a tendency of herding. The quadratic relation suggests that CSAD reaches its maximum value when R_{mt} = - ($\alpha_1/2\alpha_2$) reaches its minimum value. That is, if R_{mt} increases, over the range where average daily returns are less than R_{mt}, CSAD will fall down. Using a 0.044 maximum market return as a threshold of market stress, with α_1= 0.393, the estimated value of the α_2 parameter needs to be (-4.455) or smaller.

Table 3. The coefficients of herding using the CSAD against market return – The CCK approach

	Obser.	δ_1	δ_2	Adj. R^2	P-val. (F)
All Firms					
ALL Period(2003-2010)	1960	0.393(1.00)	65.88***(3.89)	0.09	0.001***
Before (2003-2006)	972	0.463***(12.05)	-5.14***(-3.14)	0.14	0.000***
After (2007- 2010)	988	0.771(0.93)	172.5***(36.51)	0.08	0.000***
Financial firms					
ALL Period (2003-2010)	1960	0.495***(13.59)	1.338*(1.78)	0.10	0.000***
Before (2003-2006)	972	0.585***(10.97)	0.966*(1.87)	0.11	0.000***
After (2007- 2010)	988	0.415***(8.533)	3.95*(1.84)	0.18	0.000***
Nonfinancial firms					
ALL Period (2003-2010)	1960	0.376***(14.06)	-1.171*(-1.92)	0.10	0.000***
Before (2003-2006)	972	0.393***(11.53)	-4.455***(-3.07)	0.13	0.000***
After (2007- 2010)	988	0.137***(30.12)	-0.184***(-22.18)	0.51	0.000***

The Table reports the estimated coefficients of the regression model in Eqs (4). $CSAD_t$ is the dependent variable. δ_1 and δ_2 are the coefficients of $|R_{mt}|$ and $(R_{mt})^2$, respectively. Before the crisis, the number of financial (nonfinancial) firms is 43 (112) before the crisis. However, during the crisis, the number of financial (nonfinancial) firms is 105 (145). The levels of confidence (1%, 5%, and 10%) are signed by ***, **, and *, respectively.

Table 4 provides the results of the empirical specification, in Eq. 5, estimated for the up and down market returns values. In Panel A, the value of $(1-D)*R_{mt}$ (coefficient δ_1) simplifies a comparison of linear coefficients in the up market. However, $D*R_{mt}$ (coefficient δ_2) is used to compare the linear coefficients of the down market. The coefficient, δ_1, is negative and significant in the period after the crisis for both types of firms. This strongly confirms the prediction that CSAD decreases when market return increases. This suggests evidence towards herding in extreme market conditions.This result is inconsistent with the predictions of the rational capital asset pricing model and the dummy variable regression results in Table 2. No evidence of linear herding is reported when the market falls down in both periods. For all firms, evidence of linear herding is reported before and after the crisis only when market is trending up. However, the coefficients, δ_3, for both types of firms, are positive and significant before and after the crisis. This strongly confirms the prediction that there is no evidence of the herd behavior which consistent with the results of Fu and Lin et al. (2010) and Henker et al. (2006). The finding of this study however contradicts the results of Chen et al. (2008) and Goodfellow et al. (2009). To interpret, in the Jordanian stock market, market participants would not have enough power to convert the linear herding to nonlinear one.

Table 4. The coefficients of asymmetric herding in the up and down market

	Panel A: The coefficients of herding in the up and down markets using the CSAD– The CCK approach						Panel B: The regression coefficients of linear and nonlinear herding in the up and down markets							
	Obs.	δ_1	δ_2	δ_3	Adj. R^2	P-val. (F)	δ_1	δ_2	δ_3	δ_4	Adj. R^2	P-val. (F)	Wald Coeff test H_0: $\alpha_3 - \alpha_4 = 0$	
													$\alpha_3 - \alpha_4$	χ^2
ALL firms														
ALL Period	1960	-3.10***	4.03***	165.9***	0.02	0.00***	-1.050	5.98***	72.23	247.0***	0.09	0.00***	-174.9	10.12***
(2003-2010)		(-2.06)	(2.58)	(3.70)			(-0.62)	(3.45)	(1.25)	(4.50)				
Before	972	0.36***	0.56***	-4.97***	0.14	0.00***	0.183	0.714***	5.74	3.96	0.13	0.00***	1.78	0.62
(2003-2006)		(-5.12)	(8.51)	(-8.51)			(1.06)	(3.93)	(1.02)	(0.70)				
After	988	-6.56***	8.36***	388.8***	0.03	0.00***	-1.96	11.77***	169.6	537.4***	0.05	0.00***	-367.8	11.85***
(2007-2010)		(-2.16)	(2.66)	(4.15)			(-0.55)	(3.54)	(1.33)	(4.87)				
Financial Firms														
ALL Period	1960	-3.592	1.12***	19.82***	0.1	0.00***	16.23***	1.12***	--	19.82***	0.10	0.00***	---	38.08***
(2003-2010)		(-0.64)	(7.94)	(4.18)			(6.95)	(7.94)		(4.18)				
Before	972	0.232	0.954***	11.84*	0.11	0.00***	0.364***	0.755***	263.13*	5.03	0.11	0.00***	257.83	1.71
(2003-2006)		(1.09)	(4.31)	(1.92)			(2.28)	(3.10)	(1.83)	(0.66)				
After	988	-0.58***	1.45***	33.42***	0.1	0.00***	-0.384*	1.60***	23.84***	39.89***	0.10	0.00***	-16.05	20.86***
(2007-2010)		(-3.32)	(7.98)	(6.17)			(-1.87)	(8.09)	(3.22)	(6.24)				
Nonfinancial firms														
ALL Period	1960	-9.21***	0.991***	17.12***	0.11	0.00***	7.92***	0.991***	--	17.12***	0.11	0.00***	---	26.84***
(2003-2010)		(-2.25)	(9.60)	(4.93)			(4.62)	(9.60)		(4.93)				
Before	972	0.197	0.598***	1.032	0.14	0.00***	0.223***	0.642***	-7.13	2.71	0.13	0.00***	-4.42	0.17
(2003-2006)		(1.45)	(4.23)	(0.26)			(2.20)	(4.12)	(-0.08)	(0.55)				
After	988	-0.49***	1.31***	30.6***	0.12	0.00***	-0.33***	1.421***	23.09***	35.65***	0.12	0.00***	-12.56	23.65***
(2007-2010)		(-3.29)	(8.46)	(6.65)			(-1.92)	(8.47)	(3.67)	(6.56)				

In Panel A, the estimated coefficients of the regression model in Eq. (5) are reported. $CSAD_t$ is the dependent variable. δ_1 and δ_2 are the coefficients of $(1\text{-}D)*R_{mt}$ and $D*R_{mt}$ representing the proxies for herding in the up and the down market on day t, respectively. The dummy variable (D) takes value of unity if $R_{mt}<0$, or zero otherwise. δ_3 is the coefficient of R_{mt}^2 as a proxy for nonlinear herding. In Panel B, the estimated coefficients of the non-linear regression model in Eq. (6) are reported. $CSAD_t$ is dependent variable at time t. δ_1 and δ_2 are the coefficients of $(1\text{-}D)*R_{mt}$ and $D*R_{mt}$ representing the proxies for linear herding in the up and the down market at time t, respectively. The dummy variable (D) takes value of unity if $R_{mt}<0$, or zero otherwise. δ_3 and δ_4 are the coefficient of $(1\text{-}D)*R_{mt}^2$ and $D*R_{mt}^2$ as a proxies for nonlinear herding in the up and down market, respectively. For both Panels, the number of financial (nonfinancial) firms is 43 (112) before the crisis. After the crisis, the number of financial (nonfinancial) firms is 105 (145). The levels of confidence (1%, 5%, and 10%) are signed by ***, **, and *, respectively.

Recall, to test for herding (linear and nonlinear jointly) in the up and down markets, this study modifies the model as in Eq. (5). This modification is achieved by using a dummy variable procedure which takes the value of unity if $R_{mt}<0$ on day t, or zero otherwise. The proxy for linear (nonlinear) herding in the up market is generated by multiplying the positive dummy variable, 1-D, by linear (nonlinear) market return. And, the proxy for linear (nonlinear) herding in the down market is generated by multiplying the dummy variable, D, by linear (nonlinear) market return. Panel B of Table 4 reports the estimated coefficients of linear and nonlinear herding for the up and down markets as in Eq. (6). The coefficients of the up market, δ_1, are negative and significant. This suggests evidence for both types of firm in the extreme market conditions (after the crisis) confirming the finding of Chiang et al. (2010). This suggests that, when market is trending up, herding would exist because return dispersion decreases rather than increases. However, no evidence is reported for the linear herding when market is going down. That is, the coefficients of the down market, δ_2, are positive and significant. The coefficients, δ_3 and δ_4, shows evidence of the absence of the nonlinear herding when the market is down and up in both normal and extreme market conditions. To specify a test for the nonlinear coefficients of the up and down cases, the equality test of Wald is used. This test tests the null hypothesis of H_0: $\delta_3 = \delta_4 = 0$. It is rejected for both types of firms only in the period after the crisis with a negative sign. This contradicts the predictions that CSAD in general decreases when market return decreases. Indeed, these coefficients show that beyond a certain threshold, the CSAD may increase when R_{mt} increases. This evidence confirms the findings of the CH method above.

In the preceding section, it was noted that different results are reported of herding behavior. Financial firms presented no evidence of nonlinear herding while nonfinancial firms displayed evidence of nonlinear herding. It follows that, when the data are divided into up and down markets, no evidence of nonlinear herding is reported

for both types of firms. These results are useful, since they provide information conditional on certain groups of the data such as financial and nonfinancial firms. Because of this, the issue of whether herding behavior is sensitive to different quantiles of stock return dispersions is addressed here. It is also of interest to examine whether the error distribution is following a Gaussian setting. That is, quantile estimators would be more efficient than the estimators of the least squares (Buchinsky, 1998) (Note 3). In extreme market conditions, the flow of news and information can significantly influence the tails values, thus biases the estimators. To overcome these issues, a quantile regression is employed with range of conditional quantile functions for robustness. Thus, it produces more efficient estimates compared with the least squares.

Table 5. The coefficients of the quantile estimation of herding behavior for all firms

	α_1	α_2	α_3	α_4	Pseudo R^2	Chi- χ^2 (4)
Panel A: ALL period (2003-2010)						
Quantile =	-0.18***	1.06***	-3.46	7.95	0.02	35.76***
10%	(-0.94)	(5.31)	(-0.51)	(1.44)		
Quantile =	-0.71***	0.81***	31.32***	10.66***	0.02	77.78***
25%	(-7.83)	(8.65)	(10.88)	(3.77)		
Quantile =	0.064	1.38***	17.52***	20.98***	0.04	--
50%	(0.35)	(7.42)	(2.84)	(3.60)		
Quantile =	-0.155	1.54***	34.89***	18.20***	0.02	169.12***
75%	(-1.01)	(9.84)	(6.69)	3.56		
Quantile =	-4.79***	8.60***	263.3***	519.19***	0.04	103.69***
90%	(-4.41)	(7.22)	(8.10)	12.87		
Panel B: Before (2003-2006)						
Quantile =	-0.27***	0.359***	-2.04	1.73	0.11	28.82***
10%	(-3.02)	(3.62)	(-0.68)	(0.64)		
Quantile =	-0.18***	0.442***	-5.26**	3.30	0.09	47.97***
25%	(-2.37)	(5.41)	(-2.15)	(1.43)		
Quantile =	1.080***	0.551***	-6.03	4.78	0.09	--
50%	(8.74)	(4.16)	(-1.53)	(1.17)		
Quantile =	0.440***	1.671***	-0.407	23.45***	0.17	356.02***
75%	(4.66)	(17.98)	(-0.14)	(8.88)		
Quantile =	0.407***	-0.0731	0.310	-20.5***	0.12	65.73***
90%	(3.55)	(-0.45)	(0.09)	(-3.40)		
Panel C: After (2007-2010)						
Quantile =	-1.73	1.832	90.28*	-113.9***	0.03	31.73***
10%	(-1.35)	(1.47)	(1.99)	(-2.96)		
Quantile =	-1.45***	2.19***	74.90***	33.61***	0.02	34.47***
25%	(-3.83)	(5.80)	(6.18)	(2.83)		
Quantile =	-1.37***	1.93***	88.82***	41.35***	0.02	--
50%	(-9.71)	(14.15)	(17.55)	(9.37)		
Quantile =	-3.69***	8.36***	246.5***	520.16***	0.04	436.63***
75%	(-7.22)	(15.62)	(14.82)	(27.63)		
Quantile =	-19.5***	32.36***	1027.7***	1774.9***	0.08	54.32***
90%	(-2.54)	(4.55)	(4.07)	(8.96)		

The table reports the coefficients of the quantile regressionsfor Eq. (6) for all listed Jordanian firms using different quantiles. $CSAD_t$ is dependent variable at time *t*. δ_1 and δ_2 are the coefficients of $(1\text{-}D)*R_{mt}$ and $D*R_{mt}$ representing the proxies for linear herding in the up and the down market at time *t*, respectively. The dummy variable (*D*) takes value of unity if $R_{mt}<0$, or zero otherwise. δ_3 and δ_4 are the coefficient of $(1\text{-}D)*R_{mt}^2$ and $D*R_{mt}^2$ as a proxies for nonlinear herding in the up and down market, respectively. The levels of confidence (1%, 5%, and 10%) are signed by ***, **, and *, respectively. The $\chi^2(4)$ is the Chi-squared distribution with four degrees of freedom for the Wald test.

In Tables (5 and 6), the estimated coefficients of the quantile regressions of Eq. (7) with different quantiles (10%, 25%, 50%, 75%, and 90%) are recorded. Table 5 shows the estimated coefficients, α_3 and α_4, for all firms. These coefficients are positive and significant at the 5% level of confidence or better in the low quantiles (τ = 10% and 25%) up to the median level (τ = 50%). This suggests no evidence of nonlinear herding in periods before and after crisis. Beyond the median level, these coefficients remain positive and significant. It also reports evidence

of linear herding for the quantile coefficients lower and upper the median level in the all sub-period. This evidence of linear herding reflects herding tendency which is more likely to happen at the lower tails of the distribution in the period after the crisis and at higher tails before the crisis. Thus, herding is observed in lower and upper levels of quantiles for periods of market stress. However, in general, no evidence of nonlinear herding is reported in lower and upper quantiles. But, before the crisis, herding appears in lower quantiles when market is falling down (τ =25% with α_4). These results confirm the findings in Panel B of Table 4.

Panel A in Table 6 shows that financial firms display evidence of linear herding at the levels below the median when the market is trending up in the all period, before and after the crisis. This result suggests that Jordanian financial investors tend to herd in bullish markets more than beaten markets. Evidence of nonlinear herding behavior is found in the all period and in the period before the crisis at median level (see τ = 50% with α_3). In fact, the Table records negative and significant coefficients of the up market in low and high quantiles.Thus, evidence of herding is observed in the lower and upper levels of quantiles in normal market conditions. These results suggest that Jordanian financial investors display similar trading behavior to other investors. However, no evidence of asymmetric herding is captured in the up and down markets (see α_3 and α_4).

Table 6. The coefficients of the Quantile estimation of herding behaviorfor financial and nonfinancial firms

	Panel A: Financial Firms						**Panel B: Non-financial Firms**					
	α_1	α_2	α_3	α_4	**Pseudo R^2**	**Chi-χ^2 (4)**	α_1	α_2	α_3	α_4	**Pseudo R^2**	**Chi-χ^2 (4)**
ALL period (2003-2010)												
Quantile	-0.23***	0.37***	1.12	3.40	0.05	20.65***	-0.18***	0.33***	-2.91	0.901	0.10	56.55***
= 10%	(-2.99)	(4.82)	(0.48)	(1.54)			(-2.86)	(5.40)	(-1.33)	(0.53)		
Quantile	-0.59***	0.52***	22.65***	5.47***	0.05	86.10***	-0.33***	0.45***	6.98***	3.81***	0.07	59.39***
= 25%	(-10.02)	(8.46)	(12.59)	(2.85)			(-6.18)	(8.16)	(4.11)	(2.30)		
Quantile	1.41***	1.34***	-19.1***	24.61***	0.11	--	1.22***	1.07***	-14.36***	17.60***	0.11	--
= 50%	(9.08)	(8.35)	(-3.72)	(4.84)			(9.49)	(8.22)	(-3.31)	(4.26)		
Quantile	-0.008	1.70***	11.02***	19.93***	0.08	424.14***	0.066	1.54***	7.82***	18.43***	0.08	570.92***
= 75%	(-0.09)	(19.08)	(4.08)	(6.69)			(0.97)	(22.01)	(3.72)	(7.90)		
Quantile	0.30***	0.003	3.35	4.71*	0.05	35.70***	0.32***	0.056	-0.025	8.43***	0.08	103.85***
= 90%	(3.60)	(0.03)	(1.24)	(1.77)			(7.54)	(1.24)	-0.02	(6.24)		
Before (2003-2006)												
Quantile	-0.26***	0.426***	-22.68	4.395	0.05	9.67***	-0.075	0.27***	-272.5***	-0.707	0.12	50.80***
= 10%	(-2.82)	(2.83)	(-0.33)	(1.04)			(-1.36)	(3.17)	(-5.78)	(-0.30)		
Quantile	-0.35***	0.486***	169.3***	4.025	0.06	27.15***	-0.20***	0.45***	-120.1***	3.72*	0.09	50.18***
= 25%	(-5.79)	(5.30)	(3.63)	(1.49)			(-4.01)	(5.99)	(-2.97)	(1.76)		
Quantile	1.07***	0.56***	-155.0*	4.78	0.08	--	0.61***	0.47***	70.04	3.182	0.09	--
= 50%	(10.36)	(3.42)	(-1.83)	(0.94)			(7.89)	(4.00)	(1.05)	(0.89)		
Quantile	0.43***	2.00 ***	28.72	31.41***	0.15	172.03***	0.46***	1.44***	-39.83	18.79***	0.17	554.26***
= 75%	(4.19)	(13.99)	(0.31)	(7.83)			(9.82)	(21.69)	(-1.03)	(9.59)		
Quantile	0.32***	0.523***	135.6*	-9.14	0.11	74.67***	0.42***	-0.134	-51.20	-20.6***	0.12	43.35***
= 90%	(2.98)	(2.37)	(1.83)	(-1.12)			(5.03)	(-0.77)	(-0.91)	(-3.19)		
After (2007-2010)												
Quantile	-0.50***	0.407***	18.27***	4.59*	0.04	22.86***	-0.49***	0.423***	15.01***	2.904	0.08	50.35***
= 10%	(-5.15)	(4.56)	(6.96)	(1.85)			(-6.71)	(6.08)	(7.46)	(1.57)		
Quantile	-0.69***	0.56***	30.85***	7.77***	0.04	98.73***	-0.61***	0.442***	29.17***	3.00	0.06	173.17***
= 25%	(-8.79)	7.20	(13.65)	(3.20)			(-9.99)	(7.28)	(16.63)	(1.55)		
Quantile	0.114	3.39***	6.98***	86.45***	0.18	--	0.183*	2.817***	6.114	72.17***	0.19	--
= 50%	(0.89)	27.96	(1.52)	(22.51)			(1.70)	(7.83)	(1.57)	(22.63)		
Quantile	0.068	0.24*	6.80***	11.74***	0.03	22.93***	0.123	0.383***	6.14***	16.94***	0.05	41.68***
= 75%	(0.82)	(3.01)	(2.49)	(4.66)			(1.64)	(5.31)	(2.41)	(7.49)		
Quantile	0.36***	-0.18*	-0.973	1.255	0.07	27.35***	0.321***	0.065	-0.308	12.15***	0.10	90.40***
= 90%	(3.84)	(-1.97)	(-0.36)	(0.48)			(5.40)	(1.10)	(-0.15)	(7.37)		

The table reports the coefficients of Eq. (7) using the quantile regression for financial and nonfinancial firms. $CSAD_t$ is dependent variable at time *t*. δ_1 and δ_2 are the coefficients of $(1\text{-}D)*R_{mt}$ and $D*R_{mt}$ representing the proxies for linear herding in the up and the down market at time *t*, respectively. The dummy variable (D) takes value of unity if $R_{mt}<0$, or zero otherwise. δ_3 and δ_4 are the coefficient of $(1\text{-}D)*R_{mt}^2$ and $D*R_{mt}^2$ as a proxies for nonlinear herding in the up and down market, respectively. The levels of confidence (1%, 5%, and 10%) are signed by ***, **, and *, respectively.

In comparison with prior results in Panel B of Table 4, the results reported in Panel A of Table 6 are different. It shows that, for financial firms, there is evidence of nonlinear herding in the all period and in period before crisis when the market is trending up. This result contradicts the findings in Table 3 as financial firms exhibit no evidence of nonlinear herding. After the crisis, evidence of the absence of herding is also reported confirming the results in Panel B in Table 4.

Panel B in Table 6 shows that for financial firms, no evidence of nonlinear herding is found before and after crisis in the up and down markets at median level (see $\tau = 50\%$). This result contradicts the results reported in Table 3. However, these results indicate that nonfinancial investors show similar trading patterns to other investors consistent. Thus, nonlinear herding is not observed in the lower and upper quantiles in extreme and normal market conditions. Therefore, Tables 5 and 6 clearly show evidence of herding, but this evidence differs among quantile levels. Assuming that the value of quantile is close to the mean value of the least squares estimation, the Wald test is conducted. It tests the null hypothesis that the four coefficients of each quantile are equal. The χ^2 (4) statistic indicates that the null is uniformly rejected at lower and higher quantile distributions for both firms. This suggests that the estimated coefficients for all quantiles are significantly different from that of the median distribution. This similarity in test results shows that a mean or a median estimation may yield a similar statistical inference.

It is also interesting to compare the quantile regression results in the two tables above with those obtained when using the least squares in Table 4. In these Tables (5 and 6), the coefficients on α_3 and α_4 are significantly positive for all firms before and after the crisis. In the current analysis, evidence is consistent with the evidence in Table 5 for the absence of nonlinear herding. To conclude, no difference in results between the least squares estimation and the quantile estimation. Therefore, although of using different levels of quantiles, the results remain the same as in the results of the least squares. These results contradict the findings reported by Alexander (2008) and Chiang et al. (2010).

6. Conclusion

This paper has examined the herd behavior in the Jordanian equity market for financial and nonfinancial firms before and during the recent global financial crisis. Different results are reported depending upon the methodology used to detect for herding behavior. The study reports no evidence of herding because stock return dispersion does not deviate far from market return for financial and nonfinancial firms. A positive linear function is found between CSSD and the up and down market returns in both extreme and normal market conditions for both types of firms. This result supports the rational asset pricing models through providing evidence of the absence of herding for both financial and nonfinancial firms before and after crisis. During extreme periods, equity return dispersions increase rather than to decrease, so providing evidence of the absence of herding.

The study provides evidence for the absence of herding for financial and nonfinancial firms before and after crisis. This is because the relationship between the CSAD and the quadric market returns is positive and significant. Nevertheless, both types of firms had evidence of linear herding in the bullish market. The results also show evidence of the absence of before and after crisis as equity return dispersions nonlinearly increase rather than to decrease for both types of firms. However, evidence of the tendency of linear herding is present in the Jordanian stock market. The linear herding would be present because of the incomplete information disclosures. In fact, in Jordan where the evidence in favor of herding is not pronounced, macroeconomic information do not play a significant role in the decision making process of market participants. A quantile regression is used with different conditional quantiles to test for herding through the nonlinear function of market returns. It confirms the results of least squares as evidence of linear herding is reported in the up market only in low quantiles. Financial firms display nonlinear herding before the crisis at the median in the bullish market, while no evidence of nonlinear herding is reported in up and down markets.

The important implication of this study is that, in the Jordanian stock market where market participants tend to herd around the market consensus, a larger number of securities are needed to achieve the same level of diversification than in a normal market. Future research can be undertaken through an application on mutual funds. And, it would be much valuable if the most recent developed herding tests such as Bernhardt et al. (2006) and Naujoks (2009) are applied to our study set of data.

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Notes

Note 1. It should be indicated that there is a long record of studies analyzing the herding behavior in the early 1990s, such as Scharfstein and Stein (1990), Zwiebel (1995) and Trueman (1994) among others.

Note 2. To satisfy the 5%, 10% and 20% criteria in the up (down) market before the crisis, the daily return of the Jordanian stock market index has to exceed (be less than) 0.024 (-0.029), 0.017 (-0.022), and 0.012 (-0.013), respectively. After the crisis period, the daily return of the Jordanian stock market index has to exceed (be less than) 0.019 (-0.026), 0.016 (-0.018), and 0.011 (-0.012) to satisfy the three criteria indicated above respectively.

Note 3. Hoenker (2005) indicated that one of the aspects of losing efficiency in producing estimators is that the least squares estimators focus on the mean value. In this case, information about whether the tails of a distribution are fatter, or not, would be lost.

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