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Reporting Comprehensive Income: Reasons for Reporting Choices and Investor Reactions

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Abstract

This paper aims to investigate whether the reporting way of comprehensive income is influenced by some factors mentioned by the Positive Accounting Theory and whether the investors value their choice by looking at stock returns (measured in different ways) for firms in the S&P 350 Europe Index. The research results show that there is no significant association between the reporting choice of firms and the equity-based incentives, job security, volatility and leverage of the firms. Moreover, it was found that the price-earnings ratio and stock returns are associated with reporting choice, but in the opposite direction as expected. The results of a robustness test suggest that there is a significant association between the total compensation of the CEO and the volatility on one side and the reporting choice of firms on the other side. However, these results are not significant in the expected direction, but in the opposite direction.

Keywords: comprehensive income disclosure, stock price reactions, volatility, positive accounting theory, European companies

1. Introduction

After 1 January 2009 firms implementing International Financial Reporting Standards (IFRSs) have the option to report their comprehensive income in two ways: in a single statement that consists of a statement of comprehensive income or in two separate statements split up in an income statement and a comprehensive income statement (IASB, 2007). Several studies, so far, have dealt with the reporting way of (other) comprehensive income (Bamber et al., 2010; Lee et al., 2006). These studies generally investigate, on one side, the motivations for reporting comprehensive in a certain way and, on the other side, the value relevance of comprehensive income in comparison with net income or other items.

According to efficient market theory, it is expected that there should be no determinants in the choice of reporting comprehensive income, since accounting numbers are not affected. Moreover, there should be no investor reaction to the reporting choice made, because the information hypothesis states that investors capture all known information (strong form of the efficient market theory) and as the same values are disclosed under the same name and no (future) cash flow effect is applicable, no different reaction will be expected.

However, according to Positive Accounting Theory managers can make irrational accounting choices because they can get a higher bonus, avoid debt covenants or avoid political costs (Scott, 2007, p. 287-288). If investors do not capture all information and focus on the bottom line items it could be possible that they overemphasize other comprehensive income items when comprehensive income is disclosed using the more salient single statement option. As other comprehensive income items are generally volatile and transitory, this could lead to investors thinking that the firm performance is more volatile and thus risky (Bamber et al., 2010, p. 99). This could lead to negative stock price reactions, which will be anticipated for by managers.

This research aims to study whether the reporting way of comprehensive income is influenced by some factors stated by Positive Accounting Theory and whether the investors do value their choice by looking at stock returns (measured in different ways). In this light our paper proceeds as follow: In the next section we briefly discuss the

literature review in relation to comprehensive income, the revised International Accounting Standard 1 (IAS 1), the reporting ways of (other) comprehensive income and the Positive Accounting Theory. We then present our research hypotheses, methodology and data sample. This is followed by our research results. Our paper concludes with a discussion of our findings, limitations of our work and areas for future research.

2. Literature Review

2.1 Comprehensive Income

An annual statement should include a statement of comprehensive income in order to have complete financial statements (IASB, 2007, p. 12). Three items are important regarding this subject: profit and loss, other comprehensive and comprehensive income. The official definition of profit or loss according to the IASB (2007, p.12) is "profit or loss is the total of income less expenses, excluding the components of other comprehensive income."

Other comprehensive income (OCI) has been defined by the IASB (2007, p. 12) as "items of income and expense (including reclassification adjustments) that are not recognized in profit or loss as required or permitted by other IFRSs."

The components of other comprehensive income include (IASB, 2007, p. 12):

(a) Changes in revaluation surplus.

(b) Actuarial gains and losses on defined benefit plans.

(c) Gains and losses arising from translating the financial statements of a foreign operation.

(d) Gains and losses on re-measuring available-for-sale financial assets.

(e) The effective portion of gains and losses on hedging instruments in a cash flow hedge.

Finally, total comprehensive income is the change in equity during a period resulting from transactions and other events, other than those changes resulting from transactions with owners in their capacity, as owners and comprises all components of profit or loss and other comprehensive income (IASB, 2007, p. 12). Thus, the difference between profit or loss and other comprehensive income is stated by the rules of IFRS, which will tell where to place the specific account. The sum of profit or loss and other comprehensive income is the total comprehensive income of the reporting entity for that specific year.

2.2 Revised IAS 1

Before the Revised IAS 1 (IASB, 2007), comprehensive income was reported in a statement of profit and loss, and a statement of equity (regarding other comprehensive income).

However, a statement of comprehensive income was not applicable, which could present the total changes in income directly in one statement or two consecutive statements in an income statement format. With the revised IAS 1 (IASB, 2007), firms have two options regarding the disclosure of comprehensive income:

1) In a single statement of comprehensive income.

2) In two separate statements; being an income statement and a statement of comprehensive income which includes other comprehensive income, with the sum of non-owner movements carried to the statement of changes in equity.

However, in May 2010, the IASB published ED/2010/: Presentation of Items of Other Comprehensive Income (proposed amendments to IAS 1) (Deloitte, 2010, p. 1). The Exposure Draft proposes the following:

- ✓ Presentation of profit or loss and OCI as separate components in a single financial statement.
- ✓ Separate presentation in OCI of items that will be reclassified to profit or loss in a subsequent period.

Especially, the first proposition is important in the context of this paper, because it eliminates the choice option for companies using IFRS and mandates one way of reporting comprehensive income. According to the IASB, the following benefits will be the case when a single statement is used (Deloitte, 2010, p. 2):

- ✓ All non-owner changes in equity would be presented in the same statement.
- ✓ Comparability would be improved as the other presentation option currently available under IAS 1 would be eliminated.
- ✓ A clear distinction would be made between profit or loss and items in other comprehensive income, thus preserving the importance of profit or loss and at the same time highlighting the importance of the gains or losses as a result of other changes in non-owner equity.

✓ Full transparency of items included in OCI, thus highlighting to users the items in OCI that will never be recycled into profit or loss.

In the 2010 comment letters responding to the Exposure Draft, the following concerns have been raised by respondents about the proposals. (Henry, 2011, p. 86):

✓ When a single statement format will be used, net income would be de-emphasized, being seen as a subtotal rather than a bottom line.

✓ Confusions would arise about the number to use for Earnings Per Share (EPS) calculations.

✓ Items of other comprehensive income would be overemphasized.

However, on 16 June 2011 the IASB issued the amendments to IAS 1 and the two choices for reporting comprehensive income were kept intact; a mandatory single disclosure format for comprehensive income was not included. Thus, companies using IFRS are still left to choose to report in a single format or two different statements.

Another important aspect of the ruling regarding the disclosure of comprehensive income is the convergence process and specifically, the changes made by the Financial Accounting Standards Board (FASB). Before the changes in the Accounting Standards Update in the second quarter of 2011 (effective after 15 December 2011), firms implementing US GAAP had three options for reporting their comprehensive income; the first two options are similar to the current standard of the IASB (performance reporting in a single statement or two separate statements) and the other option was to report comprehensive income within the statement of stockholder's equity. The last option was deleted and therefore, the presentation possibilities of comprehensive income are similar to the options of the IASB now, although there are still calculation differences. There are two reasons for the FASB to make this change (Henry, 2011, p. 85):

✓ This will increase the prominence of items reported in other comprehensive income.

✓ This facilitates the convergence between US GAAP and IFRS (Henry, 2011, p. 85).

2.3 Prior Literature on the Reporting Way of (Other) Comprehensive Income

There have been several studies covering the reporting location/way of (other) comprehensive income (Bamber et al., 2010; Lee et al., 2006), inquiring the motivations for reporting comprehensive in a certain way and the value relevance of comprehensive income in comparison with net income or other items.

Bamber et al. (2010), who investigated the association between manager's job security and manager's equity-based compensation, and the reporting location, found that managers with more equity-based incentives and less job security are more likely to avoid performance reporting by reporting in a statement of equity. This is because reporting in a statement format increases the salience of the often volatile other comprehensive income, which conduces investors to deem the income of the firm as more volatile. Volatile income will lead to a more risky profile of the firm, which leads to a negative investor reaction and lower stock prices. As managers with less job security and more equity-based compensation have more to suffer from stock price declines, they choose to report in a statement of equity.

Lee et al. (2006) also studied the motivations for the reporting location/way of comprehensive income and they found that insurers who report comprehensive income in a statement of equity are more likely to smooth earnings by cherry-picking realized gains and losses on available-for-sale (AFS) securities. This is because they think that reporting other comprehensive income (and thus realized gains and losses on Available-For-Sale (AFS) securities) in a statement of equity is a less salient way of reporting and attracts less attention from investors, thus the earnings management engaged by the manager is less salient and the chance that an investor captures this is smaller.

Hirst and Hopkins (2008) used an experiment with buy-side financial analysts and asked them to value firms that have earnings management and no earnings management and they manipulated the experiment by reporting comprehensive income in two different formats (performance reporting and reporting in a statement of equity). They found that a clear display of comprehensive income and its components in a separate statement of performance (performance reporting) made earnings management more transparent and resulted in statistically equal stock price judgments for the earnings management and non-earnings management firms. Thus, buy-side analysts could detect earnings management easier when comprehensive reporting was reported in a performance reporting format, which lead to better stock price judgments and an efficient market. An experiment by Maines and McDaniel (2000) reached to similar results for non-experienced investors (students). This also provides support for the decision of the FASB and IASB to mandate performance reporting and delete the option of

reporting in an equity statement.

The location/reporting way of comprehensive income does not only affect the perception of users, but as well, the behavior of managers/firms. Hunton et al. (2006) showed that greater transparency in comprehensive income reporting also reduces the likelihood that managers will engage in earnings management.

Other important research about the reporting way of comprehensive income focused on the value relevance of comprehensive income and/or its components. Goncharov and Hodgson (2011) found that net income is more value relevant than comprehensive income for European companies. Cheng et al. (1993) and Dhaliwal et al. (1999) also reached to the same conclusion. Cahan et al. (2000) found that disclosure of other comprehensive income in the statement of equity is less value relevant than comprehensive income.

Chambers et al (2007) detected contradictory evidence and showed that investors, on average, price OCI, when it is reported, in the most predominant location: the statement of changes in shareholders' equity. Other contradictory evidence comes from Kanagaretnam et al. (2009), who found that comprehensive income is more value relevant compared to net income.

2.4 Positive Accounting Theory

Positive Accounting Theory (PAT) is a theory that tries to predict real-world events. It is concerned with predicting such actions as the choices of accounting policies by firm managers and how managers will respond to proposed accounting standards (Scott, 2007, p. 284). It argues that a set of accounting policies (in the context the disclosure option of comprehensive income) opens up the possibility of opportunistic behavior ex post. PAT assumes that managers are rational and will choose accounting policies in their own best interest if they are able to do so. Managers put their own interest over the interest of the firm and will try to maximize their own expected utility instead of maximizing firm profits (Scott, 2007, p. 285). While normative theories, such as decision theory, concentrate on what managers *should* do, positive theories such as PAT try to predict what managers *will* do.

Watts and Zimmerman (1986) have set up three hypotheses than can be used to predict managerial actions according to PAT:

1) The bonus plan hypothesis: This hypothesis suggests that other things being equal, managers of firms with bonus plans are more likely to choose accounting procedures that will lift up their remuneration, mainly by bringing future earnings to the current period. One of the other predictions of this hypothesis is that managers will choose accounting procedures that will lead to smooth earnings instead of volatile earnings (Scott, 2007, p. 287).

2) The debt covenant hypothesis: This hypothesis suggests that if a firm is closer to violating debt covenants, the manager is more likely to shift reported earnings from future periods to the current period, because this will decrease the chance of technical default and thus decrease the chance that the manager's actions will be constrained by covenant violations. Again, managers could also choose for accounting procedures that will lead to smooth earnings instead of volatile earnings (Scott, 2007, p. 288).

3) The political cost hypothesis: If a firm faces probable high political costs because of high profitability the managers could have a tendency to defer earnings from current periods to future periods. For example, very high reported earnings can lead to higher taxes, which will lead to higher income for governments, but higher taxes for firms.

3. Hypotheses Development

As mentioned before, this research aims to study whether the reporting way of comprehensive income is influenced by some factors according to the Positive Accounting Theory and whether investors do value their choice by looking at stock returns (measured in different ways).

Firstly, the relationship between a certain disclosure format and a higher volatility will be examined. In general, comprehensive income items are regarded to be more volatile than net income. This is because the items in other comprehensive income are mainly based on developments in the market (for example, market interest fluctuations affect actuarial gains/losses and gains/losses from available-for-sale securities), while the net income of a firm does not fluctuate very much in general, especially, compared to comprehensive income. Bamber et al. (2010) confirmed that other comprehensive income is more volatile because unrealized gains and losses, part of other comprehensive income, come from uncontrollable and volatile market forces and are, therefore, not persistent.

Henry (2011, p. 88) has examined the volatility of comprehensive income relative to the volatility of net income

by looking at the standard deviations of the two numbers for the S&P 500 companies from fiscal year 2005 until 2010 (n=2538). The results show that for the half of the companies the standard deviation of comprehensive income is 13 percent higher than the standard deviation of net income. At the maximum, the standard deviation of comprehensive income is 11 times higher than the standard deviation of net income (Henry, 2011, p. 88).

For the sample of our study (S&P Europe 350 companies, n=246; see section 4.2) we found a median of 1.54, which means that for the half of the companies the standard deviation of comprehensive income is 54 percent higher than the standard deviation of net income. At the maximum, the standard deviation of comprehensive income is 9.54 times higher than the standard deviation of net income.

The next step is to compare the single-statement reporting method with the separate statements reporting method. Since items of other comprehensive income would be overemphasized and net income would be de-emphasized in a single statement and other comprehensive items are more volatile in general, we would expect that the total performance of the firm reporting in a single statement would be regarded as more volatile.

Secondly, the relationship between a higher volatility and a negative investor price reaction will be investigated. Farrely et al. (1985) and Koonce et al. (1998) showed, with laboratory experiments, that both professional and non-professional investors associate variability in earnings with higher firm risk. According to Koonce et al. (1998) financial statement users also perceive uncontrollable items as increasing risk, so it could be expected that the uncontrollable nature of other comprehensive income items should lead to higher perceived risk in the eyes of investors. Finally, Graham et al. (2005, p. 49) showed in their research, based on interviews with CFOs, that CFOs believe that the stock market does value earnings predictability. CFOs believe that their P/E ratio would drop if their earnings path becomes more volatile, even if cash volatility stays the same. They, also, argued that investors demand a lower risk premium if the earnings path is steady. They thought this is because the market becomes more skeptical about underlying cash flows when earnings are more volatile and it regards firms with more volatile earnings (ceteris paribus) as more risky, which is reflected in a lower stock price. This is consistent with behavioral research which supports that managers are concerned that a more salient performance reporting could hurt the firm's stock price (Hunton et al., 2006; Maines and McDaniel, 2000.

Therefore, we hypothesize that firms with a higher volatility would choose to report their comprehensive income in separate statements and avoid using a single statement format.

H1a: Firms that have a higher volatility of other comprehensive income avoid reporting their comprehensive income in a more salient single statement format.

Managers should avoid reporting in a single statement format, because it leads to higher perceived volatility, higher risk and a lower stock price.

It is expected that managers could face greater risk of losing their jobs when they receive unfavorable performance evaluations, which could include poor stock price performance. These managers have a lower job security and have therefore more to lose from a more volatile performance leading to a lower stock price.

Consistent with Bamber et al. (2010), we hypothesize that managers with lower job security would choose to report their comprehensive income in separate statements and avoid using a single statement format.

H1b: Firms in which the CEO has lower job security would avoid reporting their comprehensive income in a more salient single statement format.

It is expected that managers with more powerful equity-based incentives have more to lose from lower stock prices and would prefer reporting methods that lower perceived volatility of form performance (Goel and Thakor, 2003). Maines and McDaniel (2000) also found that investors who evaluate manager's performance penalize managers for volatility in comprehensive income, only when comprehensive income appears in a salient statement. Consistent with Bamber et al. (2010), we hypothesize that firms in which the CEO has more equity-based incentives would choose to report their comprehensive income in separate statements and avoid using a single statement format.

H1c: Firms in which the CEO has higher equity-based incentives avoid reporting their comprehensive income in a more salient single statement format.

According to Graham et al. (2005), managers of more levered firms are more concerned with smoothing earnings to minimize perceived risk of the firm. Therefore, managers of companies with a relative high leverage would be more likely to avoid reporting in the more salient single statement format to reduce the perceived volatility and risk (Bamber et al., 2010, p. 112). Therefore, we hypothesize that firms with a higher leverage would choose to report their comprehensive income in separate statements and avoid using a single statement

format.

H1d: Firms with a higher leverage would avoid reporting their comprehensive income in a more salient single statement format.

It has been argued that comprehensive income shown in a single statement of comprehensive income will lead to earnings looking more volatile to investors. Graham et al. (2005, p. 49) showed in their research, based on interviews with CFOs, that CFOs believe that the stock market does value earnings predictability. CFOs believe that their P/E multiple would drop if their earnings path becomes more volatile, even if cash volatility stays the same. Moreover, investors demand a lower risk premium if the earnings path is steady. This is because the market becomes more skeptical about underlying cash flows when earnings are more volatile and regard firms with more volatile earnings (ceteris paribus) as more risky, which is reflected in a lower stock price. Therefore, we hypothesize that firms that report in a single statement format will face a negative investor reaction due to higher perceived volatility/risk and have a lower stock price.

H2: Firms that report their comprehensive income in a more salient single statement format have a lower stock price.

4. Methodology and Data Collection

4.1 Methodology

Two regression models are used to answer to research hypotheses. In the first regression model, which deals with the first four hypotheses, the dependent variable will be the reporting choice and the independent variables will be the key variables and control variables. The definitions of all the variables included in both models employed in our research are shown in Table 1. The first regression model is similar to the model of Bamber et al. (2010, p. 111). The only difference with their model lies in the control variables. Because the items of other comprehensive income under US GAAP and IFRS differ, the definition of the control variables has been changed and some control variables have been added. PENSION is now the actuarial gains and losses on defined benefit pension plans instead of the unrealized gains and losses resulting from changes in the minimum pension obligation. Moreover, the variables REV (changes in revaluation surplus) and CASHFL (value of the effective portion of gains and losses on hedging instruments in a cash flow hedge) have been added, because these items exists under IFRS, but did not exist under US GAAP.

Other comprehensive income items are added because: a) Comment letters to FAS 130 show that investors have concerns about the volatility of comprehensive income and b) Chambers et al. (2007) and Lee et al. (2006) found that other comprehensive income items are value relevant. Lee et al. (2006) also concluded that size and auditor choice are value relevant and therefore these are also included as control variables.

Thus, the first regression model is:

$$CHOICE=\beta_0+\beta_1 EQUITYCOMP +\beta_2 JSECURITY + \beta_3 VOLATILITY + \beta_4 LEVERAGE + \beta_5 AFSSEC + \beta_6$$
$$PENSION + \beta_7 FORCUR + \beta_8 REV +\beta_9 CASHFL + \beta_{10} DISCQUAL +\beta_{11} LOGSIZE + \beta_{12} AUD+ \varepsilon \quad (1)$$

Job security (JSECURITY) is measured in the same way as Bamber et al. (2010). Several studies showed that CEO-chair duality (Desai et al., 2004; Goyal and Park, 2002; Lucier et al., 2004) has an influence on CEO turnover and CEOs that chair the board enjoy lower turnover. Weisback (1988) and Huson et al. (2001) show that boards dominated by insiders/outsiders are associated with lower/higher CEO turnover. Therefore, consistent with Bamber et al. (2010), the variable JSECURITY is based on these two factors and is defined as follows:

JSECURITY= CHAIRMAN+DIRECTORS

Where:

CHAIRMAN= 1 if the CEO also chairs the board of directors and 0 otherwise and

DIRECTORS= 1 if the percentage of outside directors on the firm's board is smaller than the sample median and 0 otherwise.

Disclosure quality (DISCQUAL) is a common factor derived from analyst following (ANFOR), bid-ask spreads (BIDASK) and closely held shares (CLSHR). This variable is used as a control variable because Lee et al. (2006) mentioned that firms with a higher disclosure quality are more likely to use a more salient reporting method. Finally, the auditor choice (AUD) is used, because Lee et al. (2006) noted that there is a link between disclosure quality and the auditor of the company.

Table 1. Explanation of variables

Variable	Explanation
AFSSEC	1 if the gains or losses from available-for-sales securities scaled by total assets in the comprehensive income year (2010) exceeds the sample median and 0 otherwise, manually collected from financial statements
ANFOR	The number of forecasts made by analysts for the Earnings Per Share of the company for the year 2010 in the I/B/E/S database
AUD	Auditor of the financial statements of the companies, with a 1 if the auditor is KPMG of PWC and 0 otherwise, manually collected from financial statements
BIDASK	Bid-ask spread calculated by the difference in the bid price (PB) and ask price (PA) of the company's share divided by the corresponding daily closing price (P), averaged over the month December 2010, collected from Datastream
CASHFL	1 if the gains or losses from cash flow hedges scaled by total assets in the comprehensive income year (2010) exceeds the median sample and 0 otherwise, manually collected from financial statements
CHOICE	Way of reporting comprehensive income, with a 1 for firms that report in separate statements and 0 for firms that report in a single statement, manually collected from financial statements
CI	Total comprehensive income for the comprehensive income year (2010) scaled by total assets, manually collected.
CLSHR	Closely held shares scaled by total outstanding shares (WC08021) in the comprehensive income year (2010), collected from Datastream
DISCQUAL	Disclosure quality factor extracted by closely held shares, bid-ask spreads and analysts following
EQUITYCOMP	Equity based part of the CEO compensation/total compensation of the CEO excluding pension costs, manually collected from financial statements
FORCUR	1 if the foreign currency translation scaled by total assets in the comprehensive income year (2010) exceeds the sample median and 0 otherwise, manually collected from financial statements
JSECURITY	Job security of the CEO (see explanation), manually collected from financial statements
LEVERAGE	Total non-current liabilities divided by total assets, manually collected from financial statements
LOGSIZE	Log of the common shares (WC08001) of the company, collected from Datastream
NI	Net income scaled by the total assets of the company for the comprehensive income year (2010), manually collected.
OCI	Other comprehensive income scaled by total assets, calculated as the difference between net income scaled by total assets and comprehensive income scaled by total assets.
PBOOK	Price-to-book value ratio (P/WC05476) of the company for the comprehensive income year (2010), collected from Datastream
PEARN	Price-to-earnings ratio (P/EPS) of the company for the comprehensive income year (2010), collected from Datastream
PENSION	1 if the actuarial gains or losses scaled by total assets in the comprehensive income year (2010) exceeds the sample median and 0 otherwise, manually collected from financial statements
PSALES	Price-to-sales ratio (P/WC01001) of the company for the comprehensive income year (2010), collected from Datastream
RETURN	Stock return of the company for the comprehensive income year (2010), collected from Datastream
REV	1 if the revaluation surplus scaled by total assets in the comprehensive income year (2010) exceeds the sample median and 0 otherwise, manually collected from financial statements
TOTALCOMP	Total compensation of the CEO excluding pension benefits, scaled by total assets, manually collected from financial statements
VOLATILITY	Volatility of other comprehensive income, calculated by dividing the standard deviation of comprehensive income scaled by total assets with the standard deviation of net income scaled by total assets, measured over the comprehensive income year (2010) and the two prior years, manually collected from financial statements

PWC and KMPG are used as specialist auditor, because they audit 62 percent of the sample of 246 firms (see bellow section 4.2, Sample of the study).

In the second regression, employed for the second hypothesis, stock returns are the dependent variable and the reporting choice serves with other key/control variables as the independent variables.

$$RET=\beta_0+\beta_1 CHOICE+\beta_2 CI+\beta_3 NI+\beta_4 OCI+\beta_5 VOLATILITY+\beta_6 LEVERAGE+\beta_7 AFSSEC+\beta_8 PENSION+\beta_9 FORCUR+\beta_{10} REV+\beta_{11} CASHFL+\beta_{12} DISCQUAL+\beta_{13}\ LOGSIZE+\beta_{14} AUD+\varepsilon \quad (2)$$

The dependent variable is measured by using several proxies to increase the reliability. First of all, by using the traditional way as used in finance and also as used by Dechow (1994), namely the difference between the stock price relative to last year plus the dividend payout divided by last year's stock price. And secondly, by using different ratio's, namely the price-to-book value, the price-to-earnings ratio the price-to-sales ratio. By using several ratios different effects on stock prices such as higher earnings and higher sales are filtered out and controlled against, this increases the reliability of our results.

Moreover, three extra control variables are added. Other comprehensive income scaled by total assets (OCI) is added, because Chambers et al. (2007) and Lee et al. (2006) found evidence that other comprehensive income items are value relevant for investors. Net income scaled by total assets (NI) is added, because Goncharov and Hodgson (2011) found evidence that net income is more value relevant than comprehensive income for investors. Finally, total comprehensive income scaled by total assets (CI) is added, because Kanagaretnam, Mathieu and Shehata (2009) noticed that contradictory evidence and showed that comprehensive income is more value relevant compared to net income.

The variables EQUITYCOMP, VOLATILITY, LEVERAGE and DISCQUAL have been winsorized at 5% and 95% for the first regression. For the second regression, the variables VOLATILITY, LEVERAGE, DISCQUAL, RETURN, PBOOK, PSALES, PEARN, CI, NI and OCI have been winsorized at 5% and 95%.

The results of the factor analysis to create DISCQUAL are shown in Table 2. All firms that are included in the initial sample (see section 4.2) have been used. After filtering the companies with incomplete data 329 firms/observations are left. The factor analysis has been conducted over these firms. Panel A shows descriptive statistics for the three variables. Panel B shows the results of a Spearman correlation for the three variables. The only significant relation is between analyst forecasts and bid-ask spreads; there is a negative correlation between these two variables. Panel C shows the results and the factor loadings of the conducted factor analysis. BIDASK has the greatest coefficient of all the variables and is positively related with the DISCQUAL factor. CLSHR is also positively related with the DISCQUAL factor, while ANFOR is negatively related. The DISCQUAL factor explains 39.79% of the total variance.

Table 2. Results of factor analysis to create DISCQUAL (n=329)

Panel A: Descriptive statistics of disclosure quality proxies				
Variable	Minimum	Maximum	Mean	Standard Deviation
BIDASK	0.0002	0.0063	0.0014	0.0012
CLSHR	0.0100	86.9000	22.0320	21.2748
ANFOR	0	609	133.7660	71.3490
Panel B: Spearman correlation of disclosure quality proxies				
Variable	BIDASK	CLSHR	ANFOR	
BIDASK	1			
CLSHR	0.0642	1		
p-value	0.24552			
ANFOR	-0.3143*	0.0397	1	
p-value	<0.0001	0.4729		
Panel C: Factor loadings				
Variable	DISCQUAL			
BIDASK	0.7179			
CLSHR	0.2567			
ANFOR	-0.6470			
Variance explained	39.79%			

Notes: *=significant at 1 percent level; **=significant at 5 percent level; ***=significant at 10 percent level.

A robustness test has been performed, because for a big part of the sample (58 companies) there was no information disclosed in the financial statements about the equity-based part of the CEO compensation. Therefore, instead of using the equity-based part of the CEO compensation, the total compensation of the CEO (excluding pension benefits) scaled by total assets is used as a proxy. This gives a sample of 165 firms, instead of the 107 firms that is used in the first regression. The same model as in the first regression is used, since only

EQUITYCOMP is replaced by TOTALCOMP. The variables TOTALCOMP, VOLATILITY, LEVERAGE and DISCQUAL have been winsorized at 5% and 95%. The model is as follows:

$$CHOICE=\beta_0+\beta_1 TOTALCOMP +\beta_2 JSECURITY + \beta_3 VOLATILITY + \beta_4 LEVERAGE + \beta_5 AFSSEC + \beta_6 PENSION + \beta_7 FORCUR + \beta_8 REV +\beta_9 CASHFL + \beta_{10} DISCQUAL +\beta_{11} LOGSIZE + \beta_{12} AUD+ \varepsilon \quad (3)$$

4.2 Sample of the Study

The sample of the study consists of the firms from the S&P 350 Europe Index (Datastream code: SPEU350). S&P 350 Europe Index is an equity index drawn from 17 major European markets, covering approximately 70% of the region's market capitalization (S&P, 2012). This provides a representative sample for European companies, as it represents a big part of the market capitalization of European companies. The data used are from fiscal year 2010. There are three reasons for this: First of all, the revised IAS 1 ruling is implemented after 1 January 2009, so this research could only focus on a later date. Secondly, fiscal year 2010 has been chosen instead of fiscal year 2009 to overcome problems with fiscal years not corresponding with calendar years. Thirdly, firms would have a one-year experience year and more know-how in fiscal year 2010, so fiscal year 2010 would be a better choice than the initial fiscal year 2009.

The sample composition is shown in Table 3. First of all, (the same) companies with more than one type of share or are dropped, because only consolidated reporting information is used. Secondly, companies in the financial sector are dropped, because the financial sector has its own rulings and incentives. Thirdly, since this research concentrates on the revised IAS 1 ruling, companies that do not use IFRS as reporting standards are dropped. Moreover, companies with missing data on disclosure quality, size or returns are dropped. Lastly, for the first regression, firms with missing data on (equity-based) CEO compensation and firms with a one-tier board system are dropped. Firms with a one-tier board system are dropped, because it does not correspond with the proxy used to measure the job security of the manager.

Table 3. Sample selection

All shares listed on the S&P Europe 350	365
- companies with more than 1 type of share	-26
- companies in the financial sector	-69
- companies that do not use IFRS	-6
- companies with no information on disclosure quality	-9
- companies with no information on size	-4
- companies with no information on returns	-3
Sample size for regression 2	246
- companies that do not have a one-tier board system	-47
- companies with no information on total CEO compensation	-34
- companies with no information on equity based compensation of CEO	-58
Sample size for regression 1	107

Our final sample for the second regression consists of 246 firms. When the missing data on (equity-based) CEO compensation and companies with a one-tier board system are dropped, a final sample of 107 firms for the first regression is left.

5. Research Results

5.1 First Regression

5.1.1 Descriptive Statistics

Table 4 shows the descriptive statistics for the first regression, used for hypothesis 1a-1d. Panel A shows the composition of the reporting choice in the sample. From the 107 companies, 96 (89.72%) report their comprehensive income in two separate statements. Only 11 companies (10.28%) report comprehensive income in a single statement format. The results are in line with Bamber et al. (2010), who found that 19 percent reported in a more salient performance statement, while 81 percent reported in a statement of equity. The mean of EQUITYCOMP is 0.2630, which means that on average, 26.30% of the compensation of the CEO's consist of equity-based incentives. The mean of VOLATILITY is 3.0855, which means that the volatility of comprehensive income is on average 3 times higher than the volatility of net income.

Table 4. Descriptive statistics for regression 1 (n=107)

Panel A: Sample composition					
Method		Number of observations		Percentage	
Single statement reporting		11		10.28%	
Separate statements reporting		96		89.72%	
Panel B: Summary statistics					
Variable	1st Quartile	Median	3rd Quartile	Mean	Standard Deviation
CHOICE	1	1	1	0.8972	0.3051
EQUITYCOMP	0.0645	0.2748	0.3881	0.2630	0.2015
JSECURITY	0	1	1	0.6729	0.6555
VOLATILITY	1.0466	1.7673	3.2286	3.0855	3.2353
LEVERAGE	0.1668	0.2814	0.3521	0.2755	0.1301
AFSSEC	0	0	1	0.3832	0.4884
PENSION	0	0	0	0.3990	0.1592
FORCUR	0	0	1	0.4953	0.2523
REV	0	0	0	0.0374	0.1906
CASHFL	0	0	1	0.3738	0.4861
DISCQUAL	-0.6982	-0.2359	0.1888	-0.2954	0.7287
LOGSIZE	6.7493	7.1051	7.6433	7.1993	0.6022
AUD	0	1	1	0.6449	0.4808

Table 5 presents the results of a Spearman correlation test between the variables in the first regression and the corresponding p-values. First of all, there is a significant correlation between AFSSEC and CHOICE. The positive correlation shows that firms with higher gains/losses from available-for-sale securities tend to report in the less salient separate statements method. This is in line with the results of Lee et al. (2006), who concluded that cherry-picking firms (managing earnings through realized gains and losses on securities) have a tendency to report in the less salient statement of equity instead of the more salient performance statement. There is also a positive relationship between AFSSEC and VOLATILITY, which means that firms with a relative more volatile comprehensive income have higher gains/losses from available-for-sale securities. This could be expected, because other comprehensive items are in general more volatile, as was explained before. Another remarkable significant correlation is between DISCQUAL and JSECURITY. It shows that firms with a higher disclosure quality, they also provide a higher job security. This could be the case, because firms that are doing well and where the CEO has a high job security could have fewer incentives to report less or report in a lower quality. Therefore, they could report in a higher quality and therefore could have more analysts following, for example. The correlation between LOGSIZE and AFSSEC is also significant and positive. This could be, because bigger firms should have more resources to invest in available-for-sale securities and could also have a higher expertise to make gains on these securities.

Table 5. Correlation of variables in regression 1****

Variable	CHOICE	EQUITYCOMP	JSECURITY	VOLATILITY	LEVERAGE	AFSSEC	PENSION	FORCUR	REV	CASHFL	DISCQUAL	LOGSIZE	AUD
CHOICE	1	0.0316	-0.0871	-0.0144	0.0842	0.2035**	0.0123	0.1507	0.0667	-0.1837***	-0.0259	0.0309	-0.1226
p-value	0	0.74648	0.37204	0.88241	0.38791	0.03568	0.89968	0.12115	0.49418	0.05835	0.79078	0.75175	0.20805
EQUITYCOMP	0.0316	1	-0.0744	-0.1063	-0.1867***	0.1681***	0.0226	0.0499	0.0481	-0.0830	-0.1094	-0.0456	0.2537*
p-value	0.746475	0	0.44571	0.27548	0.05429	0.08355	0.81693	0.60911	0.62197	0.39461	0.26155	0.64070	0.00851
JSECURITY	-0.0871	-0.0744	1	0.1648***	-0.0450	-0.0709	0.0741	0.1094	0.0926	0.1913	0.1999	-0.0366	0.0538
p-value	0.37204	0.445711	0	0.08977	0.64495	0.46742	0.44720	0.26135	0.34213	0.04858	0.03909	0.70757	0.58115
VOLATILITY	-0.0144	-0.1063	0.1648	1	0.2084	0.2337**	0.0842	0.0124	-0.1532	-0.0497	-0.0190	0.0915	-0.0098
p-value	0.88241	0.27548	0.08977	0	0.03144	0.01556	0.38794	0.89889	0.11519	0.61046	0.84540	0.34809	0.92009
LEVERAGE	0.0842	-0.1867***	-0.0450	0.2084**	1	0.1637***	-0.1497	-0.0490	0.0327	0.0788	0.0385	0.1248	-0.2476**
p-value	0.38791	0.05429	0.64495	0.03144	0	0.09197	0.12362	0.61550	0.73765	0.41908	0.69349	0.19999	0.01030
AFSSEC	0.2035**	0.1681***	-0.0709	0.2337**	0.1637***	1	-0.0991	0.1035	0.0474	-0.1719***	-0.1734***	0.2197**	0.1430
p-value	0.03568	0.08355	0.46742	0.01556	0.09197	0	0.30949	0.28828	0.62759	0.07664	0.07418	0.02316	0.14145
PENSION	0.0123	0.0226	0.0741	0.0842	-0.1497	-0.0991	1	0.0752	0.0267	0.0073	0.0899	0.0343	-0.0267
p-value	0.89968	0.81693	0.44720	0.38794	0.12362	0.30949	0	0.44069	0.78479	0.94063	0.35646	0.72548	0.78491
FORCUR	0.1507	0.0499	0.1094	0.0124	-0.0490	0.1035	0.0752	1	-0.0967	-0.1087	-0.0941	-0.0890	-0.0460
p-value	0.12115	0.60911	0.26135	0.89889	0.61550	0.28828	0.44069	0	0.32125	0.26469	0.33434	0.36161	0.63754
REV	0.0667	0.0481	0.0926	-0.1532	0.0327	0.0474	0.0267	-0.0967	1	0.0514	0.0487	0.0941	-0.1626
p-value	0.49418	0.62197	0.34213	0.11519	0.73765	0.62759	0.78479	0.32125	0	0.59854	0.61814	0.33439	0.09424

Variable	CHOICE	EQUITYCOMP	JSECURITY	VOLATILITY	LEVERAGE	AFSSEC	PENSION	FORCUR	REV	CASHFL	DISCQUAL	LOGSIZE	AUD
CASHFL	-0.1837***	-0.0830	0.1913**	-0.0497	0.0788	-0.1719	0.0073	-0.1087	0.0514	1	0.1079	-0.1126	-0.0724
p-value	0.05835	0.39461	0.048578	0.61046	0.41908	0.07664	0.94063	0.26469	0.59854	0	0.26814	0.24789	0.45786
DISCQUAL	-0.0259	-0.1094	0.1999**	-0.0190	0.0385	-0.1734***	0.0899	-0.0941	0.0487	0.1079	1	-0.5523*	0.0370
p-value	0.79078	0.26155	0.03909	0.84540	0.69349	0.07418	0.35646	0.33434	0.61814	0.26814	0	< 0.0001	0.70474
LOGSIZE	0.0309	-0.0456	-0.0366	0.0915	0.1248	0.2197**	0.0343	-0.0890	0.0941	-0.1126	-0.5523*	1	0.1005
p-value	0.75175	0.64070	0.70757	0.34809	0.19999	0.02316	0.72548	0.36161	0.33439	0.24789	< 0.0001	0	0.30233
AUD	-0.1226	0.2537	0.0538	-0.0098	-0.2476	0.1430	-0.0267	-0.0460	-0.1626***	-0.0724	0.0370	0.1005	1
p-value	0.20805	0.00851*	0.58115	0.92009	0.01030**	0.14145	0.78491	0.63754	0.09424	0.45786	0.70474	0.30233	0

Notes: * significant at 1 percent level; ** significant at 5 percent level; *** significant at 10 percent level; **** Spearman correlation.

5.1.2 Regression Results

The results of the regression are shown in Table 6. Panel A presents the mean and standard deviation separately for both reporting methods. The last column reports on the results of a two-tailed t-test between the two samples. The results are not significant and lead to a rejection of the first four hypotheses. The p-values for VOLATILITY, JSECURITY, EQUITYCOMP and LEVERAGE are, all four, not significant, thus hypotheses 1a, 1b, 1c and 1d are rejected, respectively. However, there is a significant correlation between AFSSEC and CHOICE and CASHFL and CHOICE. As explained before, this is probably because cherry-picking firms (managing earnings through realized gains and losses on securities) have a tendency to report in the less separate statement method. The relationship between gains/losses from cash flow hedges (CASHFL) and the reporting choice (CHOICE) is negative, which means that firms with lower gains/losses from cash flow hedges tend to report in separate statements, although this relationship is significant at 10 percent. Panel B shows the coefficients and the p-values resulting from a probit regression for the first regression. In line with the two-tailed t-test, no significant relationship has been found between the key variables and reporting choice, thus hypotheses 1a, 1b, 1c and 1d are rejected. Again, there is a significant relationship between AFSSEC and CHOICE, although it is significant at a 10 percent level. In short, the regression results lead to a rejection of hypotheses 1a, 1b, 1c and 1d.

Table 6. Regression 1 results (n=107)

Panel A: T-test results					
	Single statement		Separate statements		Two-tailed t-test
Variable	Mean	St. Deviation	Mean	St. Deviation	P-value
EQUITYCOMP	0.2424	0.1979	0.2653	0.2028	0.72255
JSECURITY	0.8182	1.6030	0.6563	0.6622	0.44034
VOLATILITY	3.3305	3.5788	3.0574	3.2130	0.79235
LEVERAGE	0.2364	0.1080	0.2800	0.1321	0.29465
AFSSEC	0.0909	0.3015	0.4167	0.4956	0.00174*
PENSION	0.1818	0.4045	0.1979	0.4005	0.89985
FORCUR	0.2727	0.4671	0.5208	0.5022	0.12127
REV	0.0000	0.0000	0.0417	0.2009	NA****
CASHFL	0.6364	0.5045	0.3438	0.4775	0.05825***
DISCQUAL	-0.2435	0.7624	-0.3013	0.7286	0.80455
LOGSIZE	7.1789	0.7944	7.2016	7.5815	0.90646
AUD	0.8182	0.4045	0.6250	0.4867	0.20839
Panel B: Probit regression results					
Variable	Coefficient		St. Error		P-value
EQUITYCOMP	-0.0044		0.2355		0.85059
JSECURITY	-0.1645		0.2266		0.46769
VOLATILITY	-0.2644		0.2173		0.22373
LEVERAGE	0.1705		0.2397		0.47695
AFSSEC	0.6149		0.3311		0.06327***
PENSION	0.9024		0.2266		0.68349
FORCUR	0.3225		0.2278		0.15691
REV	1.5687		198.3744		0.99369
CASHFL	-0.3248		0.2082		0.11880
DISCQUAL	0.1991		0.3086		0.51871
LOGSIZE	0.0715		0.2564		0.78023
AUD	-0.3031		0.2735		0.26780

Notes: * significant at 1 percent level; ** significant at 5 percent level; *** significant at 10 percent level; ****=not available because single statement values were all constant (0).

5.2 Second Regression

5.2.1 Descriptive Statistics

Table 7 displays the descriptive statistics for the second regression. The mean of RETURN is 0.54, which indicates that the average return of the 246 firms is 54%. The average price-to-book ratio is 89, the average price-to-earnings ratio is 26 and the average price-to-sales ratio is 0.00005. The mean of total comprehensive income scaled by total assets is 0.070 and the mean of net income scaled by total assets is 0.068, which indicates that total comprehensive income was slightly higher than net income. The mean of VOLATILITY for this sample is 2.4863 and slightly lower than the volatility of the sample used in the first regression (3.0855).

Table 7. Descriptive statistics for regression 2 (n=246)

Panel A: Sample composition					
Method		Number of observations		Percentage	
Single statement reporting		12		4.88%	
Separate statements reporting		234		95.12%	
Panel B: Summary statistics					
Variable	1st Quartile	Median	3rd Quartile	Mean	Standard Deviation
RETURN	0.2612	0.4719	0.7137	0.5403	0.3435
PBOOK	1.5099	2.6271	141.1928	89.3507	154.7864
PEARN	11.3882	16.1699	25.9586	26.0761	31.9090
PSALES	0.000001303	0.0004361	0.000041927	0.000052905	0.000097591
CHOICE	1	1	1	0.9512	0.2158
CI	0.0343	0.0611	0.0947	0.0705	0.0500
NI	0.0346	0.0557	0.0850	0.0682	0.0510
OCI	-0.0067	0.0052	0.0190	0.0043	0.0204
VOLATILITY	0.9714	1.5406	2.5524	2.4863	2.4754
LEVERAGE	0.2166	0.3128	0.4149	0.3185	0.1516
AFSSEC	0	0	1	0.3780	0.4859
PENSION	0	0	0	0.1789	0.3840
FORCUR	0	0.5	1	0.5000	0.5010
REV	0	0	0	0.0285	0.1666
CASHFL	0	0	1	0.3902	0.4888
DISCQUAL	-0.6202	-0.0685	0.3712	-0.0581	0.9044
LOGSIZE	6.4073	7.0299	7.4813	7.1160	0.5528
AUD	0	1	1	0.6138	0.4879

Table 8 presents the results of a Spearman correlation for the second regression. First of all, there are significant positive correlations between the investor reaction measures (for example, PEARN and RETURN, PSALES and PBOOK), because a higher/lower stock price influences all measurements in the same directions, so a positive significant correlation can be expected. Secondly, between NI/OCI and the different investor reaction measures there are significant positive correlations. This could also be expected, because as Kanagaretnam et al. (2009) and Goncharov and Hodgson (2011) concluded, these numbers are value relevant for investors and this should be incorporated in the stock price/investor reaction. Also, LOGSIZE and DISCQUAL are significantly correlated with some of the investor reactions both positively and negatively. This is unexpected, because a positive correlation would seem more logical. DISCQUAL could be positively related with investor reactions, because a better disclosure quality should give a positive impulse to stock prices as investors would prefer a higher disclosure quality. Moreover, a positive correlation between LOGSIZE and investor reaction measures could be expected as bigger companies have higher returns in general.

Table 8. Correlation of variables in regression 2****

Variable	RETURN	PBOOK	PEARN	PSALES	CHOICE	CI	NI	OCI
RETURN	1	-0.0557	0.2177*	0.0668	-0.0625	0.1150***	0.0974	0.0293
p-value	0	0.38409	0.00060	0.29680	0.32903	0.07187	0.12764	0.64743
PBOOK	-0.0557	1	0.1088***	0.7122*	-0.0757	0.2888*	0.4114*	-0.1300**
p-value	0.38409	0	0.08871	< 0.0001	0.23635	< 0.0001	< 0.0001	0.04162
PEARN	0.2177*	0.1088***	1	0.1110**	-0.0523	0.1654*	0.1208***	0.1066***
p-value	0.00060	0.08871	0	0.08228	0.41420	0.00944	0.05844	0.09517
PSALES	0.0668	0.7122*	0.1110***	1	-0.0181	0.2194*	0.3017*	-0.0255
p-value	0.29680	< 0.0001	0.08228	0	0.77776	0.00054	< 0.0001	0.69062
CHOICE	-0.0625	-0.0757	-0.0523	-0.0181	1	-0.0074	-0.0869	0.0635
p-value	0.32903	0.23635	0.41420	0.77776	0	0.90749	0.17410	0.32085
CI	0.1150***	0.2888*	0.1654*	0.2194*	-0.0074	1	0.8329*	0.3903*
p-value	0.07187	< 0.0001	0.00944	0.00054	0.90749	0	< 0.0001	< 0.0001
NI	0.0974	0.4114*	0.1208***	0.3017*	-0.0869	0.8329*	1	-0.0697
p-value	0.12764	< 0.0001	0.05844	< 0.0001	0.17410	< 0.0001	0	0.27624
OCI	0.0293	-0.1300**	0.1066***	-0.0255	0.0635	0.3903*	-0.0697	1
p-value	0.64743	0.04162	0.09517	0.69062	0.32085	< 0.0001	0.27624	0
VOLATILITY	-0.0384	0.0350	0.0838	0.0726	-0.0159	0.0715	0.0452	0.1353*
p-value	0.54844	0.58430	0.19007	0.25669	0.80334	0.26363	0.47990	0.03398
LEVERAGE	-0.1746*	-0.0147	-0.2284*	-0.0267	0.1196***	-0.1624	-0.1307**	-0.0268
p-value	0.00610	0.81882	0.00031	0.67672	0.06110	0.01080	0.04064	0.67597
AFSSEC	0.1101***	-0.1348**	0.0214	-0.0953	0.0987	-0.0434	-0.0705	0.0329
p-value	0.08484	0.03469	0.73770	0.13585	0.12248	0.49789	0.27016	0.60754
PENSION	0.0125	0.1751*	0.0510	0.2003*	0.0072	0.1295**	0.0871	0.1274**
p-value	0.84464	0.00595	0.42578	0.00162	0.91040	0.04245	0.17319	0.04592
FORCUR	0.1095***	-0.1900*	0.1225***	-0.0644	0.1132***	0.1989*	-0.0588	0.5904*
p-value	0.08649	0.00281	0.05508	0.31413	0.07631	0.00174	0.35821	< 0.0001
REV	-0.0453	-0.0343	-0.0029	-0.0883	0.0388	-0.0188	0.0046	-0.0122
p-value	0.47935	0.59256	0.96353	0.16720	0.54493	0.76947	0.94213	0.84862
CASHFL	-0.0863	-0.1549	-0.0993	-0.1336*	-0.0896	-0.0474	-0.0472	0.0613
p-value	0.17734	0.01508	0.12029	0.03636	0.16094	0.45884	0.46107	0.33837
DISCQUAL	-0.0909	0.0179	-0.2027*	0.1461**	0.0433	-0.1573**	-0.1689*	0.0723
p-value	0.15498	0.77953	0.00142	0.02201	0.49856	0.01356	0.00799	0.25840
LOGSIZE	0.0079	-0.2332*	0.1901*	-0.4528*	-0.0234	0.1298**	0.1617**	-0.1210***
p-value	0.90187	0.00023*	0.00279	< 0.0001	0.71495	0.04199	0.01114	0.05806
AUD	-0.0272	0.0292	0.0293	0.0145	-0.0633	-0.0686	-0.0324	-0.1011
p-value	0.67072	0.64811	0.64723	0.82059	0.32224	0.28353	0.61286	0.11379

Notes: * significant at 1 percent level; ** significant at 5 percent level; *** significant at 10 percent level; **** Spearman correlation.

5.2.2 Regression Results

The results of the second regression are shown in Table 9. For all the investor reaction measures, both the results of the two-tailed t-test (Panel A) and results of the linear regressions (consecutive panels) are reported on Table 9. The results of the two-tailed t-tests indicate that only stock returns (PEARN) are significantly different for the two reporting method samples. For the other three measures (PSALES, PBOOK, RETURN), the p-value of the two-tailed t-test is not significant. The results of the linear regression show that for two investor reaction measures the association with CHOICE is significant (RETURN with p-value 0.09333 and PEARN with p-value 0.01513). However, the coefficient that reports on the relationship between investor reaction and reporting choice is negative for both measures, which indicates that firms that report in a single statement have a higher stock return, while the hypothesis states that firms that report in a less salient separate statement should have higher stock returns. For the other two measures the results are not significant (PBOOK with p-value 0.66330 and PSALES with p-value 0.35742). In short, the results are mixed with a big part being not significant and the two significant results being the opposite direction of the hypothesis.

Table 9. Regression 2 results (n=246)

Panel A: T-test results					
	Single statement		Separate statement		Two-tailed t-test
Variable	Mean	St. Deviation	Mean	St. Deviation	P-value
RETURN	0.6700	0.4232	0.5337	0.3387	0.18060
PBOOK	87.6461	133.1172	89.4381	156.0642	0.96889
PEARN	47.1065	51.7941	24.9976	30.3320	0.01893**
PSALES	0.0001	0.0001	0.0001	0.0001	0.48893
CI	0.0732	0.0493	0.0704	0.0502	0.65165
NI	0.0805	0.0491	0.0675	0.0511	0.39101
OCI	-0.0003	0.0224	0.0045	0.0204	0.42524
VOLATILITY	2.8689	2.9209	2.4667	2.4561	0.58402
LEVERAG	0.2368	0.1015	0.3227	0.1527	0.05556***
AFSSEC	0.1667	0.3892	0.3889	0.4885	0.12253
PENSION	0.1667	0.3892	0.1795	0.3846	0.91047
FORCUR	0.2500	0.4523	0.5128	0.5009	0.07630***
REV	0.0000	0.0000	0.0299	0.1707	NA****
CASHFL	0.5833	0.5149	0.3803	0.4865	0.16104
DISCQUAL	-0.1695	0.9770	-0.0524	0.9024	0.66258
LOGSIZE	7.2253	0.7743	7.1104	0.5408	0.48358
AUD	0.7500	0.4523	0.6068	0.64895	0.32248
Panel B: Linear regression results (dependant variable=RETURN)					
Variable	Coefficient	St. Error	P-value		
CHOICE	-0.1083	0.0643	0.09333***		
CI	0.3217	0.2529	0.20461		
NI	-0.2535	0.2421	0.29596		
OCI	-0.1910	0.1344	0.15678		
VOLATILITY	-0.0790	0.0634	0.21373		
LEVERAGE	-0.1722	0.0645	0.00810*		
AFSSEC	0.1384	0.0660	0.03711**		
PENSION	0.0059	0.0640	0.92649		
FORCUR	0.1329	0.0764	0.08344***		
REV	-0.0531	0.0638	0.40653		
CASHFL	-0.0735	0.0649	0.25872		
DISCQUAL	0.0129	0.0730	0.86009		
LOGSIZE	-0.0627	0.0742	0.39871		
AUD	-0.0658	0.0645	0.30900		
Panel C: Linear regression results (dependant variable=PBOOK)					
Variable	Coefficient	St. Error	P-value		
CHOICE	-0.0255	0.0585	0.66330		
CI	0.2946	0.2301	0.20172		
NI	-0.0649	0.2202	0.76841		
OCI	-0.0733	0.1223	0.54956		
VOLATILITY	-0.0176	0.0577	0.76112		
LEVERAGE	0.1680	0.0586	0.00456*		
AFSSEC	-0.0003	0.0601	0.99640		
PENSION	0.1742	0.0582	0.00309*		
FORCUR	-0.1233	0.0659	0.07758***		
REV	0.0327	0.0581	0.57412		
CASHFL	-0.0977	0.0591	0.09953***		
DISCQUAL	-0.2071	0.0664	0.00206*		
LOGSIZE	-0.4314	0.0675	<0.0001*		
AUD	0.0049	0.0587	0.93373		
Panel D: Linear regression results (dependant variable=PEARN)					
Variable	Coefficient	St. Error	P-value		
CHOICE	-0.1565	0.0640	0.01513**		
CI	0.1598	0.2516	0.52589		
NI	-0.2202	0.2408	0.36155		
OCI	0.0823	0.1337	0.53902		
VOLATILITY	-0.0321	0.0631	0.61176		

LEVERAGE	-0.0840	0.0641	0.19141
AFSSEC	0.0714	0.0657	0.27792
PENSION	0.670	0.0637	0.29396
FORCUR	-0.766	0.0760	0.31479
REV	-0.0208	0.0635	0.74363
CASHFL	-0.0739	0.0646	0.25387
DISCQUAL	-0.1687	0.0726	0.02107
LOGSIZE	0.0526	0.0738	0..47715
AUD	-0.0655	0.0642	0.30835
Panel E: Linear regression results (dependant variable=PSALES)			
Variable	Coefficient	St. Error	P-value
CHOICE	-0.0540	0.0586	0.35742
CI	0.1052	0.2304	0.64847
NI	0.1214	0.2206	0.58249
OCI	-0.1041	0.1225	0.39611
VOLATILITY	0.0517	0.0578	0.37121
LEVERAGE	0.0394	0.0587	0.50328
AFSSEC	-0.0200	0.0602	0.73965
PENSION	0.1311	0.0583	0.02552**
FORCUR	-0.0280	0.0696	0.68838
REV	0.0416	0.0582	0.47499
CASHFL	-0.0359	0.0592	0.54424
DISCQUAL	-0.0911	0.0665	0.00446*
LOGSIZE	-0.4924	0.0676	<0.0001*
AUD	-0.0403	0.0588	0.49379

Notes: * significant at 1 percent level; ** significant at 5 percent level; *** significant at 10 percent level; **** not available because single statement values were all constant (0).

5.3 Robustness Test

5.3.1 Descriptive Statistics

Table 10 shows the descriptive statistics for the third regression. In Panel A, the composition of the sample is presented. There are 165 firms, of which 154 (93.33%) are using the separate statement method, only 11 firms (6.67%) report their comprehensive income in one single statement. In Panel B, the summary descriptive statistics are reported. The mean of TOTALCOMP is 0.0003, which indicates that on average the total compensation of the CEO scaled by total assets is 0.03%. The mean of JSECURITY is 0.6788, slightly higher than the JSECURITY in the first regression (0.6729). VOLATILITY equals 2.7837 and is lower than the volatility in the first regression (3.0855).

Table 10. Descriptive statistics for regression 3 (n=165)

Panel A: Sample composition					
Method		Number of observations		Percentage	
Single statement reporting		11		6.67%	
Separate statements reporting		154		93.33%	
Panel B: Summary statistics					
Variable	1st Quartile	Median	3rd Quartile	Mean	Standard Deviation
CHOICE	1	1	1	0.9333	0.2502
TOTALCOMP	0.000069	0.000185	0.000490	0.0003	0.0003
JSECURITY	0	1	1	0.6788	0.6438
VOLATILITY	0.9818	1.6317	2.9320	2.7837	2.9484
LEVERAGE	0.1894	0.2983	0.4151	0.3100	0.1511
AFSSEC	0	0	1	0.3758	0.4858
PENSION	0	0	0	0.2242	0.4184
FORCUR	0	0	1	0.4970	0.5015
REV	0	0	0	0.0303	0.1719
CASHFL	0	0	1	0.3758	0.4858
DISCQUAL	-0.5901	-0.0515	0.3217	-0.1336	0.7769
LOGSIZE	6.6221	7.0025	7.5252	7.0923	0.5957
AUD	0	1	1	0.6121	0.4888

Table 11 presents the results of a Spearman correlation test between the variables in the third regression and the corresponding p-values. The table shows the same characteristics as the results of the Spearman correlation in the first regression. There is again a positive relationship between AFSSEC and VOLATILITY, which means that firms with a relative more volatile comprehensive income have higher gains/losses from available-for-sale securities. Consistent with the results of the Spearman correlation in the first regression, the correlation between LOGSIZE and AFSSEC is also significant and positive. This could be, because bigger firms should have more resources to invest in available-for-sale securities and could also have a higher expertise to make gains on these securities.

Table 11. Correlation of variables in regression 3****

Variable	CHOICE	TOTALCOMP	JSECURITY	VOLATILITY	LEVERAGE	AFSSEC	PENSION	FORCUR	REV	CASHFL	DISCQUAL	LOGSIZE	AUD
CHOICE	1	-0.1128	-0.0657	-0.0403	0.1199	0.1572	0.0272	0.1199	0.0472	-0.1438***	0.0301	-0.0168	-0.1130
p-value	0	0.14920	0.40166	0.60690	0.12497	0.04385	0.72861	0.12506	0.54638	0.06540	0.70083	0.82991	0.14822
TOTALCOMP	-0.1128	1	-0.0548	-0.0369	-0.1589**	-0.1874**	0.1626**	-0.0176	-0.1262	-0.0200	0.2869*	-0.6253*	0.0880
p-value	0.14920	0	0.48381	0.63725	0.04163	0.01608	0.03698	0.82266	0.10620	0.79883	0.00020	< 0.0001	0.26064
JSECURITY	-0.0657	-0.0548	1	0.0529	-0.1475***	-0.0592	0.0349	0.0339	0.0873	0.0851	0.0867	0.0210	-0.0122
p-value	0.40166	0.48381	0	0.49961	0.05874	0.44977	0.65624	0.66532	0.26446	0.27662	0.26775	0.78917	0.87658
VOLATILITY	-0.0403	-0.0369	0.0529	1	0.1006	0.1845**	0.0580	0.1670**	-0.0676	0.0594	-0.0144	0.0757	-0.0212
p-value	0.60690	0.63725	0.49961	0	0.19814	0.01781	0.45911	0.03217	0.38820	0.44823	0.85419	0.33322	0.78717
LEVERAGE	0.1199	-0.1589**	-0.1475***	0.1006	1	0.1590**	-0.0500	-0.0664	0.0572	0.0389	0.1179	-0.0340	-0.1802**
p-value	0.12497	0.04163	0.05874	0.19814	0	0.04149	0.52290	0.39617	0.46541	0.61959	0.13149	0.66469	0.02066
AFSSEC	0.1572**	-0.1874**	-0.0592	0.1845**	0.1590**	1	-0.0871	0.0047	0.0818	-0.0852	-0.1591**	0.1986**	0.1297***
p-value	0.04385	0.01608	0.44977	0.01781	0.04149	0	0.26566	0.95215	0.29563	0.27633	0.04132	0.01065	0.09694
PENSION	0.0272	0.1626**	0.0349	0.0580	-0.0500	-0.0871	1	0.1050	-0.0103	0.0029	0.1205	-0.1611**	-0.0193
p-value	0.72861	0.03698	0.65624	0.45911	0.52290	0.26566	0	0.17944	0.89569	0.97038	0.12299	0.03884	0.80507
FORCUR	0.1199	-0.0176	0.0339	0.1670**	-0.0664	0.0047	0.1050	1	-0.0343	0.0047	0.0050	-0.0776	-0.0546
p-value	0.12506	0.82266	0.66532	0.03217	0.39617	0.95215	0.17944	0	0.66167	0.95215	0.94950	0.32136	0.48588
REV	0.0472	-0.1262	0.0873	-0.0676	0.0572	0.0818	-0.0103	-0.0343	1	0.0818	0.0234	0.1217	-0.0770
p-value	0.54638	0.10620	0.26446	0.38820	0.46541	0.29563	0.89569	0.66167	0	0.29563	0.76534	0.11925	0.32552
CASHFL	-0.1438**	-0.0200	0.0851	0.0594	0.0389	-0.0852	0.0029	0.0047	0.0818	1	0.1397**	-0.0602	-0.1015
p-value	0.06540	0.79883	0.27662	0.44823	0.61959	0.27633	0.97038	0.95215	0.29563	0	0.07362	0.44231	0.19443
DISCQUAL	0.0301	0.2869*	0.0867	-0.0144	0.1179	-0.1591**	0.1205	0.0050	0.0234	0.1397***	1	-0.5361*	-0.0069
p-value	0.70083	0.00020	0.26775	0.85419	0.13149	0.04132	0.12299	0.94950	0.76534	0.07362	0	< 0.0001	0.92963
LOGSIZE	-0.0168	-0.6253*	0.0210	0.0757	-0.0340	0.1986**	-0.1611**	-0.0776	0.1217	-0.0602	-0.5361*	1	0.0718
p-value	0.82991	< 0.0001	0.78917	0.33322	0.66469	0.01065	0.03884	0.32136	0.11925	0.44231	< 0.0001	0	0.35897
AUD	-0.1130	0.0880	-0.0122	-0.0212	-0.1802**	0.1297***	-0.0193	-0.0546	-0.0770	-0.1015	-0.0069	0.0718	1
p-value	0.14822	0.26064	0.87658	0.78717	0.02066	0.09694	0.80507	0.48588	0.32552	0.19443	0.92963	0.35897	0

Notes: * significant at 1 percent level; ** significant at 5 percent level; *** significant at 10 percent level; **** Spearman correlation.

5.3.2 Regression Results

The results of the third regression are shown in Table 12. Panel A presents the results of a two-tailed t-test. Contradictive to the results of the first regression, the variable TOTALCOMP is significantly different for the single statement and separate statement samples. The t-test has a p-value of 0.08719 and is significant at a 10 percent level. Besides TOTALCOMP, LEVERAGE (p-value 0.09703), AFSSEC (p-value 0.04377) and CASHFL (0.06535) are also significantly different for the two samples. Panel B shows the results of a linear regression of the model. TOTALCOMP is again significant at a 10 percent level with a p-value of 0.07691. However, as the hypothesis would predict a positive coefficient, the results show a negative coefficient, indicating CEOs of firms that have a higher total compensation choose to report the firm's comprehensive income in a single statement. Moreover, VOLATILITY is significantly associated with CHOICE with a p-value of 0.07192. Again, while a positive coefficient is expected, the results show a negative coefficient, indicating that firms that have a higher volatility of other comprehensive income report on a single statement of comprehensive income, while the opposite is expected. For the other two key variables (LEVERAGE and JSECURITY) no significant result has been found. In short, the results are mixed and do not support the hypothesis. TOTALCOMP (hypothesis 1c) and VOLATILITY (hypothesis 1a) show significant p-values, but in the opposite direction. The other two values are not significant, thus hypothesis 1b and 1d are rejected.

Table 12. Regression 3 results (n=165)

Panel A: T-test results					
	Single statement		Separate statement		Two-tailed t-test
Variable	Mean	St. Deviation	Mean	St. Deviation	P-value
TOTALCOMP	0.0005	0.0004	0.0003	0.0003	0.08719***
JSECURITY	0.8182	0.6030	0.6688	0.6473	0.45898
VOLATILITY	3.2393	3.3345	2.7511	2.9284	0.59730
LEVERAGE	0.2369	0.1072	0.3152	0.1527	0.09703***
AFSSEC	0.0909	0.3015	0.3961	0.4907	0.04377**
PENSION	0.1818	0.4045	0.2273	0.4204	0.72889
FORCUR	0.2727	0.4671	0.5130	0.5015	0.12515
REV	0.0000	0.0000	0.0325	0.1778	NA****
CASHFL	0.6364	0.5045	0.3571	0.4807	0.06535***
DISCQUAL	-0.1947	0.8215	-0.1292	0.7763	0.78810
LOGSIZE	7.1789	0.7944	7.0861	7.0861	0.61908
AUD	0.8182	0.4045	0.5974	0.5974	0.14835

Panel B: Probit regression results			
Variable	Coefficient	St. Error	P-value
TOTALCOMP	-0.3861	0.2182	0.07691***
JSECURITY	-0.2064	0.2291	0.36777
VOLATILITY	-0.3896	0.2165	0.07192***
LEVERAGE	0.2196	0.2452	0.37044
AFSSEC	0.6254	0.3442	0.06920***
PENSION	0.1583	0.2399	0.50943
FORCUR	0.4264	0.2360	0.07078***
REV	1.3648	176.1069	0.99382
CASHFL	-0.3574	0.2006	0.07473***
DISCQUAL	0.1950	0.3028	0.51950
LOGSIZE	-0.1328	0.2634	0.61398
AUD	-0.4022	0.2808	0.15205

Notes: * significant at 1 percent level; ** significant at 5 percent level; *** significant at 10 percent level; **** not available because single statement values were all constant (0).

6. Discussion and Conclusions

After 1 January 2009 firms implementing IFRS have the option to report their comprehensive income in two ways: in a single statement that consists of a statement of comprehensive income or in two separate statements split up in an income statement and a comprehensive income statement (IASB, 2007). This research has investigated whether the reporting way of comprehensive income is influenced by some factors and whether the investors do value the choice by looking at stock returns (measured in different ways).

It has been argued that other comprehensive income is more volatile than net income. As investors focus on bottom line numbers, income in single statement reports is regarded to be more volatile than separate statement reports, although only the location changes and not the actual numbers. Since investors regard more volatile firms as more risky, it is expected that firms reporting in a single statement would expect a negative investor reaction. Besides the investor reaction to comprehensive reporting, the motivations for choosing a certain reporting method have also been investigated. Because firms that have higher equity-based incentives or lower job security have more to lose from a negative investor reaction (lower stock price), it has been hypothesized that firms with CEOs that have higher equity-based incentives or lower job security would report their comprehensive income in separate statements instead of a single statement. Moreover, it is expected that firms with a higher leverage and more volatile comprehensive income relative to net income will report their comprehensive income in separate statements instead of a single statement.

The research sample consisted of firms on the S&P Europe 350 Index. The sample size for the first regression was 107 firms and for the second regression 246 firms. Two regression models have been used to test the hypotheses. In the first logit model, the reporting choice has been the dependant variable, while in the second linear model the investor reaction, measured in different ways was the dependant variable.

The results do not support our hypotheses. The first regression does not indicate a significant association between the reporting choice of firms and the volatility, job security, equity-based incentives and leverage of the firms. The results of the second regression provide some evidence that there is an association between the stock returns and the reporting choice. The price-earnings ratio and stock returns are associated with reporting choice, but in the opposite direction. Moreover, a robustness test has been conducted, which included the total

compensation of the CEO instead of the equity-based compensation. The results suggest that there is a significant association between the total compensation of the CEO and the volatility on one side and the reporting choice of firms on the other side. However, these results are not significant in the expected direction, but in the opposite direction.

Another important result is that, in both the first regression and the robustness test, it has been found that there is a significant association between the realized gains or losses on available-for-sale securities and reporting choice of firms. The positive correlation indicates that firms with higher gains/losses from available-for-sale securities tend to report in the less salient separate statements method and this is in line with the results of Lee et al. (2006), who concluded that cherry-picking firms (managing earnings through realized gains and losses on securities) have a tendency to report in the less salient statement of equity instead of the more salient performance statement.

The contribution made by this research is twofold. First of all, the empirical contribution made is that this research replicates the two hypotheses of Bamber et al. (2010) for European firms implementing IFRS instead of US firms implementing US GAAP. The context differs from previous papers, because a European setting is used instead of an US setting (Bamber et al., 2010; Lee et al., 2006) and archival quantitative data is used instead of experiments (Hirst and Hopkins, 1998; Hunton et al., 2006; Maines and McDaniel, 2000). Moreover, there is little empirical contribution made until now regarding the determinants of manager's comprehensive income reporting location choices. Moreover, the prior literature compares performance reporting (reporting in an income-statement format) with reporting in a statement of equity. This research is different, because it compares the two options in the income-statement approach (single statement reporting and separate statements reporting) for the first time and this difference in salience could be smaller than the difference in salience between performance reporting and reporting in an equity statement.

Secondly, there is a social contribution made, because these results could be of importance to the standard setters, since there is currently a project going on at the IASB, which will eliminate the separate statements choice and only leave the option for IFRS adopting firms to report comprehensive income in a single statement.

7. Study Limitations and Recommendations

There are several limitations in this study. First of all, the sample size is very small. The sample size for the first regression is 107 firms, for the second regression 246 firms. Secondly, a big part of the firms in the sample (89.73% in the first regression and 95.12% in the second regression) report their comprehensive income in separate statements, which makes it difficult to get statistical significant and reliable results. Thirdly, the equity-based incentives have been measured by looking at the reported numbers in the financial statements. Most of the firms do not report the equity-based incentives of the CEO separately and if they do, it is not always clear or comparable as corporate governance rules differ between countries.

Future research could be of qualitative kind, for example interviews with CEOs or investors about the reasons for choosing a specific reporting method or the preference and reaction of investors. Also, in future research the equity-based incentives of CEO's could be calculated separately for every firm in the same way to increase the reliability of the measure.

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The Probability Distribution of Bankruptcy upon New Debt Issuances

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Abstract

This study theoretically examines the probability distribution of corporate bankruptcy upon new debt issuances. We develop a relatively simple Markov model with three feasible corporate phases, derive the stochastic transition rates and the time-related probabilities to remain in each business cycle, and further simulate realistic corporate paths. We find that when both corporate debt and assets are stochastic, the probability to be in Chapter 11 is generally lower among borrowers that portray higher debt variability. Moreover, we detect that the most probable time to be in bankruptcy occurs within two or three years of a new debt issuance.

Keywords: debt issuance, bankruptcy, systematic risk, idiosyncratic risk,markov model, differential equations, simulations

1. Introduction

In this study we develop a rather simple theoretical model that explores the probability distribution of corporate bankruptcy upon new debt issuances. Nonetheless, our contribution does not reside within a new structural default risk model. Instead, we emphasize the universal credit consequences of corporate debt dynamics for both the borrowers and the lenders. In addition to customary derivations, we shed more light on the matter by deploying numerous computer simulations and robustness tests.

We assume this research-expedition to help corporate agents to better comprehend the potential influence of periodic changes in corporate debt on the overall likelihood to file for Chapter 11 bankruptcy protection. We associate regular oscillations in the debt level to different economic settings to direct managerial teams in their ultimate search for a higher corporate credit quality. Our notional findings further assist creditors in assessing the creditworthiness of the underlying borrowing firms. Apart from that, our theory also reveals the most likely period to be in Chapter 11 reorganization post debt issuance.

Our theory hereafter primarily predicts that whenever corporate debt is unconstrained, because of seasonal debt issuances or redemptions, and the underlying firm's assets are further stochastic, the probability to be in Chapter 11 bankruptcy protection is persistently lower among borrowers that display higher debt variability, and vice versa. Another important outcome of our model indicates that the most probable period of time to be in Chapter 11 reorganization occurs few years after a new corporate debt issuance. In most cases, the highest likelihood to be in bankruptcy protection is obtained within two or three years from debt initiation. We authenticate this notional finding for different types of debt ratios and across most practical economic circumstances. This particular observation conveys significant credit implications both for borrowers and for lenders.

This research proceeds as follows. We first propose the general theory. To gain further insight on the matter, we also deploy numerous computer simulations. Next, we conduct several robustness tests, and finally we conclude and discuss future lines of research.

2. The Theory

To formulate the conventional dynamics of corporate bankruptcy risk we define three distinct corporate phases with their respective probabilities per time unit to migrate from one phase to another, as follows. A firm can be either in (1) a "going concern" phase, which generally indicates normal operations, (2) a Chapter 11 reorganization phase, which designates a temporary period of bankruptcy protection yet without any liquidation at this stage, or (3) a Chapter 7 phase, which represents an absorbing state of default and a final liquidation of corporate assets. We denote the probability to file for bankruptcy protection as α, the probability to default

without any attempt to reorganize first as β, the probability to default while staying already in Chapter 11 as γ, and the probability to emerge from Chapter 11 back to the going concern phase as δ. Since our model aims to depict a stochastic conduct of a common firm, we further assign time-related probabilities to reside in each corporate phase. We therefore denote $\varepsilon(\tau)$ as the probability to be in the going concern phase at time τ, $\eta(\tau)$ as the probability to be in the Chapter 11 reorganization phase at time τ, and $\mu(\tau)$ as the probability to be in the Chapter 7 liquidation phase at time τ. For better clarity, we illustrate the feasible corporate cycles, the transition likelihoods, and the respective time-related probabilities in Figure 1.

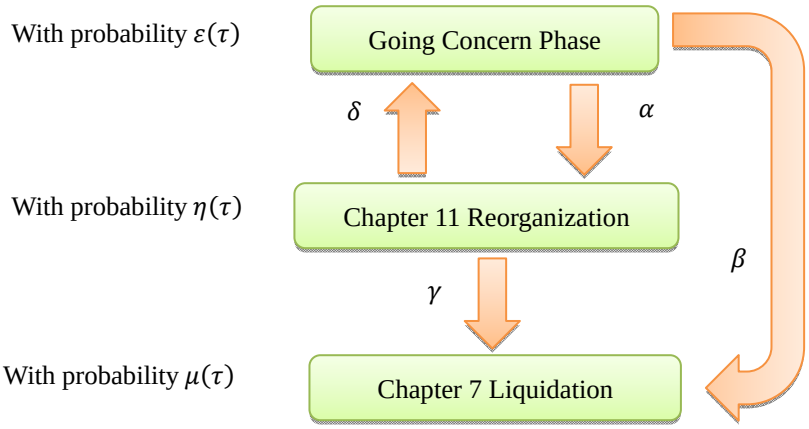

Figure 1. The model's three corporate phases and the respective migration probabilities

We can now assemble a simple Markov model of corporate survival through the following three coupled first-order differential equations:

$$\frac{\partial \varepsilon(\tau)}{\partial \tau} = \delta \cdot \eta(\tau) - (\alpha + \beta) \cdot \varepsilon(\tau) \tag{1}$$

$$\frac{\partial \eta(\tau)}{\partial \tau} = \alpha \cdot \varepsilon(\tau) - (\gamma + \delta) \cdot \eta(\tau) \tag{2}$$

$$\frac{\partial \mu(\tau)}{\partial \tau} = \beta \cdot \varepsilon(\tau) + \gamma \cdot \eta(\tau) \tag{3}$$

Since we are interested to discover the probability distribution of corporate bankruptcy upon a new debt issuance, we shall assume that at origin the underlying firm is within the going concern phase. We therefore instigate the three initial conditions of the system as follows: $\varepsilon(\tau = 0) = 1$, $\eta(\tau = 0) = 0$, and $\mu(\tau = 0) = 0$. We are concerned about the stochastic behavior of this particular system, thus we further deploy ordinary Laplace transforms and postulate explicit derivations of the time-related probabilities as:

$$\varepsilon(\tau) = \left[\frac{\omega - \rho}{2\pi} sinh(\pi\tau) + cosh(\pi\tau)\right] \cdot exp\left[-\frac{(\rho+\omega)\tau}{2}\right] \tag{4}$$

$$\eta(\tau) = \frac{\alpha}{\pi} sinh(\pi\tau) \cdot exp\left[-\frac{(\rho+\omega)\tau}{2}\right] \tag{5}$$

and from the law of total probability of mutually exclusive events we get

$$\mu(\tau) = 1 - \varepsilon(\tau) - \eta(\tau) \tag{6}$$

where, for simplicity, we define:

$$\rho \stackrel{\text{def}}{=} \alpha + \beta < 1 \tag{7}$$

as the complete exit probability from the going concern phase, which is strictly smaller than one,

$$\omega \stackrel{\text{def}}{=} \gamma + \delta < 1 \tag{8}$$

as the total exit probability from the Chapter 11 bankruptcy protection stage, which must be smaller than one as well due to the complement likelihood to remain within the same phase,

$$\pi \stackrel{\text{def}}{=} \frac{\sqrt{(\omega-\rho)^2 + 4\alpha\delta}}{2} \tag{9}$$

as a temporary variable, and further recall that the hyperbolic sine and hyperbolic cosine are defined as:

$$sinh(\pi\tau) \stackrel{\text{def}}{=} \frac{exp(\pi\tau) - exp(-\pi\tau)}{2} = \frac{exp(2\pi\tau) - 1}{2exp(\pi\tau)} \tag{10}$$

$$cosh(\pi\tau) \stackrel{\text{def}}{=} \frac{exp(\pi\tau)+exp(-\pi\tau)}{2} = \frac{exp(2\pi\tau)+1}{2exp(\pi\tau)} \tag{11}$$

At this stage of the analysis we rely on prior literature and disentangle the probability α to file for bankruptcy into two risk components, systematic and idiosyncratic. Jarrow and Yu (2001), Chauveau and Gatfaoui (2002), Hull and White (2004), Ou-Yang (2005), Neely and Winters (2006), Fletcher (2007), Eckner (2008), Giesecke (2008), and Parnes (2009) are among the more recent studies that scrutinize these systematic and the idiosyncratic bankruptcy risk components.

We therefore consider that firms fail to service their outstanding debt and consequently file for Chapter 11 bankruptcy protection primarily because of harsh macroeconomic conditions (systematic factors) and due to excess debt overhang and other intra-firm elements (idiosyncratic determinants). More formally we integrate the systematic and the idiosyncratic bankruptcy risk modules as:

$$\alpha^{firm} = \alpha_{sys}^{firm} + \alpha_{idi}^{firm} \tag{12}$$

The systematic risk module of a firm naturally depends upon a specific economic state of nature, which we classify as $\widehat{\mathbb{N}}$. The corresponding idiosyncratic bankruptcy risk component logically depends upon a particular balance between the firm's latest debt level and assets following the recent bond issuance, which we categorize as $\widehat{\mathbb{D}}$. In this setting, $P\left(\widehat{\mathbb{D}}\right)$ denotes the degree of debt variability, while $P\left(\widehat{\mathbb{D}}\right) \gg 0$ represents a relatively stable debt ratio and $P\left(\widehat{\mathbb{D}}\right) \ll 1$ signifies a fairly volatile debt structure. Therefore, we can now utilize the Bayes' theorem to unravel each bankruptcy risk element as the respective product of a conditional probability and a definite likelihood, as follows:

$$\alpha_{sys}^{firm} \stackrel{\text{def}}{=} \alpha_{sys}^{firm} \cap \widehat{\mathbb{N}} = \left(\alpha_{sys}^{firm} \mid \widehat{\mathbb{N}}\right) \cdot P\left(\widehat{\mathbb{N}}\right) \tag{13}$$

$$\alpha_{idi}^{firm} \stackrel{\text{def}}{=} \alpha_{idi}^{firm} \cap \widehat{\mathbb{D}} = \left(\alpha_{idi}^{firm} \mid \widehat{\mathbb{D}}\right) \cdot P\left(\widehat{\mathbb{D}}\right) \tag{14}$$

We can further use the Merton (1974) structural credit framework, often referred as the option theoretic valuation of debt, to express the idiosyncratic conditional probability $\left(\alpha_{idi}^{firm} \mid \widehat{\mathbb{D}}\right)$to file for bankruptcy given a firm's specific debt ratio. In this case, we write

$$\left(\alpha_{idi}^{firm} \mid \widehat{\mathbb{D}}\right) \stackrel{\text{def}}{=} \Phi(-d_2) = \Phi\left[-\frac{ln\left(\frac{A_0}{D}\right)+\left(r_f-\frac{\sigma_A^2}{2}\right)T}{\sigma_A\sqrt{T}}\right] \tag{15}$$

where A_0 denotes the present market value of corporate assets, D is the deterministic face value of debt which matures at a future time T, r_f represents the risk-free interest rate, σ_A signifies the volatility of the firm's assets, and $\Phi(\ \ )$ designates the Cumulative Distribution Function (CDF) of the standard Normal distribution. In the Merton (1974) model, $\Phi(d_2)$ is the risk-neutral probability that the borrowing firm is capable of servicing its outstanding debt. Thus, $\Phi(-d_2) \equiv 1 - \Phi(d_2)$ represents the conditional probability (given a specific debt ratio) for the underlying borrowing firm to file for bankruptcy due to intra-firm circumstances.

We can now incorporate the modified derivation for a firm's likelihood to file for Chapter 11 bankruptcy protection

$$\alpha = \left(\alpha_{sys}^{firm} \mid \widehat{\mathbb{N}}\right) \cdot P\left(\widehat{\mathbb{N}}\right) + \Phi\left[-\frac{ln\left(\frac{A_0}{D}\right)+\left(r_f-\frac{\sigma_A^2}{2}\right)T}{\sigma_A\sqrt{T}}\right] \cdot P\left(\widehat{\mathbb{D}}\right) \tag{16}$$

into equations (4), (5), and (6) and obtain conclusive time-related probabilities to be in the going concern phase, the Chapter 11 bankruptcy protection cycle, or the Chapter 7 liquidation stage at time τ as respective functions of the likelihood to have a specific debt ratio. These relations allow us to examine the probability distribution of corporate bankruptcy under various circumstances.

A word of caution is required here though. To preserve the probability α to file for Chapter 11 bankruptcy within the feasible domain of $[0, 1]$ we generally mandate that the idiosyncratic conditional probability of bankruptcy $\Phi(-d_2)$ remains sufficiently below one. In the present context, the assortment of $\Phi(-d_2) \to 1$ and at the same time the borrowing firm maintains a reasonably fixed debt ratio, i.e. $P\left(\widehat{\mathbb{D}}\right) \to 1$, is mathematically ill-defined because in most cases $\alpha_{sys}^{firm} > 0$, which clearly violates the law of total probability. This acute setting, however, portrays a borrowing firm that cannot stay fully operational, therefore its probability distribution of bankruptcy is completely irrelevant. We therefore limit our theory to cope with those borrowing firms that have debt levels at or below market value of corporate assets. In practice, these instances are the bulk of borrowing firms, while we ought to exclude merely the extraordinary trivial cases. In our later simulations we

demand that $D/A_0 \leq 1$ to avoid the situation where $\Phi(-d_2) \to 1$, which visibly triggers $\alpha \to 1$. Regardless of other transition rates, this insignificant case essentially portrays a borrowing firm that can stay only instantaneously within the going concern corporate phase. In this particular setting the probability distribution of corporate bankruptcy is obviously extraneous.

We can expose other relations within the proposed model by realistically assuming that the probability β to default and reach Chapter 7 liquidation directly from the going concern phase is proportional to the ad hoc debt ratio, hence $\beta \propto \frac{D}{A_0}$. For example, when the outstanding debt is far greater than the market value of assets, in many cases a distressed firm would abandon any attempt to reorganize and immediately liquidates its existing assets among the various classes of the debt-holders. However, we intentionally separate the emergence probability δ as well as the likelihood γ to reach Chapter 7 and default while staying already in Chapter 11 bankruptcy protection from the firm's debt ratio. These two exit routes usually depend on the projected liquidation costs, the chances to find Debtor In Possession (DIP) financiers, and the odds to overcome various obstacles during negotiations with different classes of creditors. Alderson and Betker (1995) empirically show that firms with high liquidation costs of assets tend to emerge from Chapter 11 with relatively low debt ratios, often by raising new equity capital, while the debt of these firms is more likely to be public, unsecured, and with less restrictive covenants.

Furthermore, we notice that our derivations for the time-related probabilities to remain in each corporate cycle within equations (4), (5), and (6) are linked to the Merton (1974) structural credit model through another device. As time progresses, i.e. when τ increases, the remaining time until maturity T on the firm's outstanding debt decreases. In this situation, the idiosyncratic conditional probability of bankruptcy $\Phi(-d_2)$ in equation (15) decreases with some convexity or concavity, depending on the precise corporate debt ratio. Consequently, the probability α to file for bankruptcy protection generally tends to decline. This configuration reduces the complete exit probability ρ from the going concern cycle in equation (7), while these changes further affect the temporary variable π in equation (9).

In fact, because the probability α to file for bankruptcy protection is a periphrastic function of the time unit τ we cannot analytically solve how $\varepsilon(\tau)$ and $\eta(\tau)$ advance through time. In various instances, however, as illustrated in the next section, we can ignore this somewhat concealed relationship between α and τ and differentiate by parts both time-related probabilities $\varepsilon(\tau)$and $\eta(\tau)$. Within this venue, we can utilize the facts that $\frac{\partial}{\partial\tau}sinh(\tau) = cosh(\tau)$, $\frac{\partial}{\partial\tau}cosh(\tau) = sinh(\tau)$, and $\frac{\partial}{\partial\tau}e^{-\tau} = -e^{-\tau}$, and acquire

$$\frac{\partial}{\partial\tau}\varepsilon(\tau) \cong \left[\left(\pi - \frac{\omega^2-\rho^2}{4\pi}\right)sinh(\pi\tau) - \rho cosh(\pi\tau)\right] \cdot e^{-\frac{(\rho+\omega)\tau}{2}} \tag{17}$$

$$\frac{\partial}{\partial\tau}\eta(\tau) \cong \left[cosh(\pi\tau) - \frac{\rho+\omega}{2\pi}sinh(\pi\tau)\right] \cdot \alpha e^{-\frac{(\rho+\omega)\tau}{2}} \tag{18}$$

To find the specific point where the time-related probability$\eta(\tau)$ to be in Chapter 11 reorganization reaches a local optimum level we require that $\frac{\partial}{\partial\tau}\eta(\tau) = 0$. Along this first order condition we use a simple algebra and find that an optimum time-related likelihood to stay in bankruptcy protection is achieved when

$$\frac{\rho+\omega+2\pi}{\rho+\omega-2\pi} = exp(2\pi\tau) \tag{19}$$

We notice that the ratio on the left hand side of equation (19) is independent of τ hence it is stable over time, yet the right hand side grows through time with a direct correspondence to the continuous rise in the parameter τ. Thus, we can conclude that an optimum time-related probability to stay in Chapter 11 reorganization is inevitable. In addition, to obtain a local (and in this case also global) maximum we further require that $\frac{\partial^2}{\partial\tau^2}\eta(\tau) < 0$. This second order condition commands that

$$\frac{\pi}{\rho+\omega} + \frac{\rho+\omega}{4\pi} < \frac{cosh(\pi\tau)}{sinh(\pi\tau)} \tag{20}$$

From the *definitions* of hyperbolic cosine and hyperbolic sine, when τ is relatively small, the ratio on the right hand side is rather large. More formally, $\lim_{\tau\to 0}\frac{cosh(\pi\tau)}{sinh(\pi\tau)} = \infty$. This authorizes inequality (20) to hold and a local maximum to subsist. However, when τ is fairly large, this ratio converges quite fast to one. In the latter case, since $\lim_{\tau\to\infty}\frac{cosh(\pi\tau)}{sinh(\pi\tau)} = 1$, a violation of inequality (20) is more probable. Altogether, we expect the highest probability to be in Chapter 11 bankruptcy protection at some early stage after the debt issuance, which ultimately depends upon the overall transition likelihoods in the system.

Nonetheless, because the probability α employs the CDF of the standard Normal distribution, α is in fact a

non-differentiable function of τ. Therefore, derivations (17) and (18) merely portray reduced-form approximations to the progressions of the time-related probabilities $\varepsilon(\tau)$ and $\eta(\tau)$ to remain within the going concern phase or the Chapter 11 reorganization cycle, respectively. In the next section we assess the merits of these approximations through a close examination of the relationship between the probability α to file for bankruptcy and the time measure τ for different levels of debt ratio. Yet, to better comprehend the probability distribution of corporate bankruptcy upon a new debt issuance we shall enforce the exact relations throughout the later computer simulations.

3. Main Simulations

We begin this section by validating the reduced-form approximations (17) and (18) for the evolvements of the time-related credit probabilities $\varepsilon(\tau)$ and $\eta(\tau)$ to remain within the going concern phase or the Chapter 11 reorganization cycle, respectively. For this purpose, we inspect through equation (16) how the probability α to file for bankruptcy is truly affected by the progress of the time unit τ and the consequential decline within the remaining time until debt maturity T, ceteris paribus. Yet, we first measure how the idiosyncratic conditional probability of bankruptcy $\Phi(-d_2)$ in equation (15) decreases over time with different levels of debt ratio. We therefore assign the following quantities: $A_0 = \$10$, $D = \{\$2, \$4, \$6, \$8, \$10\}$, $r_f = 3\%$ per annum, $\sigma_A = 25\%$ per year, at origin $\tau = 0$ and $T = 15$ years until maturity, but when τ gradually advances to 14 years, T simultaneously decreases to one year until maturity. We report the results of these simulations on the left panel of Figure 2. On the right panel of Figure 2 we further demonstrate how the complete probability α to file for Chapter 11 bankruptcy protection alternates with time, while in addition to the above quantities we arbitrarily select the following figures: $P(\widehat{\mathbb{N}}) = 0.2$, $(\alpha_{sys}^{firm} \mid \widehat{\mathbb{N}}) = 0.4$, thus $\alpha_{sys}^{firm} = 0.08$, and $P(\widehat{\mathbb{D}}) = 0.1$.

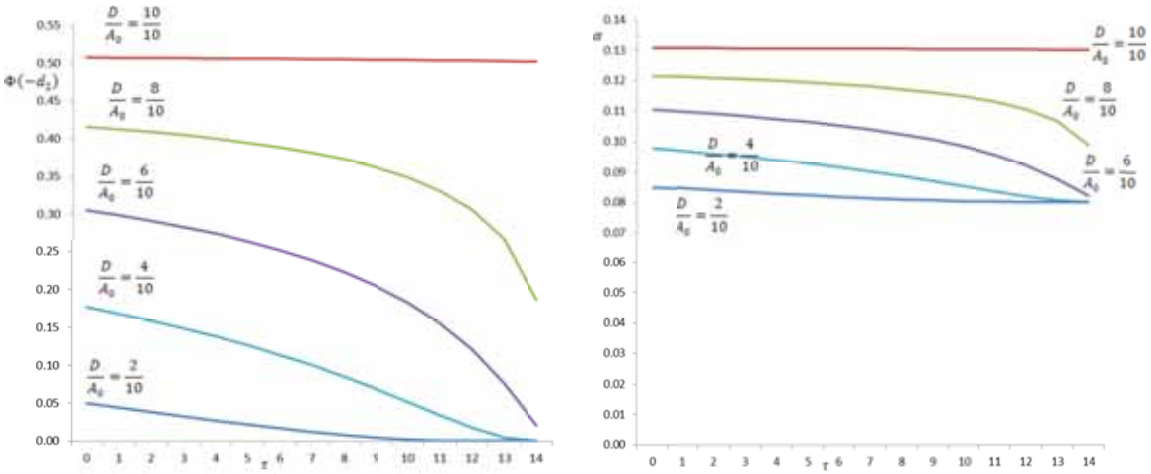

Figure 2. The evolution of bankruptcy risk over time

In the left panel we illustrate how the idiosyncratic conditional probability of bankruptcy $\Phi(-d_2)$ decreases over time with different levels of debt ratio. Within these simulations we arbitrarily select the following quantities: $A_0 = \$10$, $D = \{\$2, \$4, \ldots, \$10\}$, $r_f = 3\%$ per annum, at origin $\tau = 0$ and $T = 15$ years until maturity (when τ gradually progresses to 14 years, T simultaneously decreases to one year until maturity), and $\sigma_A = 25\%$ per annum. In the right panel we demonstrate how the probability α to file for bankruptcy protection moderately declines, while in addition to the above quantities we nominate the following figures: $P(\widehat{\mathbb{N}}) = 0.2$, $(\alpha_{sys}^{firm} \mid \widehat{\mathbb{N}}) = 0.4$, thus $\alpha_{sys}^{firm} = 0.08$, and $P(\widehat{\mathbb{D}}) = 0.1$. These simulations show that for relatively high or low debt ratios, the probability α to file for bankruptcy is reasonably autonomous of time. In these instances, equations (17) and (18) may serve as sound approximations to the evolutions of $\varepsilon(\tau)$ and $\eta(\tau)$ over time. However, for rather balanced debt ratios, the probability α to file for bankruptcy does vary through time. In these latter cases, equations (17) and (18) can only be used as rough estimations to the progressions of the time-related probability $\varepsilon(\tau)$ to remain in the going concern phase as well as the time-related probability$\eta(\tau)$ to be in Chapter 11 bankruptcy protection.

We can observe that when the firm's debt is relatively mobile, i.e. when $P(\widehat{\mathbb{D}}) \ll 1$, with rather high or low debt ratios, the probability α to file for bankruptcy is fairly independent of time. Within these occasions, equations (17) and (18) can serve as suitable approximations to the evolutions of $\varepsilon(\tau)$and $\eta(\tau)$. However, for moderately balanced debt ratios, the probability α to file for bankruptcy does vary over time as a downward sloping curve.

In these later cases, equations (17) and (18) can only be used as rough estimations for the progressions of the time-related probability $\varepsilon(\tau)$ to remain in the going concern phase as well as the time-related probability$\eta(\tau)$ to be in Chapter 11 bankruptcy protection.

Nevertheless, we learn that a fairly stable corporate debt level, i.e. when $P(\widehat{\mathbb{D}}) \to 1$, would strengthen the downward sloping curvature of the probability α to file for bankruptcy when measured with respect to changes in time τ, since then the idiosyncratic conditional probability of bankruptcy $\Phi(-d_2)$ attains a bigger weight in equation (16). For these reasons, we prefer to continue our subsequent simulations with the precise derivations of corporate bankruptcy risk and not to excessively rely on these reduced-form approximations. We now turn to evaluate the notional influence of new debt issuances on corporate bankruptcy risk through equations (4) to (16).

In the next simulations we allow the borrowing firm to issue unconstrained debt while having stochastic assets. In essence, we set a fixed $\sigma_A > 0$, and we do not restrict the debt level by disconnecting the probability $P(\widehat{\mathbb{D}})$ from all other model variables. Thus, we implicitly assume that the firm's outstanding debt can also vary over time following further debt issuances or redemptions.

We summarize the simulated results throughout Figures 3 – 4 for firms having low, mid, and high debt ratios. In Figure 3 we describe how the time-related probability $\varepsilon(\tau)$ to remain in the going concern phase varies over time τ through equation (4). In Figure 4 we portray how the time-related probability $\eta(\tau)$to be in Chapter 11 bankruptcy protection fluctuates over time τ through equation (5). For these simulations we depict hypothetical borrowing firms with relatively low, mid, and high debt ratios as: $\frac{D}{A_0} = \frac{\$2}{\$10}$, $\frac{D}{A_0} = \frac{\$5}{\$10}$, and $\frac{D}{A_0} = \frac{\$8}{\$10}$, respectively. Within each experiment we arbitrarily denote the following quantities: $r_f = 3\%$ per annum, $\sigma_A = 25\%$ per year, at origin $\tau = 0$ and $T = 15$ years until maturity (when τ gradually progresses to 14 years, T simultaneously decreases to one year until maturity), $P(\widehat{\mathbb{D}}) \in \{0.1, 0.2, \dots, 1.0\}$ (where $P(\widehat{\mathbb{D}}) = 0.1$ represents a borrowing firm that exhibits a high variability of its debt level hence higher chances for further debt issuances or redemptions, and $P(\widehat{\mathbb{D}}) = 1.0$ characterizes a firm which preserves a constant debt ratio thus no additional debt issuances beyond the latest one), $P(\widehat{\mathbb{N}}) = 0.2$, $(\alpha_{sys}^{firm} \mid \widehat{\mathbb{N}}) = 0.4$, thus $\alpha_{sys}^{firm} = 0.08$, $\beta = \frac{D}{A_0}/6 = \{0.0333, 0.0833, 0.1333\}$, $\gamma = 0.2$, and $\delta = 0.5$, thus $\omega = 0.7$.

The simulated findings indicate that throughout the entire time frame under investigation and for all types of firms having unconstrained debt and stochastic assets, the time-related probability $\varepsilon(\tau)$ to remain in the going concern phase is constantly lower (higher) among firms with lower (higher) debt mobility. When the probability $P(\widehat{\mathbb{D}})$for a specific debt level decreases (increases), hence when the debt ratio variability rises (declines), the likelihood for a borrowing firm to avoid bankruptcy and to remain fully operational increases (decreases). Furthermore, we detect that throughout the whole 14 years in our theoretical simulations and for all degrees of corporate leverage, the time-related probability$\eta(\tau)$ to be in Chapter 11 bankruptcy protection is persistently lower (higher) among borrowers having higher (lower) debt variability. These two important outcomes, however, are significantly more (less) pronounced within borrowing firms having higher (lower) debt ratios.

In addition, we detect that regardless of the specific debt ratio, the time-related probability $\varepsilon(\tau)$ to remain in the going concern cycle continuously declines as a downward sloping convex curve. This result evolves despite the fact that when time τ advances, the remaining time T until the debt maturity decays, the idiosyncratic conditional likelihood $\Phi(-d_2)$ to file for bankruptcy decreases, and the complete probability α to file for bankruptcy generally drops. The continuous shrinkage in $\varepsilon(\tau)$ through time is a direct consequence of our initial condition $\varepsilon(\tau = 0) = 1$ and due to the absorbing state of default within the Chapter 7 phase, which gradually accumulates the chances for an irreversible liquidation over time. This corporate behavior seems highly realistic, since in practice, the vast majority of firms do fail at some point.

Even more interesting is the notional conduct of the time-related probability$\eta(\tau)$ to be in Chapter 11 reorganization. It appears that this time-related likelihood reaches its highest level shortly after initiation and it continuously decays then after. This outcome is a direct result of our initial requirement for $\eta(\tau = 0) = 0$ and the ergodic properties of the absorbing state of default, which essentially compel that $\varepsilon(\tau \to \infty) = 0$, $\eta(\tau \to \infty) = 0$, and $\mu(\tau \to \infty) = 1$. The unique curvature of $\eta(\tau)$ is obtained due to an upward sloping convex shape of the first term $\frac{\alpha}{\pi} sinh(\pi\tau)$ and a downward sloping convex profile of the second term $exp\left[-\frac{(\rho+\omega)\tau}{2}\right]$ within equation (5).

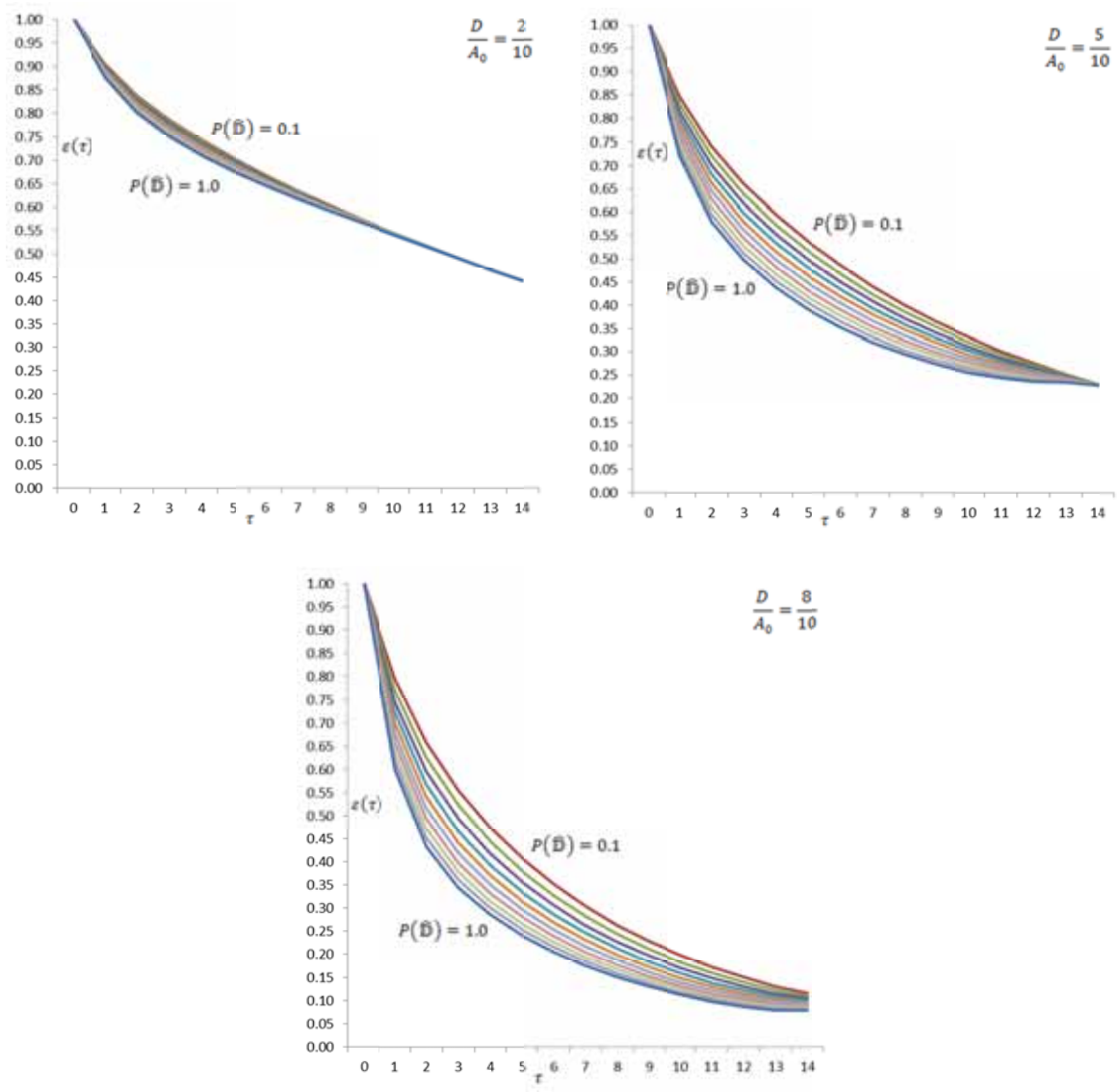

Figure 3. Time-related operational probabilities with unconstrained low, mid, and high debt ratios

In the upper left, upper right, and lower panels we describe how the time-related probability $\varepsilon(\tau)$ to remain in the going concern corporate phase changes over time τ through equation (4) with low, mid, and high debt ratios, respectively. For these simulations we depict hypothetical firms having the following arbitrary quantities: $A_0 = \$10$, $D = \{\$2, \$5, \$8\}$, $r_f = 3\%$ per annum, at origin $\tau = 0$ and $T = 15$ years until maturity (when τ gradually progresses to 14 years, T simultaneously decreases to one year until maturity), $\sigma_A = 25\%$ per year, $P(\widehat{\mathbb{D}}) \in \{0.1, 0.2, \ldots, 1.0\}$ (where $P(\widehat{\mathbb{D}}) = 0.1$ represents a borrowing firm that exhibits a high variability of its debt hence further debt issuances or redemptions are likely, and $P(\widehat{\mathbb{D}}) = 1.0$ characterizes a borrowing firm which preserves a fixed debt level), $P(\widehat{\mathbb{N}}) = 0.2$, $(\alpha_{sys}^{firm} \mid \widehat{\mathbb{N}}) = 0.4$, thus $\alpha_{sys}^{firm} = 0.08$, $\beta = \frac{D}{A_0}/6 = \{0.0333, 0.0833, 0.1333\}$, $\gamma = 0.2$, and $\delta = 0.5$, thus $\omega = 0.7$. These experiments reveal how the time-related probability $\varepsilon(\tau)$ to remain in the going concern phase decay over time, while higher debt variability is essential for staying fully operational, especially among the high debt ratio firms.

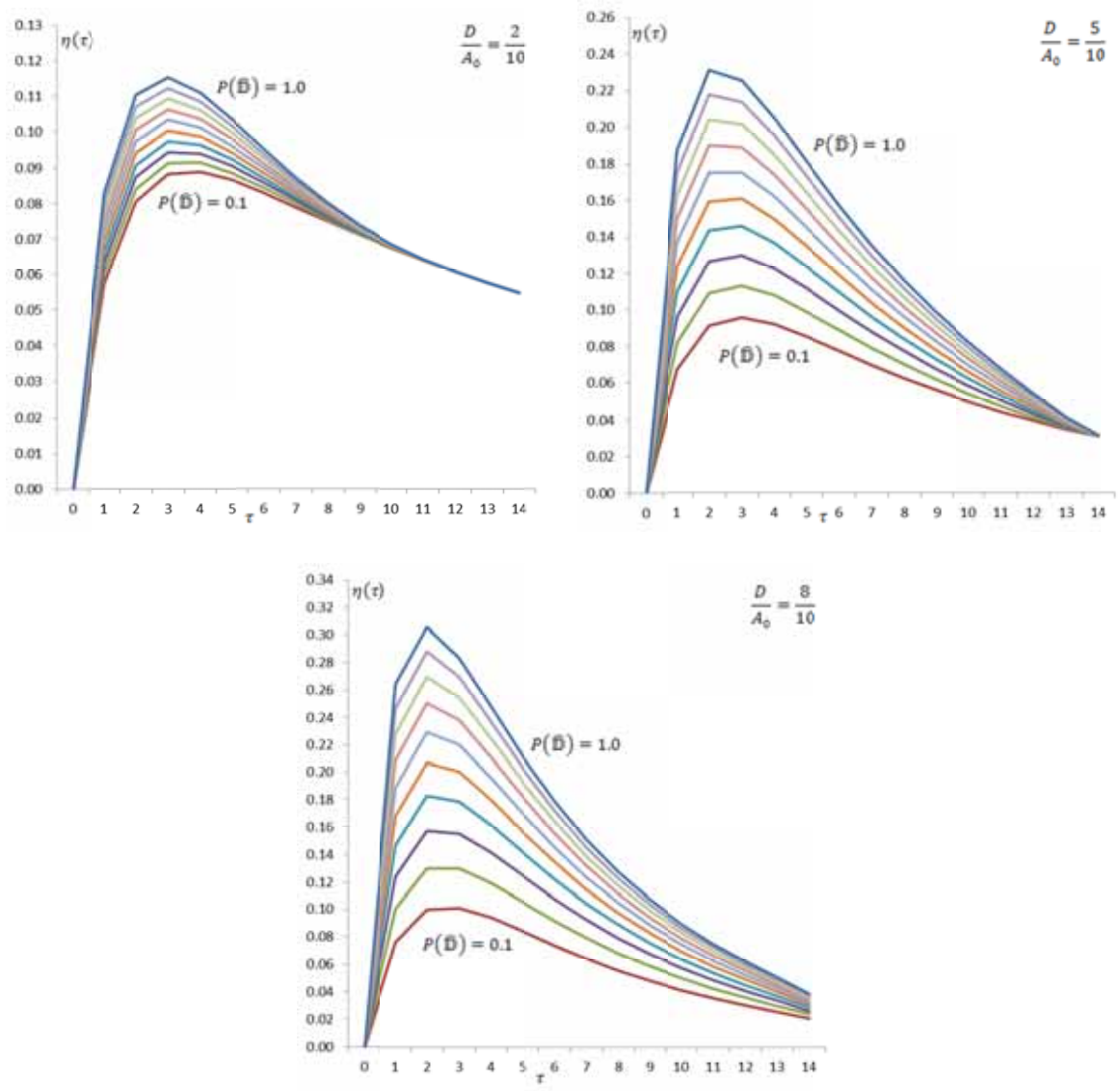

Figure 4. Time-related bankruptcy probabilities with unconstrained low, mid, and high debt ratios

In the upper left, upper right, and lower panels we describe how the time-related probability $\eta(\tau)$to be in Chapter 11 bankruptcy protection changes over time τ through equation (5) with low, mid, and high debt ratios, respectively. For these simulations we depict hypothetical firms having the following arbitrary quantities: $A_0 = \$10$, $D = \{\$2, \$5, \$8\}$, $r_f = 3\%$ per annum, at origin $\tau = 0$ and $T = 15$ years until maturity (when τ gradually progresses to 14 years, T simultaneously decreases to one year until maturity), $\sigma_A = 25\%$ per year, $P(\widehat{\mathbb{D}}) \in \{0.1, 0.2, \dots, 1.0\}$ (where $P(\widehat{\mathbb{D}}) = 0.1$ represents a borrowing firm that exhibits a high variability of its debt hence further debt issuances or redemptions are likely, and $P(\widehat{\mathbb{D}}) = 1.0$ characterizes a borrowing firm which preserves a fixed debt level), $P(\widehat{\mathbb{N}}) = 0.2$, $(\alpha_{sys}^{firm} \mid \widehat{\mathbb{N}}) = 0.4$, thus $\alpha_{sys}^{firm} = 0.08$, $\beta = \frac{D}{A_0}/6 = \{0.0333, 0.0833, 0.1333\}$, $\gamma = 0.2$, and $\delta = 0.5$, thus $\omega = 0.7$. These experiments authenticate how the time-related probabilities $\eta(\tau)$to be in Chapter 11 bankruptcy protection first increase and then decrease over time, while higher debt variability is essential for avoiding Chapter 11 bankruptcy protection, especially among the high debt ratio firms.

Furthermore, we notice that the maximum time-related probability$\eta(\tau)$ to be in Chapter 11 bankruptcy protection is repeatedly achieved within two or three years of a new debt issuance. As predicted by the theory in derivations (19) and (20), this result remains robust regardless of the specific debt ratio or the firm's debt variability. We provide some pragmatic intuition to this phenomenon by realizing that in most cases, borrowing firms can issue new debt only when they do not convey an immediate bankruptcy risk. These leveraged firms,

however, damage their own creditworthiness with every debt issuance, thus their credit quality deteriorates shortly after. Nevertheless, when enough time has passed since the debt issuance, the borrower has either adjusted its core business to the new debt level or defaulted and completely liquidated its assets.

4. Robustness Tests

Throughout the main simulations thus far we have picked arbitrary values for the model variables. In particular, we have frequently used the following pivot numbers: $r_f = 3\%$ per annum, $\sigma_A = 25\%$ per year, $\gamma = 0.2$, $\delta = 0.5$, $\left(\alpha_{sys}^{firm} \mid \widehat{\mathbb{N}}\right) = 0.4$, $P\left(\widehat{\mathbb{N}}\right) = 0.2$, $T = 15$ years until maturity, and $\beta = \frac{D}{A_0}/6$. These subjectively selected measures depict reasonable quantities that aim to represent common observed patterns.

Nonetheless, for purpose of robustness, we wish to test our theory with alternative feasible values. We therefore alternate each variable through a large spectrum of practical measures. More formally, we reproduce the previous simulations with the following sets of quantities: $r_f \in \{1\%, 2\%, \dots, 15\%\}$ per annum, $\sigma_A \in \{5\%, 10\%, \dots, 40\%\}$ per year, $\gamma \in \{0.05, 0.10, \dots, 0.50\}$, $\delta \in \{0.05, 0.10, \dots, 0.50\}$, $\left(\alpha_{sys}^{firm} \mid \widehat{\mathbb{N}}\right) \in \{0.1, 0.2, \dots, 0.6\}$, $P\left(\widehat{\mathbb{N}}\right) \in \{0.1, 0.2, \dots, 0.6\}$, $T \in (5, 10, \dots, 25)$ years until maturity, and $\beta \in \left\{\frac{D}{2\times A_0}, \frac{D}{4\times A_0}, \dots, \frac{D}{20\times A_0}\right\}$. These robustness tests do not yield materially different outcomes than the already testified results from the main simulations.

There are, however, a few interesting points to notice here. First, when the risk free interest rate reaches exceedingly high levels, near 15% or so, the differences between low and high debt variability become negligible. With exceptionally high r_f the conditional probability $\Phi(-d_2)$ to file for bankruptcy converges to zero in equation (15). In this case, the integrated likelihood α to file for Chapter 11 bankruptcy protection stabilizes in equation (16), while the effects of different debt dynamics on corporate bankruptcy risk are virtually abolished.

Second, when the two exit routes from Chapter 11 are reduced to extraordinarily low levels, i.e. when the probabilities γ or δ fall below 0.05 or so, the time-related probability $\eta(\tau)$to be in Chapter 11 reorganization attains its maximum level somewhat later than before, around four to five years after initiation. The reason for this phenomenon lies in the fact that with these lowered transition rates $\gamma$and δ, any borrowing firm that enters the bankruptcy phase is evidently assumed to remain in this corporate cycle for a longer period of time. In this setting, the time-related probability$\eta(\tau)$to be in Chapter 11 bankruptcy protection reaches its highest level a bit later than throughout the main simulations. Nonetheless, this maximum likelihood is still achieved within the first few years, as anticipated by the theory.

5. Summary

In this study we have theoretically examined the probability distribution of corporate bankruptcy upon new debt issuances. For this purpose, we have developed a relatively simple Markov model with three feasible corporate phases: (1) a going concern cycle, (2) a Chapter 11 bankruptcy protection stage, and (3) an absorbing state of default within Chapter 7 liquidation. We have presented analytical solutions for the stochastic transition rates among these corporate phases and linked the continuous dynamics of corporate debt to time-related probabilities to remain in each cycle. In addition, we have offered several reduced-form approximations that can crudely predict bankruptcy risk patterns among various borrowing firms. To better comprehend the behavioral properties of the system, we have further simulated the model derivations. Finally, we have authenticated our predictions and deployed numerous robustness tests by alternating the model variables through large sensible ranges.

Overall, the notional findings of our model project that when corporate debt is unconstrained due to seasonal debt issuances or redemptions and the firm's assets are further stochastic, the time-related probability to be in Chapter 11 bankruptcy protection is persistently lower among borrowers that portray higher debt variability, and vice versa.

A valuable product of our theory indicates that the most probable period of time to file for Chapter 11 reorganization develops a small number of years after a new corporate debt issuance. In most cases, the highest likelihood to be in bankruptcy protection is realized within two or three years of debt initiation. We ascertain this vigorous result for all types of debt ratios and across most practical economic circumstances. This perception conveys significant credit implications for both borrowers and lenders. Both of these counterparties should brace themselves individually for this hazardous corporate phase and further direct proactive measures to mitigate certain credit implications.

As future lines of research we recommend that interested parties pursue empirical tests of the prophecies of the current theory. This however, may not be a trivial journey. While debt variability over time can be measured with

relatively naïve statistical techniques, the assessment of its impact on corporate bankruptcy risk might burden quite a few difficulties. Despite a universal agreement throughout the economic literature that corporate bankruptcy risk evolves both from systematic factors and idiosyncratic determinants, it may not be a straightforward task to isolating the marginal contributions in practice. Since these two risk modules are not readily observed, it could be somewhat challenging to empirically attribute the isolated influence of debt variability on the overall risk to file for Chapter 11 bankruptcy protection. For that reason, our study remains a theoretical exercise.

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An Analytical Study of the Demand for Money in Saudi Arabia

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Abstract

Empirical studies on the demand for money have been the object of great attention by economists due to its central role in conducting monetary policy by making it possible for monetary authorities to effect desired and predictable changes in targeted macroeconomic variables such as income, interest rate and prices by appropriate changes in monetary aggregates. The present study sought to investigate the cointegrating property of money demand in Saudi Arabia by using annual data for the period 1987-2009 and applying the vector error correction model (VECM) technique. Findings indicate clearly the existence of a long run cointegration relationship between the demand for money (M_2) and its explanatory variables, namely real GDP, the interest rate, the real exchange rate and the inflation rate. The error correction coefficient was found to be statistically significant and carries a minus sign as expected. The deviation of money demand from its long run value would be corrected in about a year and nine monthes.

Keywords: cointegration, money demand, error correction, M2 aggregate

1. Introduction

The demand for money function is a basic element in conducting monetary policy by making it possible for monetary authorities to effect desired and predictable changes in targeted macroeconomic variables such as income, interest rate and prices by appropriate changes in monetary aggregates. The demand function is an important catalyst in meeting the liquidity needs of economic agents (Handa, 2009). Because of its importance, the demand for money has long been the object of great attention by scholars and researchers.

Although, initially, research in this area was confined to the developed industrial countries, work on developing countries got underway since mid 1980s and has gained great momentum since then. The development of the vector error correction model (VECM) and related techniques of estimation has given an even greater impetus to the work on the demand for money almost worldwide.

The present study aims at estimating a theoretically sound model of the demand for money function for the Kingdom of Saudi Arabia.

It will investigate the cointegrating property of money demand in Saudi Arabia using the method of cointegration, of vector error correction model (VECM). We use the M2 monetary aggregate measured in real terms to represent money demand which is the dependent variable. The independent variables include real GDP as the scale variable along with the interest rate, the real exchange rate and the inflation rate. As is widely recognized in the literature, the demand for money is a very important element in the conduct of monetary policy. This fact may be of particular relevance to the case of Saudi Arabia where fiscal policy may not be readily manipulable to policy makers. For example government expenditures are closely linked to oil revenues and the related large government spending commitments which usually leave little room for maneuvers. On the other hand, taxation is not an important policy tool in the country . Since no previous studies have been carried out in this area for Saudi Arabia, this study probably gains added importance. The rest of this paper is organized as follows; Section 2 gives a literature review; Section 3 discusses the research model and data while section 4 explains the methodology and estimation pertaining to the cointegration tests. Section 5 discusses the vector error correction estimation results and section 6 concludes the paper.

2. Literature Review

A large body of literature exists with respect to empirical investigations of the demand for money. Although the

study of the demand for money is appreciable on its own right, interest in the demand for money heightened as economists in some developed countries for instance set out to investigate whether financial reforms and innovations have adversely affected the stability of the demand for money. Thus the study by Drake and Chrystal (1994) for the UK found a stable money demand using divisia weighted monetary aggregates. Hafer and Jansen(1991) and Stock and Watson (1991) also found support for a long-run cointegrated money demand for the USA case. Miyao (1996) examines the case of Japan but cocludes that the data do not lend support to the stability of money demand in Japan. The study by Bahmani-Oskooee (2001) for the same country showed that M2 is not only cointegrated with the demand for money arguments, but that the relationship is stable.

Demand for money studies for developing countries sought in the main to explore the existence of a long run cointegration relationship for the money demand function as well as the stability of the function in many cases. Thus looking at Indian data for the period 1996Q2-2009Q2, Padhan (2011) found a long run cointegration relationship between money demand and its determinants using a number of monetary aggregates. Comparable results were reached by Achsani (2010) who studied the M2 demand for money for the case of Indonesia. A study of Bangladesh was carrid out by Hossain (2010). He concluded that a long run cointegration relationship in fact existed between broad money and the explanatory variables in the money demand function.

Some money demand studies were also done on African countries. For example a study of the Kenyan case by Adam (1992) confirmed the existence of a long run cointegrating relationship between a number of monetary aggregates and the arguments in money demand function. Likewise Oluwole and Olugbenga (2007) also confirmed the existence of an M2 money demand function for Nigeria which was also stable. The Egyptian money demand function was investigated2 was unstable by Awad (2010). Using quarterly data for the period 1995-2007, he found that money demand for M2 was unstable. On the whole, it seems that a majority of the studies on money demand support the existence of a long run cointegration relationshipfor the money demand function and that it is largely stable.

3. Model and Data

The demand for money function has been represented by theorists in a number of ways. Nevertheless, most economists would postulate that the main arguments in the demand for money function comprise the scale variable which is customarily real income, although wealth and permanent income are better recommended if available, and opportunity cost variables. The usual general equasional representation of the demand for money function is:

$$\frac{M}{P} = f(Y, R) \qquad f_Y > o, f_R < 0 \tag{1}$$

In this representation, M denotes nominal money supply, R denotes the interest rate. Money demand is assumed directly related to output but inversely related to the interest rate. However, as stated by Friedman (1987), the demand for money function can be expanded to incorporate several determinants such that we have

$$(M/P)^d = f(y, r, E, S) \tag{2}$$

Where M is the money stock, P is the general price level, y is real income, r is interest rate, E is the exchange rate and S is stock price. Equation (2) incorporates the exchange rate and stock price as additional explanatory variables for the money demand function. The moral of this is that foreign exchange and stocks are constituent parts of the asset portfolios held by investors. While money demand is expected apriori to be positively related to the exchange rate (Arango and Nadiri, 1981), the net effect of stock price could be either positive or negative from the theoretical stand point. Some economists argue that due to the weakness of financial markets in developing or emerging economies, real assets, rather than financial assets, may arguably be considered as alternatives to holding money (Sriram, 1999). Consequently we opt for the following specification for the money demand function:

$$M_{2t} = \beta_0 + \beta_1(Y)_t + \beta_2 r_t + \beta_3 E_t + \beta_4 \pi_t + et \tag{3}$$

Where M_2t is the monetary aggregate in real terms, Y the real income, r the interest rate, E the real exchange rate, π the inflation rate and e is an error term. According to Arango and Nadiri (1981) and Bahmani – Oskooee and Pourheydarian (1990), an estimate of β_1 should have a positive sign, β_2 and β_3 could be negative or positive while β_4 is expected to be negative.

In order to estimate the model, annual data for the period from 1987 to 2007 will be used. Data for the monetary aggregate M_2, the interest rate and real GDP were obtained from various issues of the annual reports of the Saudi

Arabian Monetary Agency (SAMA) which is actually the central bank for the Kingdom of Saudi Arabia. The data for the real exchange rate and inflation were obtained from various issues of the international financial statistics published by the International Monetary fund.

4. Methodology and Estimation

We use the vector error correction model (VECM) integration technique (Johansen 1988) and Johansen and Joselius (1990)) to examine the long run cointegration relationship between the demand for money and its determinants. The application of integration requires that time series be tested for stationarity. A time series is said to be stationary if its mean and variance are invariant over time and the value of the covariance over the relevant time duration depends only on the gap or lag between the two time periods and not on the particular point in time in which the covariance is measured (Gujarati 2007). If the time series are stationary at level, then it would be possible to run a regression directly a'la the method of least squares. However, if the time series are not stationary at level, we take their first difference and then test their stationarity thereafter.

4.1 Unit Root Tests

To test for stationarity we use the Augmented Dickey-Fuller (ADF) and the Philips- Perron unit root testes. The model estimates are made both with a constant (C) and with constant and trend (C &T). The results of the unit root tests are presented in tables 1 and 2 below.

Table 1. Tests of time series stationarity at level [1]

Variables	Dickey and Fuller (C)	Phillip-Perron (C&T)	Phillip-Perron (C)	Dickey and Fuller (C&T)
M2	9.9571***	5.877359***	8.014959***	5.877359***
INFLATION	-2.378662	-2.838116	-2.378662	-2.831450
GDP	0.215271	-1.583092	0.224082	-1.645010
INTEREST RATE	-1.774517	-2.526306	-1.605299	-4.844019***
EXCHANGE RATE	-1.980556	-0.966056	-1.980556	-0.966056

Notes: *, **, ***: statistically significant at the 10 percent, 5 percent and, 1percent level respectively. The time lag was chosen automatically through the Schwartz Info Criterion 1-

Table 2. Tests of time series stationarity at first difference

Variables	Dickey and Fuller (C)	Phillip-Perron (C&T)	Phillip-Perron (C)	Dickey and Fuller(C&T)
M2	-0.570769	-1.984814	-0.406534	-1.907513
INFLATION	-5.963571***	-6.138676***	-5.976999***	-6.180467***
GDP	-4.123323***	-5.416393***	-4.455469***	-5.416393***
INTEREST RATE	-3.196739**	-2.963899	-3.025709**	-2.879203
EXCHANGE RATE	-2.774075*	-3.091266	-2.724948*	-2.708339

Notes: *, **, ***: statistically significant at the 10 percent, 5 percent and, 1 percent level respectively.

The results of the ADF and PP tests with constant (C) and with constant and trend (C&T) indicate the presence of unit roots or non stationarity of all variables at level. However all the variables show stationarity for their first difference mostly at the 10 percent level of significance except for the M2 variable which has been found stationary at level. Since we have a mixture of variables in the model some of which are integrated of order one, I (1) and others are integrated of zero order, I (0), then it is possible to estimate the longrun relationship between them using the cointegration technique. (Enders 2008; Gujarati, 2007). Thus we move on next to run cointegration tests for the time series of the variables to find the extent of the long run relationship between the demand for money and its explanatory variables. If indeed a cointegration relationship exists, then the vector error correction can be used to identify the nature of the relation between the model variables in the short and long runs.

4.2 Results of Cointegration Tests

We proceed now to run the cointegration test of Johansen (1988) and Johansen- Juselius (1990) based on the maximum likelihood estimation procedure. In this test we look for the number of cointegration vectors present in the series. In this n variable case, the presence of at least one cointegrating vector is sufficient to establish the existence of cointegration among the variables. The twin statistics of trace and maximum eigenvalue are used to

determine the number of cointegration vectors.

The results are reported in table 3 below.

Table 3. Cointgration test between money demand and its explanatory variables

Included observations: 24 after adjusting endpoints
Trend assumption: Linear deterministic trend
Series: M2 INFLATION GDP INTERESTRATE EXCHANGERATE
Lags interval (in first differences): 1 to 1
Unrestricted Cointegration Rank Test

1 Percent	5 Percent	Trace		Hypothesized
Critical Value	Critical Value	Statistic	Eigenvalue	No. of CE(s)
76.07	68.52	122.6611	0.942545	None **
54.46	47.21	54.09896	0.771935	At most 1 *
35.65	29.68	18.62395	0.395894	At most 2
20.04	15.41	6.527812	0.182033	At most 3
6.65	3.76	1.705408	0.068593	At most 4

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 2 cointegrating equation(s) at the 5% level
Trace test indicates 1 cointegrating equation(s) at the 1% level

1 Percent	5 Percent	Max-Eigen		Hypothesized
Critical Value	Critical Value	Statistic	Eigenvalue	No. of CE(s)
38.77	33.46	68.56216	0.942545	None **
32.24	27.07	35.47501	0.771935	At most 1 **
25.52	20.97	12.09614	0.395894	At most 2
18.63	14.07	4.822404	0.182033	At most 3
6.65	3.76	1.705408	0.068593	At most 4

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Max-eigenvalue test indicates 2 cointegrating equation(s) at both 5% and 1% levels

The test for cointegration between money demand and its explanatory variables, namely real GDP, the interest rate, exchange rate and inflation in the kingdom of Saudi Arabia and for the period 1987-2009 shows that cointegration in fact exists between the variables of the model with two cointegration vectors available at the 5 percent level of significance based on the trace test and one cointegration vector at the 1 percent level of significance. As for the maximum eigenvalue test, it indicates the existence of two cointegration vectors at both the 5 percent and 1 percent level of significance. Consequently it is possible to estimate the equilibrium long run relationship between money demand and its explanatory variables and employ vector error correction in estimating short run relationship.

4.3 Granger Causality

Having established cointegration between the variables, causality between the variables is tested for using the Granger (1987) causality test. Engel-Granger show that if a cointegration relation exists between the model variables, this implies that they are also causally related unidirectionally or bidirectionally. Different lags will be used to determine the direction of causality to and from money demand since some of the variables may not affect money demand instantaneously but their effect may show after a certain amount of time. The results of the causality tests are shown in tables (4), (5) and (6) below.

Table 4. One lag causality test results

Causality direction	F-Statistic	Probability
M2 ➔ INFLATION	5.46423	0.02738
GDP➔ M2	6.73392	0.01535
M2➔ Interest rate	4.43393	0.04687
Exchange rate➔ Inflation	4.63111	0.04086
Inflation ➔ Exchange rate	8.79088	0.00641
GDP ➔ Interest rate	4.77001	0.03991

Table 5. Two lags causality test results

Causality direction	F-Statistic	Probability
M2➔ Interest rate	5.09674	0.01690
GDP ➔ Interest rate	5.09723	0.01690
Exchange rate➔ GDP	3.65611	0.04181
Interest rate ➔ Exchange rate	4.92123	0.01896

Table 6. Three lags causality test results

Causality direction	F-Statistic	Probability
Interest rate ➔ M2	3.47529	0.04089

The results show that real. GDP affects the demand for money and the interest rate with a lag of one period (i. e one year), whereas money demand affects inflation and interest rate in the following year but the effect on the interest rate is carried over to the third year before a counter-effect ensues in the fourth year from the interest rate to money demand. There is also a unidirectional effect from the exchange rate to real GDP. There is also a bidirectional effect between inflation and the real exchange rate with a one period lag.

5. Vector Error Correction Model (VECM) Results

On estimating the research model using vector error correction with first difference and a log of two periods, the researcher obtained the results for the long run and short run relationships between the demand for money and its explanatory variables as indicated in the following equation: (These results are also shown in table (7) portrayed at the end of this section)

D(M2) = -0.53*(M2(-1) + 16.33*INFLATION(-1) + 0.096*GDP(-1) + 30.34*INTERESTRATE(-1) - 1.72*EXCHANGERATE(-1) - 396.14) + 2.11*D(M2(-1)) + 1.92*D(M2(-2)) + 4.26*D(INFLATION(-1)) - 1.49*D(INFLATION(-2)) + 0.144*D(GDP(-1)) + 0.04*D(GDP(-2)) + 1.436374307*D(INTERESTRATE(-1)) + 23.06*D(INTERESTRATE(-2)) + 0.65*D(EXCHANGERATE(-1)) + 0.83*D(EXCHANGERATE(-2)) - 86.59

In analyzing the results, we first point out that the error correction coefficient was about 0.53, with a negative sign and statistically significant. This means that the disparity between the value of money demand in period (t-1) and its long run equilibrium value is corrected by as much as 53 percent. This means that the deviation of money demand from long run value is corrected in about a year and nine monthes. Further, there is a statistically significant long run relationship between money demand and each of the interest rate, inflation rate and the exchange rate but the relation between money demand and real GDP is not significant statistically.

There is also a statistically significant long run relation between the inflation rate and money demand such that a rise of inflation by 1 percent results in an increase in money demand by 16.33 percent, whereas in the short run results show a positive and significant relation between money demand and inflation in the following year only such that a rise in inflation by 1 percent increases money demand in the following year by 4.26 percent. There is also no statistically significant long run relation between GDP and money demand in the kingdom of Saudi Arabia. As for the short run, results indicate that there is a statistically significant relationship between the two variables in the following year only such that an increase in GDP by 1 percent increases money demand in the following year by 0.14 percent. The interest rate is apparently a very important determinant of Saudi money demand both in the short and long runs with an increase in interest rate by 1 percent in the long run resulting in a rise of 30.34 percent in money demand. In the short run an increase of 1 percent in the interest rate leads to an increase of 23.06 in money demand in two year's time.

As for the relation between the real exchange rate and the money demand function, it showed a negative long run relationship in which a rise in the real exchange rate (a depreciation of the riyal) by 1 percent reduces the demand for money in the long run by 17% But the short run in contrast shows a positive statistically significant relation between the real exchange rate and money demand where an increase by 1 percent in real exchange rate in the short run leads to an increase in money demand by 0.83 percent after two years.

There is also a statistically significant relation between money demand in any single year and the following couple of years such that an increase in money demand by 1 percent in a certain year increases money demand in the following two years by 2.11 and 1.92 percent respectively.

Lastly, the coefficient of determination is 97 percent which means that the explanatory variables (real GDP, the

interest rate, the real exchange rate, the inflation rate) account for 97 percent of the variation in money demand the remainder (3 percent) is due to factors not included in the model.

Table 7. Results of the vector error correction model (VECM)

Vector Error Correction Estimates
Sample(adjusted): 1987 2009
Included observations: 23 after adjusting endpoints
Standard errors in ( ) & t-statistics in [ ]

				CointEq1	Cointegrating Eq:
				1.000000	M2(-1)
				16.33043	INFLATION(-1)
				(1.86210)	
				[8.76988]	
				0.096374	GDP(-1)
				(0.06080)	
				[1.58520]	
				30.34201	INTERESTRATE(-1)
				(3.70493)	
				[8.18964]	
				-1.720920	EXCHANGERATE(-1)
				(0.57819)	
				[-2.97638]	
				-396.1432	C
D(EXCHANGERATE)	D(INTERESTRATE)	D(GDP)	D(INFLATION)	D(M2)	Error Correction:
0.100636	-0.013744	-3.876082	-0.016614	-0.534779	CointEq1
(0.05160)	(0.01160)	(0.77736)	(0.02401)	(0.10507)	
[1.95041]	[-1.18430]	[-4.98618]	[-0.69210]	[-5.08965]	
-0.342162	0.057398	14.97498	0.068830	2.117969	D(M2(-1))
(0.18433)	(0.04146)	(2.77717)	(0.08576)	(0.37537)	
[-1.85620]	[1.38445]	[5.39218]	[0.80259]	[5.64230]	
-0.228176	0.033417	9.051918	0.076852	1.921435	D(M2(-2))
(0.16439)	(0.03697)	(2.47664)	(0.07648)	(0.33475)	
[-1.38804]	[0.90384]	[3.65491]	[1.00487]	[5.73985]	
-1.907760	-0.133830	23.39226	-0.332957	4.267811	D(INFLATION(-1))
(0.91700)	(0.20624)	(13.8155)	(0.42663)	(1.86736)	
[-2.08043]	[-0.64889]	[1.69319]	[-0.78044]	[2.28548]	
-0.250414	-0.160072	3.132356	-0.014603	-1.491797	D(INFLATION(-2))
(0.71322)	(0.16041)	(10.7454)	(0.33182)	(1.45239)	
[-0.35110]	[-0.99788]	[0.29151]	[-0.04401]	[-1.02713]	
0.006036	0.003051	0.424753	-0.011651	0.144513	D(GDP(-1))
(0.02711)	(0.00610)	(0.40837)	(0.01261)	(0.05520)	
[0.22270]	[0.50052]	[1.04011]	[-0.92387]	[2.61812]	
-0.002952	-0.007394	-0.803459	-0.001444	0.040613	D(GDP(-2))
(0.03186)	(0.00717)	(0.48004)	(0.01482)	(0.06488)	
[-0.09264]	[-1.03175]	[-1.67373]	[-0.09744]	[0.62593]	
-0.649116	0.456498	27.92451	0.715490	1.436374	D(INTERESTRATE(-1))
(1.08392)	(0.24379)	(16.3303)	(0.50428)	(2.20727)	
[-0.59886]	[1.87253]	[1.70999]	[1.41882]	[0.65075]	
-1.888574	0.196935	148.1269	0.797685	23.06340	D(INTERESTRATE(-2))
(2.19241)	(0.49310)	(33.0306)	(1.02000)	(4.46456)	
[-0.86142]	[0.39938]	[4.48453]	[0.78205]	[5.16588]	
0.159994	0.057765	7.791149	-0.031360	0.656073	D(EXCHANGERATE(-1))
(0.16938)	(0.03810)	(2.55185)	(0.07880)	(0.34492)	
[0.94459]	[1.51632]	[3.05314]	[-0.39796]	[1.90211]	
-0.197513	-0.027858	4.623349	0.011095	0.831701	D(EXCHANGERATE(-2))
(0.14029)	(0.03155)	(2.11356)	(0.06527)	(0.28568)	

[-1.40791]	[-0.88290]	[2.18747]	[0.16999]	[2.91132]	
15.26136	-2.649367	-611.4255	-2.921066	-86.59473	C
(8.94207)	(2.01117)	(134.720)	(4.16021)	(18.2094)	
[1.70669]	[-1.31732]	[-4.53848]	[-0.70214]	[-4.75550]	
0.729577	0.593896	0.813194	0.530179	**0.970808**	R-squared
0.459153	0.187791	0.626387	0.060359	**0.941616**	Adj. R-squared
301.3430	15.24349	68399.38	65.22515	1249.614	Sum sq. resids
5.234006	1.177188	78.85509	2.435069	10.65839	S.E. equation
2.697906	1.462421	4.353134	1.128472	33.25603	F-statistic
-62.22227	-27.90516	-124.6083	-44.62262	-78.57919	Log likelihood
6.454110	3.470014	11.87898	4.923706	7.876451	Akaike AIC
7.046542	4.062446	12.47141	5.516138	8.468883	Schwarz SC
-2.840000	-0.298652	47.26522	0.359565	38.19130	Mean dependent
7.117003	1.306207	129.0086	2.512061	44.11082	S.D. dependent
			39979957	Determinant Residual Covariance	
			-322.0607	Log Likelihood	
			-364.4727	Log Likelihood (d.f. adjusted)	
			37.34545	Akaike Information Criteria	
			40.55445	Schwarz Criteria	

6. Conclusion

This study sought to investigate the cointegrating property of money demand in Saudi Arabia using annual data for the period 1987-2009 and the vector error correction model (VECM) technique. The results of the study indicate clearly that a long run cointegration relation in fact exists between the demand for money (M_2) and its explanatory variables, namely real GDP, the interest rate, the real exchange rate and the inflation rate. By using the (VECM) approach to estimate the long run relationship between money demand and its arguments, the long run relationships as well as the short run dynamics of the model were uncovered with the error correction coefficient found to be statistically significant and with a negative sign as expected. Granger causality tests show among other things that money demand affects inflation and interest rate in the following year but the effect on the interest rate is carried over to third year but a counter effect ensues in the fourth year from interest to money demand. There is also a bidirectional shown between inflation and the exchange rate with a lag of one period, a result which indicates that the real exchange rate has been one the sources of inflation in Saudi Arabia .

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When Risks and Market Inefficiency Shake Hands – An Empirical Analysis of Financial CDS

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Abstract

This paper examines the relation between absolute CDS premium and the market efficiency of financial institutions. We test the random-walk hypothesis on 3-years CDS data set using: Q-statistics portmanteau tests by Box and Pierce, variance ratio tests by Lo and MacKinlay, variance ratio tests using ranks and signs by Wright, and wild bootstrapping variance ratio tests by Kim. We find that CDSs with the highest means and the highest standard deviations tend to fail the random-walk hypothesis. These CDSs have the highest potential to trade in an inefficient market with the highst potential for speculation and market manipulation (i.e. by hedge funds). This inefficiency negates the original function of hedging. To reconstitute the function of hedging and to overcome a CDS market that is driven by speculation our research concludes that it is necessary to adopt further regulations for the CDS market.

Keywords: Credit Default Swaps, credit derivatives, market efficiency, random-walk-hypothesis

1. Introduction

Credit Default Swaps (CDS) are the most common credit derivatives and the most important risk management tools for credit risks. CDSs allow investors to insure their portfolios against pre-defined credit events. The functionality is as follows: The protection buyer makes periodic payments (in the amount of the CDS spread) and the protection seller offers to compensate the protection buyer (also periodically) if a pre-defined credit event occurs. If no credit event occurs, the CDS contract terminates without any compensation payments. The market for credit derivatives is a global, over-the-counter financial market which started in the mid-1990s and is dominated by banks, insurers, reinsurers, hedge funds, investment funds and large non-financial companies. Furthermore it is a transparent market where every market participant has the possibility to get all necessary information via information systems (e.g. Bloomberg). Most contracts are regulated by the International Swaps and Derivatives Association (ISDA). Therefore, it is to be expected that the CDS market should be an efficient market in the definition of Fama. The market reached its peak, according to the International Swaps and Derivatives Association (ISDA (2010)), right before the beginning of the financial crisis at the end of 2007 with a notional value around 62.2 Trillion USD. That value has declined continuously since the outbreak of the financial crisis. The latest estimates by the ISDA (2010) are for a notional value up to 26.3 trillion USD in 2010. Nevertheless CDS still represent a relevant factor within the financial market: (i) CDS spreads became an economic indicator for corporate credit liability. Therefore CDS spreads have a direct impact on corporate debt ratings and credit rates. (ii) For countries, CDS became the most important factor for the emission price of bonds. Corporate credit liability and sovereign debt prices play a large role in the economy. Thus, CDS spreads greatly influence our economic welfare. In this analysis we concentrate our research on CDS for banks. Investors pay credit spreads to protect them against the risk of default by the bank. In 2011/2012 CDS spreads for banks are at historic highs. This is due to the fear of contagion of the European debt crisis, disappointing earnings trends, expectations of rating downgrades and unsettling comments by politicians and international institutions. The collapse of Lehman Brothers has caused the CDS markets to become a target for speculators. The near collapse of Greece has further increased speculation. For investors hedging portfolios with CDS it is important to know if the increase in speculative activity affects market efficiency. Therefore our essay focuses on the problem of weak-form market efficiency of CDS markets. We check market efficiency by using the random-walk

hypothesis. The data we use in our research is 3-years of daily and weekly CDSs on 30 international banks. We test the random-walk hypothesis by using the latest test statistics (Box & Pierce Q-statistics, variance ratio tests by Lo and MacKinlay, variance ratio tests using ranks and signs by Wright and wild bootstrapping variance ratio tests by Kim). The main interest of our research is the relation between CDS premiums and market efficiency. We support our findings with the use of the scoring model framework.

2. Literature Review

In general, contemporary research of the CDS market consists of 2 different streams: informational efficiency in the CDS market and regulatory issues of CDS as a financial instrument. There is no research analyzing the random-walk hypothesis of CDS markets.

On the first stream, one of the findings in the empirical research of Ancharya and Johnson (2007) concluded that there is an information flow from the CDS market to the equity markets. The analysis of Jenkins et al. (2011) verified the informational efficiency of the CDS market. This is shown by the relationship between movements in subsequent CDS prices and previously announced accounting information. Hull et al. (2004) and Norden and Weber (2004) analyzed the response of stock and CDS markets to rating announcements. The empirical findings of Norden and Weber (2004) showed that the CDS and stock market anticipate rating downgrades. Anticipation starts approximately 60-90 days before the announcement day. Further findings came to the conclusion that stock and CDS markets also reviews for downgrade, and that the CDS market tends to react more quickly. Callen et al. (2009) evaluated the impact of earnings on credit risks in the CDS market. They found that a 1% increase in earnings reduces the CDS premium by 5% to 9%. Zhang (2009) showed the plausibility of the existence of informational efficiency by testing CDS prices on a variety of credit events. Furthermore his analysis showed that CDSs in comparison to stocks have more frequent large price changes. Within an empirical analysis Blanco et al. (2005) tested the theoretical equivalence of CDS prices and Investment-Grade bonds. Their results showed that first CDS prices are substantially higher than credit spreads and second the CDS market lead the bond market in the price discovery process for credit risks. Coudert and Gex (2010) analyzed the link between CDSs and bonds. They came to the conclusion that the CDS market (for corporations) leads the bond market in the price discovery process. Zhu (2006) identified that in the short run the derivatives market moves ahead of the bond market in price discovery, while in the long run credit risks are equally priced. These results imply that the CDS market needs less time to process new information.

On the second stream, Avellanda and Cont (2010) first gave an overview of existing forms of transparency in CDS markets. Second, in speaking about the importance of evaluating costs and benefits they introduced further possibilities of increasing transparency for CDSs. Duquerroy et al. (2009) showed an overview of the CDS market and pointed out challenges for regulators to improve transparency. Cont (2010) disclosed the impact of CDSs on financial stability. She argued that an unregulated market opens the possibility of contagion (especially in the case of counterparty risk) and systematic risks. Further she introduced central clearing as a method to reduce counterparty risks.

3. Data and Methodology

3.1 Data

Our CDS data collection consists of a set of CDS spreads of international banks provided by Bloomberg. Because CDSs are traded in the OTC market, mainly in London and New York, gaps in the data collection are unavoidable. CDS prices delivered by Bloomberg are intraday prices averaged to one daily price that represents the arithmetic mean of prices received by the agency during the previous 24 hours. We adjusted the data sample for weekends and public holidays. We considered daily observations on 3-year CDS spreads from December 14th 2007 to August 22nd 2011 for the analysis. As the data set spans the period of nearly 4 years our data has an adequate sample period to gain statistically valid evidence to address our problem statement. Every CDS spread that gets used in our sample must meet the following 2 filter criteria: (i) the observed entity has to be a system-relevant bank in its country; (ii) the entity provides a reasonable number of observations (minimum 250), as the number of observations is especially important to achieve significance in the accomplished statistical tests. The filtering yields us 30 entities (22 European banks, 6 American banks and 2 Asian-Pacific banks) and 26236 observations on CDS spreads. Additionally, in order to strengthen the comparability, we build out of the data of the daily observations a data set of weekly observations which still consists of 5373 observations. To get a better impression and for preparing the data for the test statistics we make use of descriptive statistics. Table 1 summarizes daily observations on the logarithm data set of the CDS spreads. Table 2 does the same for weekly observations. As for the necessary test statistic, we test the sample set for normality using Kolmogorov-Smirnov and Jarque-Bera test. We strongly reject the normality assumption for both the daily and weekly data set.

Table 1. Descriptive statistics (daily)

	Bank of America	Barclays	BayernLB	BNP	Citigroup	Commerzbank	Credit Mutual	Credit Suisse	Deutsche Bank	Erste Bank
Mean	0,002529214	0,002101716	0,001440076	0,002493941	0,0014678	0,002260265	0,000213446	0,001489854	0,001762979	0,000766301
Median	0	0	0	0	0	0	0	0	0	0
Maximum	130,8546936	104,4972341	101,9509725	66,68574194	189,5755951	89,0086553	82,85414602	88,59916585	85,01785195	165,0807336
Minimum	-0,476924072	-0,387116042	-0,267338082	-0,347401307	-0,819920497	-0,312374648	-0,255350435	-0,387115969	-0,420001423	-0,473287704
Std. Dev.	0,069149661	0,06476644	0,044569388	0,068371301	0,075981284	0,06659043	0,030826097	0,063548292	0,065789446	0,0423009
Skewness	0,1219924	-0,412609	0,999305	-0,218194	-1,487039	0,7046877	3,485156	-0,2703211	-0,01278158	-0,06530696
Kurtosis	11,65283	6,258725	17,98842	3,871748	31,20216	10,08363	82,71571	8,288042	7,101699	39,31944
Kolmogorov-Smirnov	0,4273	0,4279	0,4429	0,4246	0,4326	0,426	0,4613	0,4288	0,427	0,4522
Probability	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16
Jarque-Bera	5298,074	1554,253	12775,53	592,0539	38314,38	4042,972	177142,6	2690,374	1966,957	45865,73
Probability	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16
Observations	936	936	936	936	936	936	617	936	936	712

	Goldman Sachs	HSBC	HSH	ING	JP Morgan	LBBW	LBHT	Macquarie	Merill Lynch	Morgan Stanley
Mean	0,001357774	0,001249372	0,001014051	0,001766561	0,001166712	0,001726046	0,000573336	3,60072E-05	0,001165887	0,00126043
Median	0	0	0	0	0	0	0	0	0	0
Maximum	148,618876	66,29828239	192,5398728	86,18421978	76,82485471	117,2708306	108,8114504	226,7099471	195,9603947	218,9469781
Minimum	-0,825447583	-0,328504067	-0,312984255	-0,371563556	-0,586529579	-0,672093771	-0,484323683	-1,488077055	-0,775211761	-1,143357132
Std. Dev.	0,070618665	0,05649592	0,04162417	0,059311795	0,073335649	0,050338856	0,037080798	0,078489125	0,065584943	0,073468307
Skewness	-0,1779251	0,4209303	-0,2363533	-0,1177319	-0,2412468	-0,4994438	0,1300032	-7,223284	-1,078299	-3,021617
Kurtosis	36,43218	12,67751	12,04204	7,957335	13,04762	64,75417	63,83512	155,3044	28,75652	77,59216
Kolmogorov-Smirnov	0,4331	0,4358	0,4389	0,4301	0,4251	0,4461	0,4525	0,44	0,4335	0,4402
Probability	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16
Jarque-Bera	51769,77	6295,691	5664,129	2471,61	6648,455	141550,9	137530,9	896087	32431,94	236225,5
Probability	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16
Observations	936	936	936	936	936	810	810	884	936	936

	Natixis	Nomura	NordLB	Rabobank	RBS	Santander	Societe General	UBS	Unicredit	WestLB
Mean	0,001025494	0,000846824	0,001711558	0,00140459	0,001136529	0,002425742	0,002744081	0,001674382	0,001930772	0,001674264
Median	0	0	0	0	0	0	0	0	0	0
Maximum	175,9085715	153,2917766	104,2941655	68,71455753	140,9852086	122,351839	91,13524029	110,2081566	85,44125753	128,4422633
Minimum	-0,409784769	-0,315081047	-0,472253349	-0,496814887	-0,546968287	-0,440654556	-0,427894957	-0,414433778	-0,174807485	-0,336472237
Std. Dev.	0,04955574	0,04706296	0,048378066	0,060118647	0,065110181	0,066838553	0,06210175	0,061585957	0,040438355	0,054220621
Skewness	0,9370441	0,4235043	0,9162107	-0,8851651	0,6236538	-0,3587463	0,1256015	0,5745485	0,388656	1,58052
Kurtosis	35,82997	12,98046	31,82812	11,97985	33,96301	6,651318	5,22655	17,04353	5,983109	20,98675
Kolmogorov-Smirnov	0,4418	0,4364	0,4398	0,4288	0,4381	0,4242	0,4306	0,4312	0,4491	0,4358
Probability	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16
Jarque-Bera	43714,52	6176,155	34303,07	5719,386	42544,05	1745,438	1067,817	11380,29	451,9891	17567
Probability	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16
Observations	815	876	810	936	884	936	936	936	298	936

Table 2. Descriptive statistics (weekly)

	Bank of America	Barclays	BayernLB	BNP	Citigroup	Commerzbank	Credit Mutual	Credit Suisse	Deutsche Bank	Erste Bank
Mean	0,010944743	0,015813539	0,003287209	0,014044116	0,011562085	0,006876808	0,000914789	0,008302769	0,011087497	0,001519884
Median	0,013927933	0,026547407	0	0,013832011	0,012647394	0,003669158	0	0,010510174	0,010696271	0
Maximum	0,416514944	0,597660753	0,300648261	0,530749654	0,879745215	0,468725293	0,435573995	0,489014327	0,539276104	0,435318071
Minimum	-0,534520035	-0,4283046	-0,312434439	-0,570544858	-0,694757354	-0,508497334	-0,255248924	-0,487547939	-0,526093096	-0,521296924
Std. Dev.	0,141552675	0,135374283	0,080598074	0,146991121	0,15864929	0,135489964	0,061271565	0,126570927	0,140690419	0,097985232
Skewness	-0,4165143	0,1802407	-0,5734668	-0,05550764	0,2298433	-0,2737894	1,961857	-0,2981317	-0,1788083	-0,0427315
Kurtosis	1,873618	2,271332	3,192385	1,554018	6,599131	2,389623	22,83348	2,393754	1,825576	7,551322
Kolmogorov-Smirnov	0,376	0,3869	0,4265	0,3739	0,3731	0,3908	0,4374	0,3906	0,3783	0,4242
Probability	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16
Jarque-Bera	33,6351	42,3112	92,0542	19,4184	350,0787	48,0811	2818,006	4,87E+01	27,6849	344,5549
Probability	4,97E-08	6,49E-10	< 2.2E-16	6,07E-05	< 2.2E-16	3,63E-11	< 2.2E-16	2,68E-11	9,73E-07	< 2.2E-16
Observations	192	192	192	192	192	192	126	192	192	145

	Goldman Sachs	HSBC	HSH	ING	JP Morgan	LBBW	LBHT	Macquarie	Merill Lynch	Morgan Stanley
Mean	0,005645198	0,006365493	0,005353957	0,012626222	0,008707367	0,002656534	0,0001153	0,00265508	0,008111803	0,00801411
Median	0,009678454	8,10929E-05	0	0,013889476	0,000388939	0	0	0	1,67055E-06	0,007549954
Maximum	0,588157556	0,44857077	0,227997054	0,386636082	0,521284373	0,251314428	0,384738978	0,732678019	0,44510429	0,790040001
Minimum	-0,654822066	-0,529402009	-0,259323208	-0,478395287	-0,533898971	-0,672093771	-0,484323683	-1,32985305	-0,749236275	-0,882630869
Std. Dev.	0,137045785	0,115959332	0,070003109	0,123022403	0,150440513	0,081385585	0,077310067	0,1689237	0,139149837	0,147956834
Skewness	-0,4247358	-0,6209675	-0,1261076	-0,6997216	0,000926049	-3,206158	-0,2668123	-2,457785	-0,6628314	0,007841373
Kurtosis	4,273315	4,234022	2,246398	2,509119	2,050676	28,51705	14,55241	24,67095	4,748157	12,18515
Kolmogorov-Smirnov	0,3794	0,4024	0,4189	0,3876	0,3703	0,4309	0,4273	0,3941	0,3741	0,3829
Probability	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16
Jarque-Bera	151,8626	155,7548	40,8793	66,033	33,6449	5873,585	1457,894	4772,507	194,419	1187,826
Probability	< 2.2E-16	< 2.2E-16	1,33E-09	4,55E-15	4,94E-08	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16
Observations	192	192	192	192	192	165	165	181	192	192

	Natixis	Nomura	NordLB	Rabobank	RBS	Santander	Societe General	UBS	Unicredit	WestLB
Mean	0,003473429	0,000451241	0,005391955	0,007141626	0,011113105	0,014604382	0,016426955	0,01032811	0,004156152	0,011285155
Median	0	0,062557972	0	0,016297805	0,009478744	0,002131724	0,012412506	0,008700503	0	3,71181E-05
Maximum	0,274901444	0,39111766	0,472253349	0,394024503	0,626455806	0,515938456	0,602569118	0,35829964	0,307606695	0,54690168
Minimum	-0,487836106	-0,478035801	-0,472253349	-0,523248144	-0,626455806	-0,474312926	-0,474665642	-0,627300615	-0,228080725	-0,63111179
Std. Dev.	0,099103765	0,092915831	0,083722091	0,133215985	0,126907085	0,144985655	0,137246006	0,133412585	0,093795719	0,117309987
Skewness	-0,9427466	-0,1008396	0,3009053	-0,8535683	-0,4671648	0,06538897	0,2639506	-0,9029849	0,419681	-0,6123122
Kurtosis	4,425717	5,777642	12,31166	2,703386	7,566127	1,929067	2,591628	4,331597	0,9684752	7,011917
Kolmogorov-Smirnov	0,3975	0,4169	0,4246	0,3846	0,3937	0,3729	0,3915	0,3924	0,4197	0,3954
Probability	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	1,32E-09	< 2.2E-16
Jarque-Bera	160,0659	249,2711	1044,582	81,7809	438,316	29,9072	55,9617	176,1941	4,1062	405,3335
Probability	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	< 2.2E-16	3,20E-07	7,05E-13	< 2.2E-16	0,1283	< 2.2E-16
Observations	166	179	165	192	181	192	192	192	60	192

3.2 The Random-Walk Hypothesis

Fama (1970) defined an efficient market as one in which prices reflect all available information. In this case the prices reflect even hidden or insider information. If there is no additional data for the investors available, nobody has the ability to take advantage on the market in predicting prices. The market tends to have a semi-strong efficiency if prices already reflected all public information i.e. companies' annual reports. The weak-form market efficiency refers to the predictability in time series of prices on the basis of past information. Samuelson (1965) demonstrated that the price-generating process of a weak-form efficient market should only be affected by the arrival of new information. New information is assumed to appear at random, so prices should follow a random-walk. Price changes are not dependent on each other. A simple random-walk process can be defined as:

$$P_t = P_{t-1} + u_t \tag{1}$$

where

P_t = Price at time t

u_t = error term for time t

As Campbell et al. (1997) stated, there are three different versions of the random-walk hypothesis, each of them being slightly more stringent. The strongest assumption implies that all error terms u_t are independent and identically distributed (i.i.d.):

$$u_t \sim \text{IID}(0, \sigma^2) \tag{2}$$

This assumption implies that absolutely no information on price changes can be obtained from the past. We applied homoscedastic variance ratio tests by Lo and MacKinlay and nonparametric variance ratio tests based on ranks by Wright to test the strong version of random-walk hypothesis.

The semi-strong form implies that the distribution of the arrival of news can change over time, but it is still independent:

$$u_t \sim \text{indep}(0, \sigma^2) \tag{3}$$

This form is very difficult to test because every single might come from a totally different distribution. We did not test the semi-strong version of the random-walk hypothesis.

The weak form is based on the correlation of the error terms and implies:

$$\text{cov}(u_t, u_{t-k}) = 0 \tag{4}$$

This version is especially important, as heteroscedasticity may be a reason for rejecting the strong version of the random-walk hypothesis.

We applied Q-statistics portmanteau tests, heteroscedastic variance ratio tests by Lo and MacKinlay, nonparametric variance ratio tests based on signs by Wright and wild bootstrapping variance ratio tests by Kim to test the weak version of the random-walk hypothesis.

3.3 Box-Pierce Q-Statistics

The Q-statistics portmanteau test developed by Box and Pierce (1970) is a possible method for testing a time series for white noise, an uncorrelated sequence of errors, which is also a definition for a weak-form random-walk. We used the relative future price change as a sequence for the sample basis. The Box-Pierce Q-Statistics are calculated as a linear operation of various squared autocorrelations with different time lags, all weighted equally. It can be defined as:

$$Q_m = n \sum_{k=1}^{m} r_k^{\,2} \tag{5}$$

where

Q_m = Box-Pierce Q-statistic for *m* time lags

m = number of coefficients

n = number of observations

r_k = autocorrelation coefficient for time lag *k*

To test the validity of the random-walk hypothesis, the Q-statistic is computed for various values of *m*. For large sample sizes *n*, Campbell et al. (1997) showed that the sample autocorrelation coefficients are asymptotically independent and normally distributed.

$$\sqrt{n}r_k \sim \mathrm{N}(0,1) \tag{6}$$

Thus if the price change series is Gaussian distributed, then the Q-statistic is distributed like the sum of squares of *m* Gaussian random variables. So this statistic is asymptotically distributed as the chi-square distribution with *m* degrees of freedom.

The null hypothesis can be defined as:

$$H_0 : Q_m \sim \chi_m^{\,2} \tag{7}$$

Q-statistics points out any deviation from the null hypothesis of no autocorrelation in any direction, and at all considered time lags depending on the value of *m*. The selection of *m* is critical for the statistical power of the test, as too small values of *m* would disregard possible higher order autocorrelation, and too high values of *m* would reduce statistical significance. We tried to avoid this problem by calculating all Q-statistics for *m* = 1 to *m* = 10, for both daily and weekly observations.

3.4 Variance Ratio Tests by Lo and MacKinlay

The variance ratio tests by Lo and MacKinlay (1988) were first proposed to test for a random-walk in case of homoscedasticity and later extended to the more general case of an uncorrelated random-walk in case of heteroscedasticity. This test utilises data sampled at various frequencies. Lo and MacKinlay (1989) demonstrated that variance ratio tests are statistically more powerful than the Box-Pierce Q-statistics. As an important property of a random-walk, the variance of its increments is linear in the observed period. Specifically, the variance estimated from the q-periods returns should be *q* times as large as the variance estimated from one-period returns, or:

$$\frac{Var\left(r^{q}{}_{t}\right)}{Var\left(r_t\right)} = q \tag{8}$$

where

$r^{q}{}_{t}$ = Returns of a sample *t* for a the period with a length of *q*

r_t = Returns of a sample *t* with one-period length

The variance ratio *VR(q)* can be defined as:

$$VR(q) = \frac{Var\left(r_t^{\,q}\right)}{qVar\left(r_t\right)} \tag{9}$$

The null hypothesis is therefore:

$$H_0 : VR(q) = 1 \tag{10}$$

Lo and MacKinlay derived asymptotic standard normal test statistics for their variance ratios. We used two different test statistics: *z(q)* in case of homoscedasticity, and *z*(q)* in case of heteroscedasticity. The first statistic *z(q)* assumes an i.i.d. error term. The standard normal *z(q)* test statistic can be computed as:

$$z(q) = \frac{VR(q)-1}{\sqrt{\phi(q)}} \approx N(0,1) \tag{11}$$

where

$$\phi(q) = \frac{2(2q-1)(q-1)}{3q(nq)} \tag{12}$$

The heteroscedastic test statistic *z*(q)* allowed us to relax the requirements of i.i.d. increments. Despite the presence of heteroscedasticity, the test statistic *z*(q)* is still asymptotically standard normal in case of a random-walk. It can be defined as:

$$z^*(q) = \frac{VR(q)-1}{\sqrt{\phi^*(q)}} \approx N(0,1) \tag{13}$$

where

$$\phi^*(q) = \sum_{j=1}^{q-1} \left[\frac{2(q-j)}{q} \right]^2 \hat{\delta}(j) \tag{14}$$

and

$$\hat{\delta}(j) = \frac{\sum_{k=j+1}^{nq} (P_k - P_{k-1} - \hat{\mu})^2 (P_{k-j} - P_{k-j-1} - \hat{\mu})^2}{\left[\sum_{k=1}^{nq} (P_k - P_{k-1} - \hat{\mu})^2 \right]^2} \tag{15}$$

where

$\hat{\mu}$ = Average return

We used both homoscedastic and heteroscedastic test statistics for aggregation values *q* of 2, 4, 8 and 16.

3.5 Variance Ratio Tests Using Ranks and Signs by Wright

Wright (2000) introduced alternative variance ratio tests based on ranks and signs. He showed that for some processes his nonparametric variance ratio tests are performing better in rejecting violations of the random-walk hypothesis than the tests recommended by Lo and MacKinlay. He explained the outperformance of ranks- and signs-based tests by the mention of two potential advantages. First, his tests often allow for computing the exact distribution. As it is not necessary to appeal to any asymptotic approximation, size distortions can be neglected. Second, if the sample data is highly nonnormal, tests based on ranks and signs may be more powerful than other variance ratio tests. Formally for the ranks-based tests, let $r(r_t)$ be the rank of the difference of the futures prices r_t among $r_1, r_2, ...r_t$. Then, r_{1t} and r_{2t} are the ranks of the futures price differences, defined as:

$$r_{1t} = \frac{\left(r\left(r_t - \frac{T+1}{2} \right) \right)}{\sqrt{\frac{(T-1)(T+1)}{12}}} \tag{16}$$

$$r_{2t} = \Phi^{-1}\left(\frac{r(r_t)}{T+1} \right) \tag{17}$$

where Φ^{-1} is the inverse of the standard normal cumulative distribution function.

The series r_{1t} is a simple linear transformation of the ranks, standardised to have a sample mean 0 and a sample variance 1. The series r_{2t}, known as the inverse normal or van der Warden score, has a sample mean 0 and a sample variance approximately equal to 1. The rank series r_{1t} and r_{2t} substitute the difference in futures prices $(P_t - P_{t-q})$ in the definition of the variance ratio test statistic by Lo and MacKinlay z(q) in equation (11), which is written as R_1 and R_2:

$$R_1 = \left(\frac{\frac{1}{Tq} \sum_{t=q+1}^{T} (r_{1t} + r_{1t-1} ... + r_{1t-q})}{\frac{1}{T} \sum_{t=1}^{T} r_{1t}^2} - 1 \right) * \frac{1}{\sqrt{\phi(q)}} \tag{18}$$

$$R_2 = \left(\frac{\frac{1}{Tq} \sum_{t=q+1}^{T} (r_{2t} + r_{2t-1} ... + r_{2t-q})}{\frac{1}{T} \sum_{t=1}^{T} r_{2t}^2} - 1 \right) * \frac{1}{\sqrt{\phi(q)}} \tag{19}$$

where $\phi(q)$ is defined in equation (12).

Wright (2000) demonstrated that under the assumption that the rank $r(r_t)$ is an unbiased, random permutation of the numbers $1,2,...,T$, the test statistics' distribution can be provided. So the exact sampling distribution of R_1 and R_2 may easily be simulated to an arbitrary degree of accuracy, for a given choice of T and q. Therefore, the distribution does not suffer from disturbance parameters and the test can be used to construct a test with exact power.

By using the signs of the differences instead of the ranks, it may be possible to apply a variance ratio test that is exact in case of conditional heteroscedasticity. Formally, for a time series r_t, let $u(r_t,k)=1(r_t>k)-0.5$. Thus $u(r_t,0)$ is 0.5 if r_t is positive and -0.5 otherwise. Let $s_t=2u(r_t,0)=2u(\varepsilon_t,0)$. Clearly, s_t is an i.i.d. series with zero mean and variance equal to one. Each s_t is equal to 1 with a probability 0.5 and is equal to -1 otherwise. The test statistic based on signs S_1 is given by:

$$S_1=\left(\frac{\frac{1}{Tq}\sum_{t=q+1}^{T}(s_t+s_{t-1}...+s_{t-q})^2}{\frac{1}{T}\sum_{t=1}^{T}s_t^2}-1\right)*\frac{1}{\sqrt{\phi(q)}} \tag{20}$$

In Monte Carlo experiments and empirical tests, Wright showed that this test could be exact and more powerful than other variance ratio tests under both homoscedastic and heteroscedastic conditions.

3.6 Wild Bootstrapping Variance Ratio Tests by Kim

Kim (2006) proposed variance ratio tests based on wild bootstrapping – a re-sampling method that approximates the sampling distribution of the test statistic. The main advantage of this finite sample test is the fact that it does not rely on asymptotic approximations. Therefore, it is robust to nonnormality. Wu (1986) and Mammen (1993) demonstrated that wild bootstrapping should be a natural choice in case of conditional and unconditional heteroscedasticity. The test is based on a Chow and Denning (1992) joint version of the Lo and MacKinlay test statistic $z^*(q)$, as provided in equation (13), selecting the maximum absolute value from a set of l test statistics. The test statistic can be written as:

$$MV(q_i)=\max_{1\le i\le l}\left|z^*(q_i)\right| \tag{21}$$

The wild bootstrap variance ratio test can be conducted in three stages, as below:

(i) Form a bootstrap sample of *T* observations $a_t^*=\eta_t a_t,(t=1,...T)$ where η_t is a random sequence with zero mean and unit variance; a normal distribution is used here.

(ii) Calculate $MV(q_i)$ using a_t^* from the bootstrap sample generated in stage (i)

(iii) Repeat stages (i) and (ii) *m* times, for example, 1.000 times in this paper, to form a bootstrap distribution of the test statistic $MV(q_i,j)_{j=1}^m$.

The bootstrap distribution $MV(q_i,j)_{j=1}^m$ is used to approximate the sampling distribution of $z^*(q)$ given in equation (13). The p-value of the test is calculated as the proportion of $MV(q_i,j)_{j=1}^m$ greater than the sample value of $z^*(q)$.

In Monte Carlo simulations, Kim demonstrated that wild bootstrapping variance ratio tests are powerful and robust alternatives for testing the random-walk hypothesis.

3.7 Scoring Model

For a classification and to strengthen our results of the test statistics we made use of scoring model framework. In the building process of the scoring model our criteria to be considered is the likelihood of the CDSs following a random-walk by using the findings of the statistical tests discussed previously. We grouped the daily and weekly data by mean and standard deviation into groups of 2, 3, 5, 6, 10, and 15 (by beginning with the highest value). Tables 3 and 4 give an overview of the mean and standard deviation by each CDS premium for daily and weekly observations on the whole sample period.

Table 3. 3-years-daily CDSs hierarchy criterion

	Bank of America	Barclays	BayernLB	BNP	Citigroup	Commerzbank	Credit Mutual	Credit Suisse	Deutsche Bank	Erste Bank
Mean	130,8546936	104,4972341	101,9509725	66,68574194	189,5755951	89,0086553	82,85414602	88,59916585	85,01785195	165,0807336
Std. Dev.	64,86629986	44,02737896	29,69461359	26,66804929	133,348233	35,90607546	16,74891693	43,15266456	30,04504635	79,88832072

	Goldman Sachs	HSBC	HSH	ING	JP Morgan	LBBW	LBHT	Macquarie	Merill Lynch	Morgan Stanley
Mean	148,618876	66,29828239	192,5398728	86,18421978	76,82485471	117,2708306	108,8114504	226,7099471	195,9603947	218,9469781
Std. Dev.	85,41383078	29,45933326	94,70740844	31,50860556	36,43257667	29,94748324	20,50043827	176,545263	103,0839325	171,2676201

	Natixis	Nomura	NordLB	Rabobank	RBS	Santander	Societe General	UBS	Unicredit	WestLB
Mean	175,9085715	153,2917766	104,2941655	68,71455753	140,9852086	122,351839	91,13524029	110,2081566	85,44125753	128,4422633
Std. Dev.	81,27748818	99,25397355	22,71577923	38,10027693	44,61844192	59,48669476	33,92455644	64,7211344	25,92535805	58,09428332

Table 4. 3-years-weekly CDSs hierarchy criterion

	Bank of America	Barclays	BayernLB	BNP	Citigroup	Commerzbank	Credit Mutual	Credit Suisse	Deutsche Bank	Erste Bank
Mean	132,2217719	105,4190835	102,0772871	67,40837711	190,6145455	89,45609371	83,35530977	89,10242552	85,51332242	165,4319069
Std. Dev.	68,14195276	45,08538812	30,42968009	28,25598777	134,2360244	36,97590313	16,87476937	43,59615161	30,56086868	80,59166713

	Goldman Sachs	HSBC	HSH	ING	JP Morgan	LBBW	LBHT	Macquarie	Merill Lynch	Morgan Stanley
Mean	150,0772936	66,39357474	193,3335187	86,82173067	77,42137036	117,8968777	109,0618349	230,2822219	199,0327564	223,2924291
Std. Dev.	87,2426391	29,67613537	95,81573007	32,61386464	36,78412901	30,58386337	20,4508095	189,6569151	106,582215	185,382174

	Natixis	Nomura	NordLB	Rabobank	RBS	Santander	Societe General	UBS	Unicredit	WestLB
Mean	176,830132	154,0756525	105,014608	69,01168366	141,8650048	123,2874973	92,18039675	110,7190797	87,26832258	129,9435249
Std. Dev.	82,05259876	99,82464572	24,0522336	38,53236169	45,79818507	60,9809604	37,05479549	65,04001555	29,63463782	60,11028041

To determine how well each group member m satisfies the criterion, we assigned a scoring paradigm r_{tmi} by alternative i for every statistical test t in terms of how well it satisfies the criterion. The scoring paradigm has the following structure:

7 Scores: 0% significance within the comprehensive survey

6 Scores: up to 100% significance in the first quarter and 0% significance in the other three quarters within the comprehensive survey

5 Scores: up to 50% significance in the first two quarters and 0% significance in the last 2 quarters within the comprehensive survey

4 Scores: up to 33.33% significance in the first three quarters and 0% significance in the last quarter within the comprehensive survey

3 Scores: up to 100 % significance in the first two quarters and 0% significance in the last two quarters within the comprehensive survey

2 Scores: up to 66.66% significance in the first three quarters and 0% significance in the last quarter within the comprehensive survey

1 Score: up to 100% significance in the first three quarters and 0% significance in the last quarter within the comprehensive survey

0 Scores: exceed 0 % significance in the last quarter within the comprehensive survey

In the next step we chose the relative importance of each statistical test by matching weights w_t. We assigned the Box-Pierce Q-Statistics the weight w=1, Variance Ratio Test by Lo and Mac Kinlay the weight w=1, Variance Ratio Test using Ranks and Signs by Wright the weight w=2 and Wild Bootstrapping Variance Ratio Tests by Kim the weight w=2.

In the following step we computed the aggregated score for each group member:

$$S_m = r_{tmi} w_t \tag{22}$$

In the final step we ranked every group by its achieved scores starting by the highest score result.

4. Results

4.1 Results from the Box-Pierce Q-Statistics

We used a chi-square distribution on 5 per cent level with m degrees of freedom to test the validity of the

random-walk null hypothesis of all 30 CDS for daily and weekly observations. We tested for the existence of autocorrelations by logarithmic means of Q-statistics within the limits of *m*=1 to 10.

For the daily observations only the CDS of Natixis shows no significance at the 5 per cent level, for all values of m. 9 CDS show a pattern of significances at the first lags (Erste Bank, Rabobank), or at the last lags (Credit Mutual, Credit Suisse, LBHT, Nomura) or at the beginning and at the end of the lags (HSBC, JP Morgan, Macquarie). Furthermore 20 CDS are significant at the 5 per cent level, for all values of m. The value of each CDS increases as m is raised for daily and weekly observations. There is a large difference in the autocorrelation values of Q-Statistics which ranges from 0.0165 (Credit Mutual, *m*=1) to 78.9984 (RBS, *m*=10).

For the weekly observations 9 CDS (Credit Mutual, Deutsche Bank, Erste Bank, Goldman Sachs, ING, LBBW, Merill Lynch, Natixis, Macquarie) show no significances at the 5 per cent level, for all values of *m*. This result conforms only to the daily findings of Natixis. 7 CDS (Barclays, BNP, Commerzbank, JP Morgan, Nomura, NordLB, Rabobank) can be identified to be significant at the 5 per cent level for all values of *m*. As a comparison only Barclays, BNP, Commerzbank and NordLB conform to the daily observations. Parallel to the findings above there are identified patterns within the remaining 14 CDS. These patterns can be found in no significance at the first lags, at the last lags or at the beginning and at the end of the lags.

As an intermediate result of the daily and weekly findings from the Box-Pierce Q-Statistics it can be ascertained that null hypothesis of a random-walk existing for all values of *m* is highly possible within the time series of the Natixis CDS.

4.2 Results from the Variance Ratio Tests by Lo and MacKinlay

The variance ratio tests by Lo and MacKinlay check for homoscedasticity and heteroscedasticity to test the existence of a random-walk within the CDS data basis. We compared the results of the Variance Ratio Test with the random-walk null hypothesis at a level of 5 %. For this purpose we made use of a two-sided standardized normal distribution. Furthermore test statistics used aggregation values of q = 2, 4, 8, and 16.

For the daily observations with low values only Credit Mutual, Credit Suisse, Macquarie and Natixis exhibit signs of a random-walk within their time series under homoscedasticity and heteroscedasticity at the significance of 5%. Further, 10 CDSs show no significance at the 5% level under heteroscedasticity at all aggregation levels. Bank of America, Barclays, BayernLB and Erste Bank are significant under homoscedasticity and heteroscedasticity at the aggregation level 2 and 4. Unicredit is significant under heteroscedasticity and homoscedasticity at the aggregation levels 2, 4 and 8. LBBW shows no existence of a random-walk under the assumption of homoscedastic at all aggregation levels. NordLB shows fully significance at all aggregate levels for both homoscedasticity and heteroscedasticity, providing no indication of a random-walk. The rest show differences in rejection and compliance to the random-walk hypothesis. There is a predominant diminishment of positive initial values between *q*=2 to *q*=16. Negative initial values don't change in a clear pattern from *q*=2 to *q*=16. The highest value of homoscedasticity is for Bank of America (5.0926851 at level 2) and the lowest for NordLB (-5.516824 at level 2). The highest value of heteroscedasticity is for Unicredit (3.270464 at level 4) and the lowest for NordLB (-3.371303 at level 2).

For the weekly observations 20 CDSs are not significantly homoscedastic or heteroscedastic at all aggregation levels. Out of these 20 CDSs only the CDSs of Credit Mutual, Credit Suisse and Macquarie confirm the findings of daily observations. Nomura is significantly homoscedastic at all aggregation levels. Within the daily observations only Nomura is significant on the level 8 and 16. Most of the remaining CDSs are significantly homoscedastic and heteroscedastic at the aggregation level of 2 and/or 4. There is a predominant advancement of negative initial values between the levels of 2 and 16. In comparison to the daily observations Nomura shows the highest value of homoscedasticity (3.275605 in level 4). But as in the daily observations NordLB has the lowest value in the weekly observations (-4.298436 in level 2) as well. The highest value of heteroscedesticity is for Nomura (2.765704 in level 4) and the lowest JP Morgan (-3.006155 in level 2).

As an intermediate result of the daily and weekly findings from the variance ratio tests by Lo and MacKinlay it can be pointed out that only Credit Mutual, Credit Suisse, and Macquarie exhibit no evidence of homo- and heteroscedasticity. Therefore, a random-walk is highly probable only for these 3 CDSs. The remaining 27 CDS likely do not follow a random-walk.

4.3 Results from the Variance Ratio Test Using Ranks and Signs by Wright

The variance ratio tests by Wright analyze the existing of a random-walk with ranks (*R1*, *R2*) under homoscedasticity and signs (*S1*) under heteroscedasticity. The results of the tests have to be transferred to value systems conceived by Wright. The range of numbers that belongs to each value system depends on the number of

observations and on the chosen quantile. To determine the existence of a random-walk within the data we compared the results of the Variance Ratio Test with the random-walk null hypothesis at a level of 5%. Further we used aggregation values of q = 2, 4, 8, and 16 for the variance ratio tests.

For the daily observations 11 CDSs do not exhibit signs of a random-walk within their time series for both *R1* and *R2*. Moreover 4 Banks show no significances at all aggregation levels under the 5 % hypothesis in *R1* (Bank of America, Citigroup, Credit Suisse) or *R2* (Rabobank). BayernLB has no significance at the rank *R2*, but shows significance under *R1* at lag 4. Most of the remaining 14 CDS are not significant at the aggregation level 2 and 4 or level 2, 4 and 8. The highest value for the test on homoscedasticity can be seen in Credit Mutual (12.643859 in lag 16/*R1*) and the lowest in NordLB (-3.961521 in lag 2/*R2*). Under heteroscedasticity (*S1*) we find significant results on all lags for 24 CDS. The other 6 CDS are significant at lag 2 and 4 (BNP, Deutsche Bank, Morgan Stanley) or at lag 2, 4 and 8 (Barclays, Commerzbank, Societe General). For daily and weekly observations there is a predominant diminishment of positive initial values between q=2 to q=16. Contrary to positive initial values, negative initial values change from q=2 to q=16 by raising values.

For the weekly observations 13 CDS are insignificant under both *R1* and *R2* for all levels of aggregation. But these findings are in contrast to 0 CDS that are insignificant under both *R1* and *R2* for daily observations. Further 5 CDS are insignificant at *R1* (Morgan Stanley, Rabobank) or *R2* (Erste Bank, LBBW, LBHT). Nomura and Macquarie show significance for all aggregation levels under *R1* and *R2*. The other 10 CDS mostly are insignificant for lag 2. On the test for heteroscedasticity (*S1*) we find fully significant results by the CDS of Credit Mutual, HSBC, HSH, LBBW, LBHT, Macquarie and Nomura. These 7 CDS are also fully significant under daily observations. Further 12 CDS are fully insignificant, but have no accordance on daily observations. The other 11 CDS are very unspecific regarding their significance to the four chosen lags. This means that there are no specific patterns that can be identified.

As an intermediate result we find no evidence of a random-walk at any of the tested levels for both daily and weekly data.

4.4 Results from the Wild Bootstrapping Variance Ratio Tests by Kim

The variance ratio tests by Kim analyze the existing of a random-walk on a 5 percent level of significance. We use aggregation values of q = 2, 4, 8, and 16.

For daily observations 13 CDS show no significant results for lags of 2, 4, 8, and 16. By contrast, the CDS of NordLB shows significant results for all investigated lags. Most of the other 16 CDS are significant for just q=2 or q=2 and q=4. The highest value within the test statistics is for Barclays (0.991082 in q=16) the lowest value belongs to NordLB (0.000006 in q=2). Noticeable is an increasing value of the test statistic for the most CDSs by raising m's for daily and weekly observations.

For weekly observations 21 CDS are not significant for all of the chosen aggregation levels, while 11 CDS are also not significant under the daily observations. For Nomura we find significant results on all levels, which is in contrast to the results for Nomura in the daily observation (significant for lag 16 only). The remaining 8 CDS are mostly significant on all levels except on lag 2.

As an intermediate result of the daily and weekly findings from the Wild Bootstrapping Variance Ratio Tests by Kim it can be ascertained that a random-walk under all investigated levels within the time series is possible for the following 11 CDS: Bayern LB, Credit Mutual, Credit Suisse, Deutsche Bank, HSBC, ING, LBHT, Macquarie, Morgan Stanley, Natixis and Nomura.

4.5 Results Scoring Model

The results of the scoring models for 3-years-daily mean-ranked, 3-years-weekly mean-ranked, 3-years-daily standard-deviation-ranked, 3-years- weekly standard-deviation-ranked are as follows (see Table 5 to 8):

It appears that subgroups (and their consisting entities) with low values for mean or standard deviation has higher scores and a better rank within the scoring model. This can be tested by dividing the number of subgroups in each group by 2 and adding the sums of the first half and the last half of the subgroups separately. An efficient market implies a high probability for the existence of a random-walk, otherwise it would be an inefficient market. Our findings for the daily and weekly data sorted by mean shows that CDSs with the lowest means have the highest total scores. This implies a high probability for the existence of a random-walk and consequently the highest market efficiency, the lowest speculation and the lowest market manipulation. The same results can be found for the daily and weekly data sorted by standard deviation as low volatilities (as the prices of the derivatives) have the highest market efficiency, the lowest speculation and the lowest market manipulation.

In contrast to this result, companies with a low value for mean or standard deviation are often victims of market manipulation and organized speculations (i.e. by Hedge Funds) as they seem to be traded in an inefficient market with a low probability of a random-walk. Taken as a whole our results show that a company's CDS with a low absolute risk (mean) and a low volatility has higher market efficiency and less market manipulation as compared to companies with high values.

A closer look at the results discloses spikes within the subgroups. In the first moment these spikes seem to weaken our results but as we see the results as a whole these spikes get moderated by the value of the other subgroup members i.e. Table 5: G2_6 (ranked 8th by its mean) achieved with the other 4 by its mean worst-ranked subgroups (G2_7 – G2_10) a total value of 262.63 scores in comparison to 218.482 scores for the 5 best-ranked subgroups (G2_1 – G2_5).

Furthermore our results for daily observations consist of higher scores in comparison to weekly observations. The crucial factor for the different high values for daily and weekly observations depends on the much better performances on Box-Pierce Q-Statistics and Variance Ratio Test Using Ranks and Signs by Wright.

If it comes to the point to choose the scoring model that fits best to the assumption presented above, it can be asserted that for 3-years-daily mean-ranked CDSs groups of 6, for 3-years-weekly mean-ranked CDSs groups of 6, for 3-years-daily standard-deviation-ranked CDSs groups of 15 and for 3-years-weekly standard-deviation-ranked CDSs groups of 3 are the best choices. These scoring models represents best the findings of CDSs with the lowest mean and standard deviation have the highest market efficiency and CDSs with the highest mean and standard deviation have the highest market inefficiency.

Table 5. 3-years-daily CDSs mean-ranked

Groups of 2	Sum	Rank
G1_1	43,33	4
G1_2	24,5	11
G1_3	45,166	2
G1_4	12,5	15
G1_5	37,496	7
G1_6	17,666	13
G1_7	29,324	10
G1_8	29,996	9
G1_9	14,994	14
G1_10	38,158	6
G1_11	40,83	5
G1_12	22	12
G1_13	45,994	1
G1_14	44,996	3
G1_15	34,162	8

Groups of 3	Sum	Rank
G2_1	51,33	5
G2_2	61,666	2
G2_3	32,164	10
G2_4	35,498	9
G2_5	37,824	7
G2_6	36,49	8
G2_7	57,988	3
G2_8	43	6
G2_9	68,99	1
G2_10	56,162	4

Groups of 5	Sum	Rank
G3_1	84,996	3
G3_2	77,996	4
G3_3	55,49	6
G3_4	74,648	5
G3_5	87,824	2
G3_6	100,158	1

Groups of 6	Sum S8	Rank S8
G4_1	112,996	2
G4_2	67,662	5
G4_3	74,314	4
G4_4	100,988	3
G4_5	125,152	1

Groups of 10	Sum	Rank
G5_1	162,992	2
G5_2	130,138	3
G5_3	187,982	1

Groups of 15	Sum	Rank
G6_1	218,482	2
G6_2	262,63	1

Table 6. 3-Years-weekly CDSs mean-ranked

Groups of 2	Sum	Rank
G1_1	61,32	10
G1_2	45,656	14
G1_3	70,478	5
G1_4	37,158	15
G1_5	78,976	2
G1_6	71,972	4
G1_7	65,648	7
G1_8	57,318	12
G1_9	55,314	13
G1_10	81,972	1
G1_11	62,31	8
G1_12	69,148	6
G1_13	73,316	3
G1_14	61,974	9
G1_15	60,312	11

Groups of 3	Sum	Rank
G2_1	98,644	5
G2_2	78,81	9
G2_3	77,812	10
G2_4	110,294	2
G2_5	95,972	6
G2_6	82,308	8
G2_7	112,626	1
G2_8	100,804	4
G2_9	103,97	3
G2_10	91,632	7

Groups of 5	Sum	Rank
G3_1	140,63	6
G3_2	152,958	5
G3_3	167,944	2
G3_4	164,28	3
G3_5	173,444	1
G3_6	153,616	4

Groups of 6	Sum	Rank
G4_1	177,454	5
G4_2	188,106	3
G4_3	178,28	4
G4_4	213,43	1
G4_5	195,602	2

Groups of 10	Sum	Rank
G5_1	293,588	3
G5_2	332,224	1
G5_3	327,06	2

Groups of 15	Sum	Rank
G6_1	461,532	2
G6_2	491,34	1

Table 7. 3-years-daily CDSs standard-deviation-ranked

Groups of 2	Sum	Rank
G1_1	43,33	4
G1_2	25,166	12
G1_3	20	13
G1_4	47,664	1
G1_5	18,666	14
G1_6	26,332	10
G1_7	25,832	11
G1_8	33,33	8
G1_9	44,996	2
G1_10	30,996	9
G1_11	43,994	3
G1_12	38,484	6
G1_13	34,162	7
G1_14	5,664	15
G1_15	42,496	5

Groups of 3	Sum	Rank
G2_1	60,496	3
G2_2	28	10
G2_3	56,664	4
G2_4	35,998	9
G2_5	38,167	7
G2_6	65,996	1
G2_7	49,996	5
G2_8	63,478	2
G2_9	37,162	8
G2_10	45,16	6

Groups of 5	Sum	Rank
G3_1	71,996	4
G3_2	82,83	3
G3_3	64,494	5
G3_4	96,992	2
G3_5	102,978	1
G3_6	61,822	6

Groups of 6	Sum	Rank
G4_1	88,496	4
G4_2	92,662	3
G4_3	104,158	2
G4_4	113,474	1
G4_5	82,322	5

Groups of 10	Sum	Rank
G5_1	154,826	3
G5_2	161,486	2
G5_3	164,8	1

Groups of 15	Sum	Rank
G6_1	219,32	2
G6_2	261,792	1

Table 8. 3-years-weekly CDSs standard-deviation-ranked

Groups of 2	Sum	Rank
G1_1	61,32	9
G1_2	70,978	7
G1_3	9,832	15
G1_4	77,478	2
G1_5	71,644	6
G1_6	61,312	10
G1_7	75,308	3
G1_8	59,646	12
G1_9	72,306	4
G1_10	61,308	11
G1_11	71,984	5
G1_12	82,972	1
G1_13	62,148	8
G1_14	57,312	14
G1_15	58,324	13

Groups of 3	Sum	Rank
G2_1	94,974	7
G2_2	47,156	10
G2_3	114,136	2
G2_4	96,298	6
G2_5	103,298	4
G2_6	103,962	3
G2_7	98,632	5
G2_8	117,632	1
G2_9	92,136	8
G2_10	85,648	9

Groups of 5	Sum	Rank
G3_1	132,798	6
G3_2	158,454	4
G3_3	164,61	3
G3_4	165,27	2
G3_5	185,28	1
G3_6	147,46	5

Groups of 6	Sum	Rank
G4_1	142,13	5
G4_2	210,434	2
G4_3	207,26	3
G4_4	216,264	1
G4_5	177,784	4

Groups of 10	Sum	Rank
G5_1	291,252	3
G5_2	329,88	2
G5_3	332,74	1

Groups of 15	Sum	Rank
G6_1	455,862	2
G6_2	498,01	1

5. Conclusion

Investors hedging portfolios with CDSs need information on the question of whether the increase in speculation affects market efficiency or not. To answer this question our research has examined the relation between the absolute CDS premium and market efficiency. We focused on CDSs for international banks. To check market efficiency we tested the random-walk hypothesis by different test statistics. The strongest version of the random-walk hypothesis was tested by homoscedastic variance ratio tests by Lo and MacKinlay and by nonparametric variance ratio test based on ranks by Wright. The weak form gets tested by Q-statistics portmanteau tests by Box and Pierce, heteroscedastic variance ratio tests by Lo and MacKinlay, nonparametric variance ratio tests based on signs by Wright and wild bootstrapping variance ratio tests by Kim.

We find that for daily and weekly data CDSs with the lowest mean and the lowest standard deviation have the highest probabilities for the existence of a random-walk. Consequently these CDSs are affected by the highest market efficiency, the lowest speculation and the lowest market manipulation. This finding is consistent as CDSs with the highest means and the highest standard deviations have the lowest probabilities for the existence of a random-walk. Therefore these CDSs have the highest potential to trade in an inefficient market with the highest potential for speculation and market manipulation. The results of our analysis show that the CDS market of financial institutions is already a target for market manipulation and speculation. Many of these financial institutions are global players and have become “too big to fail”. Their insolvency would affect other financial institutions, the financial system and the global economy. To reduce speculation we support new regulations on the CDS market. These regulations should safeguard against dangerous speculation and market manipulation in order to protect our quality of life.

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A Financial Analysis of Certain Flexible Loans: Calculation of the Average Duration

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Abstract

The current economic and financial crisis situation, in general, and the real-estate crisis, in particular, have favoured the introduction of new banking products, especially loans, which, on the one hand, try to make the investment in housing attractive through novel mortgage loans and, on the other hand, to adapt to the possible financial difficulties of the borrower. In effect, lot of families need to have a house, but the banks are afraid that the borrower punctually could not face the corresponding payments. In this case, some financial entities give the borrower the possibility of deferring some payments until the end of the loan term, under the conditions which will be detailed hereinafter. In this paper, we present a mathematical expression of the average duration of the loan and the value of the payment that would amortize the loan in the initially stipulated period.

Keywords: loan, mortgage, payment, deferred annuities, average duration

1. Introduction

The framework of this paper is the current situation of uncertainty in the financial markets and the labour instability and precariousness present in our modern society. In this context, we will focus on loans and, more concretely, on mortgage loans, where the borrower can have serious problems to repay some loan annuities. Thus, in order to try to partially solve this uncertainty (derived from the labour market), some loans have arisen in the banking market giving the borrower the possibility of deferring the payment of a part of his/her debt to a later period at the end of the transaction. In any case, it is necessary to clarify that this is not a debt condonation but a postponement in the payment of the debt. All this is independent of the principal amortization method (Ferruz, 1994) which can be any of the classic methods of loans amortization (French method, constant principal repaid method, American method, etc.).

In effect, in the financial market, when contracting a mortgage loan (Van Horne, 1997; Brealey and Myers, 2002; Brealey et al., 2004), there exist lot of possibilities of choosing several banking products whose underlying amortization methods are the classic ones, among them we can mention the French method (equal payments over the term: the most usual), the constant principal repaid method and the American method (Ayres, 1963). Even within these methods of amortization, some other financial characteristics can be considered, such as the interest-only loan and fixed or variable interest rates (Cruz and Valls, 2003).

On the other hand, we observe as, recently, credit institutions have started to offer, among their products, other modalities of mortgage loans, named, in general, *flexible loans*, since they offer to the borrower the possibility of choosing the amount or the instant of payment of some loan parameters. Within this new type of loan, it is necessary to mention the different mortgage loans offered by the Spanish banking:

- the first one gives the borrower the possibility of choosing the payment per year, increasing or reducing the loan duration, and
- the second one provides the borrower the possibility of paying at least ten times per year, since he/she can defer the payment of up to two payments.

In effect, one of the modalities of flexible loans (offered by the BBVA bank) is that in which the borrower can choose the postponement of up to two monthly payments, with the additional interest, in each of the years of the loan interval. Said in another way, the borrower can choose the payment of 10, 11 or even 12 monthly payments per year. In general, in this type of loan, there exists an upper bound for the total number of deferred payments.

Obviously, in case of no interest charges for the deferred payments, the most favourable choice for the borrower consists of postponing the delivery of the first two monthly payments of every year. We insist that this option implies a postponement and not a cancelation of the debt by the bank. There is not doubt that we are in presence of a random financial transaction (Gil and Gil, 1987; Gil Peláez, 1992) in which the monthly payments are variables characterized because the maturities are certain and the amounts are random (Suárez, 1991).

De Pablo (1991 and 1998) has been one of the first scholars in introducing the flexibility in the analysis of loans having tried to correct the amount of the payments according the rate of inflation of each period. From another point of view, Cruz et al. (1996) have applied the former methodology to loans applied to the Agricultural Sector. Later, García et al. (2001) proposed a novel amortization method based on annuities according to the cash-flows expected by the investment to which the loan was applied.

Despite the wide offer described in the former paragraph, there exist other possibilities of mortgage loans amortization that have not been defined yet and that can result very interesting, due to their flexibility, depending on the economic situation of the borrower.

This paper is organized as follows. Section 2 analyzes the real case proposed by the flexible loans described in this Introduction. Later, we determine the average duration of this type of loan and introduce the expression of the payment that would amortize the loan within the term initially proposed by the bank, taking into account the expected number of payments that the borrower would postpone. In Section 3, we solve the general case in which the borrower can defer up to p payments within the same year, without any limit of postponements through the total term of n years (loan duration), except the trivial limit $p \cdot n$. Section 4 solves the problem proposed in the two former sections in the case of a restriction on the total number, m, of deferred payments (of course $m < p \cdot n$ holds). Finally, Section 5 summarizes and concludes.

2. Flexible Loans without Any Limit on the Payments Postponement

Let us consider a flexible loan in which the borrower can defer up to two monthly payments within the same year. The payment of the deferred monthly amounts would take place immediately after finishing the loan, more postponements not being allowed. In this Section, we are going to assume that there is not a total limit on the number of deferred monthly payments or, what is the same, that this limit is $2n$, being n the number of years of the loan term.

A first solution to this problem consists in calculating the expected number of unpaid monthly payments and to repay all them at the end of the loan term with their respective accumulated interest charges. Nevertheless, we are interested in solving this problem keeping constant the payment during the loan duration and its extension.

To do this, we are going to calculate the present value of any combination of 10, 11 or even 12 monthly payments which, with the same probability, the borrower can choose according his/her economic needs.

In effect, if i is the effective annual interest rate to be applied to this financial transaction, $j_{(12)}$ is the nominal interest rate payable per months and $i_{(12)}$ is the equivalent monthly interest rate (Zima and Brown, 1988), tables 1 and 2 include, respectively:

- the discounted values of all possible choices of postponement of two monthly payments by the borrower, and
- the discounted values of all possible choices of postponement of one monthly payment by the borrower.

Table 1. Discounted values of the possible choices of postponement of two monthly payments

Month	1	2	3	…	12
1	-	$(1+i_{(12)})^{-1}+(1+i_{(12)})^{-2}$	$(1+i_{(12)})^{-1}+(1+i_{(12)})^{-3}$	…	$(1+i_{(12)})^{-1}+(1+i_{(12)})^{-12}$
2	-	-	$(1+i_{(12)})^{-2}+(1+i_{(12)})^{-3}$	…	$(1+i_{(12)})^{-2}+(1+i_{(12)})^{-12}$
3	-	-	-	…	$(1+i_{(12)})^{-3}+(1+i_{(12)})^{-12}$
⋮	⋮	⋮	⋮	⋱	⋮
12	-	-	-	-	-

Table 2. Discounted values of the possible choices of postponement of one monthly payment

Month	1	2	3	…	12
Present value	$(1+i_{(12)})^{-1}$	$(1+i_{(12)})^{-2}$	$(1+i_{(12)})^{-3}$	…	$(1+i_{(12)})^{-12}$

Next, we will calculate:

- the expected present value of all possible monthly rents where two payments have been deferred by the borrower,
- the expected present value of all possible monthly rents where one payment has been postponed by the borrower, and
- the present value when the borrower satisfies all monthly payments.

All this will be made under the assumption that all described cases have the same probability:

$$p = \frac{1}{\binom{12}{2} + \binom{12}{1} + \binom{12}{0}} = \frac{1}{79}$$

Firstly, let us calculate the expected present value of all possible monthly rents (Bodie and Merton, 2000) where two payments have been deferred by the borrower ($V_0^{(1)}$), assuming that the constant monthly payment to be satisfied within the same year is *m*:

$$V_0^{(1)} = \frac{1}{79} m \sum_{\substack{r,s=1 \\ r>s}}^{12} \left\{ a_{\overline{12}|i_{(12)}} - \left[(1+i_{(12)})^{-r} + (1+i_{(12)})^{-s} \right] \right\} =$$

$$= \frac{1}{79} m \left\{ \sum_{\substack{r,s=1 \\ r>s}}^{12} a_{\overline{12}|i_{(12)}} - \frac{\sum_{r,s=1}^{12} (1+i_{(12)})^{-r} + \sum_{r,s=1}^{12} (1+i_{(12)})^{-s}}{2} + \frac{\sum_{h=1}^{12} \left[(1+i_{(12)})^{-h} + (1+i_{(12)})^{-h} \right]}{2} \right\} =$$

$$= \frac{1}{79} m \left\{ \frac{12^2 - 12}{2} a_{\overline{12}|i_{(12)}} - \frac{12 a_{\overline{12}|i_{(12)}} + 12 a_{\overline{12}|i_{(12)}}}{2} + \frac{2 a_{\overline{12}|i_{(12)}}}{2} \right\} = \frac{55}{79} m \cdot a_{\overline{12}|i_{(12)}}$$

Secondly, let us calculate the expected present value of all possible monthly rents where one payment has been deferred by the borrower ($V_0^{(2)}$), assuming, the same as the former paragraph, that the constant monthly payment to be satisfied within the same year is *m*:

$$V_0^{(2)} = \frac{1}{79} m \sum_{r=1}^{12} \left\{ a_{\overline{12}|i_{(12)}} - (1+i_{(12)})^{-r} \right\} = \frac{1}{79} m \left\{ 12 a_{\overline{12}|i_{(12)}} - a_{\overline{12}|i_{(12)}} \right\} = \frac{11}{79} m \cdot a_{\overline{12}|i_{(12)}}$$

Finally, the present value when the borrower satisfies all monthly payments ($V_0^{(3)}$) is:

$$V_0^{(3)} = \frac{1}{79} m \cdot a_{\overline{12}|i_{(12)}}$$

Therefore, the expected present (V_0) of all possible modes of payment would be:

$$V_0 = V_0^{(1)} + V_0^{(2)} + V_0^{(3)} = \frac{67}{79} m \cdot a_{\overline{12}|i_{(12)}}$$

By considering that the loan term is 15 years, the expected present value would be:

$$V_0 = \frac{67}{79} m \cdot a_{\overline{12}|i_{(12)}} \cdot \ddot{a}_{\overline{15}|i} = \frac{67}{79} m \cdot s_{\overline{12}|i_{(12)}} \cdot a_{\overline{15}|i} = \frac{67}{79} m \cdot a_{\overline{15}|i}^{(12)}$$

2.1 Analysis of the Average Duration of a Flexible Loan

A question derived from the analysis of flexible loans is the calculation of the average duration, *d*, that arises in this random financial transaction. If we consider that, in the period of extension to repay the outstanding monthly payments, the borrower continues having the possibility to defer the payment of 0, 1 or 2 monthly payments, we would propose the following equation:

$$\frac{67}{79} m \cdot a_{\overline{12}|i_{(12)}} \cdot \ddot{a}_{\overline{d}|i} = C_0 = m \cdot a_{\overline{12}|i_{(12)}} \cdot \ddot{a}_{\overline{n}|i}$$

from where, by simplifying:

$$\ddot{a}_{\overline{d}|i} = \frac{79}{67}\ddot{a}_{\overline{n}|i}$$

But, taking into account that the function $\ddot{a}_{\overline{x}|i}$ is increasing with respect to *x*, it can be stated that $d > n$. More specifically,

$$d = -\frac{\ln\left(1 - \frac{79}{67} i \cdot a_{\overline{n}|i}\right)}{\ln(1+i)}$$

or:

$$d = -\frac{\ln\left[\frac{79}{67}(1+i)^{-n} - \frac{12}{67}\right]}{\ln(1+i)}$$

Graphically:

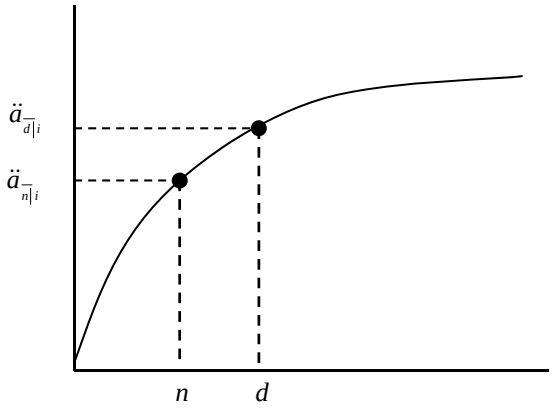

Figure 1. Present value of a unitary rent payable at the beginning of each period

2.1.1 Example

For a loan to be amortized in 10 years by the French method with constant monthly payments, 6% effective annual interest rate, an extension in the duration of something more than 2.5 years is expected; more specifically, 2.6212396 years.

In case that the borrower had to repay the deferred monthly payments consecutively when the initial term *n* of the loan has finished, the extension *d* of the loan would be evidently lesser. To do this, we would propose the following equation:

$$\frac{67}{79} m \cdot a_{\overline{12}|i_{(12)}} \cdot \ddot{a}_{\overline{n}|i} + (1+i)^{-n} \cdot m \cdot a_{\overline{12}|i_{(12)}} \cdot \ddot{a}_{\overline{d}|i} = C_0 = m \cdot a_{\overline{12}|i_{(12)}} \cdot \ddot{a}_{\overline{n}|i}$$

from where, by simplifying:

$$\ddot{a}_{\overline{d}|i} = \frac{12}{79}(1+i)^n \ddot{a}_{\overline{n}|i}$$

or, what is the same:

$$a_{\overline{d}|i} = \frac{12}{79} s_{\overline{n}|i}$$

Last equation allows us to obtain *d*:

$$d = -\frac{\ln\left[\frac{91}{79} - \frac{12}{79}(1+i)^n\right]}{\ln(1+i)}$$

2.1.2 Example

In our case, for a loan to be amortized in 10 years by the French method with constant monthly payments, 6% annual effective interest rate, an extension in the duration of something more than 2 years is expected; more specifically, 2.19636353 years.

2.2 Calculation of the New Payment Which Amortizes the Loan in the Initially Stipulated Term

Another problem we can propose is the calculation of the monthly payment m' that would amortize the loan in the initially stipulated period. To do this, in the first case, we would propose the following equation:

$$\frac{67}{79}m' \cdot a_{\overline{12|}i_{(12)}} \cdot \ddot{a}_{\overline{n|}i} = m \cdot a_{\overline{12|}i_{(12)}} \cdot \ddot{a}_{\overline{n|}i}$$

from where, we can obviously deduce that:

$$m' = \frac{79}{67}m$$

2.2.1 Example

In our case, if the principal of the mortgage is \$150,000, one has:

- $i_{(12)} = (1+0.06)^{1/12} - 1 = 0.00486755$
- $m = \dfrac{150{,}000 \cdot 0.00486755}{1 - 1.00486755^{-180}} = \$1{,}252.94$
- $m' = \dfrac{79}{67}1{,}252.94 = \$1{,}477.35$

3. A Generalization of Flexible Loans

The objective of this Section is to generalize the approach presented in Section 2 for which we will present two new concepts, their corresponding notations and their respective mathematical expressions. In effect, let us consider the general case in which:

- n represents the total number of years of the loan term,
- k represents the installment in the payments (k = 2, in case of half-yearly payments; k = 4, in case of quarterly payments; …; k = 12, in case of monthly payments),
- p represents the maximum number of payments which can be deferred in every year. Obviously, $p \le k$ holds, and
- m represents the maximum number of payments which can be deferred in total, during the n years of the loan term.

If we denote by $a_{\overline{n/k|}i}$ the sum of the present values of all the possible unitary rents payable at the end of each period with n payments where k of them are zero ($k \le n$), it is verified that:

Lemma 1. $a_{\overline{n/k|}i} = \binom{n-1}{k} a_{\overline{n|}i}$.

Proof. It is obvious, taking into account that every unitary payment of the rent belongs to the $\binom{n-1}{k}$ possible combinations of k zeros taken among the $n-1$ possible allocations, without considering the position where the considered payment is located.

3.1 Example

If, as previously assumed, in one year there can be two deferred monthly payments, the sum of the present values of all possible unitary rents with 10 payments is:

$$\binom{12-1}{2} a_{\overline{12|}i_{(12)}} = \binom{11}{2} a_{\overline{12|}i_{(12)}} = 55 a_{\overline{12|}i_{(12)}}$$

Analogously, if a deferred monthly payment was allowed, the sum would be:

$$\binom{12-1}{1} a_{\overline{12}|i_{(12)}} = \binom{11}{1} a_{\overline{12}|i_{(12)}} = 11 a_{\overline{12}|i_{(12)}}$$

Finally, there is a unique rent where there are no monthly deferred payments, whose present value is $a_{\overline{12}|i_{(12)}}$.

Observe that the sum of the previous present values coincides with the result obtained in Section 2.

In general, the formula that gives us the expected present value of all rents in which 0, 1, 2, …, *p* *k*-th of year can be deferred within the *n* years of the loan term, is:

$$V_0 = \frac{\binom{k-1}{p} + \binom{k-1}{p-1} + \binom{k-1}{p-2} + \cdots + \binom{k-1}{0}}{\binom{k}{p} + \binom{k}{p-1} + \binom{k}{p-2} + \cdots + \binom{k}{0}} a_{\overline{k}|i_{(k)}} \cdot \ddot{a}_{\overline{n}|i}$$

Observe that:

$$V_0 = \frac{\binom{k-1}{p} + \binom{k-1}{p-1} + \binom{k-1}{p-2} + \cdots + \binom{k-1}{0}}{\binom{k}{p} + \binom{k}{p-1} + \binom{k}{p-2} + \cdots + \binom{k}{0}} s_{\overline{k}|i_{(k)}} \cdot a_{\overline{n}|i}$$

or, what is the same:

$$V_0 = \frac{\binom{k-1}{p} + \binom{k-1}{p-1} + \binom{k-1}{p-2} + \cdots + \binom{k-1}{0}}{\binom{k}{p} + \binom{k}{p-1} + \binom{k}{p-2} + \cdots + \binom{k}{0}} a^{(k)}_{\overline{n}|i}$$

3.2 Example

Observe that, in the case described in Section 2, the denominator in the fraction of the expected present value is:

$$\binom{12}{2} + \binom{12}{1} + \binom{12}{0} = 66 + 12 + 1 = 79$$

4. Case in Which the Total Number of Postponements Is Bounded

If we assume that the total number of possible postponements by the borrower is restricted to 10 payments during the whole loan term, the number of possible cases is:

$$f = \sum_{r=0}^{5} \binom{15}{r} \binom{12}{2}^r \sum_{s=0}^{10-2r} \binom{15-r}{s} \binom{12}{1}^s$$

This formula could be generalized to the case in which:

- *n* represents the total number of years of the loan term,
- *k* represents the installment in the payments (*k* = 2, in case of half-yearly payments; *k* = 4, in case of quarterly payments; …; *k* = 12, in case of monthly payments),
- *p* represents the maximum number of payments which can be deferred in every year. Obviously, $p \le k$ holds, and
- *m* represents the maximum number of payments which can be deferred in total, during the *n* years of the loan term.

In this case, the number of possible postponements would be:

$$f = \sum_{r=0}^{\text{int}(m/p)} \binom{n}{r} \binom{k}{p}^r \sum_{s=0}^{\text{int}((m-pr)/(p-1))} \binom{n-r}{s} \binom{k}{p-1}^s \sum_{t=0}^{\text{int}((m-pr-(p-1)s)/(p-2))} \binom{n-r-s}{t} \binom{k}{p-2}^t \cdots$$

$$\cdots \sum_{v=0}^{m-pr-(p-1)s-(p-2)t-\cdots-2u} \binom{n-r-s-t-\cdots-u}{v} \binom{k}{1}^v$$

being $\text{int}(x)$ the integer part of *x*. In what follows and taking into account that *f* is a function of *n*, *k*, *m* and *p*, it will be represented by $f(n,k,m,p)$.

On the other hand, if we denote by $(r_1,\alpha_1;r_2,\alpha_2;\ldots;r_k,\alpha_k)a_{\overline{n}|i}$ the sum of the present values of all unitary rents of $r_1+r_2+\cdots+r_k\le n$ payments payable at the end of each period and distributed into *n* periods, it is verified that:

Lemma 2. $(r_1,\alpha_1;r_2,\alpha_2;\ldots;r_k,\alpha_k)a_{\overline{n}|i}=$

$$\left[\alpha_1\binom{n-1}{r_1-1}\binom{n-r_1}{r_2}\cdots\binom{n-r_1-\cdots-r_{k-1}}{r_k}+\alpha_2\binom{n-1}{r_2-1}\binom{n-r_2}{r_3}\cdots\binom{n-r_1-\cdots-r_{k-1}}{r_k}+\cdots\right.$$
$$\left.\cdots+\alpha_k\binom{n-1}{r_k-1}\binom{n-r_1}{r_1}\cdots\binom{n-r_1-\cdots-r_{k-2}}{r_{k-1}}\right]a_{\overline{n}|i}.$$

Proof. It is obvious, taking into account that every payment α_i of the rent is located in

$$\binom{n-1}{r_i-1}\binom{n-r_i}{r_1}\cdots\binom{n-r_i-r_1-\cdots-r_{i-2}}{r_{i-1}}\binom{n-r_i-r_1-\cdots-r_{i-1}}{r_{i+1}}\cdots\binom{n-r_i-r_1-\cdots-r_{k-2}}{r_{k-1}}$$

possible combinations of r_i-1 "spaces" taken among the $n-1$ possible remaining, without considering the space where the considered payment is located, multiplied by the number of all possible allocations of the remaining rent payments in the spaces which successively remain free and so on.

The following result shows that Lemma 1 can be obtained as a consequence of Lemma 2.

Corollary. $a_{\overline{\overline{n/k}|i}}=\binom{n-1}{k}a_{\overline{n}|i}$

Proof. In effect, it can be considered that:

$$a_{\overline{\overline{n/k}|i}}=(n-k,1)a_{\overline{n}|i}=\binom{n-1}{n-k-1}a_{\overline{n}|i}=\binom{n-1}{k}a_{\overline{n}|i}$$

Finally, taking into account the former results, the expected value of all possible combinations of the loan amortization by the borrower (of course in case of absence of a breach of contract by the borrower) is:

$$V_0=f\sum_{r=0}^{5}\binom{15}{r}\sum_{s=0}^{10-2r}\binom{15-r}{s}\left[\binom{12-1}{2-1}\binom{n-1}{r-1}\binom{n-r}{s}+\binom{12-1}{1-1}\binom{n-1}{s-1}\binom{n-s}{r}\right]a_{\overline{12}|i_{(12)}}\ddot{a}_{\overline{15}|i}$$

or, what is the same:

$$V_0=f\sum_{r=0}^{5}\binom{15}{r}\sum_{s=0}^{10-2r}\binom{15-r}{s}\left[\binom{12-1}{2-1}\binom{n-1}{r-1}\binom{n-r}{s}+\binom{12-1}{1-1}\binom{n-1}{s-1}\binom{n-s}{r}\right]a^{(12)}_{\overline{15}|i}$$

5. Conclusion

Nowadays, some Spanish banks (like the BBVA bank) are showing a certain flexibility and dynamism in adapting their offer of mortgage loans to the hard conditions that debtors have to support as a consequence of the economic and financial crisis. This uncertainty has implied that most of the loans, which only were random according to the interest rates, increase the uncertainty of other parameters characteristic of such financial transaction. This is the case of the loan presented in this paper. More specifically, the borrower has the option to defer the payment of 1 or 2 amounts until the end of the initially stipulated loan term, with a global maximum of deferred (not condoned) payments. Nevertheless, in this paper and due to methodological arguments, we have solved also the case in which this global limit does not exist. To solve these problems, we have employed the usual tools of Financial Mathematics and the Combinatorial Analysis, introducing two new concepts:

- the sum of the present values of all unitary rents payable at the end of each period with *n* payments, where *k* of them are zero ($k\le n$), denoted by $a_{\overline{\overline{n/k}|i}}$, and

- the sum of the present values of all unitary rents payable at the end of each period with $r_1+r_2+\cdots+r_k\le n$ payments distributed into *n* periods, denoted by $(r_1,\alpha_1;r_2,\alpha_2;\ldots;r_k,\alpha_k)a_{\overline{n}|i}$.

Lemmas 1 and 2 provide the mathematical expressions of these two present values, respectively, which help us to solve the problems presented in this paper. The following reseach we propose is the analysis of other flexible loans that are offered at present and even to propose other different loans which could be interesting in the current economic conjuncture.

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The Dynamic Synergies between Agriculture Output and Economic Growth in Malaysia

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Abstract

This paper investigates the dynamic synergies between agriculture sector and economic growth in Malaysia throughout historical economic policy adjustments spanning from 1970 to 2010. From the analysis, the contribution of agriculture sector output to the Malaysian economy has been decreasing despite several agriculture-led economic growth policies that have been implemented, including the very recent New Economic Model (NEM). Specifically, we employ Johansen-Juselius (1990) cointegration test and reveals that agriculture and economic growth were found to be moving together in the long run. Moreover, we examine the direction of causality between agriculture output and economic growth within the vector error-correction model (VECM). The test shows that both agriculture and economic growth have no causality direction at least in the short run but there exist a bi-directional causality movement in the long run. From this empirical testing and policy analysis, we can suggest that policy makers should pay attention to the holistic and sustainable development of agriculture sector into their policy modelling in promoting sustainable economic growth.

Keywords: agriculture economics, economic dynamism, economic sustainability, cointegration and causality analysis

1. Introduction

1.1 The Role and Issues of Agriculture Sector in the Global Economy

Agricultural economists have long been convinced and investigated the agricultural sector contribution to the overall economic growth (Wong, 2007). Theoretically, the agriculture sector contributes to the economic growth through a variety of linkages (Johnston and Mellor, 1961) and spill-over effects. It has been empirically supported that this sector is strategically important for agriculture-dependent emerging economies in Southeast Asia backed by their rich natural resources and dependency of national income to this sector (Rahman, 1998). However, despite of the significant important of agriculture sector, many developing countries have neglected and abandoned this sector in the mid 1980s (Wong, 2007; Bazemer and Headey, 2008; Headey, *et. al*., 2010; Dethier and Effenberger, 2011) as every countries were moving towards industrialization agenda to spur economic growth inspired by industrialise-based economic development in developed countries.

Today, many have realised that the significant important of the agriculture sector remain relevant and the future hope and roles of agriculture sector will always remain as an important sector to both developed and developing countries globally (Dethier and Effenberger, 2011). A vibrant agriculture sector has been the basis for a successful economic transformation in many developed countries and many of the developing countries are on the pathway in transforming their agriculture sector (FAO, 2009). The important roles of agriculture sector to the global society and economies are multifaceted. Agriculture sector is essential to human survival and eco-system sustainability (Murad, *et. al.,* 2008). This sector are sole producer and supplier of foods and fibres to feed a growing population, supply feedstock for new and expanding biotechnology industry, important to socio-economic well being of many agriculture-dependent developing countries (FAO, 2009) and supply of raw materials for industries (Wahab, 2011). However, historical trend indicates that despite the increase in global demand for agricultural products, production growth has been declining (Shamsudin, 2010). Globally, critical issues in agriculture sector remain challenging for the growth of this industry and require collective strategic and sustainable solutions. These included among others; agriculture production growth rate declining, underinvestment in agriculture, higher energy prices (Shamsudin, 2010), food crisis issues (Fuglie, 2008), and

sustainable development issues (Murad, *et. al*., 2008; Headey, *et. al*. 2010).

Empirically, there are number of studies investigating the significant contribution of agriculture sector to economic growth in other countries. In China, the contribution of agriculture sector to the economic growth depends on the government policy. Yao (2000) point out that agriculture sector could promote the growth of other sectors however those sectors were not supportive to agriculture sector. Awokuse (2009) have shown that agriculture sector could play as an engine of growth in the selected Africa, Asia and Latin America countries. Katircioglu (2006) found bidirectional causal relationship in Cyprus. On the other hand, Chebbi (2010) found that agriculture sector plays a limited role to the economic growth in the short run compare to non-agriculture sectors. Recently, Jatuporn *et. al.* (2011) found a long-run relationship between agriculture and economic growth for Thailand economy. Meanwhile, Datt and Ravallion (1996), Gardner (2003) and Tiffin and Irz (2006) have applied panel analysis in investigating the important of agriculture sector to the economic growth in developing countries. Their results indicated a causality direction significant from agriculture to economic growth. However, for developed countries, the results were unclear as reported in Tiffin and Irz (2006).

Despite the theoretical and empirical importance of this sector to socio-economic development in general, there is limited research investigating these issues. Furthermore, the important of agriculture productivity to socio-economic development has not been well understood (Headey, 2010) and some have neglected this golden sector. Specifically, in Malaysia, the agriculture is the critical sector nowadays because the share of output to GDP deteriorating over time despite the importance and increasing development expenditure allocated for this sector. Moreover, the government's policy to increase the participation of private sector under the New Economic Model is still unclear. Based on the these premises, this paper will explore the linkages of agriculture sector with economic growth in Malaysia with twofold objectives; first, to investigate the relationship between agriculture sector and economic growth in Malaysia by employing Johansen – Jesulius Cointegration Test.; and second, to examine the role of agriculture sector on economic growth in Malaysia. The rest of the paper is organized as follow; the next section provides the review of agriculture sector and economic structural changes in Malaysia. This is followed by an elaboration of data and econometric techniques employed. The subsequent section provides the analysis and discussion of the findings. The last section concludes this paper with strategic recommendation for development of agriculture sector in Malaysia.

1.2 Review of Agricultural Sector and Structural Changes in Malaysia

In Malaysia, the agriculture sector which includes livestock, fisheries and forestry plays an important role in socio-economic development. Agriculture and rural development in Malaysia are inextricably linked and has been the niche industry for Malaysia since its independence in 1957 backed by its rich and quality agriculture land bank, blessed with fertile soil, abundant rainfall, and suitable climate for food production (Frost and Sullivan, 2009; Ahmad and Suntharalingam, 2009; Matahir, 2012). Specifically, the agriculture sector plays an important role in Malaysia's economy development through provision of rural employment, uplifting rural incomes and ensuring national food security (Pemandu, pp. 41). Today, Malaysia is still basically an agricultural country though it is fast developing into an industrial country (Murad, *et. al*., 2008). Malaysia has about 4.06 million hectares of agricultural land and 80% of this land is cultivated with industrial corps such as palm oil, rubber, cocoa, coconut and pepper (Onn, 1990; Murad, *et. al*., 2008) and some allocated for agro-food production (Frost and Sullivan, 2009). The agriculture sector contributed RM20 billion or 4% of Malaysia's gross national income (GNI) in 2009. However, economic development policy shifted from agriculture-based economy to industrial-based economy in the mid 1980 caused the public and private sector to neglect this golden market share and subsequently lost its momentum contribution to GDP growth. The following table 1, 2 and 3 explain the historical contribution of agriculture sector to Malaysian's socio-economic development.

Table 1. Relative contribution of agriculture sector to the national economy (%)

Sector	1970	1980	1990	1995	2000	2006	2007	2008	2009	2010
Real GDP (%)	2.3	6.6	9.3	5.2	5.2	5.8	6.3	5.7	-2.6	5.9
Agriculture, forestry, fishing	29.0	22.9	18.7	13.6	10.5	8.0	7.6	7.5	7.7	7.5
Mining and quarrying	13.7	10.1	9.7	7.4	5.7	8.8	8.5	7.9	7.7	7.5
Manufacturing	13.9	19.6	27.0	33.1	37.5	30.9	29.9	28.9	26.6	26.7
Construction	3.8	4.6	3.5	4.4	4.8	3.1	3.1	3.1	3.3	3.3
Services	39.6	42.8	42.1	44.2	45.7	51.9	53.8	55.2	57.6	57.8

Source: Malaysia Second Outline Perspective Plan (1991); Seven Malaysia Plan (1996); Tenth Malaysia Plan (2010).

Table 2. Agriculture in the Malaysian economy

		Agriculture Sector		
Year	GDP Growth (%)	Growth (%)	Share in GDP (%)	Share in Employment (%)
1970-74	2.3	3.4	25.5	50.9
1975-79	7.3	5.2	23.3	46.4
1980-84	6.6	3.4	20.4	39.5
1985-89	4.8	4.3	19.1	32.4
1990-94	9.3	0.2	15.3	26.9
1995-99	5.2	0.1	10.1	17.9
2000-04	5.2	3.8	8.7	15.0
2005	5.3	2.6	8.5	12.9
2006	5.8	5.4	8.0	12.5
2007	6.3	2.2	7.6	12.2
2008	5.7	4.3	7.5	12.0
2009	-2.6	0.4	7.7	12.0
2010	5.9	3.8	7.5	11.0

Source: Adapted from Athukorala and Loke (2009), Pemandu (2010), and Tenth Malaysia Plan (2010).

Table 3. Agriculture and rural development expenditure

5 Years Malaysia Plan	Year	Agriculture Development Expenditure (RM Million)	Agriculture Growth (%)
Tenth Malaysia Plan	2011 – 2015	n/a	n/a
Ninth Malaysia Plan	2006 – 2010	11,435	3.0
Eight Malaysia Plan	2001 – 2005	7,860	3.2
Seventh Malaysia Plan	1996 – 2000	8,286	0.1
Sixth Malaysia Plan	1990 – 1995	8,708	0.2
Fifth Malaysia Plan	1986 – 1990	11,799	4.3
Fourth Malaysia Plan	1981 – 1985	8,727	3.4
Third Malaysia Plan	1976 – 1980	2,386	5.2
Second Malaysia Plan	1971 – 1975	1,921	3.4
First Malaysia Plan	1966 – 1970	1,114	n/a

Source: Available at http://www.pmo.gov.my; n/a denotes – data not available.

1.2.1 Agrarian-Based Economy Era: 1957 – 1985 (1st MP – 4th MP)

During this agricultural-dependant era, the development of agriculture sector played important roles in both socio-economic developments in Malaysia. In terms of social contribution, this sector is strategically important as a source of income and increases the living standards of the majority rural poor. While, in terms of economic contribution, this sector is a source of food and raw material supplier for industrial sector. Efforts extended by both public and private sectors in development of this sector had enable the agricultural production grew at the rate of 4.8% annually between 1960 and 1965. Under the First Malaysian Plan: 1956-1960, the government allocated RM478.2 million or 47.5% of its total public development expenditure for agriculture and rural development. The government strong support for agriculture sector continued in the Second Malaya Plan: 1961-1965, The First Malaysia Plan: 1966-1970, The Second Malaysia Plan: 1971-1975, The Third Malaysia Plan: 1976-1980, and The Fourth Malaysia Plan: 1981-1985. In 1960, the agriculture sector contributed about 44% to the Malaysia's GDP (Frost and Sullivan, 2009) spurred by agriculture-based economy development policy focus. During this era, about 70% of the population were resided and engaged in agricultural activities in rural areas (Arshad and Shamsudin, 1997). However, the global recession which occurred in the early 1980s caused sharp declined in the commodity prices resulting in the GDP growth rate declined from 8% in 1982 to -1% in 1986 (Onn, 1990). Agriculture sector problems during this era including; inadequate technical capacity, risk of volatile rubber prices and lack of incentives for agricultural production. Since then, the multifaceted problems encountered in agriculture sector, discourage the growth of this sector (Rahman, 1998).

1.2.2 Industrialized Economy Era: 1986 – 2000 (5th MP – 7th MP)

The limitation of economy dependency to agriculture sector bring about the ideas of diversifying the Malaysian economic structure to a more broad-based industrial economy (Onn, 1990) in the second wave of economic structural change. The industrialization era in Malaysia had started in the mid-1980s (Ahmad and

Suntharalingam, 2009). During this time, aggressive industrialization efforts had turned the manufacturing to become the leading sector of the economy and left agriculture in the back seat of the economy policy focus (Ahmad and Suntharalingam, 2009). The government economic development policies during this period have been focused on manufacturing and services (Rahman, 1998) and (Lim, 1991; Ahmad, *et. al*. 1993) as reported in Ahmad and Suntharalingam (2009). The government has been giving too much emphasis on the industrial sector, hence marginalising the agricultural sector (Ahmad, *et. al*., 2001). However, the agriculture sector development was back on the economic development agenda after the Asian financial crisis in 1997/98 (Ahmad and Suntharalingam, 2009; M. Shaffril, *et. al*., 2010). This is part of the strategy undertaken to strengthen the domestic economy position to curve external economic shock. In this regards, the First National Agricultural Policy: 1984-1991, was launched in January 1984 outlined the long-term development framework for agriculture sector in Malaysia (5th MP). During this era, the agriculture sector development policy had emphasised on development of new agricultural lands. The government had allocated higher development expenditure for agriculture sector amounting to RM 11,799 million in the fifth Malaysia Plan.

1.2.3 Broad-Based Economy Era: 2001 – 2010 (8th MP – 9th MP)

This era was aim to balance and to sustain the economic development policies. Attention to agriculture sector continued in the economic development policy radar, drawing attention to the impacts of agricultural productivity on economic growth, social issues and environmental issues (Murad, *et. al.,* 2008; Bezemer and Heady, 2008; Heady, *et. al.,* 2010). Additionally, the global slowdown has in turn affected the Malaysian economy which contracted by 1.7% in 2009. Given the openness of the Malaysian economy, the negative wealth effects of the global crisis on demand and world trade have resulted in a decline in industrial production and manufacturing exports (9th MP). During this period, the government had taken policy initiatives to further energized the agriculture sector growth under the Second National Agricultural Policy: 1992-2010 and the Third National Agricultural Policy: 1998-2010 aiming for high agricultural productivity while ensuring conservation and utilization of natural resources on a sustainable basis (Murad, et.al., 2008). Further pro-agriculture policy is provided under the Ninth Malaysia Plan: 2006-2010 with highest allocation of RM 11,435 million to re-emphasis on growth and rebrand the agriculture sector as agribusiness. Specifically, during the ninth Malaysia Plan period, the overall policy thrusts of the agriculture sector had been focusing on its reorientation towards greater commercialisation and the creation of high-income farmers as well as promotion of greater private sector investment including foreign investment. With the support from both the public and private sector, the agriculture sector has been transformed from rural agriculture to commodities based agriculture practices (Frost and Sullivan, 2009). This strategy partly contributed to the nation transformation from an agricultural and commodity-based economy to become a prosperous thriving middle-income nation. Malaysia's real Gross Domestic Product (GDP) has grown by an average of 5.8% per annum from 1991 to 2010. However, the expected agriculture sector average annual growth rate of 5.0 per cent under the ninth Malaysia Plan is still far to be achieved.

1.2.4 New Economic Model Era: 2011 – 2015 (10th MP)

The latest New Economic Model (NEM) was launched in 2010 by the current Prime Minister. The main goal of NEM is to achieve a high income nation by 2020 with inclusiveness and sustainable socio-economic policies. NEM provides a new paradigm of development thinking with a more balanced and sustainable socio-economic growth focus (Arshad, 2010). In summary, NEM bring about the economic transformation (ETP) ideas with strategic development focus on 12 National Key Economic Areas (NKEAs) through 131 entry point projects. Agriculture sector is one of the NEM's NKEAs. The agriculture NKEA will focus on selected eight sub-sectors which has high-growth potential, namely food processing, cash crops (fruits and vegetables) other products (seaweed farming, swiftlet nests, herbal products), livestock, marine and aquaculture products as well as paddy rice. This sub-sectors account for 82 % of agriculture's contribution to Malaysian GNI in 2009 (Pemandu, pp. 514-515). The agriculture's NKEA targeted the agriculture sector will be transformed into agribusiness by 2020 through inclusive demand-driven approach focusing on market needs, economies of scale and value chain integration (Pemandu, pp. 41). Specifically, the agriculture's NKEA targeted to raise total GNI contribution to reach RM49 billion by 2020 and expected to create additional 75,000 jobs mostly in rural areas. This program will require cumulative funding of RM22 billion for the next 10 years with 62% is to be generated from private sector (Pemandu, pp. 42).

However, according to some industry experts, there are few strategic agricultural sector issues that need immediate attention and policy makers' consideration. First issue; the agriculture sector contains the heaviest government involvement in business activities since in the 1970s (Arshad, 2010) from upstream and downstream activities as well as in the agriculture sector value chain system and trade mechanism. Those days, the

agriculture sector perceived by private sector players as high risk industry and the government interventions is necessary and aiming at growing and protecting this industry sector growth. At the current economic scenario, Arshad (2010) argue that this is no longer applicable and suggesting that Malaysia has to re-look at the economic relevancy of the government massive intervention and involvement in the agriculture sector. Second issue; In Malaysia, agriculture holds the key to issues such as food security and safety, climate change, resource conservation, biodiversity and poverty reduction (Arshad, 2010). As such, this sector is significantly important to partly support the achievement of prosperity and sustainable socio-economic development in the coming and foreseeable future in Malaysia. Third issues; the achievement of Malaysia to become a high income country is challenged by its ability to uplift the bottom 40% poor population that are mainly resided in the rural areas (Arshad, 2010) of which dependable on agriculture sector. Thus, The policy makers need to understand the important of agriculture sector in holistic economic development perspectives and provide support for sustainable pro-agriculture growth policy in new economic model era for a more balanced and sustainable socio-economic development.

2. Data and Methodology

We obtain series of annual Malaysian's agriculture output and GDP in real term (based year 2005) from the World Bank and the Department of Statistics, Malaysia from 1970 to 2010. These variables have been transformed into log-form.

2.1 Econometric Techniques

2.1.1 Unit Root Test

According to Nelson and Plosser (1982), most of macroeconomic data are spurious because it contents the problem of instability. Moreover, Granger and Newbold (1974), and Engle and Granger (1987) argued that regressing the non-stationarity data from conventional OLS method would result in spurious outcome. Therefore, it becomes fundamental procedure when dealing with time series data to determine the stationarity of them to show whether all the data have the same order of integration. In this paper, we employ three widely applied unit root tests, namely Augmented Dickey-Fuller (ADF) (1979), Phillips-Perron (PP) (1988) and Kwiatkowski, Phillips, Schmidt and Shin (KPSS) (1992).

2.1.2 Johansen – Jesulius Cointegration

This paper will utilize Johansen and Jesulius Cointegration (1990) approach. Several authors revealed that this approach is performing better than other cointegration tests (Gonzalo 1994). In conducting the Johansen cointegration test, all the variables must have the same order of integration. We estimate the following model:

$$\Delta y_t = \Pi y_{t-1} + \sum_{t=1}^{p-1} \Gamma_t \Delta y_{t-1} + \upsilon_t \tag{1}$$

Where $\Pi = \sum_{t=1}^{p} A_t - I$ and $\Gamma = -\sum_{j=i+1}^{p} A_t$. Δ is the first different operators; y_t is $k \times 1$ stochastic vector of endogenous variables (our studies are consists $\ln Ag_t$ and $\ln GDP_t$) and υ_t is the error term. The matrix Π consists of long run information between y_t variables in the vector. We will examine the matrix rank, r, by testing the null hypothesis that the eigenvalues Π is statistically different from zero. If Π has zero r, we could not identify the stationary linear combination and the variables in y_t are not cointegrated. However, we can decompose into two matrices such that $\Pi = \alpha\beta'$, where α indicate the speed of adjustment to equilibrium relationship, while β is the cointegrating vector. Two set of Likelihood ratio tests suggested by Johansen and Juselius (1990) then we employ to test the existence of long run equilibrium relationship among variables; (1) trace test, $LR(\lambda_{trace}) = -T\sum_{i=r+1}^{k} \ln(1-\lambda_i)$ and (2) maximum eigenvalues test, $LR(\lambda_{\max}) = -T\ln(1-\lambda_{i+1})$. T is the number of observations and λ_{i+1} is the eigenvalues $(\lambda_1 > \lambda_2 \ldots > \lambda_k)$. We used Pantula principle as suggested by Hansen and Juselius (1994) to choose the appropriate cointegration model.

Having determined the cointegration among variables, we then employ Granger Causality test to indicate the causal direction of the variables. The following models were estimated:

$$\Delta \ln ag_t = \gamma_{11} ect_{t-1} + \sum_{i=1}^{p} \phi_{1i} \Delta \ln ag_{t-i} + \sum_{j=1}^{q} \varphi_{1j} \Delta \ln gdp_{t-j} + \mu_{1t} \tag{2}$$

$$\Delta \ln gdp_t = \gamma_{21} ect_{t-1} + \sum_{i=1}^{p} \phi_{2i} \Delta \ln ag_{t-i} + \sum_{j=1}^{q} \varphi_{2j} \Delta \ln gdp_{t-j} + \mu_{2t} \quad (3)$$

From the equation (2) and (3) above, γ_{11} and γ_{21} are the coefficients measure the error correction term, ect_{t-1}. Meanwhile ect_{t-1} is the error-correction term with lag one, derive from normalized cointegrating vector. The long run causality relationship exist if ect_{t-1} is significant. The Δ is indicates the first difference explanatory variables. In other word, it represent the variables are in the short run form, μ_{1t} and μ_{2t} are the error term of the respective equations which follow the *i.i.d* criteria. To test the existence of the causality relationship in eq. (2), the $H_0 : \varphi_{1j} = 0$ of no causality is tested using the standard Wald test. If we fail to reject the null hypothesis means that there is no causality running from real GDP to agriculture output. Similarly for eq. (3), if we fail to reject the null hypothesis, $H_0 : \phi_{2j} = 0$, we conclude that there is no causal relationship running from agriculture output to real GDP. In causal analysis, there are three results will appear, (1) bidirectional causality; both agriculture and real GDP has causal relationship running from each other, (2) one-way causality direction; only one variable causes the other, and (3) no causality; the two variables do not have causality direction.

3. Results and Discussion

In our case, if the two variables, lnag and lnGDP are integrated at the same level, both the variables could have long run equilibrium. In doing so, Augmented Dickey-Fuller (ADF) (1979), Phillips-Perron (PP) (1988) and Kwiatkowski, Phillips, Schmidt and Shin (KPSS) (1992) have been employed to determine the level of integration of the variables. From table 4, all the three tests have shown that the selected variables are not stationary at level but there are stationary after first differencing even though for KPSS test, the agriculture output is rejected at 10 % significant level. Therefore we can conclude that all the selected variables have the same order of integration, *I* (1).

Table 4. Unit root test

Variables	ADF test	PP	KPSS
Level			
ln ag	- 2.248	- 2.440	0.771**
ln GDP	- 1.725	- 1.672	0.793*
First difference			
Δ ln ag	- 6.210*	- 6.225*	0.366***
Δ ln GDP	- 5.258*	- 5.299*	0.261

Notes: *, **, *** significant at 1%, 5% and 10%. ADF and PP critical value are based on MacKinnon (1996) one-sided p-values. KPSS critical values are based on Kwiatkowski-Phillips-Shin (1992, table 1). Lag length criteria follows AIC criterion.

Having determined the level of integration of the selected variables, we then performed the Johansen and Juselius (1990) co-integration test and results are as reported in table 5. It clearly shows that the trace and max eigenvalue statistics is rejected at 5%, suggesting the existence of one cointegration rank between the variables. The normalized cointegration vector shows that real GDP has a positive relationship with agriculture output. It suggests that an increase in agriculture output as much as 1%, real GDP will increase by 4.9% and this value is significant at 5%.

Table 5. Cointegration test

Panel A: Johansen cointegraion results					
Hypothesis		LR test statistics		Critical values at 5 %	
H_0	H_1	$LR(\lambda_{trace})$	$LR(\lambda_{\max})$	$LR(\lambda_{trace})$	$LR(\lambda_{\max})$
$r \geq 0$	$r \geq 1$	32.5698*	25.6567*	20.2618	15.8921
$r \geq 1$	$r \geq 2$	6.9131	6.9131	9.1645	9.1645
Panel B: Normalized cointegrating vector					
$\ln gdp_t$	$\ln ag_t$	Constant			
1.000	4.9536**	-153.062			
	(2.792)	(67.22)			

Notes: *, **, are significant at 1% and 5%.

The existence of cointegration among variables does not represent direction of causality between the variables. As discussed from the earlier section, we employ a VECM Granger causality to examine the nature of interdependence between agriculture output and economic growth, and the results are reported in table 6 below. Firstly, we estimate the OLS of eq. (2) and eq. (3) as reported in panel (A) and then we employs VECM Granger causality test to detect any direction of causality between agriculture sector and economic growth. In the short run, both real GDP and agriculture output are identical or not relating to each other because we cannot reject the null hypothesis of no causality. However, in the long run analysis shows the ECT_t were rejected at 1 % level of significant. We can suggest that both economic growth as proxy by real GDP and agriculture sector output has a bidirectional causality running from each other. In other words, agriculture becomes an influence factor that could promote the economic growth in the long run. Similarly, an increase of GDP also could contribute to the increase in the agriculture output production in the long run. For example, eq. (2) that there is a long run relationship between real GDP and agriculture output. After short-run shocks, real GDP will deviate 0.53% to achieve equilibrium. Similarly to eq. (3) that we find a causality direction from agriculture to real GDP and they will converge to achieve equilibrium in the long run for almost 0.7%. Apart from that, panel (C) of the table we provide diagnostic tests to ensure the reliability of the model. For LM test shows that the residuals of the two models were free from serially correlated as we cannot reject the null hypothesis and we also found that the residuals are normally distributed as show from the normality test.

Table 6. Causality test

Panel A: Estimation result for equation (2) and (3)			
Independent variables	Δ lnag$_t$	Δ lnGDP$_t$	
Δlnag$_{t-1}$	-0.0276	-0.2441	
ΔlnGDP$_{t-1}$	-0.2277	0.1905	
ECT $_{t-1}$	-0.0053*	-0.0067*	
Panel B: Short run and long run Granger causality			
Null hypothesis	χ^2-statistics		ECT$_{t-1}$
	Short run Granger non-causality test		
lnGDP does not granger cause lnag	2.2175		- 0.0053*
lnag does not granger cause lnGDP	1.7967		- 0.0067*
Panel C: Stability test			
Stability test	*LM test*	*Normality test@*	*Heteroscedasticity#*
Eq. (2)	0.1299	0.7526	0.3708*
Eq. (3)	0.5630	52.230	0.8975

Notes: * denotes a rejection region at 1% level of significant. Both equation fail to reject H_0: residual is not serially correlated. # using Bruesh-Pagan-Godfrey method.@ Both equations pass the normality test as Jarques-Bera statistic shown that residual is normally distributed.

4. Limitations

The relationships between agriculture and economic growth is contextualizes into a narrow perspective of one to one variable relationship (i.e agriculture value added output – GDP). In this paper, we also ignored the other non-agriculture industries output in our economic structural analysis perspective.

5. Conclusion

The significant important of agriculture to Malaysian's socio-economic development is both theoretically and empirically supported. We re-examine this issues with a recent data to reflect the current economic environments. This paper provides empirical findings that there exist a co-integration relationship between agriculture and economic growth in Malaysia. Our findings from granger non-causality tests indicate agriculture and economic growth are identical. The increase in agriculture output seems to be no effect to the Malaysian economic growth at least in the short run, vice versa. However, in the long-run non-causality test, both variables have a feedback respond. In other words, agriculture sector output can cause economic growth and economic growth will also promote agriculture output in the long run. To recap, Malaysia development policy has re-emphasis back on the neglected agriculture sector after we experienced the 1997/98 crisis and pressured by the recent world trends in emphasising on the agriculture sector to curve the climate change and sustainable development issues. However, despite numerous efforts to revive the lost momentum of agriculture sector, the current contributions of this sector to Malaysia's GDP still not enough and unable to recover the growth rate of 44 % recorded before the industrialization era as well as the targeted 5 % growth rate per annum. In this respect,

the Malaysian government should pay extra attention to the holistic and sustainable development of agriculture sector which is critical in supporting the Malaysia's 2020 vision. Otherwise, things would remain status quo.

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The Impact of IFRS on the Value Relevance of Accounting Information: Evidence from Turkish Firms

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Abstract

Value relevance is being defined as the ability of information disclosed by financial statements to capture and summarize firm value. Value relevance can be measured through the statistical relations between information presented by financial statements and stock market values or returns. In many studies, Ohlson model (1995) has been adopted to explore relationships among the market value of equity and two main financial reporting variables, namely the book value of equity per share (represents balance sheet) and earnings per share (represents income statement). This study investigates the value relevance of accounting information in pre- and post-financial periods of International Financial Reporting Standards' (IFRS) application for Turkish listed firms from 1998 to 2011. Market value is related to book value and earnings per share by using the Ohlson model (1995). Overall book value is value relevant in determining market value or stock prices. The results show that value relevance of accounting information has improved in the post-IFRS period (2005-2011) considering book values while improvements have not been observed in value relevance of earnings.

Keywords: value relevance, accounting information, IFRS, Ohlson model, ISE

1. Introduction

In this study, we explore the impact of International Financial Reporting Standards' (IFRS) adoption on the relevance of book value and earnings for stock valuation in Istanbul Stock Exchange (ISE). Turkey has mandated listed companies in ISE to use IFRS since 2005. International integration and growing economy force Turkish firms to use international standards in accounting and auditing to be integrated to the international environment. Reporting financial information in terms of international accounting standards could ease economic and financial integration because the most important issue for decision makers all over the world is to receive better financial information from financial reports.

Accounting information contained in financial statements is expected to be useful for decision makers. In order to provide this, financial statements should meet some basic characteristics. "*If financial information is to be useful, it must be relevant and faithfully represent what it purports to represent. The usefulness of financial information is enhanced if it is comparable, verifiable, timely and understandabl*e" (Conceptual Framework, 2010: A33).

Basic qualitative characteristics of financial statements are relevance and faithful presentation. "*Relevant financial information is capable of making a difference in the decisions made by users. Information may be capable of making a difference in a decision even if some users choose not to take advantage of it or are already aware of it from other sources*" (Conceptual Framework, 2010: A33). Besides relevance, financial information is needed to be presented faithfully. "*To be useful, financial information must not only represent relevant phenomena, but it must also faithfully represent the phenomena that it purports to represent. To be a perfectly faithful representation, a depiction would have three characteristics. It would be complete, neutral and free from error. Of course, perfection is seldom, if ever, achievable*" (Conceptual Framework, 2010: A34).

The existing literature presents contradicting results about whether the value relevance of accounting information has decreased or increased over time. Recent empirical studies have revealed that value relevance of accounting information has declined over the past few decades (Khanagha, 2011; Perera & Thrikawala, 2010). Core et al. (2001) claim that the U.S.A. entered to a New Economy Period and traditional financial variables do not affect

firm value in that period. They tested this claim for the period 1975-1999 and concluded that the ability of traditional financial variables to explain firm value decreased. Marquardt and Wiedman (2004) investigated the effect of earnings management on the value relevance of net income and book value in determining equity values. They observed a decline in value relevance of net income and they also found that when relevance of net income is low, book value has a greater effect in determining stock prices.

There is a need for evaluating whether implementing IFRS has improved value relevance of accounting information in Turkey since the financial statements have been presented in accordance with IFRS for almost 8 years. This study investigates the value relevance of accounting information in pre- and post-financial periods of International Financial Reporting Standards' (IFRS) application for Turkish listed firms from 1998 to 2011. As focusing on pre- and post-IFRS periods, this study aims to explore value relevance of book value and earnings per share to assess stock prices especially in post-IFRS periods. Using the Ohlson model (1995), market value is related to book value of equity per share and earnings per share. The results indicate that overall book value is value relevant in determining market value or stock prices and value relevance of accounting information has improved in the post-IFRS periods (2005-2011).

1.1 Turkish Accounting System and IFRS

Turkish government has played a key role in establishing and developing an accounting system through its bodies. Turkish accounting regulations, most applications, and rules were taken from the countries with which Turkey has both political and economic relationships. Related to the accounting applications, France and Germany have played an important role. From 1950s onwards, as a result of increasing relationships with the U.S.A., the Turkish Accounting System has been affected by US accounting practices. After 1987, with the application for EU membership, International Accounting Standards together with EU regulations and the rapid globalization movements around the world affected the Turkish Accounting System (Toraman & Bayramnoğlu, 2006: 235).

IFRS have been developed by the International Accounting Standards Board, accepted by more than 100 countries around the world, and required for different types of companies. With the growth of economies and an increase in the number of publicly traded companies, Capital Markets Board of Turkey (CMB) has required publicly traded companies to apply IFRS starting with January 1st, 2005 (Suadiye, 2012: 301). Prior to 2005, Turkish firms were using Turkish Uniform Accounting System (Turkish GAAP) that was legislated in 1994. Karapınar et al. (2006) state that the development of accounting standards dates back to 1980s and first accounting standard presented by the CMB dated January 29, 1989 under the title of "Serial: XI, No: 1 – The Communiqué for the Rules and Principles Pertinent to Financial Statements and Reports in the Capital Markets".

Within the bounds of Turkey's economic development, the CMB was established in 1981 by the Capital Markets Law No: 2499 next to banking which is the traditional financing system (Marşap & Akbulut, 2006: 7). The regulatory and supervisory authority of securities markets and institutions in Turkey is the CMB. It regulates principles of capital markets and oversees the rights and interests of investors as well (TSPAKB, 2012: 3).

In Turkey, firms listed on ISE have been required to report their financial statements according to IFRS since 2005. Prior to that all required firms had to report their financial statements by Turkish GAAP.

2. Literature Review

Value relevance is being defined as the ability of information that is presented by financial statements to capture and summarize firm value. Value relevance can be measured by the statistical relations between information that financial statements present and stock market values or returns (Suadiye, 2012). Even though the concept is not new, the term "value relevance" was used by Amir et al. for the first time in 1993 in the related literature (Carnevale et al., 2009; Suadiye, 2012).

The value relevance of accounting information has been studied in many perspectives. Miller and Modigliani's (1966) study was one of the first studies investigating relations among accounting figures and other financial parameters. Miller and Modigliani (1966) investigated equity values that involved cost of capital in electric utility industry. The seminal article by Ball and Brown (1968) presented the relation between stock returns and earnings (Suadiye, 2012). As Ohlson (1991: 1) indicated "*Without exaggeration, it can be said that the Ball-Brown (1968) paper has had an enormous influence on modern empirical accounting research. Their analysis has led to an informational perspective on accounting data*". Ball and Brown (1968) related accounting income to stock prices. Besides Ball and Brown (1968) several researchers have examined the relation between stock prices or returns and accounting information. Ohlson model (1995) relates market value of a firm to accounting data (earnings, book values, and dividends). The model has been tested by many studies for many

countries.

Ali and Hwang (2000) used accounting information of manufacturing firms in 16 countries for 1986-1995 and reported that the value relevance of financial reports is lower for countries where the financial systems are bank-oriented rather than market-oriented. Similar results were received for the countries where the private sector is not a part in the standard setting process and where tax rules have a greater impact on financial accounting measurements.

Cooke et al. (2009) examined the degree of long-run explanatory power of the book value of net assets for market value by investigating time series relations of five conglomerates in Japan for the period 1950-2004. Their results showed that in four of the five firms there is evidence of a long-run relationship between market value and the net book value of assets. Perera and Thrikawala (2010) found relations between market price per share and selected accounting information of commercial banks for 5 years in Sri Lanka. According to their findings, there is a relationship between accounting information and market price per share.

Al-Horani's (2010) study shows that both univariate and multivariate analyses present no evidence of value relevance of earnings components for aggregate banks as using commercial banks data for the period 2000-2008 in Amman Stock Exchange. Glezakos et al. (2012) related book value and earnings per share to share prices in Athens Stock Exchange for 38 firms. They presented that the value relevance of book value and earnings per share increased over time. Alali and Foote (2012) stated that earnings are positively related to cumulative returns and that earnings per share and book value per share are positively related to price per share in Abu Dhabi Stock Exchange.

2.1 Previous Studies Related to Impact of IFRS on Value Relevance of Accounting Information

Iatridis (2010) focuses on the effects of switching UK GAAP to IFRS in the UK. The results show that implementations of IFRS generally reinforce accounting quality and lead more value relevant accounting measures. However study of Papadatos and Bellas (2011) indicated that relation between mandatory implementation of IFRS and value relevance of accounting information may not be in the same direction for every firm since they stated that both firm size and fixed assets became significant factors in their study.

Dobija and Klimczak (2010) explored value relevance of accounting information in Polish market and found that market efficiency and value relevance did not noticeably improved after adoption of accounting standards while supporting harmonization process and foreign investment.

Khanagha (2011) examined the value relevance of accounting information in pre- and post-periods of IFRS implementation in United Arab Emirates (UAE). The results showed that accounting information is value relevant in UAE stock market in general but the value relevance of accounting data decreased with IFRS application. It is also stated that cash flows' incremental information content increased in the post-IFRS period.

Macías and Muiño (2011) examined accounting systems of countries some of which are full adopters and others are partial adopters of IFRS in Europe. They believed that accounting system serves the needs of capital providers in full adopter countries and it serves other purposes in partial adopter countries. Their results show that quality of accounting information improves with the full implementation of IFRS. Requiring the use of local standards in the preparation of legal entity financial statements presents lower level of accounting quality both prior to and after IFRS adoption. Macías and Muiño (2011) state that adoption of IFRS in these countries are mostly for satisfying regulatory needs and not for satisfying investors' and creditors' needs.

Van der Meulen et al. (2007) investigated the attribute differences (value relevance and timeliness) between US GAAP and IFRS earnings. They found that US GAAP and IFRS only differ with regard to the predictive ability as US GAAP outperforms IFRS in given controlling differences. However, they did not observe significant and consistent differences for the value relevance attribute. Verleun et al. (2011) investigated the impact of the Sarbanes-Oxley (SOX) Act on the quality of financial statements in U.S.A. for technology and non-technology firms. They presented evidence that the enactment of SOX has had a positive effect on accounting quality. They stated that the value relevance of accounting information has also increased after SOX was enacted.

Callao et al. (2007) focused on IBEX-35 companies to see the effects of the new standards on comparability and relevance of financial reporting in Spain. Their results show that local comparability is adversely affected if both IFRS and local accounting standards are used in the same country at the same financial period. Because of worsened local comparability, Callao et al. suggested an urgent transformation of local rules according to the international accounting standards. They also stated that even though value relevance of accounting information has not been significantly improved in the short run with the implementation of IFRS, it is expected to improve in the medium and long run.

Karampinis and Hevas (2011) investigated IFRS implementation and value relevance of accounting data. They explored potential effects of IFRS implementation on two salient properties of accounting income; value relevance and conditional conservatism. Their results show that only minor improvements have been observed related with selected properties of income. Karampinis and Hevas (2009) found similar results for value relevance of mandatory application of IFRS in Greece. They concluded that mandating IFRS may be beneficial for the selected period. Study of Iatridis and Rouvolis (2010) also provided that IFRS adoption leads to more value relevant accounting measures in Greece Stock Exchange for 254 firms.

In Turkey value relevance of accounting information has also been analyzed in several perspectives. Kirkulak and Balsari (2009) analyzed the effect of inflation-adjusted data on explaining the market value of equity and stock returns in Turkey. They reported that both historical cost-based book value and earnings information and inflation-adjusted information are value relevant and they complement each other. Using them together results to more value relevance. However, they also stated that comparing value relevance of inflation-adjusted information is a unique opportunity since firms reported their financial statements in both historical cost numbers and inflation-adjusted numbers only for the year 2003. Because of lower inflation rates and the implementation of international accounting standards since 2005, applying inflation accounting would not be needed (Gücenme & Poroy Arsoy, 2006).

Aktaş (2009) related data from balance sheet and income statement with the stock prices in Turkey. The study concluded that changes in net income, assets per share, book value per share, and liabilities per share are value relevant in calculating stock prices for the period of 1992-2007. Türel (2009) compared the value relevance of accounting information for the periods 2001-2002 and 2005-2006. The results showed that the value relevance of earnings and book value of equity has increased after adopting IFRS for the given period.

3. Data and Methodology

3.1 Sample Selection and Data

To test the value relevance of accounting information, our data covers the period from 1998 to 2011. The period is divided as pre-IFRS (1998-2004) and post-IFRS (2005-2011) periods to observe improvements on the value relevance of accounting information. Market Value per Share (MVPS) or stock prices, Book Value per Share (BVPS), and Earnings per Share (EPS) data was collected from Istanbul Stock Exchange (ISE) listed firms that implemented IFRS in 2005. Firms operating in financial sector were excluded from the sample due to different reporting requirements. Table 1's first column (column A) represents our initial sample that is not used in any regression models but used for detecting and excluding influential observations. The second sample is created as subtracting influential observations from initial sample (column B). The last sample contains firms that reported positive earnings (column C).

Table 1. Numbers of firms 1998 – 2011

Years	Initial Sample (A)	Initial Sample – Influential Observations (B)	Positive Earnings Reported (Positive EPS) (C)
Pre-IFRS			
1998	136	130	115
1999	135	131	93
2000	151	142	116
2001	137	131	81
2002	138	133	104
2003	147	138	104
2004	152	145	110
Post-IFRS			
2005	152	144	103
2006	154	147	108
2007	158	149	120
2008	146	142	81
2009	145	137	90
2010	149	139	100
2011	155	146	114
Pooled Data		1954 observations in 14 years (1998 – 2011)	

3.2 Methodology and Models

Ohlson model (1995) is used for detecting value relevance of accounting data for the given period. The model is used to test our samples in four perspectives. The first one is to test value relevance of accounting data that does not contain influential observations (Table 1, column B). The second approach is to investigate the value relevance of accounting data for the firms that reported positive earnings (Table 1, column C). The third perspective is to test value relevance of pooled accounting data for the given time period and 1954 observations. And finally the Ohlson model (1995) is applied to see the improvements on the value relevance of accounting information in the pre- and post-IFRS periods.

A modified price model (Ohlson, 1995), which consists of two major indicators from financial reports (balance sheet and income statement), is used to test the value relevance of financial reporting in many studies. Ohlson model (1995) is adopted to explore relations between equity market value with two main financial reporting variables, namely the equity book value per share (represents balance sheet) and earnings per share (represents income statement). The equation of this econometric model is as follows (Kwong, 2010: 9-10):

$$MVPS_{it} = \alpha_0 + \beta_1 BVPS_{it} + \beta_2 EPS_{it} + \varepsilon_{it} \quad (1)$$

where $MVPS_{it}$ is the market value per share of firm i at time t (fiscal year-end), $BVPS_{it}$ is the book value of equity per share of firm i at year t, and EPS_{it} is the reported accounting earnings of firm i at the fiscal year ended at time t.

In this study, the model (Model 1) is designed as market value per share (*MVPS*) or stock prices as dependent, book value per share (*BVPS*) and accounting earnings per share (*EPS*) as independent variables for the selected firms and the period of 1998-2011. Model 1 used data that do not include influential observations (Table 1, Column B).

Model 2 is used for pooled data that covers the time period of 1998-2011 for all firms and Model 3 is applied for testing firms that reported positive earnings.

Finally, Model 4 is designed to see the improvements of the value relevance of accounting data after IFRS implementation. β_3 and β_4 present the difference between coefficients of book value and earnings per share for the pre- and post-IFRS periods. If the difference of coefficients is positive (negative), that means the variable's value relevance increases (decreases) in the post-IFRS period. In order to detect changes in coefficients, pre- and post-IFRS dummy variables (*D*) are used. "0" is used for pre-IFRS period (1998-2004) and "1" is for the post-IFRS. $\beta_3$and β_4 are dummy variable coefficients of *DBVPS* and *DEPS* respectively.

Model 1. $MVPS_{it} = \alpha_0 + \beta_1 BVPS_{it} + \beta_2 EPS_{it} + \varepsilon_{it}$

Model 2. $\mathrm{MVPS_{it}} = \alpha_0 + \beta_1 \mathrm{BVPS_{it}} + \beta_2 \mathrm{EPS_{it}} + \varepsilon_{it}$

Model 3. $\mathrm{MVPS_{it}^{+}} = \alpha_0^{+} + \beta_1^{+} \mathrm{BVPS_{it}^{+}} + \beta_2^{+} \mathrm{EPS_{it}^{+}} + \varepsilon_{it}^{+}$

Model 4. $\mathrm{MVPS_{it}} = \alpha_0 + \alpha_1 \mathrm{D} + \beta_1 \mathrm{BVPS_{it}} + \beta_2 \mathrm{EPS_{it}} + \beta_3 \mathrm{DBVPS_{it}} + \beta_4 \mathrm{DEPS_{it}} + \varepsilon_{it}$

4. Results

Table 2 presents the results of Model 1, yearly cross-sectional regressions of price on earnings and book value. Coefficient estimates are calculated based on Ordinary Least-Squares (OLS) estimation. The adjusted R^2 ranged from 25% in 2010 to 75% in 2004 for the yearly cross-sectional regressions of price on earnings and book value and the mean is 54%. In each year the book value's coefficient estimates are significant and positive ($p < 0.05$). As it is presented in Table 2, *F* test values are statistically significant in each year as well. Additionally coefficient estimates of earnings are positive in each year and statistically significant for the years of 1998, 1999, 2000, and 2007. Multicollinearity is evaluated by Variance inflation factors (*VIF*). *VIF* indicate that multicollinearity is not likely to be a serious problem.

Table 2. Yearly cross-sectional regressions of price on earnings and book value

$$MVPS_{it} = \alpha_0 + \beta_1 BVPS_{it} + \beta_2 EPS_{it} + \varepsilon_{it}$$

Years	α_0	p[a]	β_1	p[a]	β_2	p[a]	$\overline{R}^{2}$ [b]	F-stat.	p[a]	VIF[c]
1998	0.9948	0.4067	1.2720	0.0006	5.3246	0.0000	0.6621	46.25	0.0000	1.8230
1999	0.6597	0.7541	4.3335	0.0000	7.5911	0.0039	0.6346	33.18	0.0000	1.9060
2000	0.9720	0.3035	1.1777	0.0000	4.1818	0.0064	0.5797	17.83	0.0000	2.6540
2001	2.3716	0.0011	1.2801	0.0000	0.5390	0.3347	0.6693	76.19	0.0000	2.4930
2002	1.9011	0.0000	0.8069	0.0000	0.2353	0.6886	0.6182	58.83	0.0000	1.6680
2003	1.4526	0.0001	0.5907	0.0000	1.1191	0.2036	0.5678	23.45	0.0000	1.5570
2004	0.7599	0.1633	0.7841	0.0025	2.2685	0.2781	0.7518	22.11	0.0000	2.9120
2005	-0.7138	0.7054	2.3125	0.0232	-1.4830	0.7488	0.3935	72.24	0.0000	2.5230
2006	-0.3577	0.7827	2.0629	0.0212	-1.6938	0.6475	0.4435	26.33	0.0000	3.6710
2007	0.3692	0.6576	1.0295	0.0065	2.4258	0.0894	0.4596	12.83	0.0000	2.1100
2008	0.7332	0.0660	0.7837	0.0000	0.4769	0.5210	0.6930	35.45	0.0000	1.9940
2009	1.1564	0.5973	2.0499	0.0000	-6.7340	0.2305	0.4441	39.95	0.0000	1.0070
2010	-0.7215	0.7957	3.0433	0.0163	2.6823	0.5541	0.2502	29.09	0.0000	1.3670
2011	-0.1100	0.9470	2.4494	0.0002	0.2319	0.9279	0.3480	14.03	0.0000	2.6210

Notes: [a] White's Heteroscedasticity-Consistent Variances and Standard Errors. Statistically significant if p<0.10 10%, p<0.05 5%, and p<0.01 1%. [b] $\overline{R}^2$: Explanatory power of book value and earnings per share to market value per share.[c] VIF for Ohlson model. If VIF >10, it indicates multicollinearity.

The results of the pooled data presented in Table 3 – Panel I show that the coefficient estimates of both earnings and book value are positive. However, only book value has significant effect on the market value per share or stock prices. That means only book value is a significant accounting variable for selected ISE firms' stock valuation.

It can be said that book value and earnings per share jointly explain 38% of the cross-sectional variation in stock prices for the period of 1998-2011.

Variance inflation factor (*VIF*) was also calculated and found to be within the acceptable limit (1.79) as presented in Table 3 because the *VIF* value is smaller than 10.

The results of multiple linear regression of stock prices on book value and earnings for firms that reported positive earnings are presented in Table 3 – Panel II. The coefficient estimates of both book value and earnings per share have positive and significant (p<0.01) effects on stock prices of selected ISE firms.

The coefficients of book value and earnings are about 1.00 and 6.02 for the firms that reported positive earnings with adjusted R^2 value of 0.47. The results show that the earnings per share is a dominant valuation variable in the firms that reported positive earnings compared to book value.

Table 3. Pooled and positive earnings reported data: Cross-sectional regressions of book value and price on earnings

	Panel I [a] $MVPS_{it} = \alpha_0 + \beta_1 BVPS_{it} + \beta_2 EPS_{it} + \varepsilon_{it}$		***Panel II*** [b] $\mathrm{MVPS}_{it}^{+} = \alpha_0^{+} + \beta_1^{+}\mathrm{BVPS}_{it}^{+} + \beta_2^{+}\mathrm{EPS}_{it}^{+} + \varepsilon_{it}^{+}$	
	Coefficient	p- value[c]	Coefficient	p- value[c]
α_0	1.5715	0.0291	0.6191	0.5499
β_1	1.5903	0.0000	1.0018	0.0000
β_2	1.4970	0.1831	6.0246	0.0000
F-stat.	51.8829	0.0000	41.8742	0.0000
$\bar{R}^{2}$ [d]	0.3886		0.4769	
VIF[e]	1.7910		2.7080	

Notes: [a] Ohlson model (1995) pooled sample results for the years of 1998-2011 period. [b] Ohlson model (1995) results of pooled data for the firms reported positive earnings for the period of 1998-2011. [c] White's Heteroscedasticity-Consistent Variances and Standard Errors. Statistically significant if p<0.10 10%, p<0.05 5%, and p<0.01 1%. [d] $\overline{R}^2$: Explanatory power of book value and earnings per share to market value per share. [e] *VIF* for Ohlson model (1995). If *VIF* >10, it indicates multicollinearity.

Regression results presented for each year in Table 2 consistently support the pooled data results in Table 3 – Panel I. Table 2 and Table 3 reveal that book value is relevant in determining stock prices. The question is whether value relevance of accounting information has improved after the implementation of IFRS. In order to answer that question, pre- and post-IFRS implementation data is needed to be compared. Table 4 reveals that comparison.

The slope coefficients and related *p*-values, adjusted R^2, and *F*-statistics for pooled and positive earnings data are reported in Table 4. The slope coefficient of *DBVPS* is significant (p<0.05) while the coefficient of *DEPS* is negative and insignificant. The adjusted R^2 of the model for pooled data is about 0.40. In order to see the structural breaks in the model, Chow Test is applied for the pooled data and the data of the firms reporting positive earnings. Chow test is detected in certain range of p values (if p<0.10 10%, p<0.01 1% the case of statistically significant structural break).

Coefficients of β_3 and β_4 present changes or improvement in value relevance of accounting information after IFRS for book value and earnings per share respectively. Positive coefficient means an increase in value relevance of accounting data, while the negative sign presents a decline. Based on that, it can be seen that value relevance of accounting information has increased significantly in the post-IFRS period for the book value of per share because the coefficient of book value increased by 0.9580 (as β_3) and the change is positive. However, this improvement has not been observed in value relevance of earnings per share since the value of earnings coefficient decreased by -2.7146 (as β_4) and the change is negative. It can be concluded that value relevance of accounting information decreased significantly in the post-IFRS period for earnings per share.

Table 4. The results of chow test for the pooled and positive earnings data

	Panel I [a]		***Panel II*** [b]	
	Coefficient	*p*- value[c]	Coefficient	*p*- value[c]
α_0	3.7712	0.0000	3.6176	0.0000
β_1	0.9986	0.0003	0.0939	0.5825
β_2	2.9144	0.0234	8.0338	0.0000
β_3	0.9580	0.0216	1.6992	0.0000
β_4	-2.7146	0.2261	-4.6375	0.0441
F-stat[d]	2.3775	0.0681	5.7306	0.0007
$\bar{R}^2$	0.4029		0.5145	

Notes: [a] $MVPS_{it} = \alpha_0 + \alpha_1 D + \beta_1 BVPS_{it} + \beta_2 EPS_{it} + \beta_3 DBVPS_{it} + \beta_4 DEPS_{it} + \varepsilon_{it}$. [b] $MVPS_{it}^{+} = \alpha_0^{+} + \alpha_1^{+} D + \beta_1^{+} BVPS_{it}^{+} + \beta_2^{+} EPS_{it}^{+} + \beta_3 DBVPS_{it}^{+} + \beta_4 DEPS_{it}^{+} + \varepsilon_{it}^{+}$. [c] White's Heteroscedasticity-Consistent Variances and Standard Errors. Statistically significant if p<0.10 10%, p<0.05 5%, and p<0.01 1%. [d] For Panel I F (3.2015), for Panel II F (3.144) Chow test for the presence of a structural break, if p<0.10 10%, p<0.01 1% the case of statistically significant structural break.

As Table 4 and Table 3 have been compared, it can be seen that the results of the firms reported positive earnings in Table 3 – Panel II and the results of pooled data are consistent with each other. Coefficient estimation of β_3 is positive while coefficient of β_4 is negative and the values are statistically significant. The results can be interpreted as that value relevance of book value per share has increased after implementation of IFRS for the selected firms of ISE. Since Chow test is 5.73 at the 1% level, change of value relevance of accounting information is statistically significant. However, value relevance of earnings per share has decreased in post-IFRS period for the selected firms of ISE.

5. Concluding Remarks and Suggestions for Further Future Research

International Financial Reporting Standards (IFRS) have been developed by the International Accounting Standards Board, accepted by more than 100 counties around the world, and required for different types of companies. With the growth of economies and numbers of publicly traded companies, Capital Markets Board of Turkey (CMB) required public companies to apply IFRS for fiscal years starting on or after 1 January 2005.

The value relevance of accounting information has been studied in many perspectives. Literature has offered contradicting results about whether relevance of accounting information has declined or increased over time. Although some recent empirical studies reveal that value relevance of accounting information declines, literature contains many studies revealing that value relevance of accounting numbers increases. Many countries' results show that adopted IFRS significantly improve value relevance of accounting information. This study is consistent with the studies that reveal an increase in the value relevance of accounting information after implementation of IFRS.

In many studies Ohlson model (1995) has been adopted to explore relations between equity market value with two main financial reporting variables, namely the equity book value per share (represents balance sheet) and earnings per share (represents income statement).

This study investigates the value relevance of accounting information in pre- and post- financial periods of International Financial Reporting Standards (IFRS) applications for Turkish listed firms from 1998 to 2011. Market value is related to book value and earnings per share by using the Ohlson model (1995). Overall book value is value relevant in determining market value or stock prices. The results show that value relevance of accounting information has improved in the post-IFRS period (2005-2011) considering book values while an improvement has not been observed in value relevance of earnings.

Results of pooled data and firms that report positive earnings show that book value is value relevant in determining stock prices for the selected firms and years. Reviewing value relevance of book value, improvements have not been observed in earnings.

IFRS have improved value relevance of accounting information in Turkey for the selected firms and periods. This result may be caused that IFRS applications, i.e. fair value presentation of financial reports, would lead to a closer book and market values.

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Nonlinear Income Convergence and Structural Breaks: Further Empirical Evidence

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Abstract

In this paper we reexamined the study done in King and Ramlogan-Dobson (2011) as well as Chong et al. (2008) by investigating the nonlinear convergence among the G16 countries using alternative methodology. We find that the results are sensitive to the method of analysis even after allowing for structural breaks. With semi-parametric model only six (6) cases of convergence were identified and eight (8) cases when we use nonlinear Fourier unit root test. With relative transition model all the sixteen (16) countries exhibit convergence with United States and Norway converging a little above group average.

Keywords: convergence, structural breaks, fractional integration, nonlinear Fourier transform

1. Introduction

In a recent paper King and Ramlogan-Dobson (2011) hereafter KR investigate the role of structural breaks in nonlinear income convergence applied to sixteen (16) OECD countries for the period 1950-2004. The study is an extension of a previous study by Chong et al. (2008) hereafter CHLL within a nonlinear framework but without incorporating structural breaks. Whereas CHLL (2008) find evidence of convergence for only four countries, KR using nonlinear LM test and in the presence of structural breaks find evidence of convergence for ten countries, which is more than double the number obtained under CHLL. The results seem to suggest that tests that ignore structural breaks are susceptible to misleading results. Our study revisits the income convergence hypothesis in the two studies by reexamining the issue within fractional integration framework, nonlinear Fourier transform and relative transition model to determine if the method materially affects the outcome. An attractive feature of fractional integration is that it allows for the existence of continuum of situation between I(0) and I(1) cases. In the case of nonlinear Fourier approximation it allows us to incorporate multiple structural breaks with unknown functional forms and hence to control for the effect of unknown forms of nonlinear deterministic terms in testing for a unit root. With respect to relative transition model, the approach provides a detailed characterization of the transition paths to equilibrium and also provide a simple test for convergence or divergence in the data generating process (DGP). Thus, the combination of these approaches enable us to determine the sensitivity of the results to different methods of analysis.

The rest of the study is organized in four sections. Section I has been the introduction. In section 2 a brief review of the literature is provided. Section 3 articulates the econometric tests and report the empirical results Section 4 concludes.

2. Literature Review

The literature on income convergence is vast and growing. At one end there is the neoclassical growth theory which states that over the long run there is the tendency of per capita income of different countries to converge to steady state (Solow 1956, Barro and Sala-i-Martin 1995, Bernard and Dulauf 1995). At the other end there is the 'new' endogenous growth theory that challenges the former insisting that social increasing returns to scale associated with human and physical capital cause divergence (Romer 1986, Lucas 1988). According to the new endogenous growth theory there is no automatic mechanism that prevent economies from divergent steady states. For example, the structure of incentives to invest which are different among countries is said to be one of the

critical factors promoting divergence (North 1990, Barro and Sala-i-Martin 1997). It is therefore not surprising that the debate has attracted significant interests among scholars and development economists to determine which of the two competing schools of thought best describe convergence behavior.

Testing for convergence within time series framework had been based on unit root test of stochastic convergence indicated in Ben – David(1993), Bernard and Durlauf (1995). According to Carlino and Mills (1993) stochastic convergence implies that shocks to the income of a given country relative to the average income across a group of countries will be temporary. A common test for stochastic convergence involves testing for a unit root in the log of the ratio of per capita income relative to the group average or to the dominant economy. Failure to reject the unit root null hypothesis is indicative of divergence, while its rejection is supportive of stochastic convergence.

Whereas many studies on convergence had been carried out on the assumption of linearity, there is growing literature that it may be nonlinear and that linearity is too restrictive. Greasley and Oxley (1997), Kapetanios et al. (2003), Datta (2003), CHLL (2008), KR (2011) are indicative of this line of empirical enquiry. CHLL (2008), and KR (2011) adopt nonlinearity within a Smooth Transition Autoregressive process.

However, recent research claims that growth convergence cannot be appropriately investigated in a I(0)/I(1) framework given the evidence in the empirical literature that aggregate output or its components are suitably modeled by fractionally integrated processes. By its design fractional integration accounts for the long-memory characteristic of the series through the differencing parameter **d** that can take any values not necessarily integers. The justification for fractional integration stems from the fact that it is a consequence of aggregation over heterogenous firms and multiple sectors (Lo and Haubrich (2001)).

One problem with KR (2010) study is that the use of conventional procedures for detecting and dating structural breaks tend to find spurious breaks, usually in the middle of the sample, when in fact there is only fractional integration in the data (Hsu 2001, Kramer and Sibbertsen 2002, Mayoral 2006). Indeed traditional test as indicated in KR and CHLL considers only integer integration versus short memory and structural breaks, even in cases where there is empirical evidence for the hypothesis of fractional integration. If the model is in fact fractionally integrated, contradictory results are likely to be found when different methods are adopted. This problem is also examined in our study by conducting a battery of tests.

We adopt three approaches. The first pertains to the semi-parametric long memory narrow band model of Geweke and Porter-Hudak (GPH, 1983). The second approach is the nonlinear Fourier transform which allows for structural breaks(Enders and Lee 2006, 2009; Becker et al. 2006). In this method the trigonometric terms is defined to capture unknown nonlinearities in the equilibrium level. The third approach is the relative transition model of Phillips and Sul (2007a, 2007b).

3. Econometric Method and Results

Let Y_{it} be the per capita income level of country i in time t and Y_{jt} the corresponding income of country j in time t. Let $X_t = \log Y_{it} - \text{Log} Y_{jt}$ be the corresponding income ratio or per capital income differential. As in KR we use US as the dominant economy.

Therefore

$$X_t = \alpha + \beta t + w_t,\ w_t \sim I(d)\ i=1,2,\ldots,n,\ i \neq j \quad (1)$$

$$or\ (1-L)^d w_t = C(L)\mathcal{E}_t,\ \mathcal{E}_t \sim iid(0,\delta\varepsilon^2) \quad (2)$$

where L is the lag operator, $C(L) = \sum c_k L^k$, $C(0) = 1$, and **d** is the fractional integration parameter, k=lag length, w_t is a zero-mean fractionally integrated process. We assume that the process is invertible (**d**> -0.5). Consequently w_t can be rewritten as an infinite AR(p) process:

$$\sum \boldsymbol{\pi}_k (d) w_{t-k} = C(L)\mathcal{E}_t\ ,\ \boldsymbol{\pi}_k(d) = \frac{\Gamma(k-d)}{\Gamma(-d)\Gamma(k+1)}\ ,\ Lim\ \boldsymbol{\pi}_k(d) = \frac{k^{-(d+1)}}{\Gamma(-d)} \quad (3)$$

Γ (.) is the gamma function.

The value of **d** indicates the persistence of the shocks: the smaller d the less persistent will be the shocks.

Case 1: When $-0.5<d \leq 0$, w_t is short – memory, that is I(0). The coefficient $\boldsymbol{\pi}_k$ in (3) reduces to (1/k) and decay rapidly towards zero. In the context of fractional integration we call this configuration rapid catching –up or short-memory catching-up or convergence ($\alpha \neq 0\ ,\ \beta \neq 0$).

Case 2: When $0 < d \leq 0.5$, w_t is a long memory stationary converging process. The autoregressive coefficients in (3)

decay smoothly. Any observed difference in the per capita income in the remote past still has an influence in the current year. We call this long memory catching- up. It occurs when a country spends a long time on the transition path towards the common equilibrium deterministic trend($\alpha \neq 0, \beta \neq 0$).

Case 3: When 0.5 <d<1, we have long memory non-stationary but mean- reverting converging process. The autocorrelation coefficients in (3) are characterized by a high persistence, meaning that any difference observed in per capita income in (the very far past has a long lasting influence. This transition dynamics is referred to as long memory mean-reverting caching-up ($\alpha \neq 0, \beta \neq 0$).

Case 4: When $d \geq 1$, w_t is explosive. In this case, there is a magnification effect. Any initial difference is not expected to be reversed in future. We call this condition stochastic divergence ($\alpha \neq 0, \beta \neq 0$).

Similarly for conditional convergence ($\alpha \neq 0, \beta = 0$) *three distinct cases may emerge:*

Strict convergence $-0.5 < d \leq 0$

Long memory conditional convergence $0<d<0.5$

Long memory mean-reverting convergence $0.5<d<1$

Finally absolute convergence ($\alpha = 0, \beta = 0$) *occurs when d=0, long memory stochastic convergence when* $0<d<0.5$, *long memory mean-reverting convergence when* $0.5<d<1$.

In general, d>0, the I(d) process is often called long memory process, because the autocovariance function is not summable so as to capture long range dependence of a time series. When $d \geq 0.5$, the I(d) is nonstationary, but mean reverting and when when $d \geq 1$ the I(d) is a purely non-stationary process.

Several authors have focused on a semi-parametric estimation of the memory parameter alone. An important property of stationary fractional series on which these semi-parametric methods are based is:

$$f(\lambda) \approx G\lambda^{-2d} \text{ as } \lambda \rightarrow 0^{+}, \text{ where } f(\lambda) \text{ is the spectral density of the series and } 0<G<\infty, \text{ so that}$$

$$Log(f(\lambda)) \approx k + d(-2log\ \lambda) \tag{4}$$

for small frequencies. From discrete Fourier transforms of equation (4) we obtain a regression of $\log[I_x(\lambda_j)]$ on a constant and $-2\log \lambda_j$, for j=L, L+ 1, . . . m, with $L \geq 1$ and m<n. This is the basis for the log periodogram (LP) regression of Gewke,Porter-Hudak (GPH, 1983) which uses narrow band, the broad band based Moulines and Soulier (1999) regression, and local whittle Gaussian maximum likelihood estimator of Robinson (1995a, 1995b). In this study we use GPH and test for bias using Davidson and Sibbertsen (2009) Hausman-type test and differentiate between spurious I(d) model and long memory in the fractional integration parameter results by splitting the sample into two, run the regression and test for parameter constancy of ***d*** using Shimotsu (2007) adjusted Wald (Wc) statistic distributed as χ^2(b-1) where b is the number of samples.

3.1 Nonlinear Fourier Unit Root Test

The nonlinear Fourier unit root test relies on a Fourier approximation for the transition function which captures structural change with a transition regime. It takes the form:

$$\Delta X_t = \psi_0 + \theta X_{t-1} + \psi_1 Sin(2\pi kt/T) + \psi_2 Cos(2\pi kt/T) + \sum \phi_t \Delta X_{t-i} + e_t \tag{5}$$

where k ($1 \leq k \leq 5$) is the number of frequencies of the Fourier function, t is a trend term, T is sample size, and $[\psi_1 Sin(2\pi kt/T) + \psi_2 Cos(2\pi kt/T)]$ captures structural change in the sequence $\{X_t\}$. The unit root test allows for an unknown number of endogenous structural breaks with unknown functional forms.

There is nonlinearity and unknown breaks in the function if the hypothesis $\psi_1 = \psi_2 = 0$ is rejected using F-statistics F(k) of Table 3 in Enders and Lee (2004). The K in F(k) is the k_{min} obtained from the regression (5) which gives the minimum residual sum of squares (RSS) for different frequencies. As earlier indicated rejection of the above hypothesis is indicative of the presence of structural breaks. If $\theta=0$, (using the τ_{DF} statistics from Table 3, Enders and Lee 2004), there is unit root. However, if If θ is significantly differently from zero, we reject the unit root through taking into account nonlinearity and possible structural breaks and therefore X_t is stationary (stochastic convergence).

3.2 Relative Transition Model

The relative transition paths to long-run equilibrium model was proposed by Phillips and Sul (2007a, 2007b). It is based on the reduced form of a Solow growth model allowing for heterogenous speeds of convergence and transition effects over time (see also Dufrenot et al. 2009). Let h^i_t be the relative transition path of counry i at time t relative to the group of 16 countries with which she shares the same technology. We then have:

$$h^i_t = Y^i_t/(N^{-1}\sum Y^i_t) \sim \delta^i_T(rT/T)\mu_T(rT/T) \rightarrow p\ \delta^i_T(r)\mu_T(r) \text{ as } T \rightarrow \infty$$

*w*here N is the sample of countries, T is the time span of the study, r is the fraction of time corresponding to the observation t, μ_T (r) the common steady state growth curve, $\delta^i_T(r)$ the limiting transition curve for the economy, and $\rightarrow$p indicates convergence in probability.

The relative transition regression model is given by

$$Log\ H_t = c - 2pLog(t) + e_t \quad (6)$$

where $H_t = T^{-1}\sum(h^i-1)^2$, $H_t \sim ct^{-2p}$ *as* $t \rightarrow \infty$, $i=1,2,\ldots n$

where $p > 0$ and statistically significant indicates convergence and $p<0$ means divergence. The G16 countries was subdivided into three subgroups. Group A comprise five countries -USA. Canada, UK, and Germany; group B Australia, Austria, France, Italy, and Switzerland; group C Norway, Sweden, Denmark, Belgium,Finland and Netherlands. For each subgroup we fit the relative transition model for the period 1950-2006. We first removed the cyclical component in the log of per capita income using a Hodrick-Prescot Filter and then use the smooth component of the filter to estimate the relative transition coefficients.

The data were extracted from Angus Madison (2006) per capita GDP 1990 International Geary Khamis dollars table. The sample size is 1950-2006, two more data points than those used by KR. The fractional integration models were estimated using Time Series modeling (TSM) 4.34 (James Davidson 2002-2011) at http://www.timeseriesmodelling.com/ and OX 6.20 (J.A. Doonik, 1994-2010) was required as a complement to run the package. The nonlinear Fourier unit root was carried out using RATS 7.3 computer software. The relative transition curves were fitted using Eviews 7.0.

Table 1 presents the results based on GPH (1983) semiparametric long memory estimation method.

Table 1. Geweke-Porter-Hudak estimation and test results

Country	*d*	*t-value*	*Bias test*	*Sub Sample ds*	*Wc, b=2*
Australia	0.2495	0.714	1.332	0.835	30.33802*
Austria	0.8599	2.46	0.815	0.779	0.579203
Belgium	0.934	2.673	0.223	0.913	0.039028
Denmark	1.283	3.671	-0.166	1.082	3.575408
Finland	0.8569	2.451	-0.161	0.961	0.959036
France	1.0507	3.006	0.609	1.051	7.96E-06
Germany	0.933	2.669	-0.216	0.964	0.085047
Italy	0.9988	2.857	-0.099	0.867	1.53732
Netherlands	0.811	2.321	-1.138	1.058	5.399175*
Norway	0.9916	2.837	-0.514	1.056	0.367033
Sweden	1.0972	3.139	1.087	1.339	5.174234*
Switzerland	1.4005	4.006	-0.846	1.273	1.438646
UK	0.644	1.843	-0.5	0.833	3.161237
Japan	1.149	2.630	-0.288	1.147	2.212563
Canada	1.357	3.881	1.183	1.214	1.809696

Note:* Indicates rejection of the null at 5% level. $\chi^2_{0.95}(1) = 3.84$.

Our results, based on fractional integration, are inconclusive Eight (8) countries namely Denmark, France, Italy, Norway, Sweden, Switzerland, Japan and Canada indicate nonstationarity and hence divergence process. Six (6) countries (Austria, Belgium, Finland, Germany, Netherlands, UK) have estimated fractional integration parameter between 0.5 and 1.00 suggesting long memory but mean- reverting converging process. The transitional dynamics is in the tradition of long memory mean-reverting caching-up. Only Australia ($d<0.5$) shows evidence of stationary convergence or catching-up with USA. Of the seven (7) countries that show convergence, only four (4) namely Australia, Austria, Belgium and Germany were among those contained in KR converging countries. For the results based on fractional integration the adjusted Wald test do not support the view that structural breaks account for all the observed persistence.

Table 2 reports the results based on nonlinear Fourier unit root tests. First we note that the null hypothesis of linearity is rejected at 5 percent level for ten (10) countries based on the sample value of the F(k) statistic (those marked with *) in column three, where estimated k represent frequency with the minimum residual sum of squares (RSS). Eight (8) countries (Australia, Austria, Denmark, France, Italy, Sweden, Switzerland and UK) indicate evidence of convergence based on their estimated τ_{DF} values which exceed the critical value at k_{min} frequency.

Thus, while KR obtain convergence for ten countries our results based on nonlinear Fourier approximation indicate convergence for eight countries, two less than the result in KR. Of the eight countries for which convergence is obtained six of them are contained in KR set of ten countries while the remaining two (Italy and United kingdom) were part of the five set of countries in KR for which divergence was the case.

Table 2. Results based on nonlinear Fourier Unit Root Test

	Θ	F(k)	K_{min}	Lags	τ_{DF}
1	Australia	3.969*	5	3	-2.915*
2	Austria	7.701*	1	3	-5.272*
3	Belgium	3.647	1	0	-2.979
4	Canada	6.237*	2	0	-2.949
5	Denmark	8.770*	5	2	-3.703*
6	Finland	2.579	1	1	-2.753
7	France	4.018*	5	0	-3.132*
8	Germany	4.712	1	1	-2.845
9	Italy	12.311*	1	0	-5.256*
10	Japan	3.355	1	1	-2.353
11	Netherlands	3.492	3	0	-2.374
12	Norway	5.501*	3	3	-1.333
13	Sweden	8.696*	2	4	-3.284*
14	Switzerland	20.960*	1	3	-5.498*
15	Uk	9.320*	1	4	-4.451*

Notes: τ_{DF} at 5% with k_{min} (1) -3.816, k_{min} (2) -3.270, k_{min} (3) =-3.059, k_{min} (5) -2.910, F(k): k_{min} (1) 7.137, k_{min} (2) 4.256 , k_{min} (3) 3.539, k_{min} (5) 3.139

Table 3. Log(t) test of transition convergence – Regression: Log Ht=c-2ρlog(t) + et

Countries	ρ	t-ratio	Conclusion
A. USA, Canada, Japan, UK, Germany	0.562	20.704	Convergence
B. Australia, Austria, France, Italy,Switzerland, France	0.608	16.239	Convergence
C. Norway, Swedan, DenmakFinland, Belgium, Netherlands	0.322	10.318	Convergence

Table 3 and Figure 1 pertain to the results based on relative transition paths. The relative transition paths for each of the three subgroups reveal absolute convergence for all the subgroups (see Table 3). Figure 1 provides detailed characterization of the transition paths to long-run equilibrium or conver-gence of each of the G16 countrie. The relative transition curves show how the trajectories followed by these countries become closer over time. Some countries (Canada, USA, Switzerland, UK, Australia) start above average and follow a downward trend, while others (Japan, Italy, Germany) start below average and exhibit upward transition. As reported above in Table 3, the Log(t) test does not reject the null hypothesis of no convergence, thereby indicating that for the G16, there is a common factor driving their economies together in the long run. These factors include, but not limited to, technology, quality of their institutions, and labour productivity. The good news is that there is no evidence that the G16 countries are in general converging to a GDP per capita level below average, which is a sign of improvement in the standard of living over time. The USA and Norway show convergence slightly above the group average. while Japan's performance is slightly below group average. It is remarkable to observe that KR also concluded that "Norway is the only country to catch up with the US over the entire period. Overall, the differences in the trajectories of the countries that are initially above and those initially below the average are reduced over time in all the countries.

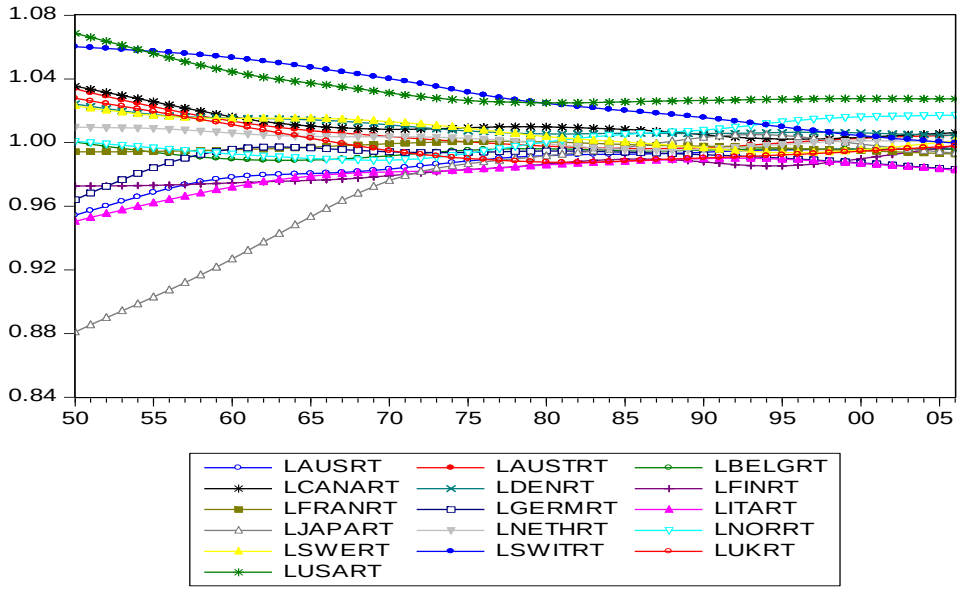

Figure 1. Relative transition paths for the 16 industrialized countries

Notes: Lausrt, Laustrt, lbelgrt, lcanart, ldenrt, lfinrt, lfranrt, lgermrt, litart, ljapart, lnethrt, lnortt, lswert, lswtrt, lukrt, lusart represent relative transition paths respectively of Austria, Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherland, Norway, Sweden Switzerland, United Kingdom and United States.

4. Concluding Remarks

In this study we reexamined the results presented in CHLL and KR using alternative method to determine if the approach materially affected the results obtained. First we found that with respect to convergence with the United States only six countries (Austria, Australia, Belgium, Finland, Germany, Netherlands and United Kingdom) are convergent based on fractional integration. This is two more than in CHLL but four fewer than in KR. When we use nonlinear Fourier unit root test we obtain eight countries that are converging with the USA. This is two fewer than in KR. However, when we use relative transition path model we found that all the G16 countries exhibit convergence both in terms of the log(t) test and in terms of the trajectories of the logarithm of per capita income followed by these countries. The results show no evidence that the G18 countries are converging to a GDP per capital level below average. We conclude that findings of convergence studies are not robust to methodology adopted. It seems to us that relative transition model provides a more fruitful line of inquiry for future research.

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Workers' Remittance and Their Effect on the Level of Investment in Nigeria: An Empirical Analysis

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Abstract

Despite the increasing importance of remittances in total international capital flows, the relationship between remittances and stock of capital formation has not been adequately studied. This paper studies one of the links between remittances and fixed capital formation, in particular how local financial sector development influences a country's capacity to take advantage of remittances. Using time series data for the period 1977-2010, the study employed the ADF and Philip-Perron modified unit root tests and based its analysis on a Dynamic Ordinary Least Squares- two–stage Instrumental Variable [2SIV] approach to control for the endogeneity problem that arises from utilization of lag independent variables. We find that remittances boost stock of physical investment in Nigeria countries with positive relationship with developed financial systems by providing complementarities to finance investment in a developed financial system. Substantial government allocation on social services is equally important in accelerating capital formation. The findings of this study strongly suggest that for Nigeria to benefit from international transfers, Nigeria financial sector should be fine-tuned to complement remittances potential capital formation.

Keywords: workers' remittances, investment, dynamic, ordinary least squares, Nigeria

1. Background

Developing countries have experienced a tremendous surge in the inflow of remittances in the past decades. The phenomenon became a major source of foreign exchange earnings, exceeding private capital flows, export earnings and foreign aid. In 2007, officially recorded worldwide migrants' remittances were $385 billion, $278 billion of which was to developing countries. The worldwide figure rose to $440 billion in 2010, of which that of developing countries reached $325 billion. Registering a quick recovery to the level in 2008, remittances fell only 5.4 percent in 2009 compared to a 36 percent decline in foreign direct investment (FDI) between 2008 and 2009 and a 73 percent decline in private debt and portfolio equity flows from their peak in 2007 in the face of the economic crisis (World Bank, 2011).

Nigeria remains the single largest recipient of the phenomenon in Sub-Sahara Africa while receiving between 30 percent and 60 percent of the region over the last decade (Chukwuone *et al*, 2008). Remittance flows to the country amount to US$9 billion in 2009 with a growth rate of 4.8 percent between 2009 and 2010 (World Bank, 2010). The overwhelming majority of remittance in Nigeria is person to person flows mainly from the United States, the United Kingdom, Italy and other Western Europe countries. Chukwuone *et al* (2008) believe that inflows from abroad have been key stabilising factors to the Nigeria naira against other international currencies in the past three years.

Given the tremendous increase in remittance inflows into the developing world including Nigeria, economic impact on the receiving country emerged an important topic of study. If remittances are a source of a country's capital resource, along with foreign investment, domestic savings and foreign aid, economic theory predicts a positive long run effect on the economic growth prospects of the recipient country. However, if remittances are primarily used by households to alleviate short-term cash constraints through consumption activities, the anticipated outcome would be poverty reduction for the recipient economies through improved living standards. These economies could have access to better health care and education improving their overall well-being,

advancing a country's capital formation with the expectation of a positive impact on long-term economic growth.

This study seeks to examine whether or not the Nigerian Diaspora and their remittances do leverage physical investment improvement in Nigeria. A closer reading of the literature suggests that the research on the related issue dominate journal articles from the perspective of growth but say little on their physical investment channel. Not surprisingly, the verdict of such literature is ambiguous, shaky and fails to underpin the impact of the resources in Nigeria settings. Moreso, in an attempts to unpack the unknown quantum, namely the probe into remittance –investment growth nexus, the study realises that the current fragmentary evidence of the impact of Diaspora and remittances on growth enhancements precludes a conclusive verdict in literature and that the subject requires more empirical evidence particularly in Nigeria where the subject matter is to our knowledge very scarce.

Following the introduction, the rest of the paper is organized into four sections. Section two presents the remittance trends and stylized facts. In section three, the literature is reviewed. Section four consists of the methodology - theoretical underpinnings and model specification and method of data analysis is presented. Presentation of results and discussions are done in section five and the paper concludes in section five with concluding remarks and recommendations.

Overall, examination of the stylized facts based on the aggregate quantity of workers' remittances reveals remittances' relative global macroeconomic importance. Flows of workers' remittances have been growing consistently over time and now represent the largest balance of payments inflow to Nigeria. Their relative stability versus that of other inflows to Nigeria may provide additional macroeconomic benefits in terms of cyclicality of output and consumption, issues that this study will not examine.

2. Trends of Remittances and Stylised Facts

Remittance flows proved to be resilient during the global financial crisis and became even more important as a source of external financing in many developing countries. Officially recorded remittances sent to developing countries reached $325 billion, registering a quick recovery to the level in 2008. India was the largest developing country recipient of workers' remittances in 2010 with US$53.1 billion, followed by China, Mexico, Philippines, Bangladesh, Nigeria, Pakistan, Lebanon, Vietnam and Egypt (Figure 1).

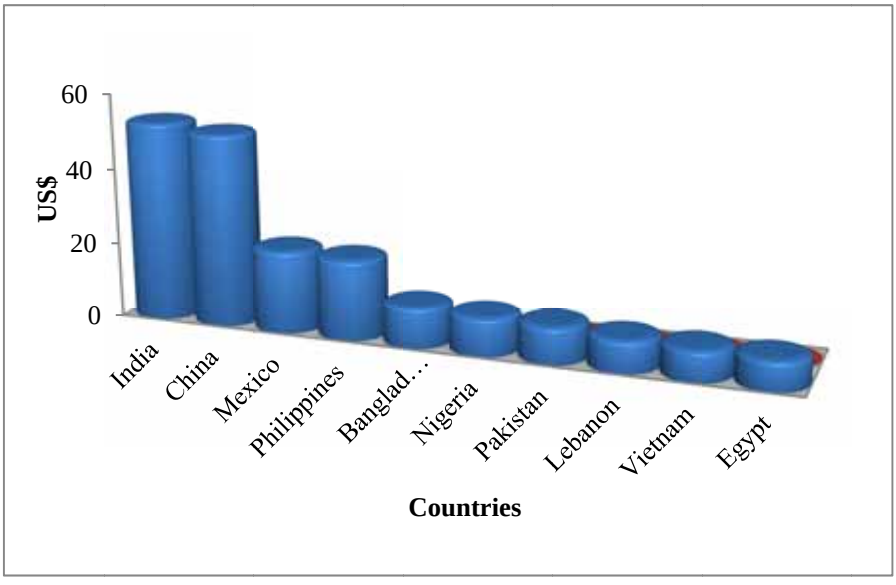

Figure 1. Largest recipient of remittances in developing countries in 2009

Source: World Bank Statistics (2010) and authors' calculation.

In sub-Saharan Africa, Western Africa receives high level of the remittances as percentage of GDP to the entire block, with Gambia, Togo, Senegal and Cape Verde in descending order, dominating the pack. Although Nigeria remain unarguably the highest recipients in absolute term (figure 2).

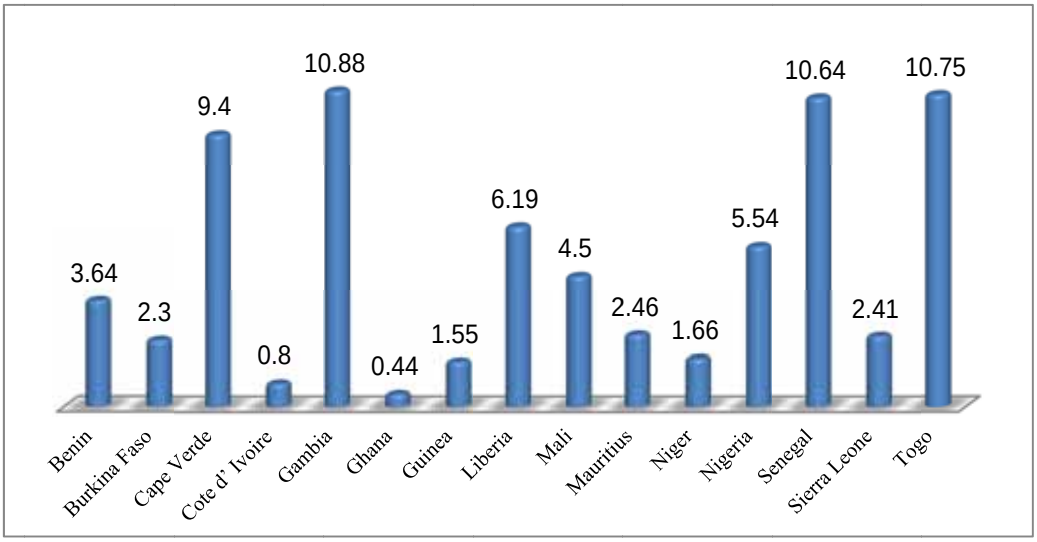

Figure 2. Remittance as %GDP in West African countries, 2010

Source: World Bank Statistics (2010) and authors' calculation.

In terms of their importance in the balance of payments and their contributions to economic performance, workers' remittances recently exceed both official aid and FDI capital flows to Nigeria and have generally displayed much less variability than other balance of payments (figure 3). The next section reviews the literature.

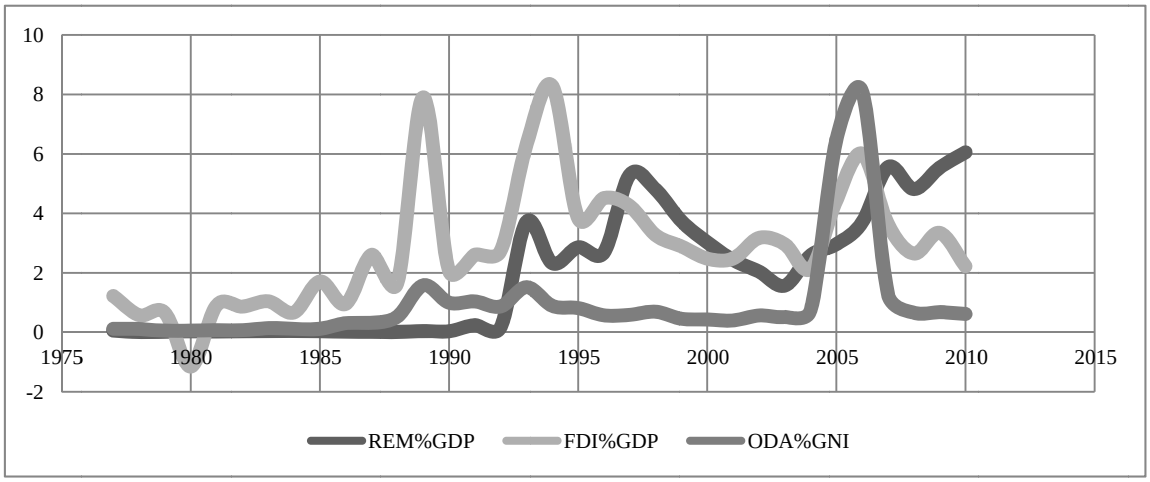

Figure 3. Ratio of remittances, official flows and FDI to GDP in Nigeria, 1977-2010

Source: World Bank Statistics (2010) and authors' calculation.

3. Empirical Literature Review

According to the World Bank (2006) remittances are more effective in both raising investment and enhancing growth in countries with higher levels of human capital, strong institutions, and good policy environments. Remittances are a stable form of external finance and often increase during times of economic hardship (Biller, 2007). In contrast, remittances can also deteriorate the balance of trade by stimulating an increase in imports (Biller, 2007). Remittances also have the tendency to create demand for leisure and reservation wages that as a consequence can reduce the participation of persons in the productive labour force, thus reducing the labour supply (Fajnzylber & Lopez, 2007 and Grifin et al, 2008). Lucas (2005) found that remittances impact positively on investment in India, Morocco and Pakistan. The results from a study conducted by Leon-Ledesma and Piracha (2004) for 11 transition economies of Eastern Europe for the period 1990-1999 affirm the view that remittances have a positive impact on productivity and employment, both directly and indirectly, through investment.

Similarly, Ratha (2003) provides empirical evidence that remittance is a component of foreign savings which complement the total pool of resources available to investment in Mexico, Egypt and sub-Sahara Africa. Extending the work of Ratha, Amavilah (2008) and Kagochi *et al* (2010) examine the relationship between remittances and economic growth in a cross-country panel data analysis of six Sub-Saharan Africa (SSA) countries within the conventional neoclassical growth framework. The results of the study suggests that while remittances have a positive impact on economic growth of SSA countries with high GDP per capita they do not cause direct impact on economic growth of low GDP SSA countries. The study also finds that capital formation, life expectancy and education have a positive impact on economic growth in SSA. Ahortor and Adenutsi (2009) and Adenutsi (2011) also found significant positive impact of remittances on economic growth.

A different perspective on the long-run impact of remittances comes from Glytsos (2001) and Chami *et al* (2003) that extend the work of Kozel and Adelman (2000). Adopting two-stage least squares (TSLS), Glytsos point to different inter-country priorities of remittance spending and to asymmetric impact of remittance changes. The analysis also reveal a uniform country performance of instability and uncertainty, with great temporal and inter-country fluctuations of remittance effects and conclude that the good done to growth by rising remittances is not as great as the bad done by falling remittances.

In a broader dimension Rao and Hassan (2009) investigates the indirect and direct effects of remittances on the growth rates for 40 developing countries. Their study analyses the strength of these effects using the standard incomplete panel data methods of OLS of both FE and RE combined with the Generalized Method of Moment (GMM). While they evidenced a positive and significant growth effects on remittances they however reported that the direct growth effects of remittances is insignificant. The Ordinary least square (OLS) and Fixed Effects (FE) Instrumental Variables Regressions model of Bajara *et al* (2009) similarly suggest that decades of private income transfers—remittances—have retarded long run economic growth in remittance-receiving economies. According to them, this negative effect might be due to the fact that the phenomenon are generally not intended to serve as investments but rather as social insurance to help family members finance the purchase of life's necessities. This reason to me is however not in tandem with the standard economic growth theory which presupposes economic growth as a first order condition to poverty reduction as confirmed by the empirical study of Anyawu and Erhjikarpor (n.d) in their study of the examination of the impact of international remittances on poverty reduction in African countries. The authors use panel data of 33 African countries over the period 1990-2005 and found that international remittances – defined as the share of remittances in country GDP – reduce the level, depth, and severity of poverty in Africa.

Other opponents argued that remittances may increase inequality, because it is the rich who can migrate and send back money, making recipients even richer Stahl (1982). At the macroeconomic level, large inflows of foreign exchange can have serious consequences resulting from the advance effects on tradable commodities and on relative competitiveness due to an appreciation of real exchange rates in the receiving country. One is the possibility that countries can face a situation similar to the "Dutch Disease" in which the inflow of remittances causes a real appreciation, or postpones depreciation, of the exchange rate. This has the effect of restricting export performance and hence possibly limiting output and employment especially in small economies where remittance inflows are large in comparison to the country's GDP (Jadotte, 2009; and Catrinescua, Leon-Ledesmab, Pirachac, and Quillind, 2009).

The macro econometrics investigation of Zuniga (2011) is recent restatement and empirical test of this proposition. Zuniga while controlling for remittances at level of developing countries and adopting panel vector autoregressive (panel VAR). He posed mixed result by suggesting that remittances have a positive, albeit small, impact on economic growth in Eastern European economies, the Americas and Asia; but does not appear to have a statistically significant impact on African economic growth. Other opponents argue that at macroeconomic level, large inflows of foreign exchange can have serious consequences resulting from the advance effects on tradable commodities and on relative competitiveness due to an appreciation of real exchange rates in the receiving country. One is the possibility that countries can face a situation similar to the "Dutch Disease" in which the inflow of remittances causes a real appreciation, or postpones depreciation, of the exchange rate. This has the effect of restricting export performance and hence possibly limiting output and employment especially in small economies where remittance inflows are large in comparison to the country's GDP (Jadotte, 2009; Ratha, 2004; and Catrinescua, Leon-Ledesmab, Pirachac, and Quillind, 2009).

The multiplier stories capture at least the short-run impact of remittances on the receiving economy suggesting that the phenomenon may in fact be detrimental to long-run growth. One piece of evidence that is quite suggestive comes from Kozel and Adelman (2000). They performed a labour a labour force participation and labour supply study of Pakistan using data from the 1986 PIDE survey. They found a significant negative impact

of remittances on the labour force participation of males. Stahl and Habib (1989) based their study on Keynesian multiplier using input- output tables for Bangladesh to construct a simple remittance multiplier for the year 1976 to 1988. The average value for the multiplier is found to be 1.24, and this implies basically a consumption effect. Nishat and Bilgrami (1991) use the same Keynesian structure to estimate the remittance multiplier but for Pakistan. They found a multiplier of 2.43, which even more primarily operate through the consumption effect. The model is a simple- consumption, investment, import demand and taxes are each single-equation functions of disposable income or GNP- so this estimate should be used with caution. Adelman and Taylor (1990) construct a social accounting matrix for Mexico and found that for every Dollar received from migrants working abroad, its GNP increased by US$2.69 to US$3.17 depending on whether remittances were received by urban or rural households. According to them, rural households tend to consume more domestically produced goods, hence generate larger multiplier effects than urban households. Based on a data set of 74 low and middle income developing countries Durand *et al* (1996) further explore the implication for Adelman and Taylor's analysis.

This exchange makes concrete an underlining question raised by the number on remittances, and by those who argue that that they are used as capital flows to finance investment and growth. Given that remittances are quite large relative to the sizes of many sub Sahara African economies, if their role are principally a capital flow to finance economic growth, why has their being this great controversial evidence on remittance economic growth linkages. Of course this evidence may as well exist, but might not be apparent because of the lack of a unified model to capture the growth effect of remittances. Obviously, a discussion of the phenomenon at the cross - country level, credible and appropriate in checking the logical conclusions of country studies, even as it creates, at the same time, the necessary opportunity to appreciate the role of remittances on the development process requires much more deeply empirical investigation. We therefore review next the remittances- financial deepening literature.

Agu (2009) specified a four-sector medium scale macro model to investigate the relationship between remittances flows and the macro economy in Nigeria. He found a weak link between remittances and the real sector and components of aggregate demand. The possible reasons for this weak link between remittances and the real sector of the Nigerian economy, he argued, could be the existence of leakages of remittances proceeds through imports. Tomori and Adebiyi (2007) and Chukwuone *et al* (2007) in their study of the effect of remittances on poverty levels argued that remittance is an important channel to alleviate poverty in developing countries. Whereas Tomori and Adebiyi (2007) used partial equilibrium framework, Chukwuone *et al* (2007) employed living standard survey in their analysis. Also, Kure and Nwosu (2008) examine the impacts of remittances on growth in Nigeria where growth, investment, human and private capital are estimated, using data for the period 1990-2007. One important finding from their paper is that remittances have a positive impact on economic growth in Nigeria through investment in private and human capital, with a pass-through effect on private consumption. Very recently, Udah (2011) conducted an investigation into the channels by which remittances impact on economic performance in Nigeria using the Ordinal Least Squares estimation technique. To test the time series characteristics and long run relationships of the variables included in the model, he employed the Ng and Perron modified unit root tests and Autoregressive Distributive lag (ARDL) bounds testing approach to co-integration developed by Peseran and Peseran. Udah reported that remittances affect economic performance in Nigeria through its interaction with human capital and technology diffusion. He suggests that for Nigeria to benefit from international transfers, policies should be fine-tuned to attract more remittances into the educational sector and technological transfers.

Regardless of what might be the motivation, role of remittances on private investment are mixed. Obviously, a discussion of the phenomenon at the country level, credible and appropriate in checking the logical conclusions of specific country studies, even as it creates the necessary opportunity to appreciate the role of remittances on the development process requires much more deeply empirical investigation in Nigeria.

4. Methodology

4.1 Theoretical Framework

Harrod-Domar Growth Model is a simple one which postulates that changes in national income ΔY depends linearly on changes in capital stock ΔK and that investment or changes in capital stock is financed out of domestic savings S in the closed economy version of the model i.e ΔK = S. The model says that domestic savings S itself depend on national income Y, i.e. S = sY, where s is the saving ratio of income:

$$\Delta Y = b\Delta K \quad (1)$$

$$\Delta K = S = sY \quad (2)$$

Substituting (2) into (1), we have

$$\Delta Y/Y = sb \tag{3}$$

Harrod-Domar explained that equilibrium economic growth is determined by the product of savings ratio s and annual investment returns. This means that economic growth will proceed at the rate at which society can mobilise domestic savings resources coupled with the productivity of investment. Realising that the major constraint on the part of developing economies is the shortage of capital, the Harrod- Domar model prescribed the open extension where investment can be finances both by the domestic and the foreign capital flow (emphasis on remittance). Then the model may be written as:

$$\Delta Y = b\Delta K \tag{4}$$

$$\Delta K = S + F \tag{5}$$

Substituting (4) into (5) and dividing through Y, we have

$$\Delta Y/Y = b[(S/Y) + (F/Y)] \tag{6}$$

$$\Delta Y/Y = b[s + f] \tag{7}$$

This implies that if f >0, economic growth can be increased beyond what domestic savings resources will allow. In order words remittance inflow can supplement domestic investment funds to enhance the capacity of the economy to grow.

4.2 The Model

The relationship between physical capital investment and remittances will be formally tested using Stock and Watson (1993) Dynamic Ordinary Least Squares (DOLS). The model specification will follow the work of Griffith et al (2008) with little modification as follows:

$$\Delta lprivin = \beta^i X_t + \Delta \sum_{J=-k}^{k} \lambda_j^{\ i} \Delta X^i{}_{t-j} + \varepsilon_t \tag{8}$$

where lcinvin is fixed capital investment, *X* =[*lrgdp, lremit, lfdi, lfd, rir*] with

$lcinvin_{t-1}$ denotes the initial level of capital investment, *lrgdp* is real gross domestic product , lremit is remittances, lfdi being foreign direct investment, lrcredit is real private sector credit. All these variables are in logs and will be deflated by the retail price index. *Bx* is a vector of β-coefficients, so that *Blrgdp*, for example, is the coefficient with respect to *lrgdp*. ε_t is the error term. However, to the extent that income growth is one of the main determinants of remittances as well as being affected by remittances, there is an endogeneity problem, which has the tendency to have made this result biased and inconsistent and not reliable for policy formulation. Also the inclusion of the leads and lags of the first differences of the I(1) regressors intend to take care of serial correlation and endogeneity issues, making the DOLS procedure an unbiased and asymptotically efficient estimator of the long-run relation, even in the presence of endogenous repressors (Stock and Watson, 1993).

Instrumental variables are therefore used to deal with endogeneity problem in estimating the relationship between capital formation and growth in remittances. Adopting the model used by Chami and others (2003), in the first-stage regression, the growth rate of remittances is estimated as a function of other variables (instruments) that are correlated with remittances growth but uncorrelated with the stochastic error term in the second-stage regression. The following equation is therefore estimated in the first-stage regression:

$$\Delta LREM_t = \alpha_0 + \alpha_1 \Delta LCF_t + \alpha_2 Y_t + \alpha_3 \Delta CPI_t + \alpha_4 \Delta RIR_t + \omega_t \tag{9}$$

Where WR is the log of workers' remittances and instrumental variables are, per capita GDP in Nigeria (Y_N), Inflation as measured by the consumer price index (CPI), real interest rate in Nigeria. CF is fixed capital formation in Nigeria. The fixed capital formation is essentially used as a proxy for physical capital formation. The growth of per capita real income is then estimated as a function of the fitted growth rate of remittances (ΔW) from the first stage regression.

The second stage equation is therefore estimated as follows:

$$\Delta CF_t = \alpha_0 + \alpha_1 \Delta CF_{t-1} + a_2 \Delta Y_t + \alpha_3 \Delta \hat{W}R_t + \alpha_4 FDI_t +$$

$$a_5 \Delta FD_t + a_6 FD * REM_t + \varepsilon_t \tag{10}$$

We are interested in testing whether the marginal impact of remittances on capital formation α_3 is statistically

significant. While remittances have the potential to affect capital formation, we examine one specific link between remittance and capital formation, specifically through financial markets. The hypothesis we would like to test is whether the level of financial depth in Nigeria affects the impact of remittance on capital formation. To this end we interact the remittances variable with an indicator of financial depth and test for the significance of the interacted coefficient.

All the data will which covered from 1977 to 2010 and are sourced from the Central Bank of Nigeria Statistical Bulletin Annual Statistical Digest of the International Financial Statistics (IFS) of the International Monetary Fund (IMF) and the World Development indication of the World Bank. The Augmented Dickey Fuller Test and Philip Peron unit root tests will be carried out on each variable to test for stationary.

4.3 Estimation Technique

Before estimating the models, the variables used in the model are subjected to stationary tests, using Augmented Dickey-Fuller (ADF) and Philip Perron test following equation 1.

Our ADF test consists of estimating the following equation:

$$\Delta Y_t = \alpha + \beta_t + \delta Y_{t-1} + \Psi \sum_{i=1}^{m} \Delta Y_{t-1} + \varepsilon_t \tag{11}$$

Where α represent the drift, *t* represents deterministic trend, β, δ, ψ are parameters to be estimated, m (lag length) is a lag large enough to ensure that ε_t is a white noise process; and Δ is the difference operator. In the ADF approach, we test whether $\delta = 0$

The Philips-Perron test is based on the following statistic:

$$\tilde{t}_\alpha = t_\alpha \left(\frac{\gamma_0}{f_0}\right)^{1/2} - \frac{T(f_0 - \gamma_0)(se(\hat{\alpha}))}{2 f_0^{1/2} s}$$

Where: $\hat{\alpha}$ estimate; $\tilde{t}_\alpha$ is the t-ratio of $\alpha; se(\hat{\alpha})$ is the coefficient standard error; T is the sample size or number of observations and *s* is the standard error of the test regression. In addition, γ_0 is a consistent estimate of the error variance in the standard Dickey-Fuller equation (calculated as $(T-k)s^2/T, where$ k is the number of repressors). The remaining term, f_0, is an estimator of the residual spectrum at frequency zero.

If the variables are integrated of order one 1(I) or of different order of integration, we test for the possibility of significance of the variable relationship using 2 stage instrumental least square procedure.

4.4 Data Analysis and Results

All variables are tested at levels and first difference using ADF unit root test. The justification for the use of ADF unit root is based on large sample (n > 30).

The ADF-unit root test results reported in (appendixes table 1) revealed that all the variables under consideration are stationary at first difference. This implies that the null hypothesis of non-stationary for all the variables is rejected. Next, the Philip-Perron (PP) test is conducted to complement the ADF. The results also show the rejection of the non hypothesis and presented in table 2 of the appendices.

This Lagrange multiplier ((autocorrelation) (LM)) test indicates that there is no serial correlation in the residual since the Obs*R-square is significant at 5 percent. The second stage regression results as presented in table 3 is cast on the principle of moving from "general to specific" estimations such that only results for the models' most significant economic and statistical properties are reported and discussed in the final analysis. Estimated equations show good statistical and theoretical properties with respect to the data used. While the effect of remittances capital is conspicuous, the R^2 and adjusted R^2 are in the range of 0.94 and 0.92 clearly indicating that the functions explain nothing less than 92 percent of the linear behaviour of the dependent variables in the lower case and 94 percent in the upper case during the 1977 to 2010 periods. R^2 is the fraction of the variance of the dependent variable explained by the model. The F value of 62.67 is highly significant, easily passing the significant test at the 1 and 5 percent levels.

The estimated coefficient of the lagged investment variable is large and positive. This implies that the value of additional capital good exceeds its cost and leads to strong inducement to invest (Keynes, Marginal Efficiency of Capital (MEC)). Regarding the remittances variable, it is remarkable that this is positive and significant. Specifically, the result indicates that a percentage increase in remittances will bring about nothing less than 22 percent increase in capital formation in Nigeria. Also in accordance with the results previously found, the

interaction between remittances and financial depth is positive and significant. This result implies that the growth effects of remittances are enhanced in deeper financial systems, supporting complementarities of remittances and other financial flows. In other words, it provides evidence of complementarities between remittances and financial instruments boosting fixed capital formation in Nigeria.

Interestingly, the results from our model indicate that the GDP per capita has a positive relationship with capital formation but lost its statistically significance. Validating the theoretical disincentive nature of the Nigerian budgetary allocation which adds a substantial number to the current expenditure in the face an extremely small capital stock coupled with the current rate of low capital formation. This result according to Nurkse (1956) implies 'a circular constellation of forces tending to act and react upon one another in such a way as to keep a poor country in a state of poverty'. Expectedly, the results from our model indicate that FDI has a positive and statistically significant effect on the total fixed capital in Nigeria. Accordingly, we find that a 1 percent increase in FDI flow to Nigerian economy would result in about 44 percent increase in the physical capital formation in Nigeria. There appear to be a robust relationship between fixed capital formation and FDI in Nigeria between the periods of 1977 to 2009.

Finally, CUSUM square for stability of short-run dynamics and long-run parameters of investment function, it is core that cusum of squares stay within the 5 percent critical bound (represented by two straight lines whose equations are detailed in Brown, Durbin, and Evans, 1975, Section). The CUSUM of squares plots does not move outside the 5 percent critical lines. This result is suggestive of coefficient stability, therefore, we can safely conclude that the estimated parameters for the short-run dynamics and long-run of remittances function exists over the entire sample periods since residual result shows the future tendency of further stability. Also, the normality test lends credence to the parsimony of our model parameters. Considering the values of Jarque-Bera, Kurtosis and the skewness, it suggests that the model is normally distributed which implies that the result of the model is robust for policy analysis.

5. Conclusion

What is the investment impact of remittances? How does financial development influence the growth effects of remittance? To shed light on these important questions, this paper uses DOLS to provide empirical evidence on the impact of remittances on investment and also its interaction with financial development in Nigeria over the period 1977 to 2010. The results indicate that remittances have significant positive effect on investment. The complementarities between the interactive variable implies that remittances can bring about more growth if financial sector is more developed and other incentives are provided for remittance recipient economies. By becoming a complement for credit markets, remittances if well managed can help improve the allocation of finance to capital formation and boost economic growth.

These findings do not, however, give insight into all the channels through which remittance may affect growth. In particular we did not explore other possible impact of remittance on growth. Also apart from FDI, financial development, economic growth, we also left other possible determinants of capital formation like institutional aspect that may explain this effect. It is possible for example those other factors other than the ones specified may explain why remittances can have positive impact on fixed capital formation. Nonetheless, we interpreted the nil impact of economic growth on fixed capital formation as suggestive evidence of poor government expenditure on capital goods.

Overall, our empirical analysis provides the first macroeconomic evidence of how remittances and financial development may interact in promoting capital formation the evidence that remittances complement liquidity constraints and help undertake profitable investment in Nigeria is encouraging but while many policy-makers stress the need to stimulate remittances by reducing transfer cost, the biggest challenge is to understand how remittances can complement financial development in Nigeria.

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Appendix

Table 1. Unit root test using ADF statistic

Stationarity test for variables					
Variables		**ADF test stat**	**Critical values**		**Order of integration**
			1%	**5%**	
LCF	Level	0.496698	-3.670170	-2.963972	I(1)
	1st diff	-3.582835	3.670170	-2.963972	
FD	Level	-0.960991	-3.646342	2.954021	I(1)
	1st diff	-6.225771	-3.653730	-2.957110	
LFDI	Level	-0.442837	-3.646342	-2.954021	
	1st diff	-4.862137	-3.653730	-2.957110	I(1)
LREMFIT	Level	-1.274574	-3.699871	-2.976263	
	1st diff	-17.24638	-3.699871	2.976263	I(1)
LRGDP	Level	-1.198639	-3.646342	-2.954021	
	1st diff	-4.312394	-3.653730	-2.957110	I(1)
LREM*FD	Level	-0.583711	-3.646342	-2.954021	I(1)
	1stdiff	-5.438177	-3.653730	-2.957110	

Source: Computed by the author. Note: tests include intercept only.

Table 2. PP-unit root test statistics

Stationarity test for variables					
			Critical values		**Order of integration**
Variables		**ADF test stat**	**1%**	**5%**	
LCF	Level	0.326274	-3.653730	-2.957110	I(1)
	1st diff	-4.434140	-3.661661	-2.960411	
	Level	-0.796691	-3.646342	-2.954021	I(1)
FD	1st diff	-6.229040	-3.653730	-2.957110	
LFDI	Level	-1.239808	-3.661661	-2.960411	
	1st diff	-13.31058	-3.679322	-2.967767	I(1)
LREM*FD	Level	-0.583711	-3.646342	-2.954021	
	1st diff	-5.430980	-3.653730	-2.957110	I(1)
LRGDP	Level	-1.572699	-3.646342	-2.954021	
	1st diff	-4.430814	-3.653730	-2.957110	I(1)

Source: Computed by the author.

Table 3. Serial correlation LM test

Unlike the Durbin-Watson statistics for AR(1) errors, LM test may be used to test for higher order ARMA errors and is applicable whether or not there are lagged dependent variables.

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	3.571556	Probability	0.045369
Obs*R-squared	7.598243	Probability	0.022390

Source: Computed by the author.

Table 4. Estimates for capital formation

Dependent Variable: LCF				
Method: Least Squares				
Date: 04/27/07 Time: 23:21				
Sample(adjusted): 1979 2010				
Included observations: 31				
Excluded observations: 1 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-41.64414	15.49596	-2.687419	0.0129
DLCF	1.112992	0.552780	2.013446	0.0554
FD	-0.139919	0.078403	-1.784608	0.0870
LFDI	0.449957	0.219624	2.048764	0.0516
LREMFD	3.193947	1.371055	2.329554	0.0286
LREMFIT	0.222392	0.100830	2.205622	0.0372
LRGDP	2.176586	1.415337	1.537858	0.1372
R-squared	0.940004	Mean dependent var		11.77387
Adjusted R-squared	0.925005	S.D. dependent var		1.882073
S.E. of regression	0.515410	Akaike info criterion		1.707970
Sum squared resid	6.375531	Schwarz criterion		2.031774
Log likelihood	-19.47354	F-statistic		62.67111
Durbin-Watson stat	1.211197	Prob(F-statistic)		0.000000

Source: Computed by the author.

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The Empirics of an Optimal Currency Area in West Africa

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Abstract

The successes, in the 1990s, of some established currency areas, such as the Euro and the CFA zones, re-awakened interest in their optimality as the inability of individual economies to compete in and maximally benefit from an increasingly globalized world was greatly acknowledged. This fact was not lost on the ECOWAS member countries that agreed to set up a currency union by 2020. However, the depth of the European sovereign debt crisis and its protracted duration are enough to raise concern in Abuja and other West African capitals as their self-imposed deadline for monetary integration looms. This paper tests the optimality of ECOWAS as a currency area by using two methodologies: a reduced VAR to examine the response of the economies to external price shocks from France, the UK and the US, and a co-integration analysis of the theory of Generalized Purchasing Power Parity (GPPP) to determine the existence of a co-integrating relationship between the exchange rates of four of the currencies that are currently in existence. The results of the study are mixed. The VAR model shows that external shocks from the three foreign countries do not affect all the members similarly. The effects of some of the shocks are statistically insignificant on more than half of the countries. However, the result of the cointegration analysis supports optimality as it identified at least one co-integrating equation and, in some cases, two.

Keywords: optimal currency areas, regional integration, co-integration, VAR, ECOWAS

1. Introduction

The successes, in the 1990s, of some established currency areas, such as the Euro and the CFA zones, re-awakened interest in currency areas and their optimality as countries recognized that their individual economies are not competitive enough to effectively participate in an increasingly globalizing world. However, the European sovereign debt crisis highlighted the problems and tensions that will inevitably arise within a monetary union when imbalances build up and become unsustainable (Ulrich (2012)). The depth of the crisis and its protracted duration are enough to raise concerns in Abuja and other West African capitals as their self-imposed deadline for monetary integration looms.

The renewed interest of member countries of the Economic Community of West African States (ECOWAS) could be traced back to 1999 when the heads of state agreed to relax the long-held principle that consensus must be reached before a resolution is adopted and implemented, and instead agreed that a group of member countries could proceed to adopt and implement a resolution even if others are not ready. This change, championed by former Presidents Olusegun Obasanjo of Nigeria and Jerry Rawlings of Ghana, set into motion the re-engagement in a monetary integration exercise with renewed vigor to form a monetary union by December 2009. However, by June 2009, it was obvious that this deadline was not feasible because many countries did not reach the convergence criteria and it was decided to extend full integration to 2020 in two stages. Firstly, a West African Monetary Zone (WAMZ) comprising five countries – The Gambia, Ghana, Guinea, Nigeria and Sierra Leone will be formed to launch a single currency called the "Eco" in 2015. Secondly, the Eco will be merged with the CFA franc of the monetary union of eight francophone countries (Note 1) called *Union economique monetaire ouest africaine* (UEMOA), which is already in existence.

This study is an assessment of the optimality of the ECOWAS sub-region as a currency area using two

methodologies: (i) a reduced Vector Autoregression (VAR) to examine the response of the economies of the countries that want to form the currency union to external shocks from France, the UK and the USA, and (ii) co-integration analysis of the theory of Generalized Purchasing Power Parity (GPPP) to ascertain the existence of at least one co-integrating relationship between the real exchange rates of four currencies currently in the sub-region (CFA, Dalasi, Naira and Cedi). The study builds on and complements similar studies on West Africa such as Fielding and Shields (1999), Ricci (1997) and Ramirez and Khan (1999).

The paper is divided into seven sections including this introduction. Section two contains a review of the literature on optimal currency areas, section three gives an overview of ECOWAS economies with respect to trade, integration and the convergence criteria, while section four outlines data sources and methodology. Section five contains the theoretical background of the models that anchor the empirical analysis and section six estimates and interpret the models. The paper ends with a summary and conclusions in section seven.

2. Literature Review

Renewed interest in "optimal currency areas" (OCA) has spurred continued growth in the literature since the pioneering works of Mundell (1961), McKinnon (1963) and Kenen (1969). Mundell (1961), who can be credited with its birth, identified it by using factor mobility and defined currency areas as "areas within each of which there is factor mobility, but between which there is factor immobility". However, Rose (2006) argues that Mundell's idea of labor mobility is no longer viewed as a viable adjustment mechanism because the nominal rigidities that are responsible for business cycles do not last forever. From a monetary perspective, Scitovsky (1967) and Ingram (1973) used a variant of Mundell's original argument, to argue that financial integration should be a key characteristic of an optimum currency area. From the same perspective, Alesina and Barro (2000) contend that forming a currency union involves trading off the benefits of commitment to price stability against the loss of an independent stabilization policy. Harberler (1970), Fleming (1971), Kindelberler (1973) and others all contributed to the micro foundations of optimal currency areas. Ishiyama (1975) argues in favour of the cost-benefit analysis approach to OCA since the net effect determines which way to go. Corden (1972) argues in favour of limited fiscal integration by contending that monetary integration does not require parallel fiscal integration. On the other hand, Bhatia (1985) argues that a case exists for enforced fiscal integration in a union and maintains that there is a need for a coordinated strategy to diversify and develop the economy. A centralized strategy would be more manageable and efficient than a national one. Using a nested logit regression, Fischer (2011) argues that long-term structural economic variables determine a given country's currency bloc affiliation. Trade integration, he finds, plays a significant role in a country's anchor currency choice, but distance to the location of the central monetary authority is not significant to some. Exploring whether sharing a single currency may set in motion forces bringing countries closer together, De Grauwe and Mongelli (2005) tested the endogeneity of monetary integration and finds different endogeneities at work. However they cautioned for moderate optimism arguing that the strength and pace of endogeneities remains to be seen.

Empirically, various models have been used including VAR models (structural and reduced form), cost benefit analysis (CBA), generalized purchasing power parity and various other indices. Investigating to see if the CFA franc zone of West Africa is an optimal currency area, Fielding and Shields (1999) used a modified method of Blanchard and Quah (1989) to estimate a VAR appropriate for a small open economy, which is the method used in this study. They found that there was a high degree of correlation between inflation shocks on the CFA and those on a representative Anglophone country, Kenya. So, if the policy response to inflation shocks is immediate and inflation is all that matters, the cost of CFA membership to current members is unlikely to be huge. Moreover, the correlation of inflation shocks across the two monetary unions of the CFA is as high as the correlation within them; so there is no particular advantage in having two currencies rather than one although they also found a rather different picture with regard to shocks on output growth. Bergman (1999) also estimated a structural VAR model to examine the symmetry of country-specific structural shocks in Denmark, Norway and Sweden and found that they were not symmetric during the (SCU) union. On the adoption of a regional currency in the Caribbean, Anthony and Hallett (2000) finds that it would not provide any significant gains in the elimination of transaction costs because of the relatively small scale of intra-regional trade. Some countries will benefit more than others, but overall the gains will be insignificant. Similarly, on another part of the world, Tjirongo (1995) used factor mobility, openness of the economy and degree of diversification to assess Namibia's suitability in the Common Monetary Union (CMU) of South Africa, Lesotho, Namibia and Swaziland and concluded that Namibia's nominal exchange rate is not effective as a policy instrument against external shocks from South Africa; however the country could gain positive net benefits from long-term price stability. Looking at a number of supply-side characteristics of Emerging East Asian (EEA) countries, Sanchez (2005) empirically finds that the economies exhibit a high degree of cross-country supply diversity, while there is no compelling

evidence that shocks are highly correlated across the region.

With respect to the use of the theory of generalized purchasing power parities to explain real exchange rate behaviour in currency areas, Enders and Hurn (1994), Ramirez and Khan (1999), Enders (1995), Mkenda (2001) and Grandes (2003) agree that in the domain of a currency area, the real exchange rate should be stationary. All the same, Rose (2011) argue that it is empirically difficult to compare countries across exchange rates regimes, because it is usually hard to figure out what the regime of a country is in practice, since there are many conflicting regime classifications. The results from several empirical studies on the validity of the purchasing power parity have been mixed. Few studies have found evidence for the theory in the short-run while the results in the long run have been varied. Hakkio (1984) and Dockery & Georgellis (1994) have found evidence of generalized parity in the short-run. However, Krugman (1978), Dornbush (1980) and Frankel (1981) have found evidence against long-run purchasing power parity.

3. ECOWAS Economies, Trade and Convergence Criteria

ECOWAS is composed of 15 countries in West Africa (Note 2). In 2011, it was estimated to have a combined population of 279 million, an average real GDP growth rate of 3.37%, an average per capita GDP of US$ 715 and an average inflation rate of 7 per cent. These averages mask the huge disparities that exist in the region. The population ranges between 160 million in Nigeria (57% of the sub-region) and 1.7 million in Guinea Bissau (1%), while the real GDP growth rate ranged from 7.2% also in Nigeria to -4.7% in Cote D'Ivoire, which is barely recovering from almost a decade of civil strife. The range for per capita GDP is from US$ 1,490 in Nigeria to US$ 370 in Serra Leone while CPI for the period ranged from 21.5% in Guinea to 2.7 % in Benin. In the same year, ECOWAS merchandise exports amounted to US$ 154 billion representing more than a 35% increase over 2010 and is almost double the 10-year average of US$ 82 billion (WTO 2012). These exports represent about 24 percent of African exports or 0.8 percent of world exports in the year. Meanwhile merchandise imports in the year amounted to US$ 103 billion, an increase of 16 percent over 2010, and representing 19 percent and 0.6 percent of African and world merchandise imports respectively. The service trade is not quite developed in the ECOWAS region and the total service exports in 2010 amounted to US$ 8 billion representing almost 11 percent of African service exports but is negligible compared to the world's service exports of US$ 4.2 trillion in the same year. ECOWAS imports of services in 2010 amounted to US$ 31 billion, representing 19 percent of African service imports or 0.9 percent of the world's import of services.

Sets of primary and secondary convergence criteria towards which all economies must converge were agreed upon. The former include fiscal deficit of less than 4 percent of GDP, inflation rates in single digits, central bank financing of less than 10 percent of the previous year's tax receipts and gross foreign reserves of at least 3 months of import cover. The latter criteria stipulate that countries must not have any domestic arrears, their tax revenues must be greater than 20 percent of GDP, their wages and salary expenditures must be less than 35 percent of total tax revenue, they must all maintain positive real interest rates and their public investment to tax ratios must be more than 20% (see Annex Table 1 for details).

4. Data Sources and Methodology

Data used in this analysis are primarily from the *World Development Indicators* database of the World Bank, supplemented with data from the *International Financial Statistics* (IFS) and from the International Monetary Fund (IMF). As in Fielding and Shield (1999), this paper estimates reduced form vector autoregression (VAR) models for eleven (Note 3) of the thirteen ECOWAS countries that want to form a monetary union. The models are used to determine how the output growth and prices of these countries respond to external price shocks from the UK, the US and France. The premise of this methodology is that, for a monetary union to be stable, all the members must be affected in a similar manner, by an external shock. If an external shock positively impacts on some members but negatively on others, then the monetary union will not be stable.

Deriving from Enders' (1995) that the real exchange rates between two countries comprising the domain of an optimal currency area should be co-integrated, the paper also uses co-integration analysis on the theory of Generalized Purchasing Power Parity (GPPP) (Note 4) to determine whether a stable long-run relationship exists between the exchange rates of the four currencies (Note 5) of the countries and the corresponding consumer price indices. Countries qualifying to form a currency union must have their fundamental variables move together on average (see Mkenda (2001) and Ramirez and Khan (1999)). Fielding and Shields (1999) also argue that the cost of monetary union membership will depend on the extent to which price and output shocks are correlated across countries, and the degree of similarity in the long-run effects of the shocks on the macro-economy.

5. Theoretical Background

5.1 The VAR Model

As in Fielding and Shields (1999), the dependent variables of the VAR model are the real interest rate growth (Δr); nominal money stock growth (Δm); and income growth (Δy); whilst the independent variable (Δp^*) is the consumer price index (of France, the UK and the US in this paper) multiplied by the rate of nominal exchange rate depreciation. In effect, this study assesses the effects of shocks from three foreign countries. The econometric framework of Fielding and Shields (1999) also apply to this model. The identification of the model is based on the methodological framework initially introduced by Blanchard and Quah (1989) and modified by Fielding and Shield (1999). For each country, a reduced form VAR of Equation (1) is estimated.

$$X_t = A(L)X_{t-1} + e_t = (I - A(L))^{-1} e_t \quad (1)$$

Where $A(L)$ = 4 x 4 matrix of lag polynomials

$$X_t = \text{4x 1 vector of stationary variables} = (\Delta p^*, \Delta p, \Delta y, \Delta m) \quad (2)$$

e_t = Vector of reduced form residuals

The restrictions $A_{12} = A_{13} = A_{14} = 0$, i.e., Δp^* is strictly exogenous, hold. No restrictions are imposed on the reduced form residual co-variance matrix so that the reduced form innovations e_t have no obvious economic interpretation.

5.2 The Generalized Purchasing Power Parity Model

In its simplest form, the theory of purchasing power parity simply amounts to applying the law of one price. This means that the cost of a basket of goods in The Gambia should be similar to the cost of the same basket of goods in Senegal in the absence of government interventions. As Ramirez and Khan (1999) argue, this is not the case in reality since a number of complications such as differentiated products, tastes and costly information deter this law of one price. The results from several empirical studies on the validity of purchasing power parity have been mixed. Few studies have found evidence for the theory in the short run (Hakkio (1984) and Dockery and Georgellis (1994)), while the results in the long-run have been varied. Krugman (1978), Dornbusch (1980) and Frankel (1981) have found evidence against long-run purchasing power parity. As in Ramirez and Khan (1999), long-run relations are sought between the pairwise exchange rates of the five currencies that are currently circulating in the Community (CFA franc, Gambian Dalasi, Ghanian Cedi and Nigerian Naira) explained by

$$E_{jt} / E_{it} = \alpha_0 + \alpha_1 \left[\frac{CPI_{jt}}{CPI_{it}} \right] + \varepsilon_t \quad (3)$$

Where E_{jt}/E_{it} = Exchange rate of currency of country *i* with respect to country *j*.

CPI_{jt} = Inflation in foreign country.

CPI_{it} = Inflation in domestic country.

6. Empirical Analysis: Estimation and Interpretation of Results

6.1 Estimating the VAR Models

The equations of the VAR model are estimated one at a time using OLS estimation, which, according to Verbeeck (2000), is consistent because the white noise terms are assumed to be independent of the history of the dependent terms. Greene (1993) also contends that because the explanatory variables are the same in each equation, a system estimator, like seemingly unrelated regressions (SUR), provides the same estimates as OLS applied to each equation separately. Having found that the e_t are not correlated, each equation of the reduced form VAR is estimated separately using OLS, which yields efficient results since the lags of all the endogenous variables appear in all the equations. Although using Seemingly Unrelated Regression (SUR) estimation would have produced more efficient estimators than OLS, Fielding and Shields (1999) argue that this does not allow for correlation between say Δp in one country and Δy in another.

The VAR models are estimated for the period 1970 to 2010. Table 1 shows the impact of price shocks from the three foreign countries on the output growth and price changes of the participating ECOWAS member countries. In general, the results of the VAR models find that price changes from these three foreign countries affect almost half of the countries in the Economic Community but the effects are statistically insignificant on an almost equal number of countries. Where the effects are statistically significant, all three price shocks adversely affect output in the countries but directly affect both money demand and consumer prices.

Table 1. VAR estimation results

US price shocks	UK price shocks	French price shocks
significantly affects GDP growth in		
Benin	Benin	Benin
Burkina Faso	Burkina Faso	Burkina Faso
Cote d'Ivoire	Cote d'Ivoire	Cote d'Ivoire
Niger	Gambia	Niger
Togo	Niger	Togo
	Togo	
significantly affects real money demand in		
Benin	Guinea Bissau	Benin
Guinea Bissau	Niger	Cote d'Ivoire
Niger		Guinea Bissau
		Niger
significantly affects counsumer prices in		
Benin	Benin	Benin
Burkina Faso	Burkina Faso	Burkina Faso
Gambia	Nigeria	Nigeria
Nigeria	Niger	Niger
Niger	Togo	Togo
Togo		

Source: Author's computation using WB data.

Specifically, price changes in the US negatively affect output in Benin, Burkina Faso, Cote d'Ivoire, Niger and Togo, while positively impacting on money demand in Benin, Cote d'Ivoire, Guinea Bissau and Niger and prices in Benin, Burkina Faso, The Gambia, Nigeria, Niger and Togo. It is worth noting that the effects are different for The Gambia (there is an inverse relationship). A unit change in US prices affects outputs from these countries within a range of -0.5 to -0.78, while the range of the changes in money demand is 0.26 to 0.31, and that for consumer prices is between -0.16 and 0.32. For the remaining countries the effects of price changes in the US are statistically insignificant (see Annex Table 2 for details).

With respect to UK price shocks, a unit change adversely affects outputs in Benin, Burkina Faso, Cote d'Ivoire, The Gambia, Niger and Togo by between -0.30 and -0.78; positively impacts on money demand in Guinea Bissau and Niger by 0.31 and 0.27 respectively; and directly affect prices in Benin, Burkina Faso, Nigeria, Niger and Togo in a range between 0.16 and 0.30.

With regard to the effects of French price shocks, the study finds that they are more or less similar to those of the US. A unit change inversely affects output in Benin, Burkina Faso, Cote d'Ivoire, Niger and Togo, in the range of -0.55 to -0.60. As for the effects on money demand, the same countries that are affected by the US price shocks are also affected in addition to Togo and the range in this case is between 0.24 and 0.49. Alternatively, the effects of French price shocks affect exactly the same countries that are affected by UK price shocks and here the range is between 0.27 and 0.35.

6.2 Co-Integration Analysis and the Generalized Purchasing Power Parity (GPPP) Theory

Countries forming an optimal currency area should exhibit a stable long-run relationship among their exchange rates. In this methodology, Equation (3) is estimated. However, before doing this, the stationarity of the variables is first determined to check if they possess unit roots. The results show that the CFA/Cedi and the Dalasi/Cedi exchange rate series are stationary and do not have unit roots, while the CFA/Dalasi, the CFA/Naira, the Dalasi/Naira and the Cedi/Naira series are all integrated of Order 1. With regard to the inflation rates, those of UEMOA, the product of Senegal and The Gambia rates, and that of The Gambia and Nigeria are integrated of Order 1, those of Ghana/Nigeria and The Gambia are integrated of order 2, whilst the rest are stationary and integrated of Order 0. The DW statistics also indicate the absence of autocorrelation in the series except for the product of the Senegal/Ghana inflation rates. The non-stationary variables are differenced according to their order of integration and the Johannsen co-integration technique is used to determine if there exists a stable long-run relationship between the real exchange rates of the countries. This is to see if their real exchange rates are co-integrated, a condition for forming an optimal currency area. The results show that there exists at least one co-integrating equation between the real exchange rates of the countries and this supports the optimality of the

region as a currency area (see Table 2).

Table 2. Number of Cointegrating equations

Exchange Rate	Countries	Number of Cointegrating	
		Trace test	Max-eigen value test
CFA/Dalasi	Senegal-Gambia	2	2
CFA/Cedi	Senegal-Ghana	2	2
CFA/Naira	Senegal-Nigeria	1	1
Dalasi/Cedi	Gambia-Ghana	2	2
Dalasi/Naira	Gambia-Nigeria	2	2
Cedi/Naira	Ghana-Nigeria	2	2

Source: Author's computation using WB data.

7. Summary and Conclusions

The study shows mixed results for the optimality of the ECOWAS region as a currency area. The VAR shows that external shocks from the US, the UK and France significantly affect only half of the eleven members that want to form the currency area. In the remaining cases, the impacts of these shocks are statistically insignificant. This asymmetry would pose a problem for the optimality of the economic community as a currency area. On the other hand, the perspective of generalized purchasing power parity is more conclusive. The co-integration analysis identified the existence of at least one co-integrating equation between the real exchange rates of the countries. As Ender's (1995) argues, the real exchange rates between two countries comprising the domain of an optimal currency area should be co-integrated, therefore this result supports the optimality of ECOWAS as a currency area. Given that half of the results (the GPPP model) support the optimality of ECOWAS as a currency area, while some asymmetrical shocks have been identified by the VAR model, forming an optimal currency area in West Africa, a stable currency union between these countries calls for the prudent development of a comprehensive, compensation mechanism. Learning from the European sovereign debt crisis, it would be equally important to set up a contingency fund that would be adequately funded, especially during boom periods, to support countries in the magnitudes that would be needed if a crisis erupts. In the absence of these two (compensation mechanism and fund), the resulting currency union could be unstable.

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Notes

Note 1. These are Benin, Burkina Faso, Cote D'Ivoire, Mali, Niger, Senegal, Togo and Guinea- Bissau.

Note 2. Benin, Burkina Faso, Cape Verde , Cote D'Ivoire, The Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo.

Note 3. Guinea Conakry and Sierra Leone were dropped from this analysis due to the lack of data. Missing data are estimated using the annual growth rate of the actual data.

Note 4. GPPP theory contends that in the absence of government interventions, the price of a basket of goods would cost the same in The Gambia as in Senegal.

Note 5. These are the CFA, the Dalasi, the Cedi and the Naira. Again the currencies of Guinea and Sierra Leone have been dropped because of lack of data.

Appendix

Appendix 1. ECOWAS convergence criteria

Criteria	Target
Primary	
Fiscal Balance / GDP	≥ -4%
Inflation Rate (End-period)	≤ 5%
Gross Foreign Reserves (in months of imports)	≥ 6 months
Central Bank Financing of Budget Deficit in relation to previous years Tax Revenue	≤ 10%
Secondary	
Change in Domestic Arrears	≤ by 2003
Tax Revenue (% of GDP)	≥ 20%
Wage Bill/Tax Revenue	≤ 35%
Domestically Financed Investment/Domestic Revenue	> 20%
Nominal Exchange Rate	Stable rates
Real Interest Rate	> 10%

Source: African Development Bank.

Appendix 2. Vector autoregression estimates

	Effects of US price shocks			Effects of UK price shocks			Effects of French price shocks		
	Coefficient	t-statistic	Adj. R^2	Coefficient	t-statistic	Adj. R^2	Coefficient	t-statistic	Adj. R^2
				GDP					
Benin	-0.653	[-6.793]	0.571	-0.670	[-5.221]	0.439	-0.601	[-4.027]	0.315
Burkina Faso	-0.640	[-4.396]	0.365	-0.617	[-6.164]	0.510	-0.554	[-5.609]	0.461
Cote d'Ivoire	-0.690	[-4.522]	0.521	-0.779	[-4.914]	0.552	-0.584	[-4.055]	0.483
Gambia	-0.169	[-1.049]	0.002	-0.306	[-2.324]	0.139	-0.177	[-1.120]	0.009
Guinea Bissau	-0.054	[-0.510	0.122	-0.058	[-0.553]	0.124	-0.050	[-0.473]	0.121
Ghana	-0.076	[-0.218	-0.185	-0.041	[-0.119]	-0.187	-0.031	[-0.159]	-0.085
Mali	-0.163	[-1.453]	0.014	-0.170	[-1.501]	0.020	-0.160	[-1.461]	0.015
Nigeria	-0.098	[-0.302]	-0.172	-0.253	[-0.767]	-0.146	-0.177	[-0.568]	-0.160
Niger	-0.566	[-3.134]	0.252	-0.582	[-3.200]	0.262	-0.586	[-3.380]	0.288
Senegal	0.023	[0.262]	-0.018	0.028	[0.318]	-0.017	0.0155	[0.172]	-0.020
Togo	-0.781	[-5.321]	0.458	-0.779	[-5.179]	0.441	-0.600	[-4.390]	0.376
				Money demand					
Benin	0.321	[2.119]	0.051	0.256	[1.383]	-0.017	0.485	[2.697]	0.115
Burkina Faso	0.072	[0.447]	-0.209	0.0246	[0.204]	-0.031	0.0571	[0.505]	-0.025
Cote d'Ivoire	0.258	[1.974]	0.322	0.240	[1.689]	0.303	0.244	[2.065]	0.329
Gambia	-0.179	[-1.805]	0.187	-0.111	[-1.348]	0.267	-0.159	[-1.605]	0.165
Guinea Bissau	0.310	[2.409]	0.386	0.305	[2.413]	0.387	0.316	[2.514]	0.398
Ghana	-0.305	[-1.016]	-0.025	-0.270	[-0.911]	-0.034	0.069	[0.393]	-0.002
Mali	-0.039	[-0.696]	0.024	-0.047	[-0.833]	0.033	-0.035	[-0.640]	0.021
Nigeria	0.008	[0.040]	0.305	-0.026	[-0.128]	0.305	0.007	[0.040]	0.305
Niger	0.276	[2.407]	0.148	0.267	[2.267]	0.128	0.241	[2.078]	0.100
Senegal	-0.050	[-1.208]	-0.019	-0.053	[-1.343]	-0.005	-0.047	[-1.155]	-0.025
Togo	0.186	[1.263]	0.022	0.216	[1.475]	0.046	0.297	[2.358]	0.136
				Consumer price					
Benin	0.219	5.244	0.408	0.294	[7.036]	0.564	0.350	10.330	0.741
Burkina Faso	0.182	[1.961]	0.060	0.160	[2.178]	0.055	0.189	[2.853]	0.131
Cote d'Ivoire	0.061	[0.733]	0.259	0.014	[0.156]	0.247	0.062	[0.818]	0.261
Gambia	-0.161	[-2.059]	0.526	-0.102	[-1.442]	0.4360	-0.139	[-1.760]	0.504
Guinea Bissau	0.027	[0.368]	0.519	0.018	[0.248]	0.518	0.033	[0.460]	0.521
Ghana	-0.225	[-0.690]	0.287	-0.283	[-0.893]	0.297	0.147	[0.706]	0.146
Mali	-0.001	[-0.046]	0.040	-0.003	[-0.082]	0.041	-0.004	[-0.114]	0.041
Nigeria	0.323	[2.729]	0.669	0.301	[2.409]	0.650	0.334	[2.993]	0.685
Niger	0.273	[2.903]	0.419	0.253	[2.570]	0.382	0.265	[2.845]	0.413
Senegal	-0.068	[-1.606]	0.211	-0.070	[-1.727]	0.224	-0.063	[-1.485]	0.199
Togo	0.260	[3.096]	0.384	0.239	[2.736]	0.341	0.278	[4.048]	0.386

Source: Author's computation using WB data.

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Do Microcredit Programs Ameliorate Standard of Living? Spotlight on Major Microcredit Organizations in Bangladesh

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Abstract

Microcredit organizations are playing a pivotal role by conducting various programs on the significance and efficiency of microcredit in Bangladesh. With a view to improving the standard of living through poverty alleviation these organizations provide small loans to impoverished people living in the rural area. This study aims to explicate the significance of the microcredit programs in reducing poverty and to what extent these programs are helpful to borrowers' income generation that leads to better standard of living. The results find that in case of food consumption and household income generation microcredit programs have significant contributions. This study recommends that some important issues like effective utilization of loan, loan repayment system, interest rate and proper training programs should be conducted by the NGO so that the borrowers of fund can increase their household income.

Keywords: standard of living, poverty alleviation, microcredit program, microcredit organization, Bangladesh

1. Introduction

Poverty alleviation efforts in Bangladesh started under the purview of rural development at the beginning of this century through organizing credit cooperatives for helping the poor farmers. The farmers were continuously exploited by the landowners and the lenders of short term loan who imposed strict rules and policies in the agreement. They charged high compounding interest on the loan and if any farmer was unable to pay the interest with principal in due time the money lenders took over the land from farmers.To wipe out this scenario the credit cooperatives came into existence for alleviating the poverty of the rural people. The uprising of micro finance and its demand were initially started in Bangladesh. The microcredit program in Bangladesh is a unique innovation of credit delivery technique to enhance income generating activities in rural poor people.

1.1 Issue of the Study

The purpose of this work is to provide an analysis of how the different programs of microcredit organizations contribute to the family income of their members that ultimately lead to a better life in terms of health, education, food consumption and earnings. It will analyze and compare the results of operations by major microcredit organizations as part of the microcredit practices in Bangladesh.

1.2 Objectives and Scope of the Study

The objectives of this paper are to measure the effect of microcredit programs on poverty reduction in the selected areas, assess the impact of microcredit on increase households income as well as upliftment of their living standard above poverty line.This paper also tries to analyze the effect of microcredit on poverty alleviation at MonirampurUpazila (sub district) in Bangladesh through the study of four major organizations: Grameen Bank (GB), Association for Social Advancement (ASA), Bangladesh Rural Advancement Committee (BRAC)

and Thengamara Mohila Sabuj Sangha (TMSS).

1.3 Significance of the Study

This study will support the microcredit organizations in Bangladesh as well as prospective organizations planning to help the people especially poor people living in the remote area. These organizations will be benefited by designing their programs which would eradicate the poverty and offer a better life to the poor people. It also serves to understand the nature and operations of microcredit organizations in general, as well as enabling them to evaluate themselves with the sample taken for the purpose of the study.

2. Overview of Microcredit Organizations in Bangladesh

Generally NGOs, state-owned commercial banks, private commercial banks, Grameen Bank, implement microcredit programs in Bangladesh. There are 35 million clients out of which 8.4 million clients are from Grameen Bank. The services provided by this sector include loans for ultra poor, microenterprise loans, general microcredit for small-scale self employment, agricultural loans, seasonal loans and loans for disaster management. Microcredit is defined as the loan amount upto BDT 50,000 and if it exceeds it is termed as microenterprise loan.

In spite of having more than a thousand of institutions are operating microcredit programs, 87% of total saving of this sector is represented by only 10 large Microcredit Organizations and Grameen Bank. With the help of microcredit, various income generating activities are performed by the poor people and around 30 million poor people are directly benefited from microcredit programs.

Though in 2011 the world economy faced a recession, the microfinance sector in Bangladesh shows strong resilience and increasingly contributes to the national economic growth. Around 3 percent of GDP in 2011 is contributed by microfinance sector. In June 2010, total outstanding loan of this sector (only licensed MFIs) was BDT 145.0 billion and in June 2011, it was BDT 173.8 billion that represent 20.0 percent growth in this sector. Total saving of this sector was BDT 63.3 billion in June 2011 compared to previous year from 26.1 million which is also increased by almost 23.25 percent. The members of these institutions are 93 percent women.

3. Literature Review

The microcredit approach believes that the poor can be trustworthy and, if provided with loans, can use them successfully in micro-enterprises to generate income. Thus, these programs provide small loans to the poor for self-employment to increase income allowing them to improve their standard of living (Karim and Osada, 1998). According to Wahiduddin (2004), one-third of all rural households in Bangladesh are connected with the microcredit programs. The program extends small loans to poor people for self-employment activities thus allowing the clients to achieve a better quality of life (Hussain, 1998; Morduch, 2000; Rahman and Hossain, 1995). Microfinance programs are generally found to be effective in reducing poverty and improving children's schooling and nutritional status (Morduch and Haley 2002, Kabeer, 2008; Khandker, 2005). In their review of evidence from a number of microfinance programs across the developing world, Morduch and Haley (2002) conclude that microfinance programs reduce vulnerability and have a positive impact on poverty reduction. Several studies also find that the women's borrowing is positively associated with self-reported measures of empowerment (Hashemi, Schuler and Riley, 1996; Zaman 1999; Pitt *et al*, 2006). The Grameen Bank - the largest microcredit institution - and the Bangladesh Rural Advancement Committee (BRAC) - the largest non-governmental organization (NGO) - are the pioneers of microcredit in Bangladesh for almost three decades. Microcredit in Bangladesh is not only a very topical issue – the founder of the Grameen Bank has just been awarded the 2006 Nobel Peace Prize and that it has also been a topic of interest to researchers throughout the world.

The success of microcredit has captured the interest of many researchers in broad areas such as women's empowerment (Hashemi*et al*, 1996; Sen, 1997; Goetz and Sengupta, 1996), sustainability and outreach, (Khandker and Khalily, 1995; McNamara and Morse, 1998; Sharma and Zeller, 1999), group-based lending (Ghatak, 1999; Stiglitz, 1990; Varian, 1990) and poverty alleviation. Research suggests that access to credit has the potential to reduce poverty significantly (Khandker, 1998). Literature also substantiated the argument that older members' asset valuation and weekly household expenditures are respectively, 112 percent and 26 percent higher than those of the newer members (Mustafa and Ara, 1996). Based on the success stories (Hossain, 1988; Hulme and Dhattacharya, 1996; Yaron, 1992; Montgamery*et al.*, 1996; Wahid, 1993; Khandker, 2003) it is assumed that microcredit is improving the standard of living and well-being of the borrowers by improving their income and food consumption. Pitt and Khandker (1998) and Khandker (2005) prominently reinforced three broad ideas about microcredit: that it is effective in reducing poverty generally, that this is especially so when

women do the borrowing and that the extremely poor benefit the most (Roodman*et al*, 2009).

Hashemi et. al. (1996) finds members of GB and BRAC have more contribution to the household's income. They create an "index" of empowerment through a linear weighted combination of individual empowerment indicators.

Like Hashemi et al. Mizan (1993) also develops an index, called the Household Decision Making (HHDM) Scale. The value of this scale were computed from the answer given by the respondents regarding their decisions of food purchase, children's education and marriage, medical expenditures, investment, woman's earnings in business, purchase and sale of land, hiring of outside labor, purchase of agricultural inputs, providing financial support to husband's family, and purchase of clothes for self and other household members.

Mizan (1993) finds that in case of woman member of Grameen Bank, there is a positive effect between number of years a woman had borrowed and the monthly income on the HHDM score. This result is also supported by the work of Mustafa et al. (1996) and Morduch (1998). They showed that in Bangladesh programs mainly focused and devoted to microcredit has a positive impact on the members regarding material well-being, reduction in seasonal vulnerability and ability to face emergencies.

By assisting to build assets micro-credit programs help reduce the vulnerability of the poor. These programs also provide emergency assistance during natural disasters. At the same time, it is noticed that if credit schemes can be linked with other financial inventions then the results of credit program on poverty and living standard could be ameliorated (Zaman, 1999).

4. Data Sources and Variables Definition

Both primary and secondary data have been used in this study. The major part of the study is mainly based on primary data which are collected from the field survey in 2011. Personal interview and observation of the respondents were used to collect the data. This study will also utilize data from secondary sources, which are the reports, brochures, magazines of microcredit organizations. Data was also drawn from various internet based sources.

The variables used in this study to analyze the effect of microcredit programs on poverty alleviation are Average Age, Average Education, Total Family Member, Total Food Consumption, Male Share Percentage, Credit Amount, Interest Amount and Investment Sector.

5. Methodology

We analyze data on 200 respondents from four organization's members and used multiple linear regression analysis to examine the effect of microcredit on family income and food consumption in household.

The primary data were collected from 200 members being only 50 members from each of the four major microcredit organizations selected at random from Monirampur Upazila under Jessore district in 2011. The study area is located in southern part of Bangladesh. The people are poor due to frequent natural calamities damaging agricultural and other commodities. After coding the raw data properly, multiple linear regressions were used to analyze the results.

6. Result Analysis

6.1 Identification Features of the Respondent

From the Table 1, it is found that in all the four organizations, majority members fall between 21-30 years age groups indicating that young members are interested to participate in microcredit program. Except the case of TMSS (34%) female members were most dominant in ASA (100%), GB (100%) and in BRAC (86%).

Table 1. Identification features of the respondent

Org. Name	Age					Sex		Profession		
	Age(Year)					Percentage (%)		Percentage(%)		
	<20	21-30	31-40	41-50	>50	Male	Female	House wife	Farmer	Others
ASA	1	31	18	8	2	-	100	100	-	-
BRAC	1	23	15	8	3	14	86	86	12	2
TMSS	3	22	14	9	2	66	34	34	30	36
GB	4	21	17	5	3	-	100	100	-	-

Source: Field Survey, 2011.

6.2 Involvement with Other NGOs

Among the randomly selected 50 microcredit recipients of each of the four organizations in TMSS 92%, in GB 90%, in ASA 44% and 20% of BRAC were not involved with any other microcredit organizations. But along the main organization recipients which microcredit from another organization were 65% of BRAC, 42% of ASA, 8% of GB and 6% of TMSS recipients. Percent of recipients which took microcredit from two and three other organizations along with the main organizations were very small indeed (Table 2). So it is thus evident that most of the members are satisfied to get microcredit from one or two organizations.

Table 2. Involvement with another's NGOs

OrganizationName	None (%)	One organization (%)	Two organizations (%)	Three organizations(%)
ASA	44	42	10	4
BRAC	20	65	8	4
TMSS	92	6	2	-
GB	90	8	2	-

Source: Field Survey, 2011.

6.3 Microcredit in Income Generation

Table 3 shows that the recipients of microcredit mainly used it agriculture related venture being 90% in ASA, 82% in BRAC, 66% in GB and 56% in TMSS. While the remaining percent was mainly used in small business for income generation. It is thus evident that agriculture sector is the most prominent for investment of microcredit to generate income of the households.

Table 3. Area of income generation

Organization Name	Agriculture(%)	Small business(%)	Others(%)
ASA	90	10	-
BRAC	82	18	-
TMSS	56	28	16
GB	66	34	-

Source: Field Survey, 2011.

6.4 Impact on Family Income and Food Consumption

To gauge the level of income generated by the borrowers of microcredit from GB, BRAC, ASA and TMSS data on various factors were considered in this study. The parameters in consideration were the respondent average age, average education, total family member, total food consumption, male share, credit amount, interest amount and investmentsector.

6.4.1 Impact on Total Family Income

According to table 4 average ages is insignificant this implies that there is no significant difference among all borrowers of middle age group. In case of average education the borrowers of GB showed significant difference at 5 percent level and TMSS at 10 percent level and their positive coefficient value is acceptable in respect of Bangladesh. Total family member is found highly significant at 1 percent level for members of all the four organizations which imply that all family size is properly maintained to generate house hold income using the borrowed money. In respect of total food consumption members of both ASA and TMSS showed significant difference at 1 percent level while BRAC members at 5 percent level. In BRAC and ASA male share is significant at 1 percent. In case of credit and interest amount members of GB showed significant difference at 5 percent and at 1percent level respectively, while in case of members of TMSS credit amount showed 10 percent level of significance.

Table 4. Total family per capita income regression estimates

Independents variable	GB	BRAC	ASA	TMSS
Average age	0.000 (0.973)	-0.015 (0.063)	-0.007 (0.152)	-0.005 (0.549)
Average education	0.110 (0.022*)	0.014 (0.594)	0.060 (0.201)	0.136 (0.079**)
Total family member	0.228 (0.001***)	0.348 (0.000***)	0.341 (0.000***)	0.444 (0.001***)
Total food consumption	-0.012 (0.369)	0.264 (0.015*)	0.168 (0.000***)	0.376 (0.003***)
Male share (%)	0.067 (0.804)	3.181 (0.001***)	3.203 (0.000***)	1.038 (0.232)
Credit amount	0.205 (0.022*)	-0.152 (0.167)	0.435 (0.122)	-0.163 (0.061**)
Interest amount	3.693 (0.006***)	1.067 (0.353)	-2.006 (0.111)	
Investmentsector	0.019 (0.602)	0.137 (0.391)	-0.203 (0.303)	-0.107 (0.265)
R^2	0.980	0.965	0.963	0.965
Adjusted R^2	0.976	0.958	0.956	0.959
F	249.807	139.774	133.424	164.328

Note:***- significant at P=0.01; **- significant at P=0.1; *- significant at P=0.05 and the R^2 are shown in the parentheses.

6.4.2 Impact on Household Total Per Capita Food Consumption Regression Estimates

Average age and average education are not statistically significant in respect of borrowers of any of the four organizations suggesting that these are able to meet goal of microcredit (Table 5). In terms of total family income significant level at 5 percent in BRAC and 1 percent in ASA and TMSS that means borrowers are better off in terms of food consumption compare to GB borrowers. In points of male share in family its showing that significant level at 10 percent in BRAC, 5 percent in ASA and 1 percent in TMSS but in GB not significant due to more women based family are prior to get credit from GB than others organizations. In case of BRAC credit amount is significant at 5 percent level and at 10 percent level for GB, ASA and TMSS. It shows that credit money is beneficial to the borrowers of fund. Interest rate is the most prominent factor now in microcredit program so, from our result its showing in GB significant level at 1 percent and BRAC and ASA at 5 percent level but in TMSS value is excluded due to fix interest rate. So, from the above finding its clear that all borrowers are in better conditions in terms of food consumption because of their income increased after participate in microcredit program and investment sectors are not in significant level because most of the borrowers they used borrowed money in agriculture sector.

Table 5. Total family per capita food consumption regression estimates

Independents variable	GB	BRAC	ASA	TMSS
Average age	0.011 (0.794)	-0.005 (0.625)	0.020 (0.255)	-0.010 (0.191)
Average education	-0.0825 (0.888)	0.025 (0.483)	0.323 (0.063)	0.019 (0.832)
Total family member	-1.426 (0.097**)	0.287 (0.048*)	-0.693 (0.006***)	0.227(0.151)
Total income	-1.662 (0.369)	0.512 (0.015*)	2.377 (0.000***)	0.498 (0.003***)
Male share (%)	3.180 (0.318)	2.589 (0.061**)	-7.150 (0.015*)	2.828 (0.003***)
Credit amount	1.820 (0.090**)	0.316 (0.036*)	-1.963 (0.061**)	0.184 (0.065**)
Interest amount	42.343 (0.008***)	3.936 (0.011*)	10.223 (0.028*)	
Investmentsector	0.087 (0.842)	0.128 (0.567)	-0.069 (0.926)	0.039 (0.727)
R^2	0.290	0.962	0.840	0.955
Adjusted R^2	0.152	0.954	0.809	0.947
F-Value	2.096	128.575	26.949	126.343

Note:***- significant at P=0.01; **- significant at P=0.1; *- significant at P=0.05 and the R^2 are shown in the parentheses.

7. Policy Implications

From the above findings it has been observed that borrowers of microcredit are better off in terms of household income and food consumption compared to before involvement with microcredit also their living standard was improved. The results of this study strongly support the microcredit can reduce rural poverty if interest rate reduced to flexible level usually it varies between 30-40 percent and this is higher than commercial bank's lending rate also repayment system should consider because of the system of loan repayment in weekly installments, such repayment has to be often made out of family income other than that generated by the use of borrowed funds therefore, this can sometimes be a burden on the borrowers and it limits their ability to borrow larger amounts also one-year repayment period is also not enough time for borrowers.

From this discussion it may be concluded that microcredit can help the poor families to break out of the poverty cycle but the impact of microcredit is mainly assessed in terms of the income gains for the borrowing households, the less perceptible beneficial impact on various aspects of human development is no less important. The positive impact of microcredit on healthcare practices, family planning and schooling behavior is now well recorded.

8. Conclusion and Recommendation

In our study area, lot of NGOs are working to alleviate poverty but most of the respondents are not involved with another NGO. All members are enjoying their personal demand due to being a NGO member. Most of the respondents want to enhance the effectiveness of microcredit in income generation and aspire to receive proper training to increase income. They consider agriculture sector as the most suitable to generate earnings.

Improvement of food consumption in the household is a positive indicator to microcredit program. It was found that from the study that family food consumption increased after using microcredit. Similarly their expenditure for sickness and medication also an increasingly higher number of members started using sanitary latrine after income generation through microcredit. The study found that most of the members invest borrowed money in agriculture sector to generate income through the use of new agriculture technology. Also it is revealed that their education and cultural expenditure increased with the increasing income generation. The findings revealed that there has been continuous development in the parameters like family income, per capita food consumption, health, living standard and total household expenditure.

It may conclude that all the organizations which are related with microcredit are better off in terms of poverty alleviation. These results suggest that microcredit programs are fruitful in changing the borrowers' impoverished situation evidenced by increase in income, consumption of food and standard of living.

Regarding interest rate the study found that interest rate is higher in NGOs (GB, BRAC and ASA) than government led BRDB. It is suggested that softer consideration is needed for repayment system and fixing interest rate. The borrowers is likely to benefit from proper training program for finding out appropriate newer areas of investment and thus to generate income to improve their living standard above poverty line.

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Fair Value, Capital Accumulation and Financial Instability: A Macrodynamic Model

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Abstract

This article examines the relationship between fair value accounting and ambivalences of the modern finance. The subprime crisis has opened the debate. Much empirical work at the micro level has developed to study the financial and economic impacts of this tool. The accelerator and amplificatory effect of this tool and its role and the cyclical transmission of contagion, remain ambiguous. In this regard, two points of view have proved controversial. We identify its shortcomings by a macro dynamic model for the purpose of stimulating financial stability. The interest rate is set by banks according to a weighting that varies with capacity utilization and capital accumulation. System stability is studied according to the Minsky's regime which recognizes the role of interest rates as a source of crisis.

Keywords: financial instability, fair value, capital accumulation, contagion

1. Introduction

The insertion of finance in the economy and the abandonment of the Keynesian's concept "veil of money" by relaxation in the regulatory (Note 1) process were accompanied with a constitutive change in the design of the accounting discipline like a normative tool to a source of information and evaluation (positive theory). This was accompanied with the increase of the weight of finance in the eightie's years and the development "financialization process" (USA, UK), which coincided with the emergence of post Keynesians models (stock-flow models) based on an integration of the financial sector in the study of macrodynamic model (Minsky, 1978-86). In this regard, in an economy without financial contingencies and complete markets, the flow of funds to the most productive agents is constrained and therefore the distribution of wealth is irrelevant. In the presence of uncertainty, the distribution of wealth can change depending on the situation.

2. Theoretical Evidence

From the nineties, a wave of financial crises had bounced and spread in time and space. This behavior leads regulators and supervisors (IMF, BIS) to set new prudential measures for performance reasons: the fair value tool and agreements Bale 1 and 2. This was to mitigate the risks and ambivalences of modern finance. At this stage, the study of the impact of the fair value tool in the recent crisis, based on a macrodynamic model combined with Minsky's Financial Instability Hypothesis, is original. With historical cost valuation methodology, the phenomenon of panic generates downward revision of asset values in the financial markets. In addition to the fair value tool falling asset values causes immediate panic in the market. In addition to the fair value tool falling asset values causes immediate panic in the market. These two findings add to Minskyan perspective, which states that the market conditions of the products of goods and services and the financial, finance and internal structure of liabilities, influence the price of capital. This price, according to Minsky, has two different values: offering price and demand price. Thus, investment is induced by the difference between the estimated cost of capital on the stock market and the property on the real market. This is similar to the Tobin's Q analysis who presents the ratio between the market value and the replacement value of fixed capital. These findings form the basis of our analysis by providing how valuation in the fair value accounting may cause destruction to the financial system stability.

In his theory of financial instability, Minsky (1982) argues that wealth is macroeconomically determined in isolation from the conjectural cycle. The choice of assets by economic agents is arbitrary (Note 2). Firms build

their physical capital; require funding by issuing asset or directly from the financial intermediaries (banks). Households, when to them, choose the most profitable distribution by buying assets or savings. In the absence of coordination and sometimes divergent interests, we are witnessing the rise of increased volatility related to interest gap between the value of the asset and the market. A second argument presented by Minsky and adopted by Taylor and O'Connell (1985), resulted from the strong substitutability portfolio choice for households.

Brunnemeier (2011) develops a model to analyze the effects of nonlinear amplification of debt on financial instability and concludes that when the net production of agents becomes depressed, the allocation of resources (capital) in the economy becomes less efficient and could reduce asset prices. Acharya (2009), advance a common model in which banks manage simple debt contracts give risky assets and no risk to specific industries determining the correlation of their portfolio. In addition, banks prefer to lend to similar industries (banking specialization). In this context, the central bank plays a regulatory role whose purpose is to maximize the welfare of the owners (Note 3) of the banks and depositors by integrating social and environmental costs of financial distress.

Bankruptcy leads to a reduction in the overall supply of capital (deposits) in the economy, causing the recession of investment activity (negative externality). In contrast a positive externality, resulting in a scaling or migration of depositors, occurs. A preference for a high correlation arises as a consequence expressed by the limited liability of the bank despite shareholders equity and the nature of externalities. This situation represents a systemic risk of default as described in the work of Jensen and Meckling (1976) and Stiglitz and Weiss (1981). And appropriate intervention by the central bank to mitigate individual risk and systemic shifting incentives of bank owners with a policy of satisfaction capital requirements. Acharya (2009) shows that under a certain structure, each bank can reduce optimally the individual risk of failure. Despite the systemic risk arising from the correlation remains unchanged. This point of view suggests the examination of the complementarities of individual behavior and of the underlying problems of agency. Those mechanisms can be fruitful direction to explain the collective behavior of agents and their reaction against the balance. Externality failure of an operator acts negatively on the profitability of others.

Fazzari et al. (2008) analyzes the dynamic cyclical short-term and medium-term simulation, rather than the asymptotic instability. Cash flow relative to income are mainly governed by the debt service, income distribution remains constant. To do so, the authors have developed a function that links the level of real investment (which depends on the available internal cash flow (Note 4)) to the changes in real output via an accelerator. Lima and Meirelles (2007) develops a post Keynesian macro dynamic model on growth and operating capacity (Note 5) that credit demand is endogenous. The debt situation of firms is explicitly modeled taking into account the Minsky's hypothesis of financial fragility. The interest rate is set by banks as a markup over a base rate determined exogenously (Note 6) by the monetary authorities. This increase varies with the operating capabilities while the debt ratio varies depending on the interest rate of capital accumulation and growth. To the system dynamics, Lima and Meirelles (2007), to establish the properties stability of the system, include the interest rate and the ratio of debt related to the capital as state (Note 7) variables representing the HIF. In this context the movement of capital in the market is designed as a currency exchange; ie one actual currency against future payment. Lima and Meirelles (2007), lead to results that the increase in real wages leaves profit rates unchanged and increases the degree of exploitation, thus creating a positive feedback on consumption, which in turn increases the rate of exploitation. Another result is that the impact of short-term bank markup or a change in the debt/equity ratio remains ambiguous. However, the increase in the level of real wages despite awareness of exploitation, leave the growth rate unchanged.

The reason is that this increase leaves the general rate of profit unchanged. In turn, an interest rate or higher debt, lowering the general rate of profit, reduces the rate of growth when the capitalists, financial capitalists deducted productive - show a higher proportion of income than the rate of profit. The impact of changes in interest rates on growth seems ambiguous when productive capitalists have a propensity savings higher than those of financial capitalists. In fact, a high level of debt, by increasing the rate of expected profit, will raise the growth rate. The equilibrium solution in the long term will necessarily be stable when the markup is procyclical and the interest rate is lower than the growth rate. In turn countercyclical bank policy to support the long-term equilibrium in dependence of the relative size of the interest rate and growth will be ineffective. Indeed, procyclical banking markup, given a procyclical interest base rate, implies a procyclical rate. Therefore, monetary policy conducted by a procyclical base rate in hedge financing scheme, can contribute to dynamic stability provided that the interest rate is lower than the growth rate. Consequently, an equilibrium solution in the long term, in a speculative area, the stability properties depend not only on the cyclical behavior of the markup bank but on the savings rate of capitalists. Therefore, as in the hedge regime, monetary policy conducted by a procyclical base

rate could contribute to dynamic stability in a speculative regime. Finally, Lima and Meirelles (2007), show that the equilibrium solution in the long term within the Ponzi area will be unstable dependence of the propensity to save by the capitalists or the cyclical behavior of bank markup. A general implication of the model, therefore, is that the system is more prone to instability, but becomes more financially fragile.

Asada (2004), studying the impact of price flexibility of macroeconomic instability using the Fisher effect debt with a macrodynamic model, introducing the Phillips curve and the assumption of adaptive expectations. An analytical demonstration was conducted when the contribution of the increase in the speed of price adjustment and adaptation of expectations to the destabilization of the economy. An analysis of intermediate values of the parameters shows that cyclical fluctuations occur through the Hopf bifurcation theorem. Asada (2004), made from the criticism of Keynesian models, post Keynesian IS-LM and its traditional interpretations microeconomic rigidity of wages and prices. This standard states that the vision of full employment equilibrium is reached automatically if wages and prices are flexible. Thereby reducing the level of nominal wage and price levels, contributes to increased production and job if the economy is depressed. And the persistence of unemployment is called the rigidity of wages and prices. Asada (2004), provides that this classical interpretation finds no basis in the Asian economies and Japan (1990). In contrast, this «conventional» view contributes to the worsening of depression and destabilizes the economy. This vision of a deflationary spiral is ignored in the orthodox literature that challenges the stabilizing effect of price flexibility. Asada (2004), built a model similar to Chiarella, Semmler and Flaschel (2000, 2001).

A model consists with five-dimensional system with linear differential equations. The introduction of price flexibility in the model gives them more dimensions, increasing the speed of price adjustment and the adaptive expectations, to destabilize the economy rather than stabilizing. The profit rate of risk-free assets, the interest rate on the interbank market and the share of profits in national income are constant. This implies that the monetary authorities (the central bank), slightly involved in the credit market (in terms of post Keynesian horizontalists; Moore (1988)). An investment function, the Irving Fisher effect debt, microeconomic foundation of the behavior of profit maximization in net cash flow is developed in this model using the assumption of adjustment costs increasing Uzawa (1969) and the assumption of increasing risk of investment Kalecki (1937).

Asada (2004) shows the existence of a negative feedback mechanism to target instability, made by the increase in the real debt of the firm, explained by the collapse in price levels during the depression, and implies an increase in the real wealth of creditors. This has not only a negative effect on the capital expenditures of the firm, but also induces an increase in spending of income. The stabilizing effect of wealth is ambiguous compared to destabilizing debt. Another neglected dimension in this model is the effect of the nominal interest rate. This is considering a monetary policy that seeks to hold the interest rate constant to maintain constant a real exchange rate demand. In this case the Keynesian effect no longer works.

Palley (1996) combined Minsky's approach with demand theory of Kaldor (1956). As a first step, this allows to analyze the effect of increases in debt on aggregate demand, in the second step, study the process of debt repayment and its effect when the reduction in aggregate demand. Skott (1995) modified the model of Kaldor (1940) to develop this dynamic relationship. Minsky and al (1994) argue that the behavior of the economy depend not only in endogenous dynamic process, the structure of institutions and the intervention of the authorities but also in the conductor pattern of the economy. So the initial conditions are not defined beforehand, but taxed at short time by the use institutional or reactions of the authorities. *"A ruling conjecture… is that the aptness of institutions and interventions will largely determine the extent of which the path of economy through time is tranquil or turbulent: progressive, stagnant or deteriorating"*, Gatti, Gallegati and Minsky (1994).

Minsky et al (1994) studied the case of a closed economy with four types of agents: households, firms, banks and government. Households represent the workforce, consumers and depositors (hold liabilities of banks). Firms provide consumer goods, demands goods and equipment investment, bank lending and lead productive force (work). Banks provide passive and require financial assets (household credit). Tax authorities and the central bank engaged in the provision of goods and non-market services, accepting a minimum level of life and guaranteeing, explicitly or implicitly, the selection of private contracts. Public expenditure subscription or warranty shall be paid by the collection of taxes, the sale of treasury bills or by the insurance liabilities of the central bank. Three markets are included in this analysis: the credit market, goods market and labor (Note 8) market. The capital investment grows through retained earnings. Credit level and interest rate are determined by the lending market and the price level is constant, normalized to unity (Note 9). Minsky et al (1994), lead to results that whenever the value-institutionally determined endogenously decided that dominates, which refers to the current economy, is broken, a new interactive process is triggered with new conditions that generate the future value. Leverage, which plays a role similar to the accelerator coefficient, is an endogenous variable whose

oscillations are called preferences of firms with liquidity. Requirements businessmen liquidity will require external parallel the donor to become less liquid. Cash flows in the form of increased gross profits are integrated into business as increased investment and financing for firms. These overall profits decrease when some real or financial assets fail to realize capital gains which lead bankers, portfolio managers and businessmen to an increase in liquidity supply.

Taylor-O'Connell (1985) and Lavoie (1986-87), have formalized the HIF Minsky whose financial fragility and instability are endogenous and inherent to the market economy. Foley (1987) developed a model dealing with financial fragility based on the interaction between debt accumulation by businesses and capital expenditures, but with the extension of credit led to mitigate cumulative future needs corporate liquidity through inter-firm credit. Quality assessments of firms and the terms of credit availability are also key indicators to explain investment behavior as suggested in the work of Bernanke and Gertler (1989), Blinder and Stiglitz (1983), Kiyotaki and Moore (1997) among others. Jarsulic (1996) developed a growth model with debt accumulation is advanced inspired from Keynes-Kalecki models (Note 10).

Another area of research, often considered from the neo-Keynesian literature, consists in the models with financial accelerator. Although the foundations of these models are varied (see the summary of Bernanke and Gertler 1995) most of these models (formal and detailed) work through the supply in the economy, as Bernanke and Gertler (1989) and Bernanke et al. (1999). Models, focusing on cycle Goodwin, studied the evolution of the debt in interaction with changes in income distribution. Keen (1995, 1999) present a model in which endogenous cycles of debt and income can lead to an "explosion" of the standard reports debt relative to production. Asada (1989) also develops a model of Goodwin, but adds the effects of Keynesian aggregate demand.

Recently, multiple works at the micro scale treat the role of the tool in the fair value impact of financial crises are advanced. The results are sometimes contradictory between two opposing ways. O'Hara (1993) put the point on the effects of this technique on the accounting term borrowing, and discovered that the accounting system increases interest rates for long-term loans, thus inducing a change at court term borrowings. This reduces the volume of liquidity by banks and borrowers exposed to excessive liquidation. In a similar vein, Burkhardt and Strausz (2006) suggest that accounting market prices reduce information asymmetry, thereby increasing liquidity and intensify the problems of exchange rate risk. Finally, Freixas and Tsomocos (2004) put the focus on the role of banks as institutions that smooth intertemporal shocks. Allen and Carletti (2006) analyze how financial innovation can create contagion across sectors and lowers welfare relative to autarky solution. However, while Allen and Carletti (2006), focused their research on the structure of liquidity shocks that shook the banking sector as the main mechanism by which the contagion, the authors converge on the impact of different accounting methods showing this technical guide to the contagion. The holding period of the financial assets and the contact with the market, are crucial factors of contagion and amplification due to the cycle of crisis.

Our model is based on a coherent theory and inspired from the stock-flow approach as advanced in the work of Minsky and Delligatti Gallegati (1996), and Delligatti Gallegati (1994a, 1994b), Bernanke et al (1998), Asada (2001, 2004), Lima and Meirelles (2007). Three sectors are explicitly present (market, credit market of goods and services and financial markets) and five types of economic agents are introduced into the analysis. The financial sector is introduced into the analysis by the interest rate defined by the markup of the interbank market and the monetary authorities; the debt service is treated in long term. The risk is endogenous in a macroprudential analysis and markets are incomplete (Note 11). All relevant variables are endogenous, GDP, debt service, wealth, supply and demand of the currency, current account capital. The renewal of the debt is allowed for payment of some money. This is to analyze the relationship between debt and economic behavior capital in temporal dimension.

Liabilities in the balance sheet structure show a series of future payments and are maintained in the evaluation of companies. We deal with dynamic stochastic disturbances appropriate depending on the configuration parameters of endogenous derived from a dynamic periodic financial instability and weather fluctuations. Added to this, is the behavior of firms, households, and financial institutions, the structural characteristics of the economy, the status parameters, the institutional system and political intervention of regulatory authorities. Households are distinguished into two classes whose behaviors are economically different (Note 12). In this economy: workers demand excessive volume of work from receiving a salary they gave out again between consumption and savings. The capitalist class (productive and financial) receives income from profit as entrepreneurs and profits due to the holding of shares. This profit is considered as a deduction from general flow of monetary benefits generated by the stock of physical capital. Firms respond to consumer demand, require capital goods, labor, and debt. Banks agree debt (firms) and demand deposits (capitalists). The central bank plays the role of regulator and prudential supervision through monetary policy. The government manages public

spending and tax revenues.

3. Empirical Modeling

We limited the sample to five areas that the model is more rudimentary. The temporal dimension is taken into account and our analysis extends over the long term. Our model moves from the mainstream economic models that reflect the microstructural (Note 13) analysis by introducing the financial dimension into macrodynamic models. Traditional models do not refer to financial market data, in addition to monetary policy matches different interest rates for different assets (treasury bills, bonds, money ...). Therefore, the resolution of this model is based on internal systems. However, the logical structure of the transactions matrix provides two main features: the sum of any column is equal to zero (all variables are determined in a column), and the last variable is logically implied. In this way, we can say that the sum of the sector activities do not have a causal involvement on the other. However, it is possible, with all decisions should be made in an uncertain environment, for each sector, some components are arbitrarily character residual value and can't be controlled. For the two groups of households, the residual process is mainly how their holdings of deposits currents change. Firms, the monitoring of loans from the banking system and they (the banks), assets and treasury bills, are their main dilemmas. The government, the issuance of new Treasury bonds is the main constraint delivered from the economic situation and that is a challenge. Indeed, banks must two deposit kinds: term deposit and treasury bills which can bring profits (interest rate). Arbitrarily, banks earn a profit margin, which shows the excess of receipts of interest and then are distributed to households (Interest on deposits). Firms have the opportunity to finance their investments by recourse to bank loans. We assume the existence of two types of households as advanced by Marx, Kalecki (1971), Kaldor (1956) Pasinetti (1962) and Lima Meirelles (2007). Employees, who are providing the labor force, production and they receive a wage (W) departed in consumption (C) and savings (S):

$$W_t = C_t + S_t \tag{1}$$

Employees are considered investors and not entrepreneurs. Take advantage from the benefits of investments in both profitable and liquid offered by the financial market that allow them to engage their financing capacity reversible manner.

Capitalists whose income is formed by compensation (r_t) as entrepreneurs and profit rate (Π_f) of the shareholding in financial firms shares. Income is derived as follows:

$$R_t = \Pi_{ft} + r_t K_t \tag{2}$$

Banks hold a wealth (W) as prime portfolio consisting of bonds Treasure (B), reserves and liquidity (L)(assumed equal to household savings). The banks's wealth is written:

$$W_t = R_t + B_t + L_t \tag{3}$$

The profitability of one unit of capital in the financial market is given by, (the rate at which individuals expect p_{kt} to change):

$$\rho_{kt} = \frac{r(p_{kt})}{p_{kt}} + \pi_{kt} \tag{4}$$

Which (π_{kt}) represent the expected value of the rate of return on capital(R). The rate of return of holding the national currency (L) is the rate of inflation:

$$\rho_m = \pi_m \tag{5}$$

The treasure's bonds (B) are expected dependent in variable of interest rates and the inflation.

$$p_b = i_b + \pi_m \tag{6}$$

The government anticipates the growth of the population with a given rate which translates into an equivalent increase in consumer demand. And firms adopt a behavior investment to increase production and meet the potential demand. To do so, firms have recourse to bank credit to finance their new investment and meet the potential demand. It is assumed that both types of firms (Note 14) operate in two different sectors. Firms, whose capital intensive demand for credit depends on the capital, held the cost of application for new credit capital (f_{kt}) and anticipated profitability of financial assets (r_{t+1}) :

$$D_t^k = D_t^k(K_t, f_{kt}, r_{t+1}) \tag{7}$$

With investment in capital good is intensive in capital $\frac{\partial \mathrm{D_t^k}}{\partial \mathrm{kt}} > 0$, cost of capital depends $\frac{\partial \mathrm{D_t^k}}{\partial \mathrm{f_{kt}}} < 0$ and expected future returns $\frac{\partial \mathrm{D_t^k}}{\partial \mathrm{r_{t+1}}} > 0$. The second type of firms producing consumer goods based on the capital invested, the

cost of capital (p_k) and the growth level of consumer prices (p_t):

$$D_t^k = D_t^k(K_t, p_{kt}, p_t) \quad (8)$$

With $\frac{\partial D_t^k}{\partial K_t} < 0$ the investment in consumer goods is less capital intensive and decreasing the cost of capital $\frac{\partial D_t^k}{\partial p_{kt}} < 0$ and depends positively on the price level of consumer goods $\frac{\partial D_t^k}{\partial p_t} > 0$.

Both types of firms choose to finance their investments by borrowing from banks. Investment depends negatively on the interest rate of the bank (i_b) with $\frac{\partial I_{t(i_b)}}{\partial i} < 0$ and $\frac{\partial^2 I t_{(i_b)}}{\partial i} < 0$. Suppose first that firms producing consumer goods, whose price is known before, decided to meet future global demand D_{t+1} en $t+1$. Either, (Y_{ct+1}) anticipated production and firms decide to invest in (I_t) to satisfy demand in ($t+1$), and we have:

$$Y_t = \mu I_{t-1} \quad (9)$$

Whose (μ) represents a measure of productivity. Anticipated demand for the consumption good is then written:

$$D_t = a + bY_t;\ 0 < b < 1 \quad (10)$$

With (a) are autonomous spending and (b) the marginal propensity to consume. Assuming that expectations are perfect, firms anticipate that they now sell tomorrow. They must invest D_{t+1}/μ , in (t) to serve the market in ($t+1$), and their requests for credit can write:

$$\mu C_t^d = P_t D_{t+1} \quad (11)$$

Which (C_t^d) are the nominal amounts of credit given by banks. Thus, we assume that banks, to meet the demand progressive funding, decided to offer a credit equivalent amount of liquidity available (Savings:(s)) and reserves held at the central bank. In fact, as mentioned by Blinder (1985), the amount credit offered by banks varies between a demanded credit (C_t^d) and a maximum volume of disponibility (C_t), as follows:

$$C_t^o = min(C_t^d, C_t) \quad (12)$$

So the investment made by firms is equal to:

$$I_t = min\left[\frac{D_{t+1}}{\mu}, \frac{C_t}{P_t}\right] \quad (13)$$

And the market price of goods and services is adjusted according to the law of supply and demand:

$$P_{t-1} - P_t = \theta(D_t - Y_t) \quad (14)$$

Borrowing constraint related to the current interest rate on the banking market pushes firms to react by loosening this constraint as a lower interest rate. However, the liability structure of firms make significant in explaining the behavior of loan application to finance their investments. In this context the fair value tool, allowing immediate recognition of unrealized gains and losses on the balance sheets, provides a tool for the influx of funding in the financial markets.

Indeed, the value of the company remains on the market for axial issuance of shares and attract new shareholders or to persuade bankers to finance their investment as suggested by Bernanke et al: *"Everything else equal, a rise in the expected discounted return to capital reduces the expected default probability. As a consequence, the entrepreneur can take on more debt and expand the size of the firm. He is constrained from raising the size of the firm indefinitely by the fact that expected default costs also raise as the ratio of borrowing to net worth increases"*. Bernanke et al (2000). Thus, we assume the existence of a single type of assets on the market. Financial firms come from their initial capital stock held by the capitalist market financial (t) whose value is estimated at V_t and bank credit $(1-\alpha)(L_t + R_t)$ with a hazard ratio ($\overline{w}_t$)). Firms use their market valuation (Tobin's Q greater than expected 1) for a potential demand of credit equal to the difference between expenditures on capital and net worth:

$$D_{t+1} = Q_t K_{t+1} - N_{t+1} \quad (15)$$

And entrepreneurs achieve anticipated revenue estimating R_{t+1}, choose the value of the firm $Q_t K_{t+1}$with a hazard ratio defines and addresses the bank for the loan B_{t+1} ($D_{t+1} = B_{t+1}$). And leverage that, thanks to the loan, allows the firm to acquire assets with minimal capital, which corresponds to accumulate capital through debt: leverage $= \frac{D_{t+1}}{Q_t K_{t+1}}$

The firm expects profits $R_{t+1}$to cover the cost of capital and allows it to be solvable. The loan agreement entered must make a profit to cover the cost of the contract H_{t+1}. In the absence of risk of default then:

$$R_{t+1}Q_{t+1}K_{t+1} = H_{t+1}D_{t+1} \quad (16)$$

In this context and according to the Minsky's financial instability theory, the free play of individual opportunistic behavior (pushing borrowers to increase the market value of the firm to seek new loans) coincides with speculative bank. Bank to cope with this change in behavior, decided to move the idle money by introducing a risk of default " *circulate idle liquidity through asset created by Occasion so increase the amount of funding possible with a given amount of central (Note 15) bank money*" Minsky (1957). The amount of credit granted by banks depends on the availability of liquidity as mentioned by Blinder (1985). It is assumed in this context that banks choose the combination of credit allocation between productive firms $\alpha(L_t + R_t)$ and firms operating in the financial sector, whose share is $(1-\alpha)(L_t + R_t)$.

A firm operating in the sector of production their constraint reads as advanced by Blinder (1985):

$$\frac{C_t^o}{P_t} = \frac{\alpha(L_t+R_t)}{P_t} + \omega Y_t \quad (17)$$

We assume that the market for goods and services is in equilibrium and compute the steady state of the market good and service; that $I_t = \frac{C_t^o}{P_t}$ (I^*, P^*).

$$I_t = \frac{\alpha(L_t+R_t)}{P_t} + \omega\mu I_{t-1} \quad (18)$$

Subtraction I_{t-1} on both sides we can write:

$$I_t - I_{t-1} = \frac{\alpha(L_t+R_t)}{P_t} + (1-\omega\mu)I_{t-1} \quad (19)$$

The second half of the equation allows us to write:

$$P_{t+1} - P_t = \theta[a - \mu(1-b)I_{t-1}] \quad (20)$$

In the equilibrium we have: $I_t = I_{t-1}$ and $P_{t+1} = P_t$, then we obtained:

$$I^* = \frac{a}{\mu(1-b)};\ P^* = \frac{\alpha(L_t+R_t)\mu(1-b)}{a(\omega\mu-1)} \quad (21)$$

In the absence of default risk, a firm operating in the financial sector stress their credit application is written in equations (15) and (16):

$$\frac{R_{t+1}Q_{t+1}K_{t+1}}{H_{t+1}} = Q_tK_{t+1} - N_{t+1} \quad (22)$$

The cost of capital is estimated assuming equation (16) and assuming that the demand for capital is equal to the offer:

$$R_{t+1}Q_{t+1}K_{t+1} = (1+\alpha)(L_t + R_t)H_{t+1} \quad (23)$$

As stated previously, there is a single homogeneous type of share on the market that is supposed to perfect competition. In this part of the analysis is given an important role in accounting. "*Suggest that within the firm the lack of a market price is replaced by systems for allocating decisions among managers, and measuring, rewarding, and punishing managerial performance. Accounting plays a role in these systems and so appears to be part of the firm's efficient contracting technology*" Meckling and Jensen (1986). The homogeneity condition allows us to write the following formula:

$$\frac{total\ equity}{number\ of\ ordinary\ shares\ outstanding\ (N)} = book\ value\ per\ share\ (V^e)$$

So since we have assumed that capital firms are comprised of shares held by the capitalists then:

$$Q_{t+1}K_{t+1} = NV_t^e \quad (24)$$

The cost of capital is deducted as the cost per share multiplied by (N) the equation (23) gives us:

$$r_{t+1}NV_t^e = (1+\alpha)(L_t + R_t)H_{t+1} \quad (25)$$

Let us write the equation (24), in the following mathematical form by assuming that the total credit is equal to: $\frac{(1+\alpha)(L_t+R_t)H_{t+1}}{N} = C_t^d$:

$$r_{t+1} * NV_t^e = C_t^d \quad (26)$$

We proceed to anticipate the solvency of companies according to fair value accounting. We consider that the initial and final value of the share and the book value of the asset on the market evolve linearly. Mathematically (Note 16), assuming the function V primitive v_t (the present value), $[v_i, v_f] \in I$, I is the interval with the

carrying amounts of financial assets, we write the relation as the following form:

$$V_t^e = v_i + \int_{v_i}^{v_f} \mathrm{v_t} dt \tag{27}$$

We recall in this context that when a transfer of assets is made below its carrying value, an impairment loss is transferred to the income statement on the basis of the asset transferred. An asset is sold above its book value is equivalent to a profit reported in the income statement. Thus the equation (26), which is the book value of the debt of the firm becomes:

$$Nr_{t+1} * \left(v_i + \int_{v_i}^{v_f} \mathrm{v_t} dt\right) = C_t^d \tag{28}$$

With the number represented by this integral does not depend on t, we can write: $\int_{v_i}^{v_f} \mathrm{v_t} dt = F(v_f) - F(v_i)$.

4. Model Analysis

We assume that the returns are known and before we draw the curves representing the variation in the value of assets in the volume of credit. To do so, we derive the equations (28). Two cases are possible. If we assume that the return on capital is constant and known previously as the derivative of the previous equation gives:

$$\frac{\partial C_T^D}{\partial V_t} = \frac{1}{2} N r_{t+1} \int_{v_i}^{v_f} \frac{1}{2} \mathrm{V_t^2} dt = \frac{1}{2} N\, r_{t+1} = \frac{1}{6} N r_{t+1} [\mathrm{V_f^3} - \mathrm{V_i^3}] \tag{29}$$

Repayment of the credit depends on the difference between the book amounts of the asset. This relationship is made obvious in fair value accounting regime, the asset is recorded according to its market value. Three cases are possible:

➢ The book value at the maturity date is greater than the initial value, in this case the system is stable (Fig. 1). When the value is less than the cost of the credit system is speculative area (S). A situation that emerges area hedge (H), where the book value exceeds the cost of credit.

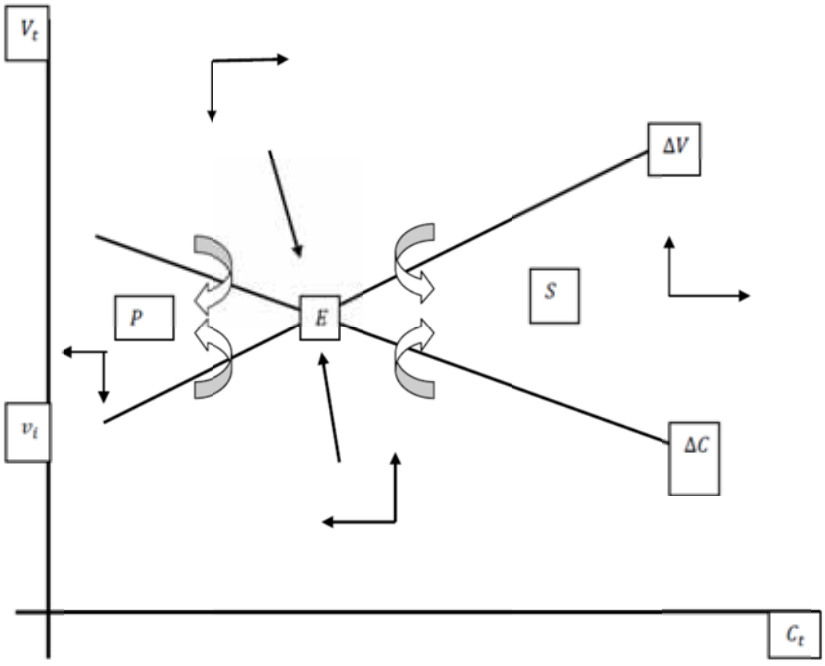

Figure 1. Hedge finance

➢ In the second case, the variation of asset's book value is zero, firms repay interest only. This situation causes the system to speculation (Fig. 2). The area which lies below the equilibrium in the system is ponzi area (P).

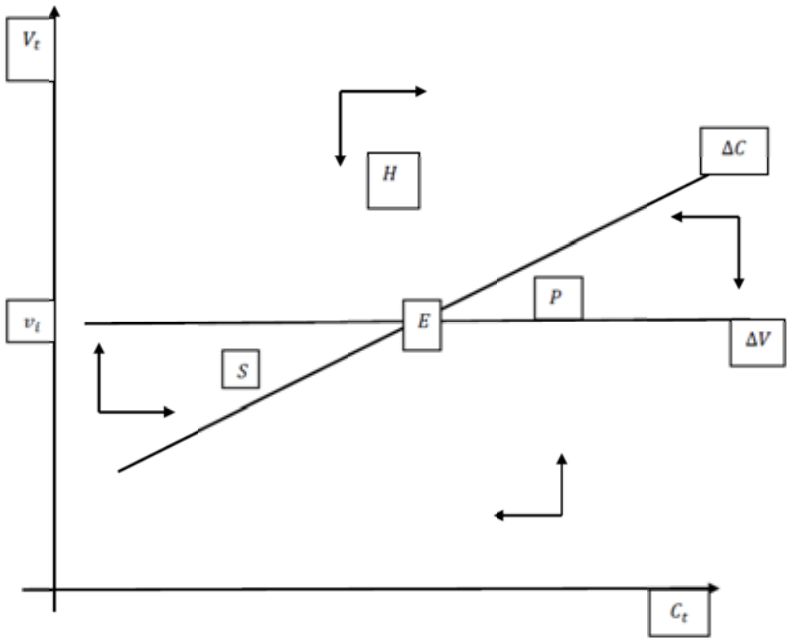

Figure 2. Speculative finance

➢ The book value at maturity is less than the initial value. And the financial system has failed (Fig. 3).

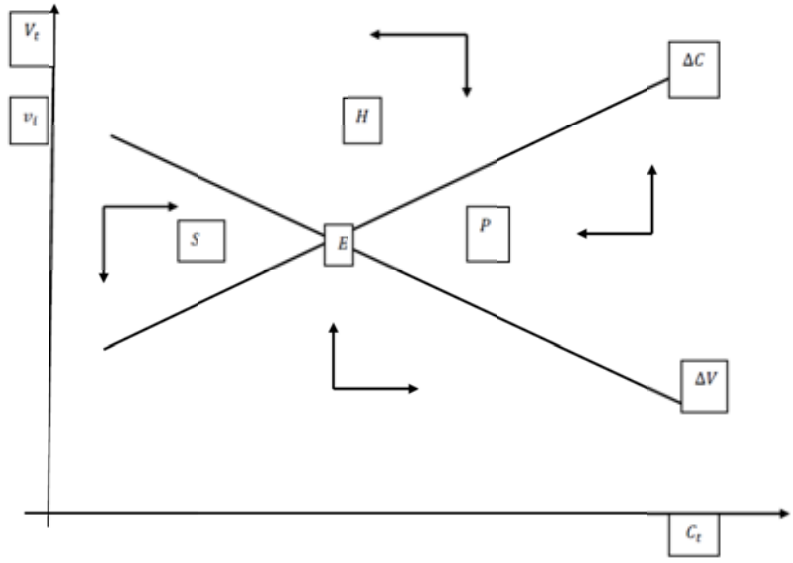

Figure 3. Ponzi finance

The hedge economy erected a period characterized by rising stock values attracting speculators seeking more value and funders who are a good opportunity to move their liquidity against attractive returns. Thus, we are witnessing the rise of speculation prompted by attractive rents. The insertion of results in the evaluation of accounting firms and the use of the fair value measurement of liabilities for accounting and solvency of firms, implied that an increase in the value of assets is reflected immediately and with same degree, the behavior of banks anticipate this change upwards as remedy sign of the firm in question. In this stage, entrepreneurs take advantage of the opportunity to build their credit needs which are unlimited if you take opportunistic behavior gents. This behavior eventually snowballs building which will be completed by high prices of financial assets markets. Attack succeeds and the economy is instable. Ponzi phase remains more remarkable than the recession. The Ponzi phase is wider spreads and undulatory propagate in space and area. The mortgage crisis in USA is exemplary to support our reasoning. Made several sectors in the real economy are affected financial (banking,

insurance, transport, production of raw materials ....) and countries of the world (Europe and countries of course). We are witnessing crises (Note 17) that spread temporally and geographically. The recognition operation and the delivery of accounting continues to apply even if economic conditions change, "*Bookkeeping, as the control and ideal synthesis of the process, becomes the more necessary the more the process assumes a social scale and loses its purely individual character*". Marx (capital).

In this level, the variation of credit does not depend on the value of the action but depends only on profitability. Historical cost regime in the asset is measured at the beginning because the book value of an asset has no relation to the market value of the asset. And the asset is valued in the accounts at its price at the date of purchase, even if its market value has meanwhile evolved. The recession is longer and this is due to the recovery time to higher market values of firms. Such values which, according to our reasoning, include in the evaluation of assets and liabilities of financial firms. In this case using the cost value, the equity value increases moderately slower than in the case of fair value. And the completion of new loan agreements and even the amount of credit is limited. In this regard, the crises in Mexico and Argentina are examples that use our reasoning well as time duration of the crisis and the recession.

5. Dynamic Model and System Stability

5.1 Interest Rates and Financial Instability Hypothesis

The theory of financial instability brought by Minsky was a closed economy whose profits determine the level of investment and consumption. Idle money is injected into the economy through the creation of new financial products. This creates a speculative market behavior from the agents who buy these products. In the presence of uncertainty, decisions depend on the assessment of asset prices. A confrontation between the offer price of capital and the sale price determines the amount of credit granted to the market. A cycle occurs, triggers the desire to move idle money and speculative behavior of buyers of financial assets. We are witnessing degradation liquidity ratio compared to shares. This will lead to an increase in the velocity of circulation of money and that is reflected in the appreciation of net debt. The cycle with the rise of speculation lead to an overstatement of asset prices and the cycle is speculative.

To establish the dynamics of interest rates and financial instability assumes a shock occurs in financial markets causing a hazard ratio $(\overline{w}_t)$. According to Minsky (1975), two consequences result from this behavior: ineffectiveness of monetary policy and leads to an increase in the debt / net worth ratio resulting in greater volatility in the value of money market assets. The risk of illiquidity and insolvency therefore increase simultaneously. And the repudiation of debt by financial firms is reflected in this equation.

$$(1-w)R_{t+1}Q_{t+1}K_{t+1} \tag{30}$$

Banks revise their estimates of interest rates like a weighting of interest rate i_t and profit rate r_{t+1} . Behavior results analytically by a weighted interest rate compared to current rates and profitability. Thus we write: $i_{t+1} = f(i_t\ ,\ r_{t+1})$

$$(1-\alpha)i_t + \alpha(1-\overline{w}_t)r_{t+1} = i_{t+1} \tag{31}$$

Thus:

$$\Delta i_t = \alpha[(1-\overline{w}_t)r_{t+1} - i_t] < 0 \tag{32}$$

With i_t represent the interest rate basis depending on the level of economic activity to decide when to change interest rates, downward or upward. The right side of equality (32) describes the banking markup, positive or negative, and Δi_t is the difference between the real and the nominal interest rate. This linear relationship seems logical. However, financial crash and according to the initial conditions of the model changes to decrease or increase the interest rate depends on the sign of the term $(1-\overline{w}_t)r_{t+1} - i_t$. This makes $(1-\overline{w}_t)r_{t+1} - i_t > 0$ or if $\overline{w}_t < 1-(i_t/r_{t+1})$. In the second case we assume that $(1-\overline{w}_t)r_{t+1} - i_t < 0$ which is equivalent to remember that $\overline{w}_t > 1-(i_t/r_{t+1})$.

Our reasoning is suitable with the financial instability hypothesis of Minsky which provides that the financial shock is caused by rising interest rates. In fact, and according to the relationships that it has lead to a rise in interest rates worsen the financial crisis and growing panic. Such a situation can be abandoned when the rates are kept down. We represent the subprime's example (Note 18) where a higher interest rate played a big part in crisis. Equity has increased during the crisis. Accounting rules were "pro-cyclical", that is to say, they aggravated the crisis.

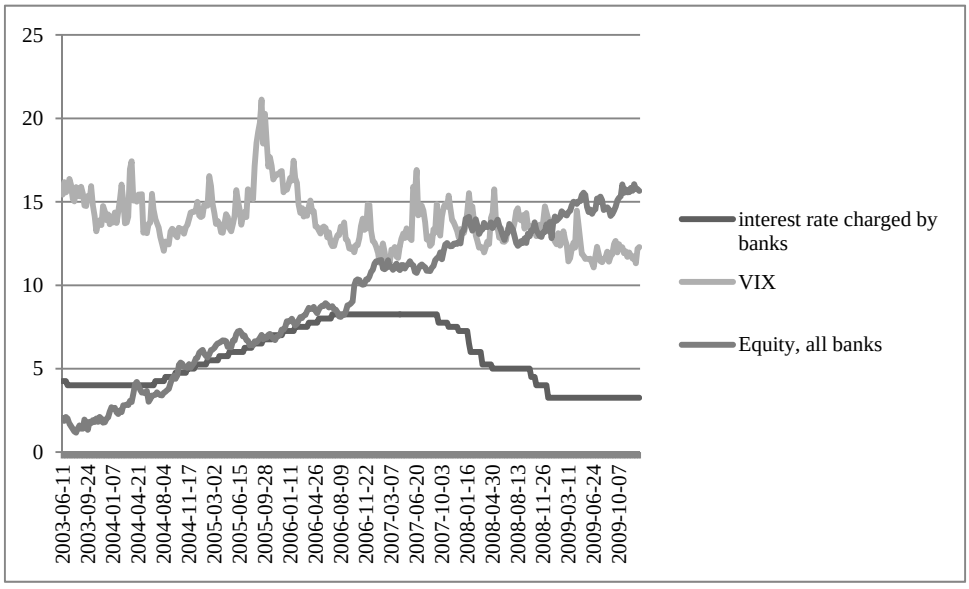

Figure 4. Subprime crisis and effect of interest rate

5.2 Interest Rates, the Effect of Feedback and Contagion

Laux and Leuz (2009), studying the effect of procyclical and contagious fair value, provide a great deal of controversy returns to the confusion about the fair value (which is new and different), *"fair value only played a limited role for income statements and bank's capital ratios Regulatory except for a Few banks with large trading positions (Note 19)"*. The new standard is far from being a compromise between relevance and reliability. Indeed, concerns the registration of said assets to market values in times of financial crisis when we recognize the relationship between contracts and regulations or that bankers and investors are concerned about the market reaction to short-term. Laux and Leuz (2009) express the roots of the crisis to worries implementation in practice impairs the contagious nature of fair value, *"it is obvious that extant accounting standards can be blamed for causing contagion effects. That it is possible to aim, in practice or in crises, the standards do not work as intended (Note 20)"*.

The banking markup policy depends on the ratio interest rates compared to the return on assets in the financial market. This makes banks anticipate a decline in interest rates and hence a negative cash margin. In this part of the analysis we take the work of Lavoie (1992) argues that the failure of macroeconomic activity, which results in an increase in the banks' preference for liquidity, pushing the banking system to increase the differential between the interest rate and the credit base. Lima and Meirelles (2007) meanwhile, argue that the banks use the level of economic activity to decide when to markup the following bank interest rates. In our case, banks have invested (α) in the real sector and $(1-\alpha)$ in the financial sector. At the end of the period, this investment has brought lower revenues than anticipated previously made the repudiation of debt from financial firms. Given the interest rate (i_t) initially known, markup cyclicality of bank depends on the distribution of bank credit between the two sectors: real and financial sectors. In this perspective, a financial shock causes the reduction of profits and therefore lowers in bank funds. This is reflected in the revision of the share of credit requested for each sector.

This behavior under the conditions of our analysis is resulted from a countercyclical markup by the downward revision of interest rates. Propagation in the "orbit" of the financial shock occurs, by contagion, the imbalance of the real sector. According to equation (21), we arrive at the lower level of interest rates. This can be misinterpreted by consumers who reduce their savings. Thus, firms, to maintain the same level of production, must increase autonomous spending (equation 10). *".... And that instability is due to the way capital and asset accumulation are holding Financed. Simons was correct: Banking, that 'is, the financing of capital asset ownership and investment, is the critical destabilizing phenomenon ... the liability structures available to units That own the massive capital assets of the economy must be constrained ... Keynes's solution-the socialization of investment -may be a way of attenuating, although not Eliminating, financial instability by Removing the financing of the capital-intensive processes most expensive capital assets and debt from private markets*"(P. 520 Minsky., 1980).

The financial shock that occurs in the market could also have a negative effect on household wealth: capitalists

and workers, as well as the level of investment. Returning to equation (1) representing the stress distribution of income of employees and in combination the effect of the shock on the general price level, two cases can be interpreted. First, if employees believe their hold constant level of consumption, they must reduce their marginal proportion to spare. This translates into a reduction of capital flows to banks. Banks and wealth is reduced. This results in a decreasing volume of credit to the productive sector as well as financial. Capitalists, for their part, their share of profit (equation 2) is shrinking due to the depreciation in value of the assets they hold. Therefore profitability ratios / capital and production / capital (y) are in descending order. Expectations are revised downwards. Of such behavior equivalent to decreasing interest rates will eventually decline of the inflation gap, nominal interest rate $(\rho - \pi^e)$. The rate of capital accumulation (g) by the banking sector deteriorates. Finally, the system sets itself up to the destabilizing Mundell-Fleming:

$$(\mathrm{y}\downarrow) \Rightarrow \pi_{\mathrm{m}}\downarrow \Rightarrow \pi^e\downarrow \Rightarrow (\rho - \pi^e)\downarrow \Rightarrow \rho_{kt}\downarrow = (\mathrm{g}\downarrow) \Rightarrow (\mathrm{y}\downarrow)$$

In the second case, maintaining the same level of savings, employees receive satisfaction reduced rigid wage regime. Aggregate demand is compressed, distinguished by declining rate of firm's profit. Demand for credit deteriorates; banks adopt a bank to encourage markup revival of investment activity. The nominal interest rate is lowered to stimulate growth. In this case, economic growth resumes its upward pace which translates into an increase in the level of production and hence the ratio of production/capital. This reasoning is explained Keynesian effect debt:

$$(\mathrm{y}\downarrow) \Rightarrow \pi_{\mathrm{m}}\downarrow \Rightarrow m\uparrow \Rightarrow (\rho)\downarrow \Rightarrow (\rho - \pi^e)\downarrow \Rightarrow \rho_{kt}\downarrow \Rightarrow (\mathrm{g}\uparrow) \Rightarrow (\mathrm{y}\uparrow)$$

Such effect that does more if we consider that the stabilizing effect of wealth is ambiguous compared to destabilizing debt (Asada, 2004). In addition, banks and in their effort to maintain a level of savings and real money demand constant, must not lower nominal interest rate. In this case the interest rate will be zero; the Keynesian effect no longer works (Asada, 2004). Our analysis corresponds to the model of Irving Fisher, who studied a microeconomic model dealing maximizing behavior of the profit rate in net cash flow in correspondence with the hypothesis of increasing cost adjustment Uzawa (1969) and assumption of increasing risk of investment Kalecki (1937). Capitalists, for their part, the financial shock induces degradation of their income from profits due to the holding of risky financial assets in the equity of companies in crisis. However, a financial shock on a growing market, which is characterized by a debt/equity base very high, resulting in lower growth and production volume. So the debt/equity ratio and interest rates decline. The amount of debt seems like disability so that the rate of capital accumulation itself up to the downside. Thus we have a Fisher's debt effect:

$$(\mathrm{y}\downarrow) \Rightarrow \pi_{\mathrm{m}}\downarrow \Rightarrow \mathrm{d}=\mathrm{D}/(\mathrm{pK})\uparrow \Rightarrow \mathrm{g}\downarrow = (\mathrm{y}\downarrow)$$

In conclusion, the results of our analysis are similar to several conclusions of the work at the micro level. Thus, we study both sides of controversial issues in the debate. Proponents of fair value accounting argue that this method of accounting reflects the true (and relevant) value balance sheets of financial institutions. This should enable policy makers and investors to better assess their risk states and undertake the discipline of the market and the most appropriate remedial policies. By contrast, opponents claim that this method of accounting leads to excessive and artificial volatility. As a result, the value of the balance sheets of financial institutions will be driven by short-term fluctuations in the market that do not reflect the value of the basic principles and the value at maturity of liabilities and assets. Our analysis extends over the long term; we concluded the immediate effect of the carrying value of assets and liabilities on the financial solvency and stability of the firms. Our analysis allowed us to affirm the view of Minsky when the role of rate interest in system instability. The residual between assets and liabilities can give a new perspective for research.

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Notes

Note 1. Adoption of innovation, deregulation, globalization … Minsky (1978-1986).

Note 2. There is no effective arbitration between the accounting valuation of capital and the market valuation.

Note 3. The resulting loss of depositors of bank failure is not internalized by the owners, this is an externality.

Note 4. A high level of cash flow increases investment firms must without the risk or cost of debt or those associated emissions of new shares.

Note 5. Lima and Meirelles (2007), consider the cyclical nature (procyclical or countercyclical) markup of banks is taken into account in conjunction with the operating capacity of firms. Increased rate of exploitation and profits raises the ability of companies to use its financial obligations, reducing their perceived risk of default and, consequently, leads to a fall in the banking markup (eg, Wolfson, 1996). Another reason is that the decline in macroeconomic activity, increasing the banks' preference for liquidity, the banking system will lead to increase the difference between the basic rate and the loan rate (eg, Lavoie, 1992). A markup procyclical bank, based on a vision of intra-capitalist, it could be supported by the increase in macroeconomic activity.

Note 6. Depend on the characteristics of banks, the macroeconomic conditions, the nature of taxation and the nature of financial structure and the underlying regulation. In the Post Keynesian monetary economy, the demand for money is essentially power financial credit by the business sector. The flow of credit does not count as an exogenous stock of money. In this particular approach, the focus is on bank loans, or assets. Liabilities are considered a causal link that responds to changes in the asset. Portfolio theory is abandoned. Kaleckian approach

for the banking sector becomes possible Rousseas, 1985, p. 135).

Note 7. Hedge, speculative and Ponzi. In this context, Lavoie (1995) presents a comparative view of the way through which post Keynesian models of growth and distribution of currency incorporate the endogenous nature of money, and the exogenous interest rate. While the short-term model developed by Lima and Meirelles (2007), is similar to the version developed by Kalecki Lavoie, who, on his side dynamics, contributes to the post-Keynesian approach incorporating a flexible bank rate. While in all variants presented by Lavoie, economic activity has no effect on the rate of interest. In the model-Lima Meirelles (2007), the ability to use a feedback effect on the decision of fixing the interest rate banks. A detailed analysis of several studies post Keynesians, the endogenous nature of money, Lima and Meirelles (1998).

Note 8. Treated endogenously whose employment is a positive function of effective demand is the given wage.

Note 9. No distinction between nominal and real variables.

Note 10. In this context, the distribution of income plays a crucial role in the dynamics of the current system and the fragility of financial instability.

Note 11. The rejection of the hypothesis of complete markets are perfect as advanced by Arrow-Debreu was destroyed in Minsky's model made of asymmetric information.

Note 12. This is according to Marx, Kalecki (1971), Kaldor (1956), Robinson (1962) and Pasinetti (1962), Asada (2004), Lima and Meirelles (2007).

Note 13. Les modèles qui introduisent les données micro pour un traitement macroéconomique sont rares (les modèles de rationnement de crédit: Getler et Blinder, IS-LM augmenté: Blinder…).

Note 14. Minsky predicted that the dynamics of the crisis is perceived through combination between the financial and productive system.

Note 15. Minsky's financial instability as: uncertainty and liquidity cycle basis, O. Brossard 1998.

Note 16. See appendix.

Note 17. Stijn Claessen "Systemic Banking Crises: A New Database Prepared by Luc Laeven and Fabian Valencia 1", November 2008.

Note 18. Dataset of equity are from Federal Reserve Board H.8, the VIX from CBOE and interest rate from Bank of Canada. The period of sample is between Juan 2003 and December 2009.

Note 19. Laux and Leuz (2009). Accounting organization and society. p857.

Note 20. Laux and Leuz (2009). Accounting organization and society. 34, pp 826-834.

Appendix

Let f be a function defined on an interval I and admitting primitivesI. F is a primitive of f on I, a and b in I. We call integral from a to b from f, the number:

$$F(b) - F(a)$$

Which does not depend on the choice of the primitive of f, because primitives f on the interval I differ from a constant function. We note this number:

$$\int_a^b f(t)dt \text{ noted: } [F(t)]_a^b$$

In the notation with the symbol of the integral, t plays the role of a dummy variable, and we

$$\int_a^b f(t)dt = \int_a^b f(x)dx$$

In addition, the number represented by the integral is independent of t.

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A Panel Data Analysis of Capital Structure Determinants: Empirical Results from Turkish Capital Market

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Abstract

The determinants of capital structure have been a widely discussed subject in the finance literature. The purpose of this paper is to determine whether firm-specific capital structure determinants in the emerging market of Turkey support the capital structure theories which were developed to explain the company structure in developed economies. Specifically, we try to answer the following questions: Firstly, are determinants of capital structure correlated with the leverage that has been declared in the developed economies setting correlated in Turkey as emerging market as well? And secondly are the modern capital structure theories (e.g. trade-off and pecking-order hypothesis) valid in explaining capital structure of the Turkish companies? In this paper, we apply econometric techniques and panel data analyses. We empirically examine the capital structure of 242 companies of different sectors that are traded in Istanbul Stock Exchange (ISE). In the period of 2000-2009 depending on the findings of the panel data analysis, we can conclude that Turkish companies do not have debt ratio targets. We suggest that Turkish companies follow a hierarchical company structure. More specifically, we claim that trade-off theory is less successful than the pecking order hypothesis in explaining the capital structure of the Turkish companies. Therefore, Turkish companies are following pecking-order hypothesis in their debt behaviors.

Keywords: capital structure, panel data, market value, emerging markets, Istanbul Stock Exchange

1. Introduction

The determinants of capital structure have been a widely discussed subject in the finance literature. Over the last five decades, the ability of financial theory to explain capital structure decisions has progressed remarkably. Researches propose theoretical models to explain capital structure patterns across companies and countries, and to provide empirical support to application of these models for the real business world (Modigliani and Miller 1958, Jensen and Meckling 1976, Myers 1977, Harris and Raviv 1991). A great number of researchers focused on capital structure decisions of publicly traded companies in emerging countries (Delcoure 2007; Chen 2004).

The empirical researches on the capital structure decisions of companies, which first appeared in the 1980s (Marsh; 1982; Breadly et al., 1984; Friend and Lang, 1988) and have continued since then, are mostly based on data collected from developed markets (USA, Japan, Germany, U.K., France, Italy and Canada etc.). Some examples of these studies are Titman and Wessels (1988), Hodder and Senbet (1990), Harris and Raviv (1991), Rajan and Zingales (1995), Wald (1999), Graham and Harvey (2001), Ozkan (2001), Chui et al. (2002), Bevan and Danbolt (2002), Giannetti (2003), Bancel and Mittoo (2004), Hall et al. (2004,), Song and Philippatos (2004), Gaud et al. (2005), Brounen et al. (2006), and Mahajan and Tartaroglu (2008). In addition, a few studies that considered emerging markets (Brazil, Mexico, China, India, South Korea, Jordan, Malaysia, Pakistan, Thailand, Turkey and Zimbabwe etc.) have been performed. For example, Booth et al. (2001) is a pioneering study on the capital structures of emerging markets. Other studies are: Chen (2004), Pandey (2001), Pandey et al. (2001), Annuar and Shamsher (1993) and Ariff (1998). In general, empirical studies have been in two different fields: the developed markets and the emerging markets. Because, the institutional structures of the companies in

developed markets are different from the structures of those in the developing markets.

In this paper, we examine the changes in the capital structure of Turkish companies. The purpose of this paper is to determine whether firm-specific capital structure determinants in the emerging market of Turkey support the capital structure theories which were developed to explain the company structures in developed economies. In other words, the main motivation for this study is to highlight the role of firm characteristics and country-specific variables in determining capital structure. Specifically, we try to answer the following questions: Firstly, are determinants of capital structure correlated with leverage that have been declared in the Developed Economies setting correlated in Turkey as emerging market as well? And secondly are the modern capital structure theories (e.g. trade-off and pecking-order hypothesis) useful in explaining capital structure of the Turkish companies within the emerging markets?

In this paper, we apply econometric techniques and panel data analyses (Chen, 2004; Cheng and Shiu, 2007; Fattouh et al., 2005; Kovenock and Phillips, 1997; Menendez and Gomez, 2000). We empirically examine the capital structure of 242 companies of various sectors that are traded in Istanbul Stock Exchange (ISE). We analyzed the capital structure determinants for companies. Apparently, firm-specific factors correlated with capital structure in emerging markets are similarly correlated in developed economies. This result is consistent with Booth et al. (2001) and Pandey (2001). These findings showed that firm-specific factors are important in determining capital structure. Aside from the difference of firm-specific factors, there are other institutional differences like economic development, financial market-specific factors (creditor and shareholder rights, level of market development, development of financial intermediaries, and the efficacy of the legal system) and country-specific factors (gross domestic product, inflation, tax rate, and loan rate).

The remainder of the paper is organized as follows: In the next section, we provide an overview of theories of capital structure and also cover the measures of the leverage and firm- and country-specific determinants of capital structure. In Section 2, we give the data source and methodology. In Section 3, we present our empirical method. We discuss the empirical results of our study in Section 4. In Section 5, we give the general conclusions that can be drawn from the findings of the study and suggestions for future research.

2. Data Source and Methodology

This study aims to question the validity of the existing capital structure theories used to detect the factors that influence the individual factors on the capital structure of publicly traded companies and the capital structure decisions in Turkey, which is an emerging market. Our database consists of the panel data set of 242 companies for the period of 2000-2009. The panel data has been collected from the yearly financial tables of the companies. The tables of the companies were taken from İstanbul Stock Exchange (ISE). With the collected data, 2420 balanced panels were built.

The dependent variable in this study is the debt ratio. In literature, while some of the empirical studies used book leverage (Chakraborty, 2010; Chen, 2004; Fattouh et al., 2005), others used market leverage (Deesomsak et al., 2004; Huang and Song, 2006) as dependent variable. Book leverage is defined as the book value of total debt divided by the book value of total assets. Market leverage is defined as the book value of the total debt divided by the book value of total liabilities plus the market value of total equity. This study considers market value-equity.

There are three measures of leverage in the study. Market short-term debt ratio, Lev-s(mv), is defined as short-term debt divided by short-term plus market value of equity. Market long-term debt ratio, Lev-l (mv), is defined as long-term debt divided by long-term debt plus market value of equity. Market total debt ratio, Lev-t(mv), is defined as total debt (short-term plus long-term) divided by total debt plus market value of equity. It should be noted that market book debt ratio (Lev-t(mv)) are used as the main measure of leverage, and the rest Lev-s(mv) and Lev-l (mv)) are employed for robustness checks.

Among the firm-specific determinants of capital structure, we discuss profitability, tangibility of assets, size, growth opportunities, and non-debt tax shields. Also, we take into consideration country-specific determinants (macro-economic factors) which are economic development, inflation and taxes. The variables used in this study and their measurements are largely adopted from existing literature. In other words, previous empirical findings in the context of developed and emerging studies guided the selection of independent variables.

Profitability (PRO): This study uses the ratio of earnings before interest tax depreciation amortization to the total assets. Tangibility of Assets (TAN): This study uses the ratio of tangible fixed assets to total assets. Firm Size (FS): We use the natural algorithm of total assets (Tang and Jang, 2007). Growth Opportunities (GO): In our study, we use the percentage rates of the total assets in years to measure growth opportunities. Non-Debt Tax

Shields (NDTS): In this study, we use the ratio of yearly depreciation and amortization amount to total assets as a measure of NDTS, as defined by Ahmad et. Al (2011). Economic Development (ED): The logarithm of percentage change at the ratio of GDP per capita was used for this study as economic development variable which is also used by Cheng and Shiu (2007). Inflation (INF): In our research, average of Consumer Price Index and Producer Price Index was taken into consideration as of inflation rate and it is added to model by taking the natural logarithm.

Taxes (TAX): In this research, the corporate tax rate of the economy is taken into account as a measure of tax variable.

As Harris and Raviv (1991) argue, different measures of leverage can produce different results and also can affect the interpretation of the results. Rajan and Zingales (1995) and Both et al. (2001) point out that the determinants of capital structures are highly sensitive to choice of leverage. Thus, three different measures of leverage are employed in this study to examine the determinants of corporate capital structure.

Two different models are used to test the validity of capital structure theories in ISE. As mentioned before, market leverage is used in the models. The dependent variables calculated depending on the market values and dependent variables determinant on the capital structure are analysed in terms of the three models given below:

Model-1 (Short Term Leverage):

$$Lev\text{-}s(mv)_{it}=\beta_0+\beta_1(FS)+\beta_2(PRO)+\beta_3(TAN)+\beta_4(GO)+\beta_5(NDTS)+\beta_6(ED)+\beta_7(INF)+\beta_8(TAX)+\alpha_{it}$$

Model-2 (Long Term Leverage):

$$Lev\text{-}l(mv)_{it}=\beta_0+\beta_1(FS)+\beta_2(PRO)+\beta_3(TAN)+\beta_4(GO)+\beta_5(NDTS)+\beta_6(ED)+\beta_7(INF)+\beta_8(TAX)+\alpha_{it}$$

Model-3 (Total Leverage):

$$Lev\text{-}t(mv)_{it}=\beta_0+\beta_1(FS)+\beta_2(PRO)+\beta_3(TAN)+\beta_4(GO)+\beta_5(NDTS)+\beta_6(ED)+\beta_7(INF)+\beta_8(TAX)+\alpha_{it}$$

β_0 stands for model constant, β_i stands for the coefficiency of independent variables, i stands for the firm number (N=243), t stands for the number of the years (T=10) and α_{it} stands for the error term.

Since the models included in regression are analysed by panel data analysis, the problem of heteroscedasticity may occur. To test whether heteroscedasticity problems exists or not we ran the Lagrange Multiplier (LM) test. The heteroscedasticity in the error term was fixed by the use of White (1980) estimator. Maximum likelihood method was used to fix the problem of autocorrelation, namely detecting correlation between the sequential error effects.

3. Panel Data Analysis

In order to determine the firm-and country-specific factors of capital structure in the emerging markets we used panel data analysis as the econometric analysis technique. The panel data analysis can be defined as a technique which uses cross data of the time dimension to predict the economical relations (Greene, 2003). The panel data analysis uses the affects of time as much as it uses the affects of the cross sections (Wooldridge, 2002). Thus, the analysis makes use of the data which has both time dimension and cross section dimension. Among the reasons why this technique has been preferred over the other techniques is that the technique lets us to control the covert effects which may be related the parameters within the set-up capital structure model. Furthermore, we expect that modelling the financial data set such that it will have both the time dimension and the cross section dimension will lead us to more accurate results.

Panel data analysis is superior to time series analysis and the cross section analysis. First of all in the panel data analyses we do not encounter the problem of observation number deficiency which is common in time series and cross section analysis. That's because, the cross observations collected throughout a period are combined, thus, the number of observations increases (Sun and Parikh, 2001). Secondly, since panel data analysis diminishes the interaction between the variables the parameters will be more reliable (Hsiao, 1999). This enhances variation and flow of information. In addition to these, panel data analysis may be used to 133nalyse more complex models when compared to time series analysis and cross section analysis (Gujarati, 2003). Further advantages of panel data analysis can be named as follows (Baltagi, 2001 and Balestra, 1992): It prevents the data loss due to the collection. It reduces the number of multicollinearity problems. It displays higher degrees of significance.

By and large, the models formed to make premises using panel data analysis are based on assumptions on features of error terms and on the instability of coefficients. These models can supply statistical information among groups of variables and among time periods. The most common models of this kind are the fixed effects model and random effects model.

The fixed effects model assumes that the coefficiencies are change among the units or among units and time. That is, the differences in the fixed effects determine the differences in behaviors of units, taking the slope coefficiencies as constant (Yaffee, 2003). The model considers the individual effects of the companies as a fixed effect (Greene, 2003). To prove the existence of effects, the fixed effects model, which is relatively easy to apply, tests the hypothesis that group-specific fixed effects are not equal to each other.

The random effects model was developed to overcome the loss of the degree of significance in the fixed effects model. The model accepts that constant coefficiencies among the units do not vary. This model, in which the individual effects of the companies are coincidental, assumes that the constant will be determined randomly in order to obtain unconsidered independent variables or the error. The model works on the basis of this assumption (Tunay, 2009).

The most common way to decide which panel data analysis should be used is the Specification Test. The test helps to determine which model would result in better premises. If the coefficiencies are irrelevant, the random effects model should be used. If they are relevant, the fixed effects model should be used (Hausman and Taylor, 1981).

4. Empirical Analysis

4.1 Descriptive Statistics

Descriptive statistics (mean and standart deviation) for the variables are given in Table 1. In Table 1 Panel-A, there is brief statistics about leverage ratios which are used as dependent variable in the study. When the summary statistics in the table are examined, in general, total debt included leverage ratios seems to be higher than leverage ratios which is calculated by short and long term debt ratios.

Table 1. Summary statistics for leverage and its determinants (2000-2009)

Panel-A: Dependent Variables			
	Firm-year observations	**Mean**	**Std.dev.**
Lev-s(mv)	2178	0.287	0.221
Lev-l (mv)	2178	0.101	0.126
Lev-t(mv)	2178	0.394	0.264
Panel-B: Independent Variables			
	Firm-year observations	**Mean**	**Std.dev.**
FS (log)	2178	13.384	1.803
PRO (%)	2178	2.735	17.918
TAN	2178	0.311	0.235
GO(%)	2178	39.24	140.077
NDTS	2178	0.071	0.643
ED	2178	0.048	0.597
INF	2178	0.093	2.765
TAX	2178	0.216	0.046

This table presents descriptive statistics for the variables used in our models. The data are from the İstanbul Stock Exchange and the sample contains 243 Turkish firms listed on the İstanbul Stock Exchange for which we have ten years of data for the period 2000-2009. **Lev-s(mv),** is defined as short-term debt divided by short-term plus market value of equity; **Lev-l (mv)**, is defined as long-term debt divided by long-term debt plus market value of equity; **Lev-t(mv),** is defined as total debt (short-term plus long-term) divided by total debt plus market value of equity. And then, **FS,** is the natural logarithm of total assets; **PRO,** is the ratio earnings before interest, taxes, depreciation and amortization to total assets; **TAN,** is measured by the ratio of net fixed assets to total assets; **GO,** is the growth rate in total assets; **NDTS,** is the ratio of annual depreciation expenses to total assets; **ED** is, percentage growth rate of GDP per capita was regarded. **INF** calculated by getting algorithms of average PPI and CPI. **TAX** calculated by annual corporate tax ratio.

Average Lev-t(mv) ratio is 0.39 and for Lev-s(mv) and Lev-l(mv) ratios are approximately and respectively 0.29 and 0.10 for the data set of 242 firm within the 10 years period. Chakraborty (2010) found a higher average ratio (0.75) for Lev-t(mv). Contrarily, Huang and Song (2006) found a lower average value (0.12) for Lev-t(mv). The largest value for dependent variable's standard deviation belongs to total leverage ratio (0.26). That the total leverage ratio takes a larger value compared to the short and long term leverage ratios confirms the situation.

Panel-B in Table 1 presents summary statistics of the dependent variables in the period of 2000-2009. The statistics given here are similar to those presented by Chakraborty (2010). In Panel-B, it is seen that FS average is 13.38, profitability rate is 2.73% and that 31% of the assets is of fixed assets. Additionally the growth rate of the Turkish companies is 39% and external debt shield is of %7 in average. When we look at the macro economic variables, the average GDP per capita growth rate in the country is 4.8%. Inflation rate is in a downward trend since the year of 2002 and is around 9.3%. Also average corporation taxes are 21.6%.

Table 2 below displays the correlation coefficiencies between the variables. It is clear that the dependent variables are related to each other. Correlation coefficient between Lev-s(bv) and Lev-s(mv) is 0.82; it is 0.81 between Lev-l(bv) and Lev-l(mv) and it is 0.78 between Lev-t(bv) and Lev-t(mv). As it is seen, short term debt has the highest relation coefficient. Similar findings were found in the studies of Huang and Song (2006).

Table 2. Correlation coefficients between variables and VIF coefficients

Variables	Lev-s(mv)	Lev-l (mv)	Lev-t(mv)	FS	PRO	TAN	GO	NDTS	ED	INF	TAX	VIF
Lev-s(mv)	1.00											-
Lev-l (mv)	0.07	1.00										-
Lev-t(mv)	0.86	0.53	1.00									-
FS	0.13	0.25	0.24	1.00								1.06
PRO	-0.27	-0.14	-0.31	0.10	1.00							1.04
TAN	-0.00	0.33	0.15	0.29	-0.13	1.00						1.07
GO	0.09	-0.04	0.06	0.03	0.09	-0.07	1.00					1.01
NDTS	0.06	-0.00	0.04	-0.03	0.03	0.03	-0.02	1.00				1.00
ED	-0.05	-0.06	-0.09	0.03	-0.05	-0.02	0.11	0.07	1.00			2.67
INF	-0.04	-0.09	-0.15	0.06	-0.16	0.12	-0.27	0.13	-0.07	1.00		3.55
TAX	0.05	0.08	0.10	0.01	0.14	-0.13	-0.05	0.10	0.16	0.12	1.00	8.66

This table presents descriptive statistics for the variables used in our models. The data are from the İstanbul Stock Exchange and the sample contains 243 Turkish firms listed on the İstanbul Stock Exchange for which we have ten years of data for the period 2000-2009. **Lev-s(mv),** is defined as short-term debt divided by short-term plus market value of equity; **Lev-l (mv)**, is defined as long-term debt divided by long-term debt plus market value of equity; **Lev-t(mv),** is defined as total debt (short-term plus long-term) divided by total debt plus market value of equity. And then, **FS,** is the natural logarithm of total assets; **PRO,** is the ratio earnings before interest, taxes, depreciation and amortization to total assets; **TAN,** is measured by the ratio of net fixed assets to total assets; **GO,** is the growth rate in total assets; **NDTS,** is the ratio of annual depreciation expenses to total assets; **ED** is, percentage growth rate of GDP per capita was regarded. **INF** calculated by getting algorithms of average PPI and CPI. **TAX** calculated by annual corporate tax ratio.

When we look at the explanatory variables, there is a high relation between TAN and FS (with correlation coefficient 0.29). Also, especially with the variables of FS, PRO, INF and TAX have both positive and negative relation with leverage ratios. Because of higher correlation coefficients, it may cause to multicollinearity error problems between variables. Variance Inflation Factor-VIF was used to test this situation. According to tests, VIF values were less than 10, so there was a not multicollinearity error problem between variables (Note 1). Therefore, all explanatory variables can be used in panel data set at the same time.

4.2 Hausman Specification Test

Hausman specification test has been used to determine which one of the alternative panel analysis methods (fixed effects model and random effects model) among the 3 panel regression models should be applied. With regard to this, H_0 hypothesis claims that "random effects exist" and H_1 hypothesis claims that "random effects do not exist". The results of the Hausman specification test for the 3 panel regression models are given in Table 3.

Table 3. Hausman specification test results

Models	Chi-square statistic	Chi-square statistic degrees of freedom	P value
Model-1 (short-term leverage)	53.16	8	0.000
Model-2 (long-term leverage)	35.88	8	0.000
Model-3 (total leverage)	97.86	8	0.000

The results presented in Table 3 show that H_0 hypothesis is rejected for leverage models with the significance level of 1%, thus not all of the individual effects in total leverage models are random, but are fixed. That is to say, the H_1 hypothesis which says that fixed effects model is more effective than random effects model. Consequently, the panel data regression was analyzed by the fixed effects model in this study.

4.3 Empirical Results

In this section, we present and discuss the findings of the panel regression analysis of the models that question which capital structure theories are suitable and acceptable for the Turkish companies. The fixed effects analysis was used in the analysis of the model (Table 3).

Initially, leverage Lev-t(mv), the basic dependent variable of Model-3, is presented. Afterwards, we present the analysis of Model-1 and Model-2, which were set on the basis of market value of the equity and short term leverage and long term leverage. Table 4 shows the findings of analysis with the dependent variable of leverages (Lev-t(mv), Lev-l(mv) and Lev-t(mv)).

Table 4. Panel regressions results on total leverage for Turkish-listed companies

Dependent variables	(Model-1) Lev-s(mv)		(Model-2) Lev-l(mv)		(Model-3) Lev-t(mv)	
	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
Intercept	0.004	(0.036)	-0.284	5.016)*	-0.3476	(-3.005)*
FS	0.015	(4.654)*	0.0630	(5.224)*	0.0262	(9.876)*
PRO	-0.001	(-7.987)*	0.001	(0.036)	-0.0130	(-8.234)*
TAN	-0.076	(-4.001)*	-0.154	(-7.102)*	-0,0036	(-0.298)
GO	0.002	(0.077)*	-0.001	(-0.654)	0.001	(3.776) *
NDTS	-0.014	(3.175)*	0.001	(0.023)	-0.008	(-1.002) ***
ED	-0.2654	(-2.8876)***	-0.3540	(-3.8876)**	-0.5885	(-3.7765)***
INF	-0.0451	(-1.0942)**	-0.0582	(-1.2374)***	-0.0656	(-0.4326)**
TAX	0.1076	(1.0853)	0.1509	(1.8765)***	0.2786	(2.6540)*
No. of obs.	2178		2178		2178	
Adj-R^2	0.68		0.59		0.73	

Notes: *, ** and *** mean statistically different from zero at the 1%, 5% and 10% level, respectively. t-values are in parenthesis.

This table presents OLS regression using panel data with fixed effect. The data are from the İstanbul Stock Exchange and the sample contains 243 Turkish firms listed on the İstanbul Stock Exchange for which we have ten years of data for the period 2000-2009. **Lev-t(bv),** is defined as total debt (short-term plus long-term)divided by total debt plus book value of equity. And then, book value of equity is replaced by market value of equity **Lev-t(bv)** become market total debt ratio **(Lev-t(mv))**. **FS,** is the natural logarithm of total assets; **PRO,** is the ratio earnings before interest, taxes, depreciation and amortization to total assets; **TAN,** is measured by the ratio of net fixed assets to total assets; **GO,** is the growth rate in total assets; **NDTS,** is the ratio of annual depreciation expenses to total assets. **ED** is, percentage growth rate of GDP per capita was regarded. **INF** calculated by getting algorithms of average PPI and CPI. **TAX** calculated by annual corporate tax ratio.

In Table 4, we see that there is a statistically significant positive relation between FS and leverage ratio calculated by the total debt ratio (Model-3). Findings of all of the regression models with FS variable are congruent with the theoretical and empirical expectations. With regard to this, we can claim that as the assets ratio gets bigger, the loan rates rise as well. In the analyses using different leverages (Model-1 and Model-2), we have found similar results. Accordingly, as FS gets bigger, the expectation of lowering the agency costs will drive the companies to undergo more debt, which makes a higher possibility for the small companies than for the big companies. This result is congruent with the expectations of the trade-off theory.

The findings of the panel regression analysis show that pecking order hypothesis is valid for the Turkish companies since the profitability is significantly negative, in parallel with theoretical expectations. In all of the models, except from Model-2, profitability is significant (Table 4). According to these findings, we can assert that the highly profitable Turkish companies prefer retained earnings as their funds, thus, their debt ratio is low. This may be even taken as a sign that shows the companies run lower risk of bankruptcy. In consequence, we can say that decrease in the debt ratio of the companies in the capital structure shows that equity value increases. Equivalently, we can argue that the increase in the equity value means that the Turkish companies are not very much eager to allocate the equity.

Most of the empirical studies report that asset structure has a positive effect on determining the capital structure.

Contrarily, tests in our study (except for Model-3) have resulted in a significant but negative relationship between asset structure and leverage. The negative relationship between the leverage and asset structure does not approve the trade-off theory, which suggests that the companies with more fixed assets in the asset structure have high debt ratio. With regard to this, we can claim that Turkish companies do not own fixed assets to collateralize.

Pecking order hypothesis, which suggests that the companies with high growth opportunities would have higher debt ratio, assumes that the variable of growth and leverage are positively related. According to the regression models where the variables of growth and of leverage, we detected a positive relation between these two variables (except for Model-2). We have not recorded a significant relation between growth opportunities and long term leverage (Lev-l(mv)) for the Turkish companies. In the light of the results of the analysis of the other models (Model-1 and Model-3), which display significant relations, we can suggest that rapidly growing Turkish companies cannot meet their needs from the internal funds. That is why they prefer short-term debt. Therefore, the idea that the directors of the companies which grow in debt would undergo more debt was not approved. In conclusion we can say that our findings suggest evidence in favour of the pecking order hypothesis.

Contrary to the theoretical expectations, we detected a positive relationship between the NDTS and leverage. Among the models set up with three variables, Model-2 (representing long term leverage) did not present significant relation. To put in another way, we can say that amortization value of the assets is not taken in consideration in the case of long term debt. All of the other models, namely Model-3 and Model-1 show significant relations. We can argue that the amortization values are considered in the models which do not involve long term debt. These findings conflict with the trade-off theory which claims that the companies with high NDTS would have higher debt ratio.

When we look at the results of country specific variables, coefficient of ED variable is negative as expected in all models. These coefficients are all statistically meaningful in different levels. This situation shows that, when the economy grows firms are using equity instead of debt. In another definition, firms are financing their growth with equities. When we assume all variables are fixed, firms in the more GDP ratio countries are using less debt compared to the firms in the less GDP ratio countries. One of the other negative macroeconomic variable is INF. INF has negative and significant relation with capital structure. According to this, increase in the inflation ratio makes debt financing more costly, so firms are using less debt in the high inflation periods. According to results of our analysis, TAX is the most important variable from country specific variables in all models. TAX variable coefficient has statistically positive and significant relation with capital structure in all models except Model-1. Positive coefficient as expected shows that, firms are using more debt to get benefit of tax shield.

In general, our findings are in accordance with the theoretical expectations and previous empirical studies. In the basic model (Model-3) the variables of FS, GO, and NDTS are marked positively whereas the variables of PRO and TAN are marked negatively. By and large, the sub-models support the findings presented in Table 4.

5. Conclusion

In our study, we analyzed the effects of the variables such as FS, PRO, TAN, GO, NDTS, ED, INF and TAX on the capital structure using the panel data analysis. We set up three different models with the dependent variables of market value of equity. The findings were interpreted in terms of the theories which explain the capital structure or debt usage of the companies (namely trade-off theory and pecking order hypothesis). Although there is a wide range of studies questioning the capital structure of companies in the developed countries, it is not the case for companies in least-developed countries. That is why; our study may be regarded as a step to fill a gap in the literature with the findings that it presents on the capital structure preferences of the companies in the emerging stock market of Turkey.

Our study aims at defining which firm- and country-specific factors are determinants on the capital structure and which of the present company structure theories are explanatory for the emerging market of Turkey. The findings presented in our study are statistically significant for all of the variables (even if in different models). That is to say, FS, PRO, TAN, GO, NDTS, ED, INF and TAX explain the dependent variables. Depending on the findings of the panel data analysis, we conclude that Turkish companies do not have target debt ratio. We can suggest that Turkish companies follow a hierarchical company structure. More specifically, we claim that trade-off theory is less successful than the pecking order hypothesis in explaining the capital structure of the Turkish companies. Therefore, Turkish companies are following pecking-order hypothesis in their debt behaviors.

Specifically, we can say that bigger companies tend to have higher debt ratios when compared to the small companies. In addition we can suggest that profitable Turkish companies prefer less debt. The companies with

large amounts of fixed assets tend to display lower debt ratios. The Turkish companies with high growth opportunities may have high debt ratios, contrary to the expectations. The Turkish companies with high NDTS may be asserted as willing to have high debt ratios. Also, Turkish companies choose to finance with equities in the periods of high inflation and high growth, whereas choose the debt financing in periods of high tax ratios to get benefits of tax shield.

In our study, we concentrated on the firm- and country-specific factor determinants on the company structure. In addition to these firm-specific factors, the special factors of financial market are considered to be relatively influential on the capital structure. The later factors have more importance in the emerging markets than they are in the economy of developed countries. In this regard, the capital structure decisions should be tested in terms of creditor and shareholder rights, level of market development, development of financial intermediaries, and the efficacy of the legal system. Testing the capital structure theories by taking all of these three different factors offers a promising research subject for the future studies.

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Note

Note 1. VIF > 10 may be multicollinearity problem (Nachane, 2006; Lee ve Kim, 2009).

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Structural Transformation, Poverty and Inequality in Nigeria: An ARDL Bound Testing Technique

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Abstract

Poverty has been a daunting global issue since the Industrial Revolution. Despite the economic successes achieved in the world, efforts to reduce poverty became prostrating in many countries. Although economists have, for long, recognized the significant role of structural transformation in economic growth and development of any economy, studies linking it with poverty and inequality are quite scanty. This paper uses ARDL bound testing technique to investigate the interrelationship among structural transformation, growth, inequality and poverty using Nigerian data. The results show that despite very low rate of structural transformation in Nigeria, there exists long-run relationship among the variables in the study. The insignificance of the structural transformation variable in the model indicates that the structural transformation is very slow in the country. The transformation that started in Nigeria in the early 1960s was disrupted by the emergence of oil as the mainstay of the economy leading to neglect of the other real sectors by the government. The failure of making best use of revenues from oil to support structural transformation of the economy led to the 'paradox of plenty', a rich country with lots of poor people.

Keywords: structural transformation, Dutch Disease, inequality, poverty, Nigeria

1. Introduction

Since the emergence of development economics as an independent sub-discipline after the end of the World War II, the pendulum of development thinking had been swinging between supporters of perfect market and state intervention. Recently, the new development thinking emphasizes getting the price right by creating a stable market environment, strengthening the institutions necessary for markets to function well and building human capital (Lin, 2012).

Structural transformation (Note 1) refers to "different arrangements of productive activity in the economy especially to different distributions of productive factors among various sectors of the economy, various occupations, geographic regions, types of products, etc." (Machlup, 1991). Structural change also refers to shifts in the relative importance of sectors of the economy on its way to development including changes in location of economic activities (urbanization), and other resulting aspects of industrialization. These are jointly referred to as Structural Transformation (Syrquin, 2007). (Note 2) Also more precisely, Chenery, Robinson and Syrquin (1986) defined structural transformation as the set of changes in the composition of demand, trade, production, and factor use that take place as per capita income increases.

The modern analyses of structural change started with (Fisher, 1935; 1939) and (Clark, 1940) who proposed the division of economic activities into primary, secondary, and tertiary sectors which served as major conceptual framework for quantitative structural analyses (Schmidt, 2005). Also Kuznets, (1971) proposed similar classification of the economy into agriculture, industry, and services sectors anchored with the central idea in sectoral analysis, arguing that long-run economic development is accompanied by shifts in the allocation of resources (especially labor) from primary sector (agriculture) to secondary sector (industry) and subsequently to tertiary sector (services). This has been supported by series of empirical studies on developed and the newly industrializing economies which revealed a steady decline of the share of labor in agriculture sector, a passing

increase and peak in the proportion of labor in manufacturing sector, and a consistent rise in the share of labor in services reflecting the transition from agrarian to post industrial stage (Schmidt, 2005).

This route of sectoral labor transition depends on the effects of sectoral differentials in productivity of labor and differences in income elasticity of sectoral demand in the course of development. As income rises, the elasticity of demand for agricultural products tends to be the lowest compared to that of manufactured goods and services. Consequently, the shares of manufacturing and services sectors in GDP tend to be largest while that of agriculture sector shrinks. Similarly, technological progress has more immediate and efficient impact on the production process of manufacturing than in the agriculture sector, while the technology-induced growth in labor productivity is greater in the agriculture and manufacturing sector than in the service sector. This means that the volume of productivity in service sector would require more labor than in the primary and secondary sectors. Given this situation, the share of agricultural labor in the GDP and demand in agricultural products are expected to decline under rising income levels, while the greater proportion of labor force is allocated to manufacturing sector as the demand for industrial products increases. Larger proportion of demand in labor force will eventually move towards the tertiary sector as technology advances and per capita income rises (Schmidt, 2005).

Although this theory has been empirically established in industrialized countries of Europe, North America and some East Asian Countries, however, it does not hold in most developing countries with different technological, demographic, and political setups which constitute different environment for structural transformation. For instance, many developing countries are having high population growth and by extension labor force that exceeds the absorptive capacity of their manufacturing sector. Consequently, surplus labor released from the agricultural sector may not be directly absorbed in the manufacturing which may compound problems of unemployment, inequality and poverty. However, resource rich countries such as Nigeria have the opportunity of supporting structural change in their economies by making good use of the revenues generated from the sale of the resources in form of investments in the soft and hard infrastructures. Failure to do that could disrupt structural transformation which may lead to perpetuation of poverty and inequality in the country.

The discovery of oil and its taking over as the leading sector in the Nigerian economy in the 1970s and as the major revenue earner to the government since then rather worsen the problems of poverty and inequality in the country. The economy became infected by what is known as "Dutch Disease" where by the focus of the government became focused on the oil sector at the expense of the other real sectors such as agriculture and manufacturing. Prior to the discovery and production of oil in commercial quantity in 1958, Nigerian economy was being driven largely by the agriculture sector contributing more than 60 percent to the GDP. From 1960 when the country became independent, it witnessed rapid changes in economic growth despite various setbacks. Real GDP increased from $12.84 billion (at 2000 constant) in 1960 to $85.6 billion in 2010 while per capita GDP rose not quite significantly from $279.5 (at 2000 constant) in 1961 to $540.34 in 2010 (World Development Indicators). This represented an increase of only 93.3 percent for the GDP in nearly half a century. This appears to be very poor compared to other Sub-Saharan resource poor countries such as, Botswana, Namibia and the Republic of Congo.

Accompanying these changes in aggregate economic activity are the shifts in the economic structures. Over the period, the Nigerian economy gradually shifted away from agriculture to industry and services sectors even though it has not been a smooth and successful transformation as experienced in advanced countries like the U.S.A, Canada, Europe and Australia, or even in East Asian miracle economies including Turkey, Brazil and India, among many others. The emergence of oil as the main driving wheel of Nigerian economy has actually subdued the structural transformation that started in the economy in the 1960s. The industrial sector has been driven by the oil subsector which by nature is not labor intensive while the manufacturing subsector which drives most successful economies in the world was completely neglected in Nigeria.

This failure of the Nigerian economy to transform during the last decades is one of the key factors that led to perpetual increase in the problem of poverty and inequality in the country.

1.1 Previous Studies in This Area Focused on This Subject

This paper analyzes the relationships among structural transformation, growth, inequality and poverty in Nigeria. The rest of the paper is organized as follows: section two present the literature review, section three presents the method of analysis and the data used. Section four discusses the empirical results, while section five concludes the paper.

2. Literature Review

The pendulum of development thought and policy, since the emergence of development as a sub-discipline of

economics after the Second World War, has been swinging between two poles; free play of market forces and state intervention. Over the last 60-70 years, economic history has recorded several instances in support of each side. During the 1980s the pendulum was swinging to the side of free market economy. This led to the prescription and forced implementation of the very unpopular Structural Adjustment Programs (SAP) on many developing countries by Washington Consensus Institutions. However, the miraculous economic performance of the emerging economies such as the BRICS, the Asian miracle economies and many other developing countries over the last few decades and the ironic persistence of high rates of poverty in the face of globalization in addition to the current global economic and financial crisis has called for revisiting economic theory in general and development theory in particular. These have also sensitized renewed interest in structural economics. The new drive in the economic development thought emphasizes active and efficient public participation, giving impetus to the economy where the market fails in providing the required industrial upgrading and improving soft and hard infrastructure (Lin, 2012). The 'new structural economics' as coined by its ardent proponent (Justin Yefu Lin) focuses on the role of structural change in achieving sustainable growth and development, and poverty reduction in developing countries.

There has for long been a convergence among development economists on the idea that economic growth is the main engine for poverty reduction. The traditional view in economics is that the benefits of economic growth (measured in terms of growth of the GDP) trickles down to the poor. Hence economic growth leads to poverty reduction. However, the recent growth experiences in the emerging economies, the growing concern about the rate of poverty during the last few decades, and the reaction of the international community through the Millennium Development Goals (MDGs) testified to the fact that the past growth focused strategies have failed to effectively reduce poverty (Pramanik 1994). Reducing poverty entails improving the average income of the poor as well as reducing income inequality in any given country. But there is some kind of trade-off between distribution and growth in the overall poverty reduction strategy which is the bedrock of development. There is, therefore, the need to strike on the right balance on what the poverty strategy should focus: pro-poor or pro-growth?

Theoretically, Kuznets (1955; 1961; 1971) was the first to explore the relationship between growth and inequality in his famous hypothesis. Ahluwalia, (1976) provided an empirical support for the 'inverted U hypothesis' using cross section data for developing and developed countries. However, this result was challenged by researchers like Anand and Kanbur, (1993) who used the very same data set that Ahluwalia used. They argued that no empirical relationship could actually be established by applying a clean data set and appropriate econometric techniques (Kabur and Lustig 1999). This result was later confirmed by researchers such as, Deininger and Squire (1998). They found no evidence of an 'inverted-U' pattern between income and inequality. On whether there existed a link between fast growth and rising inequality, they did not find any systematic evidence to support that. Ravallion and Chen (1997) also found similar results (see also Li, Squire and Zou, 1998).

Ravallion (2009) using new data for about 80 countries spanning from 1980 to 2000 found little or no correlation between rates of economic growth and changes in inequality except in some countries where growth was accompanied by rising inequality. China for example, is a good example of a country where growth-inequality trade-off happened, where both the mean income and income inequality steeply rise.

There was, however, no consensus in the case of inequality-growth relationship. While some scholars concluded that inequality hampers growth (Alesina and Perotti 1996; Alesina and Rodrik 1994; Galor and Zeira 1993; and Aghion et al. 1999, some suggested that inequality may have positive impacts on economic growth. For instance, it was argued that the marginal propensity to save of the rich is found to be higher than that of the poor as suggested by Kaldor's hypothesis. It follows that if the investment rate is positively related to the saving rate, and growth is positively related to investment, more unequal economies can be expected to grow faster. (Note 3) Another reason why inequality may positively enhance economic growth is that wealth concentration would support new investment which leads to faster growth where huge initial investment is required and there is no access to investment resources through effective capital markets. (Note 4)

Similarly, the results of empirical studies diverged on the link between inequality and growth with some studies finding no relationship between inequality and growth e.g. Barro (2000), and Lopez (2004); while some found negative relationship moving from inequality to growth, e.g. Alesina and Rodrick (1994), Alesina and Perotti (1996), while others found a positive relationship between inequality and growth, e.g. Li and Zou (1998) Forbes (2000) and Lin (2003). Pramanik (2010) on the other hand, found no consistent pattern of relationship. But what was behind these discrepancies? Forbes (2000) attributed the diverging results to the use of different countries, invariant time, omitted variables bias, and length of the period covered by the research. (Note 5)

Since economic growth increases the average income of the poor, it is assumed that the living standard of the poor would increase with the increase in income provided the benefits of growth are fairly distributed across the population. Those that argue for poverty reduction by increased growth paid little attention to the effect of distribution while others argue that growth can only be a source of poverty reduction if it is pro-poor growth (Note 6) i.e. if the poor enjoy the benefits of growth proportionately more than the non-poor (Son, 2004).

Therefore, the impact of economic growth on poverty reduction depends to a large extent on how the benefits of growth are distributed across the segments of the population. This means that growth alone is not enough for poverty reduction; it must be backed up with equitable distribution of income. Reviewing the studies dealing with the relationship between growth, income distribution and poverty, Bigsten and Levin (2000) found that there was no consistent relationship between growth and changes in inequality but countries that produced higher growth and improved income distribution have reduced poverty faster e.g. Taiwan and South Korea.

Taking the case of Malaysia, Pramanik (2010) (Note 7) uses the decomposition analysis of growth elasticity of poverty to investigate the growth effects on poverty and inequality from different perspectives including national, regional, social stratum and race. He finds no common or consistent pattern of long-term relationship between economic growth and inequality. Therefore, to maximize the benefits of growth, he favors the implementation of interventionist policy strategies during the different stages of development. He suggested that "regardless of such factors as the state of development, factor endowments, racial, geographical and regional situation, all of which influence growth, poverty and inequality – it is the degree of distribution of economic as well as intellectual power resources, i.e. economic, social and political democracy centering on human, natural and financial capital concomitant with social overhead capital, that ultimately shapes the long-term relationship between growth, inequality and poverty." (pp. 152).

Policy wise, the studies seemed to conclude that the choice of focusing on either accelerating growth or poverty reduction depends on the specific country and the existing conditions prevailing in the particular country especially, the levels of economic development, the initial poverty, and the level of tolerance of the country to inequality (Lopez 2004).

Despite extensive research conducted in various aspects of this relationship among poverty, growth, structural change and inequality, there are very few empirical studies this respect. Chatterjee (1995) observes the relationship between growth, structural change and poverty alleviation using panel Ordinary Least Squares (OLS) regression analysis. Dietrich (2009) use a panel cointegration analysis while and Cortuk and Singh (2011) time series analysis to estimate bivariate models to examine the relationship between growth and structural transformation. However, since OLS regression may lead to spurious regression due to non-stationary of time series under investigation we employ a time series analysis on Nigerian data.

3. Methodology and Data

We extend the model used by Cortuk and Singh (2011) to multivariate to include inequality, growth, and structural change as dependent variables, and poverty as our dependent variable: Cortuk and Singh's model is given as:

$$Y_t = \alpha + \beta S_{t-1} + Y_{t-1} + \delta_T DU_{Tt} + U_t \quad (1)$$

Where Y = Log of GDP Per Capita

S = Structural change index

DU_{Tt} = a dummy variable which is 1 if t > T and 0 if otherwise, and

U = random error term

Or

$$LGDPPC_t = \beta_0 + \beta_1 SCINAV_{t-1} + \delta_T DU_{Tt} + \varepsilon_t \quad (2)$$

The general form of our extended model is given as:

$$POV = f(\text{GDPPC}, \text{SCINAV}, \text{GINI}, \text{DUUMY}) \quad (3)$$

The econometric version of (1) is given as:

$$POV_t = \alpha_0 + \alpha_1 LGDPPC_t + \alpha_2 SCINAV_t + \alpha_3 GINI_t + \text{DUUMY} + e_t \quad (4)$$

where POV is poverty incidence; LGDPPC is Log of GDP Per Capita (constant 2000 US$); SCINAV is structural change index (Norm of Absolute Value); and GINI is Gini Coefficient index, a proxy of inequality and a dummy variable with 1 for a year of structural break and 0 for no structural break.

3.1 Data

The data used in the study come from various national and international sources such as, the Central Bank of Nigeria (CBN), National Bureau of Statistics (NBS) and World Development Indicators (WDI).

Various measures of structural change based on inter-temporal comparison have been proposed in the literature. This study uses the Norm of Absolute Values (NAV) (Note 8) which is as:

$$\text{NAV} = 0.5 \sum_{i=1}^{n} |x_{it} - x_{it-1}| \quad (5)$$

Where x_i is the contribution of sector i at time t and t-1.

SCI on output is calculated and use in this study from GDP data in current domestic prices provided by the CBN. (Note 9) The reason for using GDP at current prices is that although constant prices have the advantage of adjusting for the effect of price changes, however, they have disadvantage of being sensitive to the base year of the constant prices series (Productivity Commission 1998). Clark, Geer and Underhill (1996) and Productivity Commission (1998) argue that SCI data based on current prices have the advantage of:

(i) Including effect of fluctuations of prices of goods and services produced,

(ii) "Reflecting the prices in which transactions take place".

The data for agriculture sector consist of all the four components (crop production, livestock, forestry and fishing), while the manufacturing data excludes oil refinery. The data on service consist of (transport, communication, utilities, finance and insurance, hotel and restaurant, real estate and business services, public and community services).

The incidence of poverty (POV) is calculated from 1961 to 2009 based on the assumptions that the poverty incidence is negatively associated with the growth rate of GDP per capita. We use growth rate of GDP, growth elasticity of poverty, and the poverty rates of the Nigerian Living Standard Surveys to forecast and back cast the rate of poverty incidence. This method is popular with the World Bank, the ADB and was also used by the Islamic Development Bank in its Occasional Paper published in May 2010. The growth elasticity of poverty derived by Aigbokhan (2008) is adapted in this study. Aigbokhan calculated the elasticity for Nigeria as: -0.64 as non-distribution-corrected and -0.79 as distribution-corrected. Incidence of poverty calculated using the two figures (for distribution-corrected and non-distribution-corrected generates near perfectly correlated figures. The poverty incidence is expressed as a percent of total population. The Gini coefficients (a proxy of inequality) for the sample period are also calculated following similar assumption and process used in calculating the poverty incidence.

3.2 Empirical Approach

Since we are dealing with a time series data, the OLS method may not suitable for the analysis due to its restrictive assumptions. The first step in time series analysis is to investigate the stationery property of the variables. If all the series are integrated of order one: I(1) we can proceed to conduct co-integration analysis using conventional methods such as the Johansen-Juselius (J-J). However, if one of the variables involved is I(0), other method need to be used, the most popular being the Autoregressive Distributed Lag (ARDL) technique.

The first step in conducting a time series analysis is therefore, conducting unit roots tests to determine the unit roots properties of the variables. Although the ARDL technique does not require conducting unit roots tests, we use the tests to confirm the level of integration of the variables. It is found that the structural change index (SCINAV) is I(0) which support our use of the ARDL methodology. However, the conventional unit root tests have an inherent weakness of lacking the power to distinguish between unit root and near unit root. In other words, they tend to accept the null hypothesis that unit root exists where actually it doesn't. The remedy to this problem is to conduct more than one test to confirm the results. There are various unit root tests but this study adopts only three of them. They are:

(i) ADF

(ii) PP and

(iii) KPSS.

All the three tests conducted in this study confirm that the structural change (SCINAV) variable is I(0) which makes it necessary to adopt the ARDL technique proposed by Pesaran et al. (2001). We therefore, apply the ARDL – Bounds testing approach to examine the long-run cointegration relationship between poverty, structural change, economic growth and inequality in Nigeria. This method was developed by M. H. Pesaran in various studies (Pesaran and Shin (1996); Pesaran and Pesaran (1997); Pesaran and Smith (1998); and Pesaran et al

(2001). It has gained a lot of popularity among researchers in the recent years. The ARDL approach addresses the major shortcoming of the JJ approach which requires all the variables to be I(1). It also has a number of advantages over the JJ cointegration method which adds to the former's popularity in the recent time. Firstly, the ARDL model has the advantage of being more flexible as it does not impose restriction of having all the variables to be integrated of the same order like other cointegration techniques. The ARDL technique can be applied irrespective of the variables being integrated of order I(1) or I(0). Secondly, while other cointegrations techniques require large sample size, the ARDL technique is comfortably applied on even small samples. Thirdly, the ARDL method is used for both testing for the long-run relationship and estimating the long-run parameters.

Given the nature of GDP time series data, we use structural break test developed by Bai-Perron (1998) to test for existence of breaks. Studies (Note 10) have shown that time series data are susceptible to structural breaks and failure to accommodate these breaks may lead to a bias that may erroneously allow for a false acceptance or rejection of a null hypothesis of a unit root in the conventional ADF test. Perron proposed a test that extends the ADF to accommodate exogenous structural break. Perron (1997) and Zivot-Andrews (1992) proposed endogenous determination of the break points while Lee and Strazicich (2003) proposed a two breaks unit root test (Glynn et al 2007). Unlike the conventional Chow (Note 11) test the Bai-Perron test has the advantage of detecting the period of the break. We therefore, apply Bai-Perron structural break test to determine the years of breaks in our data.

Our equation (1) is expressed in ARDL model as follows:

$$\Delta POV_t = \theta_0 + \alpha_1 POV_{t-1} + \alpha_2 SCINAV_{t-1} + \propto_3 LGDPPC_{t-1} + \propto_4 GINI_{t-1} + \sum_{i=1}^{n} \theta_1 \Delta POV_{t-i} + \sum_{i=0}^{n} \theta_2 \Delta SCINAV_{t-i} + \sum_{i=0}^{n} \theta_3 \Delta LGDPPC_{t-i} + \sum_{i=0}^{n} \theta_4 \Delta GINI_{t-i} + \varepsilon_t \quad (6)$$

where ε_t is the white noise error term and Δ is the first difference operator.

The parameters α_i, i=1,2,3,4 are the long-run multipliers while the θ_i, i=1,2,3,4 are the parameters representing the short-run dynamic coefficients of the underlying ARDL model and n is the optimum lag.

Pesaran and Pesaran (1997) explain two main steps involved in the ARDL procedure. The first step is the determination of the long-run relationships among the variables using F-test which is the underlying statistics in estimating the long-run relationship. F-test indicates which variable should be normalized when long-run relationship is established in the model. The test is conducted by testing the joint significance test in order to test the null hypothesis of no cointegration by joining all the coefficients of the one lagged variables equal to zero ($H_0 : \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0$) against the alternative hypothesis which sets all one lagged variable not equal to zero ($H_0 : \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq 0$). We then check the estimated F-statistics of the null hypothesis to find out whether the long-run coefficients are jointly equal to zero and then compare the F-statistics based on (1%, 5% and 10%) levels of significance of the respective bound critical values provided by Narayan (2004). The F-statistic which is non-standard (Duasa, 2007) is compared with the upper bound I(1) values and the lower bound I(0) values of the tables given at the appendix of the article of the paper by Narayan (2004). We reject the null hypothesis of no cointegration if the value of F-statistic is greater than the upper bound value in the table and conclude that there exists evidence of long-run relationship among the variable irrespective of the order of integration of the variables. However, if the value of the F-statistic is lower than the upper bound values we cannot reject the null, while if the F-statistics lies between the upper and the lower bounds, it becomes inconclusive until more information about the order of integration of the underlying regressors is obtained.

The second step in the analysis is to estimate the coefficients of the long-run relationship. Once an evidence of cointegration exists among the variable, a long-run model of the following form is estimated:

$$POV_t = \propto_1 + \sum_{i=1}^{n} \emptyset_{1i} POV_{t-i} + \sum_{i=0}^{n} \theta_{1i} SCINAV_{t-i} + \sum_{i=0}^{n} \varphi_{1i} LGDPPC_{t-i} + \sum_{i=0}^{n} \gamma_{1i} GINI_{t-i} + \mu_{1t} \quad (7)$$

We choose the optimal lags according to least values of the Akaike information criteria (AIC) and Schwarz Bayesian Criteria (SBC). These criteria are more preferable to others due their tendency to define more parsimonious specifications (Pesaran and Shin 1998). The selected model is then estimated by ordinary least squares.

After estimating the long-run model, the short-run elasticity of the variables is estimated through error correction (Pahlavani and Wilson 2005; Duasa 2007). The short-run model will be in the following form:

$$\Delta POV_t = \propto_2 + \sum_{i=1}^{n} \emptyset_{2i} \Delta POV_{t-i} + \sum_{i=0}^{n} \theta_{2i} \Delta SCINAV_{t-i} + \sum_{i=0}^{n} \varphi_{2i} \Delta LGDPPC_{t-i} + \sum_{i=0}^{n} \gamma_{2i} \Delta GINI_{t-i} + \Psi ECM_{t-1} + \varepsilon_{1t} \quad (8)$$

where ECM is the error correction model which is given as:

$$ECM_t = POV_t - \propto_1 - \sum_{i=1}^{n} \emptyset_{1i} POV_{t-i} - \sum_{i=0}^{n} \theta_{1i} SCINAV_{t-i} - \sum_{i=0}^{n} \varphi_{1i} LGDPPC_{t-i} - \sum_{i=0}^{n} \gamma_{1i} GINI_{t-i} \quad (9)$$

After establishing the long-run relationship between the variables the normal VECM is carried out to examine the short-run dynamics of the model. Then Granger Causality Test is conducted to examine the directions of causality among the variables. The diagnostics tests, (Histogram-Normality Test, Serial Correlation LM tests, Ramsey Reset Test, and CUSUM tests) are used to confirm the significance of the estimated equations in the model.

4. Discussion of Results

Table 1 shows the unit roots tests results. The ADF test is based on Schwarz Information Criteria (SIC) and PP and KPSS on Newey-West Bandwidth. Unless otherwise stated, the tests are based on the default setting of lag length for ADF and bandwidth for PP and KPSS by Eviews. The results of the ADF and PP tests are consistent for almost all the variables which show that the hypothesis that each of the variables has a unit root cannot be rejected at 1%, 5% or 10% levels of significance, except for the structural change index (scinav). The ADF for scinav at level shows that the hypothesis cannot be rejected only at 1% but can be accepted at 5% and 10% while the PP test indicates that they cannot be rejected at 1%, 5% and 10% levels. Due to the low power of the conventional tests highlighted by many scholars, a third test (KPSS) which was introduced to complement the former tests is run. KPSS tests the null hypothesis that a series is stationary around a deterministic trend. The KPSS results confirm the ADF and PP results.

Table 1. Unit root tests results

Variable	LEVEL			FIRST DIFFERENCE		
	ADF	PP	KPSS	AD F	PP	KPSS
POV	-2.406	-2.431	0.165[2]**	-7.134	-7.001	0.078
LGDPPC	-1.95029 (2)	-1.9828	0.192[2]**	-4.159**	-4.664	0.079
LGINI	-2.77165	-3.0013	0.1332[1]***	-3.778**	-7.5226	0.0410
SCINAV	-4.105(3)**	-5.366	0.0854[3]	-5.708(3)	-11.540(3)	0.1676**
LAGR	-1.643(2)	-1.735	0. 417[1]	-5.197(1)	-6.451	0.0583[1]
LIND	-0.783(2)	-0.759	0.210**	-5.233(1)	-7.107	0.103
LSERV	-1.503	-1.456	0.444[1]	-4.679(2)	-6.489	0.049

Notes: (...) refers to the number of lags; [...] refers to number of bandwidth; *, **, and *** refer to 1%, 5%, and 10% level of significance, respectively.

Table 2 presents the results of the Bai-Perron Breakpoint Test. The result indicates existence of multiple structural breaks in 1974, 1984, and 1995 in the data. These break points correspond to the periods when some major changes occurred in the country. The first one, 1974, was the year of the first oil price shock which changed the entire economic setup in the country. The military coup that toppled the second democratic government occurred in 1983 and the military took full control of the country beginning of 1984 and started implementing the austerity measures. The period 1995corresponds with in which the structural adjustment program was abandoned by the military government.

Table 2. Bai-perron breakpoint test

Date: 07/28/11 Time: 13:07 Sample: 1961 2009: Included observations: 49						
Breakpoints	0	1	2	3	4	5
BIC	356.0528	318.7843	229.9273	198.8284	202.5170	198.8561
Log-Lik	-168.2969	-139.9331	-85.77500	-60.49601	-52.61076	-41.05073
RSS	2760.599	867.3969	95.10329	33.89164	24.56496	15.32496
N. Coefs	5.000000	10.00000	15.00000	20.00000	25.00000	30.00000
Chosen number of breaks: 3						
Breaks :	1974					
	1984					
	1995					

The result of the unrestricted error correction regression (equation 13) is used to conduct the Wald test from which the F-statistic is obtained and compared with the critical values given by Narayan (2004) as reported in Table 3.

Table 3. F-statistic of Cointegration relationship and bound critical values

Bound Critical Values*				
			Restricted intercept and no trend	
F-Stat	Lag	Sig. level	I(0)	I(1)
10.258		1%	4.428	5.816
	0	5%	3.164	4.194
		10%	2.618	3.532

Notes: *based on Narayan (2004), the number of regressors, k= 3.

The result shows that the F-statistic (10.258) is higher than the upper bound critical values at 1 percent level of significance at restricted intercept without trend meaning that the null hypothesis of no cointegration cannot be accepted at even 1 percent. As such cointegration exists among the variables in the model.

The long-run model (Table 4) shows that all the variables have the expected signs as predicted by economic theory with the income variable (lgdppc) and structural change variable (scinav) having negative sign. According to economic theory, growth reduces poverty incidence by raising the levels of income of the individuals and households. When incomes are raised the ability of individuals and households to acquire more goods and services that improve their welfare is increased. Higher incomes also entail higher demand for public services.

Moreover, due to structural change efficiency increases as labor moves from inefficient sectors like agriculture to more efficient modern sectors. This increases the income of the employees which improves their welfare and distances them away from poverty. However, the result shows that this variable (Scinav) is not statistically different from zero in the model. This is the only variable that is not significant among the independent variables. Our result shows that structural change does not contribute to poverty reduction. This confirms the assertion that one of the major constraints to development of Nigerian economy is the lack of structural transformation over the years (Lamido, 2010).

Table 4. Long-run model

	Independent variables		
	Lgdppc	Scinav	Gini
Dependant variable: (Pov)	-0.348904	-0.001427	2.002351
	(-4.151)	(-0.585)	(4.318)

Note: figures in parenthesis are t-statistics.

The inequality variable (Gini coefficient) is also significant and the positive sign conforms to prediction of economic theory that poverty reduction is more effective in a condition of low income inequality. This explains the condition of high poverty rate in Nigeria despite rising income. Wide income inequality exists in Nigeria where less than 10 percent of the population controls more than 80 percent of the wealth.

4.1 Error Correction Model for Poverty

The results from the cointegration tests permits us to conduct vector error correction model (VECM) the results of which are presented in Table 5.

Table 5. Error correction model for poverty

Dependant Variable d (POV)t	
Independent Variables	Coefficients
Constant	-0.009602 (-0.940640)
DPOV(-1)	-0.402146 (-2.275018)
DLGDPPC(-1)	0.803611 (2.070930)
DSCINAV	-0.006965 (-4.727996)
DGINI	1.952606 (3.685364)
ECT(t-1)	-0.378187 (-3.902267)
Diagnostics Tests	
Breusch-Godfrey Serial Correlation LM Test: (Lag 1)	0.186752
Breusch-Godfrey Serial Correlation LM Test: (Lag 2)	2.257270
Heteroskedasticity Test: ARCH	0.376324
Jarque-Bera	2.183

Note: Figures in parenthesis are t-statistics.

The error correction term (ECT), which is significant, indicates existence of causality in at least one direction. The ECT of the equation is significant at 1 percent and found to be negatively correlated and indicating a moderate rate of convergence to equilibrium. The dummy variable representing the structural breaks is not significant in the model thus it is eliminated.

The results diagnostics tests conducted to satisfy the classical assumptions of ordinary least squares model show no evidence of serial correlation, Autoregressive Conditional Heteroskedasticity (ARCH) effects in the disturbances in 1 percent level of significance. The Jarque-Bera normality test also suggest that errors are normally distributed. Other stability tests conducted which further support the stability of the model include Ramsy RESET test, cumulative sum of the recursive residuals (CUSUM) test and CUSUM of squares test. All the statistics of these tests exceeded the bounds at the 5% significance level (Appendix I).

The result of the Granger causality test (Table 6) shows that the null hypotheses that income, inequality and structural change does not Granger cause poverty cannot be rejected, meaning that there is no evidence of causality from the variables to poverty. However, there is an evidence of causality running from inequality to income at 5 percent level of significance.

Table 6. VECM granger causality test

Dependent Variable	Independent Variables χ^2 -statistics of lagged 1st differenced term [p-value]			
	POV	GDPPC	GINI	SCINAV
POV	-	0.087	0.470	1.073
		[0.768]	[0.493]	[0.300]
GDPPC	0.016	-	3.845*	0.760
	[0.899]		[0.050]	[0.383]
GINI	0.807	1.024	-	0.537
	[0.369]	[0.312]		[0.464]
SCINAV	1.990	0.059	0.157	-
	0.158]	[0.809]	[0.692]	

Note: * Significant at 5% level of significance.

5. Summary and Conclusions

Changing structure of production from low productivity to high productivity and the movement of labor between sector also entails increase in wages and in turn incomes of individuals and households which enables them to increase the quantity and quality of goods and services they consume thereby distancing them away from poverty. Structural change is therefore an important aspect of economic growth and poverty reduction. Resource rich countries such as Nigeria have the opportunity of supporting structural change in their economies by making good use of the revenues generated from the sale of the resources in form of investments in the soft and hard infrastructures. Failure to do that leads to the 'paradox of plenty' as we are witnessing in Nigeria, a rich country full of poor people. This paper investigates the relationships among poverty, structural change, growth and inequality.

The results of the empirical analysis indicate the existence of long-run and short run relations between poverty, economic growth, and inequality while the coefficient of structural change variable is found to be not statistically significant despite having the correct sign. Structural change in Nigeria has been very slow since the emergence of oil as the leading sector in the economy. The insignificance of the structural change variable in the model confirms the claims that lack of strong structural transformation is one of the major development issues facing the country (Lamido, 2010).

The stronger coefficient of the inequality variable in the model is an indication that inequality is a major issue in poverty reduction in the country. Inequality-reduction is therefore, found to be the major driving force in reducing poverty in Nigeria. This also supports the view that economic growth alone is not enough for poverty reduction; it must be backed up with fair distribution. In other words, there is the need to pursue inclusive growth policies in order to achieve the desired poverty reduction effect. This is because the benefits of growth do not necessarily 'trickle down' to the poor. Effective policies must be pursued to channel some of the benefits of growth to the masses.

In light of the above, the need for more adequate and effective policy measures towards reducing poverty in the country becomes apparent. This must be implemented under a suitable and effective institutional environment. Nigerian socioeconomic and political institutions have been fraught with rent-seeking activities, endemic corruption and economic mismanagement. This unfortunate condition must be controlled in order to promote a favorable economic environment that would give rise to sustained economic growth, structural transformation and poverty reduction.

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Notes

Note 1. Structural change and structural transformation are use synonymously.

Note 2. It should be noted the two terms (structural change and structural transformation) are synonymously used in this paper.

Note 3. http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTPOVERTY/EXTPGI/0 accessed on 14/5/2009 See also Marniesse, S .and Peccoud, R. Poverty, Inequality and Growth, What's at Stake for Development Aid? In Poverty, Inequality and Growth. Proceedings of the AFD-EUDN Conference (2003), Paris. www.afd.fr.

Note 4. Ibd.

Note 5. Many scholars also investigated different aspects such as the impact of initial income distribution (Easterly and Robelo 1993; Deininger and Squire, 1998; Birdsall and Londono, 1997; Morawetz, 1978; Ganagarajah, et al., 2000; and Christiaensen, L. et al. 2003), Globalization (Barro 2000; 2008) and technology (Joumotte, et al. 2008).

Note 6. A similar concept that emerged recently is "inclusive growth' (Ali, 2007) other concepts that are open used synonymously or as extension of the pro-poor growth include 'broad-based growth' and 'shared growth' (Ianchovichina and Lundstrom, 2009).

Note 7. See also Christiaensen, L. et al. 2003.

Note 8. This is the most popularly used. See for instance: (Productivity Commission, 1998; Dietrich, 2009; and Cortuk & Singh 2011).

Note 9. CBN (2010) Statistical Bulletin.

Note 10. See Perron 1989; Volgelsang and Perron 1998; Zivot and Andrews, 1992.

Note 11. Chow, G. C. (1960).

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