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Corporate Profit Growth and Variability in US Unemployment Rate

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Abstract

This study investigates effects of corporate profit growth, macroeconomic uncertainty and other key economic indicators on the potential for lower unemployment condition in the US economy. Using marginal effect probit estimates, this study finds that, sustained growth in corporate profit and appreciable economic growth (as measured by GDP growth) are significant in determining the likelihood of achieving lower unemployment rate. Overall results however, show that among variables tested, reduction in perceived macroeconomic uncertainty is the dominant variable with the potential to significantly impact the likelihood of having lower unemployment rate.

Keywords: investments growth, corporate profits, unemployment rate, probit marginal effects, macroeconomic uncertainty

JEL Classification: E27, E24

1. Introduction

Historically, corporate profit growth in both developed and developing economies around the world has been perceived as a product of vibrant macroeconomic conditions. Sustained growth in corporate profit has also been shown to reflect to some degree, the trajectory of prevailing macroeconomic policies being pursued and growth augmenting external factors. The macroeconomic literature for instance, features legion of empirical studies which addresses how macroeconomic dynamics impact corporate performance, and ultimately, profitability. Reviewed studies suggests that economies which exhibit specific growth augmenting features (low interest rates, low corporate taxes, etc.) are more likely to support significant firm growth through new projects and other long term investments; a condition which enhances the potential for appreciable growth in firm profit. Firm profit growth due to aforementioned enabling economic conditions, has also been projected to be integral in spurring growth in investments through utilization of undistributed profits. This tendency to embark on new short or long term investments due to sustained growth in firm profits, and how such condition ultimately impacts prevailing unemployment rate is the focus of this empirical study. Recent debates on trend dynamics between corporate profit growth and persistently high unemployment rate have hinged on apparent conflict between traditionally projected negative correlation between the two indicators and recent diverging trend according to available data. This projected negative association between corporate profit growth and unemployment rate is predicated on expected positive association between corporate profits and investments growth; with investment growth acting as the conduit between rate of growth in corporate profit and unemployment rate. Related literature show that this projected positive association between growth in firm profits and investment growth is not without merit. The theory of the firm for instance, projects that, highly profitable firms are more likely to be characterized by or tend to exhibit relatively high propensity to embark on new investments because of excess revenue over cost of operations. Proponents of this positive association (between corporate profit and investment growth) further argue that, sustained growth in firm profit reflects higher return on investment; a condition which makes it more likely that firms experiencing growth in profits will choose to channel more funds into additional ventures in attempt to compete away prevailing profits in the market place. In other words, the drive to enhance profitability ultimately drives additional growth in investment.

In addition to this projected positive association between corporate profit trend and investment growth, reviewed literature further provide sufficient evidence in support of inverse relationship between investment growth within an economy and prevailing unemployment rate. Available evidence suggests that, as firms expand through investments in new projects, the expansion process, all things being equal, necessitates demand for labor, ultimately bringing about a decline in prevailing unemployment rate. Although, results vary significantly on the extent to which investment growth impact prevailing unemployment rates, reviewed studies focusing on the investment

growth-unemployment rate nexus, tend to support strong negative relationship between the two variables. For instance, Ashipala and Eita (2010) showed that investment growth has significant depressing effect on prevailing unemployment rate. Additionally, Brady and Wallace (2000), Sawyer (2002), Herbertson and Zoega (2002), Smith and Zoega (2005), Kapadia (2005), Arestis, *et al.* (2007), Karanassou, *et al.* (2008), have all reached similar conclusions suggesting an inverse relationship between aggregate investment growth and unemployment rate.

This study hypothesize that if investment growth correlates negatively with unemployment rates as documented in stated empirical studies; and corporate profits growth is projected to correlates positively with investment growth, then by logical necessity, corporate profits growth should correlates negatively with prevailing unemployment rate all things being equal. In order words, if investment growth inversely correlates with prevailing rate of unemployment, and the same economic indicator is projected to have positive relationship with corporate profit growth, then deductively, corporate profit growth would be expected to have negative impact on unemployment rate, all things being equal. Recent United States (US) unemployment conditions and corporate profits growth dynamics characterizing firms in the various sectors of the economy however, seems to suggest a paradigm shift from this projected dynamic relationship. Unemployment rates (2010 and 2012 trends) among various sectors of the economy, and profitability trends as reported among most US firms seems to challenge this projected inverse relationship between corporate profit growth and unemployment rate.

Data from US Bureau of Economic Analysis (BEA) and St. Louis Fed data on the two variables, show that unemployment rates since the 2008 recession continue to be persistently high with relative downward stickiness; corporate profits growth among firms however continue to soar from quarter to quarter. Additionally, the data further show that Gross Domestic Product (GDP) growth continue to be significantly weak with no indication that the trend will attain its pre-2008 levels any time soon; a condition which suggests investments growth expected from soaring corporate profits has so far failed to materialize or are far below levels needed to significantly impact economic growth. This apparent failure of investment growth and unemployment rate to reflect to sustained growth in corporate profit in recent post recession economic environment, presents unique challenge for both economists and business analysts. The condition calls for critical re-examination of the data in order to explain this evolving macroeconomic phenomenon. This emerging conflict in projected relationship between corporate profit growth and unemployment rate further calls for the need to re-assess traditional projections by examining critical auxiliary factors which might help explain the recent trend. The condition additionally calls for identification of non-traditional factors with the potential to explain this emerging relationship between corporate profits growth and unemployment conditions in the US economy.

This study investigates the relationship between these two variables in an attempt to understand the dynamics at play in recent mismatch between corporate profits growth and unemployment conditions in the US economy. The goal is to verify how corporate profit growth dynamics influence the potential for lower unemployment conditions. This study further analyze the extent to which other key economic and performance indicators such as interest rates, labor cost, fixed investment growth, productivity level, GDP growth etc, influence potential for lower unemployment conditions. Additionally, this study also verifies how macroeconomic uncertainty impacts or moderates the relationship between the potential for lower unemployment rate and corporate profits growth. This study employs both graphical and empirical tests in its attempt to explain recent corporate profit growth and unemployment rate nexus. Attempts will also be made to find out if recent corporate profit growth and unemployment trend is unique in the historical data.

The rest of the study is structured as follows: Data on trends in US corporate profits growth and unemployment rates as well as GDP growth are first reviewed. The section also disaggregate and provide a thorough analysis of recent corporate profit growth dynamics, GDP growth and unemployment conditions as detailed in releases provided by the BEA and St. Louis Fed respectively. Relationships between unemployment rate and GDP growth; and unemployment rate and corporate profits growth are also discussed in the sequence. Section three introduces models used in testing for specific features associated with individual variables and also presents results of various empirical tests conducted. Finally, analysis and test results verifying the extent to which employed variables impact the likelihood of having lower unemployment conditions are presented followed by conclusions and possible policy implications of the results.

2. Examining Factors Influencing US Unemployment Conditions

Recent imbalance between US corporate profit growth and unemployment conditions has challenged presumed negative association between the two variables. To re-examine core factors responsible for recent fluctuations in US unemployment conditions, and the role of corporate profit growth specifically, this section reviews historical data trend conditions for the two variables. Preliminary review of the data, show that the traditional view projecting

negative association between corporate profits growth and unemployment conditions is not entirely supported. Post recession quarterly reports for instance show continual growth in corporate profits among most US firms; at the same time however, unemployment conditions remain persistently high contrary to expected negative association between the two variables. Although this study expects unemployment rate to lag investments and economic growth as well as corporate profitability as economic models project, it is also of the view that recent conditions cannot fully account for the relatively high unemployment conditions characterizing the US economy. Empirical examination of factors responsible for this condition (growth in corporate profits and rising unemployment rate) is scanty among reviewed literature; however, attempts at explaining the phenomenon continue to evolve as the US economy transitions into what some analysts have termed the “new normal” (relatively high unemployment rate and sustained corporate profit growth). Ongoing debate on the factors responsible for the present unemployment conditions however suggests that, weak US manufacturing sector growth, macroeconomic uncertainty, globalization, lingering effect of the 2008 recession, weak global economic performance etc, might be responsible for the present trend. The following section reviews the role of these factors in US unemployment conditions.

According to Michael Spence (Note 1), growing unemployment conditions in the US could be attributed to evolving trends in globalization rather than domestic factors espoused by some analysts. In his analysis of the factors responsible for growing unemployment conditions in the US, Spence showed that growing globalization has and continue to reallocate significant part of international supply chain into developing economies around the world. This condition he contends has significantly impacted job growth patterns, and wages among most developed economies such as the US. According to his analysis, the trend has redistributed employment opportunities and incomes away from advanced economies such as the US into developing economies with relatively low operational cost and lax labor and environmental laws - conditions which contribute significantly to high operational cost in most advanced economies. Spence argues that, as multi-national firms and corporations move significant part of operations to low wage economies, advanced economies such as the US loose the potential to maintain robust employment conditions, leading to relatively high unemployment rate.

In order words, to Michael Spence, relatively high US unemployment conditions in recent years could be explained by features linked with trends in globalization (growing international economic integration) apart from domestic macroeconomic conditions. This conclusion suggests that policy makers might be significantly constrained in their efforts at lowering present unemployment conditions; in that, rational firms will continue to relocate substantial part of operations into economies characterized low operational cost, further worsening prevailing unemployment conditions. This study projects that continual flow of investments into developing economies by US firms has the potential to enhance profitability among parent companies in US with no significant effect on domestic unemployment rate. This condition could then, to some degree help in explaining recent corporate profit growth-unemployment rate mismatch characterizing the US economy.

Domestic and global macroeconomic uncertainty has also been suggested as a dominant factor accounting for recent high US unemployment conditions. Proponents argue that growing uncertainties about long term repercussions of ongoing global financial system volatility, and weak domestic macroeconomic conditions has been responsible for continued depressed propensity to invest by domestic and international firms. Most firms according to proponents have shelved desire to embark on new projects with potential to augment employment growth because of perceived macroeconomic uncertainty or conflicting signals from policy makers in Washington on the economy. Supporters of this view point out that economic uncertainty makes it extremely difficult for firms to accurately forecast critical performance indicators and cash flows needed to assess viability of desired projects. This condition tends to have depressing impact on investments growth with significant negative effect on unemployment rate. Empirical studies on the effects of uncertainty on investment growth are quite extensive; however, conclusions diverge significantly on the extent to which uncertainty impact investment growth. Some of these studies suggest that the ultimate impact of uncertainty on investments growth depends on the apparent reversibility or otherwise of the investment venture in question. In order words, uncertainty might not entirely inhibits investment growth if such investment is readily reversible in the face of perceived failure with limited financial lose.

Reviewed studies on the average however, tend to favor negative association between macroeconomic uncertainty and investment growth. Ramey and Ramey (1995) and Asteriou and Price (2005) for instance, found significant negative relationship between investment growth and volatility (a proxy for uncertainty). Additionally, Federer (1993) and Driver and Moreton (1991), also found that macroeconomic uncertainty has negative impact on US equipment investment and UK manufacturing investment growth respectively. Similarly, Darby et al. (1998) also showed that real exchange rate uncertainty negatively impact investment growth in five Organization of Economic Cooperation and Development (OECD) economies. The case among developing economies further provide evidence in support of negative correlation between macroeconomic uncertainty and investments growth. Aizenman and

Marion (1999), Edwards (1989), Moguillansky (2002), and Serven (1998) all document significant negative relationship between private investment and key economic instability or uncertainty. Domestically, growing political uncertainty about the trajectory of current policies is believed to a key factor explaining weak investment growth, hiring trends and unemployment rate in US economy.

3. Examining Recent Corporate Profit Phenomenon and Unemployment Conditions

Available data show that corporate profits have witnessed appreciable growth in recent quarters despite lingering effect of the 2008 economic recession. Corporate profits data between 1947 and 2011 show that recent growth in corporate profits is not only dramatic, but also unique with regards to its relationship with prevailing unemployment conditions. Post recession data shows that these two indicators have been trending in the same direction contrary to projections. A number of factors have been put forth in an attempt to explain continuing growth in corporate profits; and why the phenomenon has failed to have any significant impact on unemployment conditions in the country. Aside factors already alluded to above, lean production methods implemented in the wake of the 2008 recession leading to lower production cost has also been sighted as a key factor responsible for recent corporate profit growth. Proponents of this condition argue that 2008 recessionary conditions necessitated massive layoffs and the need to adopt efficient or lean operational methods. Consequently, firms are now able to achieve production targets with relatively limited number of employees and at relatively lower cost leading to higher profit margins. To analysts who espouse this train of thought, significant portion of recent corporate profits growth reflects elimination of huge labor cost which characterized pre-recession (2008) corporate operations and adoption of more efficient methods of operation.

Recent corporate profit growth and dismal unemployment conditions have also been attributed to growing international market integration and variations in growth conditions associated with individual economies around the world (Note 2). Most US corporations are known to have multinational subsidiaries responsible for significant portion of core business operations. General Motors, for instance, has significant part of its operations in budding economies in Asia. Growing market integration in recent years ensures that depressed growth in a domestic economy does not significantly impact overall corporate performance and profitability of the company as whole. Some analysts are of the view that recent growth in corporate profits among US firms can be attributed to growth in earnings from abroad among subsidiaries; and does not reflect domestic performance of the parent company or macroeconomic conditions. Significant portion of recent corporate profit growth is thus believed to have accrued from operations in markets still characterized by relatively robust growth such as the Chinese and the Indian economies. This condition according to some analysts, might explain why recent corporate profits growth conditions have failed to have significant impact on US investments growth and unemployment conditions.

3.1 Structure of Recent Corporate Profit Growth

According to BEA, corporate profits with inventory valuation and capital consumption adjustments grew by \$61.2 billion in the second quarter of 2011, compared to \$19.0 billion growth in the first quarter of the same year. BEA further report that current-production cash flow (net cash flow with inventory valuation adjustment) – that is, internal funds available to corporations for reinvestments also grew by \$86.2 billion in the second quarter of 2011, compared to \$21.1 billion in the first quarter. The Bureau also documents that tax on corporate income in the same period decreased by \$1.8 billion in the second quarter, in contrast to an increase of \$17.6 billion in the first quarter of the same year. Conditions which support the view that firms during these periods had access to significant portion of their revenue, bringing about significant growth in profits.

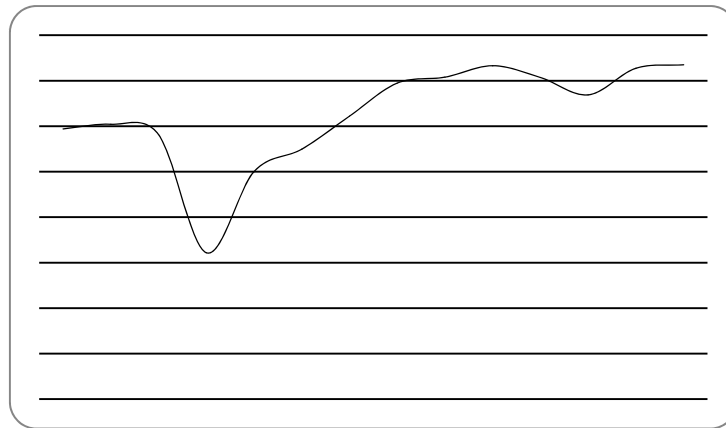
During this same period, Department of Commerce Release also documents that domestic profits of nonfinancial corporations increased by \$80.8 billion in the second quarter of 2011, compared to just \$19.7 billion recorded in the first quarter. In the same (second) quarter, BEA data further show that real gross value added of nonfinancial corporations increased significantly, and profits per unit of real value added also witnessed significant growth. According to BEA release, growth in profits, especially in the nonfinancial sector of the economy over this period in question, reflected significant decline in unit labor and non-labor costs of operations among firms over the period. This corporate profits growth dynamics forms the basis of ongoing debate about the role of corporate profits growth in US unemployment conditions; and the need to re-visit factors responsible for this perceived conflicting phenomenon.

GDP growth data analysis over the same period further indicates the trend is still weak compared to pre-recession levels even though corporate profits continue to soar from quarter to quarter. In its September 29, 2011 press release, BEA report on real personal consumption expenditure growth (a significant component of GDP growth) showed only 0.7 percent growth in the second quarter, compared to 2.1 percent growth in the first. Durable goods production during the same period (second quarter) is shown to have declined 5.3 percent in contrast to 11.7 percent growth in the first. Nondurable goods in the same period also grew by only 0.2 percent in the second quarter of 2011, compared to 1.6

percent growth in the first quarter of the same year. These trends further show that persistence growth in corporate profits over the same period had little or no measureable impact on prevailing GDP growth; a key condition necessary for employment growth.

3.2 Corporate Profit Growth between Q_1 (2008) - Q_1 (2011)

Figure 1 charts corporate profit growth among US firms between the first quarter of 2008 and the first quarter of 2011. With the exception of the fourth quarter of 2008, figure 1 show there has been sustained growth in corporate profits with substantial spike in the first quarter of 2011.

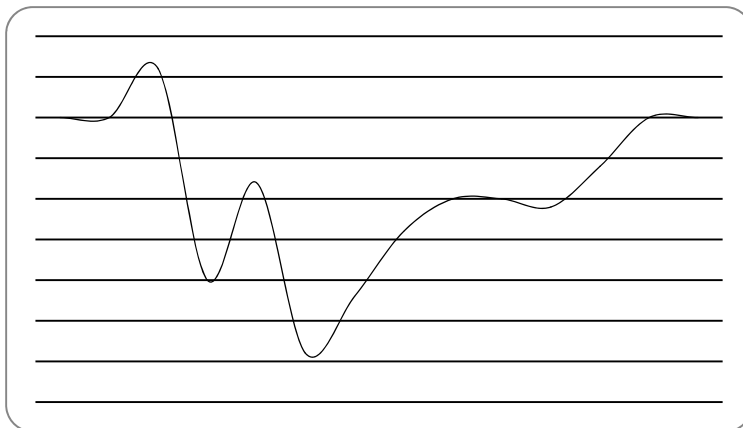


Source: Bureau of Economic Analysis

Figure 1. Corporate Profit (Billions) after Taxes between 2008 and 2011

4. Economic Performance Analysis: GDP Growth Conditions

Historical data on GDP growth show substantial variability between the first quarter of 2008 and second quarter of 2011. These fluctuations reflects periods of depressed performance after the 2008 recession. Trend analysis over this period show that GDP growth plummeted between the third quarter of 2008 and the second quarter of 2009 in responds to recessionary pressures over the period. For instance, according to the BEA annual percentage change in GDP growth was negative between the first and the second quarter of 2009 (-6.7 and -0.7 respectively) due to lingering effects of the 2008 economic shock. This negative growth trend however, stabilized in the second quarter of 2009. Between the third quarter of 2009 up to the third quarter of 2011, the economy witnessed appreciable growth in GDP with much of the trend being driven by growth in consumption expenditure according to the BEA. The data further show that between the first quarter of 2009 and third quarter of 2011, about 70 percent of of GDP growth was due to growth in personal consumption expenditures; with investment growth accounting for just about 12 percent of the growth. This recorded appreciable growth in GDP notwithstanding, Bureau Labor Statistics data shows unemployment rate during the same period was persistently high. A condition which lend credence to the fact that, modest growth experienced over the period failed to significantly reduce prevailing unemployment rate. Figure 2 reports GDP growth trends between first quarter of 2008 and first quarter of 2011.

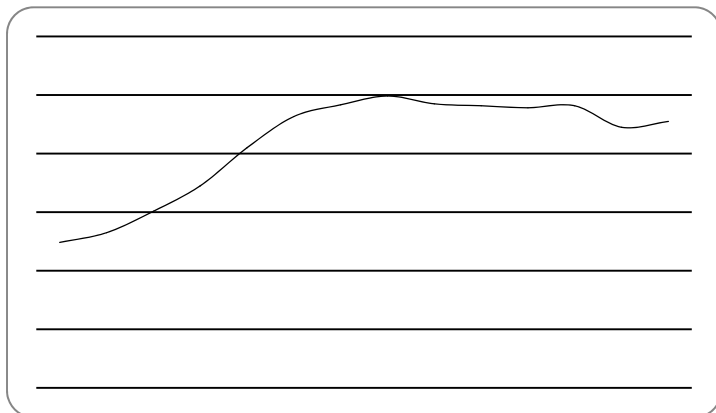


Source: Bureau of Economic Analysis

Figure 2. Gross Domestic Product Growth between 2008 and 2011

5. Civilian Unemployment Rate Conditions

According to the Bureau of Labor Statistics historical data, there have been five major surges in unemployment rate between 1960 and 2011. These surges have been characterized by unemployment rates of 7 percent and above. The first of these occurred in 1961 when unemployment rate of 7.1 percent was recorded in the month of May. The second surge following this period persisted over a two year period between 1975 and 1977; with the highest unemployment rate during the period reaching 9 percent in May of 1975. The most severe unemployment condition recorded within the period (1960 -2011) however, occurred between November and December of 1982. Relatively high unemployment conditions which started in the third quarter of 1980 continued to rise until it peaked at 10.8 percent in November and December of 1982 respectively. Unemployment rate after this period declined steadily until a measure of normalcy was recorded in the fourth quarter of 1986. The year 1992 also witnessed another surge in unemployment rate with the highest rate of 7.8 percent occurring in the month of June. Unemployment rates after this period (1992) barely rose beyond 6 percent until the fourth quarter of 2008 during the recent recession. Unemployment rate after the 2008 recession has since hovered over 8 percent to date (the first quarter of 2012). Although current unemployment rate pales in comparison to rates recorded in the first part of the 1980s, the current rate continues to have its own negative impact on the US economy. Ripple effects from the high unemployment rate continue to have significant negative impact on other key macroeconomic indicators in the economy. For instance, analysts suggest that high unemployment conditions leading to declining purchasing power might be responsible for depressed consumption expenditure and GDP growth. Figure 3 charts civilian unemployment conditions between the first quarter of 2008 and 2011.



Source: Bureau of Labor Statistics

Figure 3. Civilian Unemployment conditions (Q1 2008 and Q1 2011)

6. Empirical Analyses

This section outlines econometric model and other pre-test estimations employed in ascertaining the effect of corporate profit growth, trend GDP growth and other critical economic variables on US unemployment rate. The type and sources of data used in tests are first stated. This is followed by assessment of stationary conditions associated with time series variables tested in this study using Augmented Dicky-fuller unit root test procedure. The section further verifies cointegration conditions to assess long run associations if any, between core independent variables featured and unemployment rate. Long run test is conducted using Johansen Cointegration test procedure. Finally, I estimate effect of corporate profit growth, GDP growth, and other economic variables on the likelihood of having lower unemployment rate using marginal effects procedure in Probit statistical framework.

6.1 Data Description and Variables

This study features quarterly data spanning the period 1960 and 2011. Time series data over these periods are sourced from the Bureau of Economic Analysis, Bureau of Labor Statistics and St. Louis Fed database (FRED). Variables analyzed in this study include, unemployment rate (*unemp*), the dependent variable which is treated and coded as a binary variable to estimate the likelihood of lower unemployment rate $y_i = 1$ or otherwise $y_i = 0$. Explanatory variables tested in the study include corporate profits growth (*corpp*), non-financial sector corporate profits (*nonfcp*), productivity growth (*prody*), labor cost (*lcost*), corporate fixed investment consumption (*corpfic*), GDP growth (*gdpg*), macroeconomic uncertainty (*muc*) measured as the standard deviation of US GDP growth rate over specified data period; fixed investment growth (*fig*), consumption expenditure growth (*ceg*) and interest rate (*ir*). Analysis of the interaction between these performance and economic indicators and the likelihood of lower unemployment rate variable, forms the basis of conclusions made in this study.

6.2 Econometric Analysis

Test for stationary conditions of variables employed in the study using unit root testing methodology proposed by Dickey D A, Fuller W A (1981) is first conducted. Table 1 reports unit root test result. Initial unit roots test using specific lag and first difference results are reported. Results show that, given specified lag period (1), hypothesis of unit root cannot be rejected for most of the variables tested. Nonstationary variables in this case, satisfy the first condition in subsequent long run relationship test using Johanson cointegration procedure. Cointegration procedure in this context tests the condition that, although individual independent variables exhibits nonstationary trends, such trends might not be a 'random walk' with regards to how they relates to the study's dependent variable (unemployment rate) in the long run. In other words, unemployment rate trend might not be stationary, but its historical trend might for instance, have significant long run relationship with prevailing macroeconomic uncertainty or GDP growth etc. Table 1 report unit root results of individual variables and their first difference.

6.2.1 Unit Root Test

Table 1. Augmented Dicky-Fuller Test for Unit Roots

Variables	ADF-Stats	Lags	Results	First Difference	ADF-Stats	Results
UNEMP	-3.179	1	I(1)	Δ UNEMP	-6.355	1(0)
CORPP	-0.959	1	I(1)	Δ CORPP	-10.42	1(0)
NONFCP	-1.785	1	I(1)	Δ NONFCP	-9.435	1(0)
PRODTY	-1.825	1	I(1)	Δ PRODTY	-6.304	1(0)
LCOST	-1.323	1	I(1)	Δ LCOST	-7.187	1(0)
CORFIC	-1.101	1	I(1)	Δ CORFIC	-6.171	1(0)
GDPG	-2.987	1	I(1)	Δ GDPG	-13.61	1(0)
FIG	-5.149	1	I(0)	FIG	-5.149	1(0)
CEG	-6.713	1	I(0)	CEG	-6.713	1(0)
MUC	-16.98	1	I(0)	MUC	-16.98	1(0)
IR	-2.33	1	I(1)	Δ IR	-10.74	1(0)

6.2.2 Cointegration Estimation

According to table 1, unemployment rate, the binary dependent variable is integrated in the order 1(1). Using this

outcome, I test for cointegrating relationships between unemployment rate and individual independent variables integrated in the same order, i.e. I(1). Cointegration relationships between unemployment rate and independent variables with similar integration order are investigated by means of Johansen Maximum Likelihood cointegration technique. Table 2 reports evidence of long-run equilibrium relationship or otherwise, between unemployment rate and independent variables integrated in similar order. Out of eight long run relationship conditions tested, results show existence of long run relationship between unemployment rate and all explanatory variables tested with the exception of corporate profits growth (both corporate profit growth in general and nonfinancial corporate profit growth) and labor cost.

Table 2. Tests for Co integration

Variables	H ₀	H ₁	Trace Statistics	Critical Value
UNEMP (corpp)	r = 0	r ≥ 1	13.14	15.41
UNEMP (nonfcg)	r = 0	r ≥ 1	12.07	..
UNEMP (prodty)	r = 0	r ≥ 1	17.12*	..
UNEMP (lcost)	r = 0	r ≥ 1	9.87	..
UNEMP (corfic)	r = 0	r ≥ 1	16.61*	..
UNEMP (gdpg)	r = 0	r ≥ 1	21.91*	..
UNEMP (ir)	r = 0	r > 1	17.07*	..

*Condition of long term relationship between the variables

6.3 Probit Framework

6.3.1 The Probit Model

To estimate the probability of lower unemployment rate in the US using performance trend conditions associated with selected macroeconomic and performance indicators, the following probit function is first formulated:

$$prob [y_i = 1] = f\left(\frac{b_1 + b_2 x_i}{\sigma}\right) \quad (1)$$

where the probability of having lower unemployment rate $p[y_i = 1]$ is presumed to be a function of growth dynamics or fluctuations characterizing selected independent variables in this study; f denotes standard normal cumulative density function and x_i captures individual explanatory variables in the test. Equation 1 could further be restated as:

$$prob[y_i = 1] = f\left(\frac{b_1 + b_2 x_i}{\sigma}\right) = \int_{-\infty}^{\frac{b_1 + b_2 x_i}{\sigma}} \frac{1}{\sqrt{2\pi}} e^{-\frac{t^2}{2}} dt \quad (2)$$

Equations 1 and 2 formulate the basic probit framework from which the potential for lower unemployment rate, given specific performance conditions among explanatory variables are derived. To verify the impact of individual variables on the probability of having lower unemployment rate, marginal effects of individual explanatory variables are derived using equation 1. Using the chain rule, marginal effect of each explanatory variable on the potential for lower unemployment rate is modeled as follows:

$$\frac{\partial prob[y_i = 1]}{\partial x_i} = \frac{\partial f\left(\frac{b_1 + b_2 x_i}{\sigma}\right)}{\partial x_i} = f\left(\frac{b_1 + b_2 x_i}{\sigma}\right) b_2 \quad (3)$$

Where, x_i captures specific independent variable whose marginal effect on the likelihood of lower unemployment rate is being tested or analyzed. Equation 3 (Note 3), a nonlinear function, in this case is evaluated at the mean of individual explanatory variables. Equation 3 measures the potential for lower unemployment rate associated with individual explanatory variables; it estimates the probability of lower unemployment rate; that is $[y_i = 1]$ given a percentage growth (change) in an independent variable. Table 3 reports ordinary least square (OLS), Probit and Marginal effects Probit estimates of the likelihood of a lower unemployment rate in the US.

6.3.2 Effects of Growth Performance on the Likelihood of Lower Unemployment Rate

Table 3. Variables OLSProbit Marginal Effects

Variables	Coefficients (Std Errors)	Coefficients (Std Errors)	Coefficients (Std Errors)
Corporate Profits	0.0014* (0.0007)	0.0111* (0.0052)	0.0037* (0.0017)
Nonfinancial Corp Profits	-0.0028** (0.0010)	-0.0196** (0.0068)	-0.0066** (0.0023)
Productivity Growth	-0.1003*** (0.0097)	-0.5323*** (0.0786)	-0.1770*** (0.0239)
Corp fix Con Investments	0.0042*** (0.0009)	0.0213*** (0.0057)	0.0071*** (0.0019)
GDP Growth	0.0524* (0.0278)	0.4940** (0.1660)	0.1463** (0.0522)
Fixed Investment Growth	0.0110** (0.0037)	0.0609** (0.0215)	0.0202** (0.0071)
Consumption Exp Growth	-0.0073 (0.0125)	-0.0118 (0.0598)	-0.0039 (0.0199)
Interest Rate	-0.0636*** (0.0151)	-0.3860*** (0.0925)	-0.1284*** (0.0306)
GD Private Inv Growth	0.0496** (0.0164)	0.1371 (0.0868)	0.0456 (0.0296)
Macroeconomic Uncertainty	-0.0720 (0.0551)	-0.6994* (0.3138)	-0.2326* (0.1015)
_cons	(1.7789) (0.1957)	6.6031 (1.2233)	(0.000)
<i>N</i>	205	205	205
	$r^2 = 0.50$	Pseudo $r^2 = 0.52$	Pseudo $r^2 = 0.51$

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

*Above results controls for possible effects of labor cost on probability of lower unemployment conditions

7. Potential for Lower US Unemployment Rate Analysis

Coefficient estimates of the likelihood of lower unemployment rate given a percentage change/growth in an explanatory variable are discussed in this section. Results presented in table 3 show that corporate profit growth is significant in determining swings or trends in unemployment rate as some analysts espouse. Estimated coefficient however, indicates that corporate profits growth exerts relatively weak influence on unemployment rate compared to other independent variables tested in this study. Coefficient associated with the variable show that all else held constant, percentage growth in corporate profits in general enhances the likelihood of lower unemployment rate by 0.4 percent; a relatively significant impact which to some degree might explain growing debate on the mismatch between recent corporate profit growth trend and unemployment conditions; in that recent trends in corporate profit growth and unemployment conditions challenges this empirical estimates. In other words, verified estimates indicates 5 percent growth in corporate profits is projected to boosts the potential for lower unemployment rate by 2

percent all things being equal. This outcome, (which conflicts recent trends on the relationship between the two variables) might help explain why some analysts are baffled by positive correlation between recent unemployment rate and corporate profit growth; in that, if above estimated coefficient driven by available data accurately captures the relationship between the two variables, then recent growth in corporate profits should have had significant impact on efforts aimed at lowering prevailing unemployment rate all things being equal.

This outcome to some extent support the notion that recent corporate profits growth might reflects accrued profits from abroad by international subsidiaries of US firms with little or no link to domestic investments or operations as some analysts have argued. Table 3 additionally reports that nonfinancial sector profit growth is also significant in augmenting the potential for lower unemployment rate. However, the outcome is negative, suggesting an opposite effect on the probability of having lower unemployment rate. Percentage growth in non-financial corporate profit fails to have projected impact on unemployment rate; the condition rather decreases the likelihood of having lower unemployment rate by 0.7 percent all things being equal- a condition which best fit current relationship between corporate profit growth and unemployment rate. To ascertain potential factors which might explain this outcome, individual variables were revaluated and relevant literature reviewed for clues; however, I find no plausible explanation for the condition apart from the possibility that increasing profit margins might have accrued from lower labor cost due to high rate of layoffs which characterized post recession firm operations. Additionally, the condition might also stem from moderating and interaction effects from other variables employed which this study tried to control for.

Apart from corporate profits growth dynamics, marginal effect coefficients further show that domestic productivity level, GDP growth, interest rates fluctuations, private fixed investment growth, corporate fixed expenditure growth and macroeconomic uncertainty are all significant in assessing the likelihood of having lower unemployment rate. This study finds that productivity growth and unemployment rate might not necessarily follow known traditional paradigm suggesting a negative association between the two variables. I find that all things being equal, percentage growth in productivity may not necessarily augment the likelihood of having lower unemployment rate. Result show that sustained productivity growth might rather depress the potential of lower unemployment rate. Percentage growth in productivity is found to reduce the likelihood of lower unemployment rate by as much as 17 percent. Although this outcome defies espoused views on the relationship between the two variables, it is cogent to note that significant portion of growth in productivity in recent years tend to be less labor intensive (mainly driven by advances in technology). This result therefore suggests that recent growth in productivity might have resulted from efficient utilization of advanced technologies with little relation to the size of the labor force employed. If sustained productivity growth is predominantly driven by excessive deployment of advanced technologies, then, the condition will rather lead to relatively high unemployment conditions rather than reduce it. This outcome to some extent projects that productivity might expand as more advanced production technologies are adopted, without significant growth in employment as expected.

Growth in fixed investment consumption among firms is also found to be highly significant in determining the likelihood of lower unemployment rate. However, its impact is relatively modest compared to other variables tested in the study. Marginal effect coefficient shows that percentage growth in corporate fixed investments consumption increases the likelihood of lower unemployment condition by 0.7 percent. This outcome (as defined by coefficient estimate) suggests that corporate investments growth alone might not be enough to overcome high unemployment conditions in the US economy. Overall GDP growth is also significant in assessing the likelihood of lower unemployment rate as expected. Percentage growth in GDP increases the likelihood of lower unemployment condition by approximately 15 percent. This result is highly significant in that, it supports growing view suggesting that, for efforts aimed at reducing high unemployment rate to be successful, it should focus on addressing how to facilitate significant growth in GDP. It further lends credence to the fact that sustained growth in GDP is still a key performance indicator with the potential to significantly accelerate job growth.

Fixed investment growth in general is also found to have significant impact on US unemployment rate. Percentage growth in fixed investment increases the likelihood of lower unemployment rate by 2 percent. However, I find that growth in consumption expenditure, a substantial segment of GDP growth (70 percent of GDP growth according to BEA) is insignificant in assessing the likelihood of lower unemployment rate. This outcome is puzzling in that, it is at variance with pre-test correlation analysis indicating that the variables are negatively correlated (-0.0643) (Note 4). Given that consumption expenditure constitutes about 70 percent of US GDP growth according to BEA estimates (which has already been found to be significant), this study anticipated that growth in consumption expenditure will also have significant impact on the likelihood of having lower unemployment conditions. The result however indicates otherwise. This result however, could to some extent explain recent mismatch between consumption expenditure and unemployment rate. According to BEA, although consumption expenditure continues to experience

appreciable growth since 2010, the improvement has so far failed to significantly influence persistently high unemployment rate.

To further examine factors responsible for this outcome (why consumption expenditure growth is insignificant in determining the likelihood of having lower unemployment rate) historical data trends for the two variables (between the period 1960 and 2011) were analyzed. Historical trend analysis indicates that the relationship between the two variables has not always been negative through time as traditionally projected. There are trend instances (e.g. early 1970s, 1982-86 and in the 1990s) where the two variables have trended in the same direction contrary to traditionally espoused relationship between the variables. Again, the data also show that there have been instances where variability in consumption expenditure growth has had little or no significant impact on prevailing unemployment rate over the same period. For instance, this study's review of the data shows that fluctuations in consumption expenditure growth between the mid 1960s and early part of 1990s do not fully explain unemployment trends over the same period. Additionally, recent data further show that although consumption expenditure since the 2008 recession continues to show significant recovery, unemployment conditions over the same period have been persistently high. This inconsistent relationship between the two variables might explain above test outcome suggesting that consumption expenditure growth is insignificant in determining the likelihood of having lower unemployment rate or predicting unemployment rate trend.

Interest rate fluctuations are found to be significant in determining the likelihood of having lower unemployment rate. Marginal effect estimate indicates that percentage increase in prevailing interest rate decreases the probability of having lower unemployment condition by approximately 13 percent. This result is also significant because it supports ongoing Federal Reserve policy of maintaining low interest rate in an attempt to augment efforts at improving conditions for growth and reducing unemployment rate. Although fixed investment growth in general is found to be significant in assessing the likelihood of lower unemployment rate, this study find that gross domestic private investment growth is insignificant; suggesting that private investment growth alone might not be enough in accelerating employment growth in the US economy.

Finally, marginal effect estimates shows that macroeconomic uncertainty (as measured by volatility associated with GDP growth), has significant impact on the likelihood of lower unemployment rate. Coefficient estimate show that heightened macroeconomic uncertainty all things being equal, negatively impact the likelihood of lower unemployment conditions in the US economy. Percentage growth in the degree of macroeconomic uncertainty, (for instance, about the trajectory of the economy due to depress GDP growth) decreases the likelihood of lower unemployment rate by as much as 23 percent. In other words, among variables perceived as having significant impact on prevailing US unemployment rates, macroeconomic uncertainty might be the dominant condition. This result further suggests that, uncertain macroeconomic conditions tend to drive more of the variability in unemployment rate than other known determinants tested. Consequently, to bring about significant reduction in unemployment conditions, this result suggests the need for governing bodies to pursue policies geared towards restoring confidence in the economy. This could be done through specific, well-defined long term policy initiatives designed to reduce perceived uncertainty among potential investors as well as consumers. Long term policies with clear objectives geared towards improving the state of the economy for instance, could serve as a catalyst which can set in motion trends critical for sustain growth.

8. Conclusion

This study investigated the potential for lower unemployment conditions in the US given performance conditions associated with key macroeconomic and performance indicators. I find that both corporate profit growth and GDP growth are significant in enhancing the potential for lower unemployment rate. Among the variables tested however, reduction in macroeconomic uncertainty is found to be the dominant condition with the potential to significantly reduce relatively high unemployment rate in the US economy.

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Notes

Note 1. (In an essay entitled: Globalization and Unemployment: the downside of integrating markets – July-August 2011)

Note 2. Linked with Spencer's argument.

Note 3. Partial derivative of equation 1

Note 4. Correlation matrix conducted is based on quarterly data series between 1960 and 2011.

Taylor Rule and Monetary Policy in Ghana

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Abstract

Using time series estimations of simple forward and backward-looking Taylor type reaction functions to characterise monetary policy rules, this paper assesses to what extent these rules provide a description of interest rate response to inflation in Ghana, a developing African country widely regarded as having relatively strong state actors and good governance. Ghana's central bank officially adopted an inflation-targeting monetary policy in March 2002 following its operational independence. The paper finds that Taylor rule is not a good predictor of interest rate behaviour.

Keywords: Ghana, inflation targeting, monetary policy, Taylor rule

JEL classification: E52; E58; E61

1. Introduction

The economic goals of controlling inflation and limiting currency instability, to ensure long term economic growth, have been pursued principally through the tools of monetary policy. In the last quarter of a century, hitherto diffused objectives have been focused and price stability assigned primacy. Central banks increasingly have been assigned the agency role of achieving this central goal – in industrialised and developing countries alike. Moreover, the methods of monetary policy conduct have converged, with many developing countries increasingly adopting an explicit or implicit inflation targeting framework (Paez-Farrell, 2007), implemented with market oriented instruments such as short term interest rates (Maria-Dolores, 2005).

There is a considerable body of research work on monetary policy conduct in developed countries. Considering some contributions to the still limited literature on monetary policy conduct in the African context, Saxegaard (2006) examines the pattern of excess liquidity in Sub Saharan Africa (SSA) and its consequences for the effectiveness of monetary policy. Commercial banks may hold excess reserves due to asymmetric information problems, underdevelopment of bond markets in Africa and they may also do so due to lack of competition in the financial sector (O'Connell, 2005).

Saxegaard (2006) argues that understanding the consequences of excess liquidity requires quantifying the extent to which commercial bank holdings of excess liquidity exceed the levels required for precautionary purposes. His paper proposes a methodology for measuring this quantity and uses it to estimate a nonlinear structural vector autoregressive (VAR) model for the Economic and Monetary Community of Central Africa, Nigeria and Uganda (Note 1). Saxegaard's study suggests that excess liquidity weakens the monetary policy transmission mechanism and thus the ability of monetary authorities to influence demand conditions in the economy. Considering that Ghana has a similar financial environment as the countries studied, it would be worth knowing how effectively monetary managers influence demand conditions and inflation using the policy rate.

Following the completion of financial reforms and the economic recovery programme (ERP) in 1992, the Ghanaian economy moved towards a free market and a free market oriented monetary policy. Policy reforms included: a free floating exchange rate and trade liberalisation, growth-oriented and deficit-reducing fiscal policy characterised by a reduction in recourse to bank financing. Also, interest rates and credit had been decontrolled and structural and institutional reforms to facilitate the system of indirect monetary management put in place (Note 2). It is important to know the direction of monetary policy following these reforms.

This paper is therefore motivated by the fundamental role of monetary policy for macroeconomic stability, particularly price stability, and its subsequent implication for economic growth. The application of these ideas to Ghana, a small open developing economy, will contribute to the limited literature on monetary policy transmission in developing countries.

The paper proceeds as follows. Section 2 sets up the model. Section 3 extends the basic model for estimation and comments on the data. Section 4 discusses the empirical results from the monetary reaction functions. Section 5 concludes.

2. The Model

2.1 Taylor Rule and Its Applicability to Developing Countries

The theoretical foundation for the analysis, the original Taylor rule (Taylor, 1993), is:

$$i_t = \beta_0 + \beta_1(\pi_t - 0.02) + \beta_2(y_t - \tilde{y}_t) \quad (1)$$

Where i_t denotes the central bank's nominal interest rate (or instrument of policy); π_t , the inflation rate; $(y_t - \tilde{y}_t)$ is the output gap with y_t being the log of real GDP; and \tilde{y}_t , the log of potential output identified empirically with a linear trend. The number 0.02 is the 2 per cent inflation target, and β_0 is a benchmark recommendation when inflation and output are on target. This benchmark is also the sum of the 0.02 per cent inflation target and the assumed 0.02 per cent equilibrium real interest rate. The inflation gap and output gap coefficients are β_1 and β_2 respectively (Note 3).

The rule has been modified and used for many emerging economies (Aklan and Nargelecekenlar, 2008 and Vasicek, 2009). Taylor (2000) argues that market conditions in emerging market economies may require modifications to the rule recommended for the United States and economies with more developed financial markets.

2.2 An Adaption of the Taylor Rule

This paper proposes a rendition more suited to Ghana as a developing country following similar work by Hagan, 2004. This adapted rule involves amending two aspects of the rule: the inflation target and the equilibrium real interest rate. In May 2007, Ghana formally adopted an 'explicit' inflation targeting framework for its monetary policy, after five years of implicit inflation targeting (Note 4). The numerical target/forecast range for headline inflation is announced in the context of the annual budget, and the Bank of Ghana (BOG) communicates regularly its goals and decisions with the public and the markets. The central bank in May 2007 announced a medium term headline inflation target of 5 per cent with a band of +/- 1 per cent (Note 5) that has been the bank's unannounced target for many years following the financial reforms. The bank also set some intermediate inflation targets/forecasts to achieve the medium term goal by the end of 2010 (Note 6) and keep headline inflation at 5 per cent target in the long run. Thus, the first modification of the Taylor rule is to replace 0.02 with 0.05 as Ghana's inflation target. Another difference is that in Ghana, the target is headline inflation unlike many inflation targeting economies where core inflation is the usual target.

The second modification involves using a more suitable equilibrium real interest rate, the rate of interest on a long term index linked bond. The interest rate on a five year Ghanaian bond (Golden Jubilee Saving Bonds) launched in March 2008 is 16.1 per cent. The annual inflation rate is about 10 percent (BOG, 2009). Thus, the appropriate equilibrium real rate is taken as 6 percent (Note 7). Ghana's real GDP growth rate has averaged between 5.0 and 6.0 per cent in the last five years (BOG, 2009).

The figure 0.06, thus, replaces the 0.02 equilibrium real interest rate of the Taylor rule. With these two modifications and using Taylor's proposed values of $\beta_1=1.5$ and $\beta_2 = 0.5$, the rule amended for Ghana is:

$$i_t = 0.11 + 1.5(\pi_t - 0.05) + 0.5(y_t - \tilde{y}_t) \quad (2)$$

The benchmark recommendation, being the sum of the estimated equilibrium real interest rate and the inflation target, is now 11 per cent.

Teles and Zaidan (2010) argue that policy reaction functions of the Taylor specification assume stationarity of the data series. For developing countries and countries undergoing financial reforms, stationarity of data cannot be taken for granted.

To solve the stationarity problem, this paper adopts the conditional error-correction model (ECM) developed by Pesaran, Shin and Smith (2001), which is robust to the stationarity properties of the data. This model works well whether the underlying regressors are purely I(1), I(0) or mutually cointegrated.

The conditional ECM to estimate is given by (Note 8)

$$\Delta i_t = c_0 + b_1 i_{t-1} + b_2 \text{inflation.gap}_{(t-1)} + b_3 \text{output.gap}_{(t-1)} + \sum_{j=1}^k \sum_{m=0}^p \psi_{jm} \Delta X_{j(t-m)} + \sum_{m=1}^p \delta_m \Delta i_{t-m} + \mu_t \quad (3)$$

Where $c_0 \neq 0$; i_t is the policy interest rate, $\Delta X_{j(t-m)}$ the inflation gap and output gap vector in difference, and μ_t serially uncorrelated errors. The model allows for both short run and long run dynamics and provides a link between the variables and the steady state equilibrium.

The long run coefficients are derived by assuming that all variables are constant in equilibrium, so that Equation (3) reduces to:

$$c_0 + b_1 \text{policy.rate} + b_2 \text{inflation.gap} + b_3 \text{output.gap} + \mu = 0 \quad (4)$$

The constant and level explanatory variables then have their long run parameters given by:

$$w_0 = c_0 / -\hat{b}_1, \quad w_1 = \hat{b}_2 / -\hat{b}_1 \quad \text{and} \quad w_2 = \hat{b}_3 / -\hat{b}_1$$

where b_1 is the coefficient on the lagged level policy rate variable, c_0 is the constant term, b_2 and b_3 are the coefficients associated with the lagged level explanatory variables (inflation gap and output gap) in the short run model. Therefore equation (4) can be re-arranged as (Note 9):

$$\text{policy.rate} = w_0 + w_1 \text{inflation.gap} + w_2 \text{output.gap} + \mu \quad (5)$$

The inflation gap and output gap coefficients are compared, respectively, with the original Taylor rule values of 1.5 and 0.5 Taylor (1993), to assess the inflation stabilising policy rule of the central bank.

3. Data and Model Estimation

The strict inflation targeting rules are estimated using monthly data from 1993:01 to 2011:12 on the policy rate and inflation, and the output gap is added to estimate the Taylor rule (Note 10). The instrument of monetary policy used is the policy rate. The headline inflation is measured by its seasonally-adjusted annual percentage change. Data is drawn from the IMF international financial statistics database and the monetary time series database of the Bank of Ghana (Note 11).

In the empirical analysis, the pace of economic activity is measured using the Hodrick and Prescott filter as the deviation from growth or trend of the log of real seasonally adjusted private sector credit, following Khan (2003) and Hagan (2004) (Note 12). The Hodrick and Prescott filter assumes that the growth component which is a function of time is extracted from the log of real seasonally adjusted private sector credit through the minimisation of the transitory component. Hodrick and Prescott (1997) propose a 'lambda' value of 100 multiplied by the square of the frequency of output for their filter (Note 13).

The paper seeks to investigate two inflation stabilising policy rules scenarios with the data: the first being one of strict inflation targeting; and the other, that inflation gap and the output gap, as proposed in the Taylor rule, are the important variables that predict interest rate behaviour.

4. Empirical Results

This section characterises Ghana's monetary policy by investigating the consistency of two hypotheses for inflation control. It thus investigates first, inflation targeting in its basic form; and second, using the inflation and output gaps for monetary policy conduct.



Figure 1. A plot of the Policy rate and Inflation

The figure above shows inflation has been much more volatile than the policy rate. It also shows a sharp fall, then continuous decline thereafter, in the policy rate in 2002, which may be a sign of a structural break in the dataset. A dummy variable (taking the value 0 to 2002:03 and 1 from 2002:04) is included to check for structural breaks. Increased government spending and a rise in dollarization leading to the general election in December, 1996 contributed to high inflation in that year. The sharp rise in inflation in February 2003 came from both food and non food sources as a result of high food prices and a weakened exchange rate. The estimation results are presented in Table 1 and 2.

4.1 Short Run Analysis

Investigating the strict inflation targeting scenario with the data involves the use of lags of monthly changes of inflation gap and the policy rate in both forward and backward looking inflation stabilising rules. The dummy variable is significant in the backward looking model (see appendix Table 2) confirming a structural break in the data set. The data is therefore split in two, to investigate strict inflation targeting. Results of the dataset from 1993:01 to 2002:03 are shown as equation 3a (1) and that of the dataset from 2002:04 to 2011:12 as equation 3a (2). The final form of the model which includes the output gap with dataset from 2002:04 to 2011:12 is shown as equation 3b. The forward and backward looking inflation stabilisation rules consistent with the Taylor rule begin with twelve lags of monthly changes in the policy rate (Note 14), inflation gap and the output gap are reported in appendix Tables 1 and 2 respectively.

Comparing F -statistic and t -statistic of both the backward-looking models and the forward-looking models with their 5 per cent critical value bounds confirms the existence of a relationship in levels of forward-looking equations 3a (2) and 3b (Note 15). The statistics also confirms that a relationship exist in backward-looking equation 3a (1) and confirms the presence of a structural break in the backward-looking model (Note 16)

The inflation gap in levels is correctly signed and significant in equation 3a (2) suggesting that the period from 2002:04 to 2011:12 appears to show some form of inflation targeting from the short run analysis. The policy regime that started after the central bank's operational independence in March 2002 allows for the monetary policy committee of the central to meet and reassess the policy rate every other month. A negative differential intercept (dummy) coefficient confirms a monetary policy shift from high policy rates between 1993 and March 2002 to low policy rates after March 2002 as headline inflation falls.

4.2 Long Run Analysis

From equation 5, the long run coefficients for equation 3a (1) are given by:

$$policy.rate = 0.262 + 0.354 inflation.gap$$

The low coefficient on the inflation variable suggests that monetary policy did not follow strict inflation targeting in Ghana in the period from 1993:01 to 2002:02.

The long run coefficients for equation 3a (2) is given by:

$$policy.rate = 0.088 + 0.725 inflation.gap$$

The higher inflation coefficient may result from the central bank establishing an implicit inflation targeting framework in 2002, though the value is not identical to the reference value of 1.5 proposed by the original Taylor rule. It thus represents a shift in the policy framework of the central bank's inflation stabilisation policy in the period 2002:04 to 2011:12. This period shows less volatility, declining inflation and the policy rate.

Repeating this exercise for Equation 3b yields:

$$policy.rate = 0.092 + 0.737 inflation + 0.066 output.gap \text{ (Note 17)}$$

The insignificant policy rate response to the output gap and the small policy rate response to inflation - less than the reference value of 1.5 proposed by the original Taylor rule and even lower than unity (Note 18) - suggests an absence of central bank commitment to price stability based on the Taylor rule over 2002:04 to 2011:12.

The use of detrended private sector credit as a proxy for output gap only makes sense if there is a strong same directional relationship between the two variables. Also since detrended private sector credit is a cyclical measure which corresponds to economic fluctuations, mainly relating to the cyclical components in the economy, the insignificance of the output gap proxy may be due to shocks dominating private sector credit availability following financial and economic reforms.

5. Conclusions

Taylor rule models have been a benchmark for describing a good monetary policy. However, many authors have proposed various renditions of the standard Taylor rule specification to account for differences in structure and stages of economic and financial reforms.

Results from this Taylor rule show a weak relationship between the policy rate and inflation, suggesting that the central bank is executing an accommodative monetary policy, though excess liquidity may be a problem too (Note 19). The insignificance of the output gap may be due to shocks dominating private sector credit volatility since this paper uses de-trended private sector credit as a proxy for output gap. Detrended private sector credit is a cyclical measure which this paper assumes corresponds to economic fluctuations, mainly related to the cyclical components in the economy.

However, following the financial sector reforms which started in 1992 and in particular after March 2002 the central bank has made progress in its inflation stabilising policy. The strict inflation targeting is intended to provide benefits in terms of a credible commitment to controlling inflation, along with a more consistent and predictable monetary policy direction. The relatively stronger link between the policy rate and inflation after March 2002 represents a shift in the policy framework in the central bank's inflation stabilisation policy.

The answer may well be with a shift from short term inflation forecasts and a target that is either not announced or not credible as a primary monetary objective to explicit inflation targeting with a clearer commitment to controlling inflation. This policy framework would include announced inflation targets in the medium term and would allow policy rate increases to levels that are necessary to keep inflation within the target boosting policy credibility and, ultimately, ensuring low inflation.

Finally, a mainstream approach in literature is to estimate the constant term as the sum of equilibrium real interest rate and the inflation target. However, because of the difficulties in deriving accurate measures of these variables from the data and the fact that the models do not adequately describe the conduct of monetary policy in Ghana, this paper does not give any structural interpretation to the constant term.

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Notes

Note 1. The Central African grouping, known as CEMAC (Communauté Économique et Monétaire de l'Afrique Centrale) was established by Cameroon, Central African Republic, Chad, Congo, Equatorial Guinea and Gabon to promote economic integration among countries that share a common currency, the CFA franc.

Note 2. Structural and institutional reforms to encourage competition and the development of the bond market among others.

Note 3. Taylor (1993) proposes $\beta_1=1.5$ and $\beta_2 = 0.5$ to accurately predict US Federal Reserve rates over the period 1987-1992.

Note 4. Where Ghana established an inflation target but did not announce it as its primary monetary policy objective.

Note 5. See Alichì et al (2009).

Note 6. A missed target, headline inflation was 8.58 per cent in December 2010 and 10.75 yearly average.

Note 7. This paper uses a simple method to determine the equilibrium real interest rate as there is no available time series data on it.

Note 8. It's a backward-looking model.

Note 9. See Pesaran, Shin and Smith (2001).

Note 10. Institutional arrangements were put in place by 1993 to facilitate indirect monetary management following the economic recovery programme which began in 1983 and was completed in 1992.

Note 11. Both the IMF and the Bank of Ghana use the same variable names.

Note 12. Gross domestic product data is not available on a monthly basis.

Note 13. For monthly data 'lambda' is 14400.

Note 14. The number of lags is determined by the Akaike Information Criteria.

Note 15. See Pesaran, Shin and Smith (2001) for critical values.

Note 16. See tables in appendix.

Note 17. Not significant at 10 per cent.

Note 18. See Clarida et al., (2000).

Note 19. See Saxegaard (2006).

Appendix

Table 1. Short Run Forward-Looking Analysis Results (created using EViews)

Regressor	Structural Break Test	Equation 3a(1)	Equation 3a(2)	Equation 3b
C	0.008	0.005	0.007	0.007
policy.rate(-1)	(0.006)	(0.008)	(0.003)	(0.003)
inflation.gap	-0.043**	-0.030	-0.080**	-0.076**
dpolicy.rate	(0.017)	(0.025)	(0.025)	(0.025)
dummy	0.028**	0.023**	0.058**	0.056**
output.gap	(0.008)	(0.010)	(0.019)	(0.020)
	0.197**	0.316**	-0.201**	-0.201**
	(0.066)	(0.094)	(0.090)	(0.091)
	-0.004			0.005
	(0.003)			(0.012)
R-squared	0.128	0.186	0.113	0.114
F-statistic	8.090	8.061	4.753	3.541
SE of regression	0.012	0.015	0.008	0.008
policy.rate(-1) <i>t</i> -statistic	-2.493	-1.200	-3.242	-3.081

Table 2. Short Run Backward-looking Analysis Results (created using EViews)

Regressor	Structural Break Test	Equation 3a(1)	Equation 3a(2)	Equation 3b
C	0.012	0.017	0.003	0.003
policy.rate(-1)	(0.006)	(0.008)	(0.003)	(0.003)
inflation.gap	-0.050**	-0.065**	-0.027	-0.026
dpolicy.rate	(0.018)	(0.025)	(0.025)	(0.025)
dinflation.gap	0.0216**	0.023**	0.002*	0.001
dummy	(0.008)	(0.010)	(0.020)	(0.021)
output.gap	0.239**	0.384**	-0.202**	-0.202**
	(0.065)	(0.089)	(0.087)	(0.088)
	0.069*		-0.145**	0.146**
	(0.040)		(0.043)	(0.043)
	-0.006*			0.001
	(0.003)			(0.012)
R-squared	0.141	0.189	0.132	0.132
F-statistic	7.166	9.387	4.263	3.382
SE of regression	0.012	0.015	0.008	0.008
policy.rate(-1) <i>t</i> -statistic	-2.833	-2.593	-1.071	-1.029

Notes: ** Significant at 95% confidence level; * Significant at 90% confidence level

The dependent variable is change in the policy interest rate, dpolicy. rate. Standard errors are in parentheses. Variables preceded by 'd' are the one month differences of the respective variable in levels.

Weak-Form Market Efficiency: Evidence from the Brazilian Stock Market

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Abstract

We investigate the predictive power of various trading rules with different combinations of the most popular indicators in technical analysis for the Brazilian stock index (BOVESPA) over the period of 5/1/1996 to 3/1/2011, or 14.83 years. The empirical results show that all the buy-sell differences under single, double and triple-indicator combinations are insignificant in t-test; that is, technical trading models cannot beat the buy and hold strategy. Although few multiple-indicator trading models show profitability, their predictive power is eliminated after considering the possible interest earning from money market in the days out of stock market. The results support strongly the weak form of market efficiency for the Brazilian stock market.

Keywords: emerging markets, hypothesis testing, market efficiency, profitability

1. Introduction

Since Fama (1970) defined the Efficient Market Hypotheses (EMH) asserting that stock prices already reflect all available information, numerous empirical studies have been trying to confirm or oppose it in a stock market. There are three forms or levels of EMH:

Strong efficiency - All information in a market, whether public or private, is accounted into a stock price. No investor can earn excess return.

Semi-strong efficiency - All public information in a market is accounted into a stock price. Neither fundamental nor technical analysis can beat a market to achieve superior gains.

Weak efficiency - All past stock prices are reflected in today's price. Fundamental analysis can be used to identify stocks that are undervalued and overvalued and investors can choose a profitable company by researching its financial statements. However, technical analysis cannot be used to predict and beat a market.

Contrast to fundamental analysis focusing on income statement or balance sheet of a company, technical analysis is based upon the assumption that past price, past volume and many other indicators calculated by past data can signal future price movements. As Pring (1991) noted, "The art of technical analysis is to identify trend changes at an early stage and to maintain an investment posture until the weight of evidence indicates that the trend has reversed." Murphy (1999) also defined technical analysis as the study of market action through the use of charts for the purpose of forecasting future prices, in which a market action can be price, volume, or open interest. As a result, in order to prove the predictive power of technical analysis, stock technicians test the Weak-Form Efficient Market Hypotheses (WFEMH) by the following two approaches: (1) using the past return series or price information to determine the existence of predictability by random walk testing, or (2) applying various trading rules to seek any profit-making strategy which can drive profits above a general buy-and-hold strategy; in other words, whether trading rules can beat the market or not.

Since the Millennium, stock markets in the fast growing emerging economies have attracted the attention of the researchers and investors across the globe. With the increased movement of investments into emerging markets, greater importance is also given to the understanding of the market efficiency in emerging markets. Among the emerging countries, Brazil, Russia, India and China (BRIC) are recognized as the most influential in the new world economy to raise more interests in testing the WFEMH. Not surprisingly, in a transition period from emerged to developed, BRIC stock markets are considered to be immature due to the altering legislation environment and market structure. Investors are expected to achieve superior gains from private information or profitable trading rules. Most recently empirical works applying either random walk testing or trading rule approach, also confirm the

market inefficiency in the BRIC countries except for Brazil. The Brazilian stock index (BOVESPA) has shown relatively ambiguous testing results of the WFEMH compared with those in Russia, India and China. Some comparative studies conclude that the Brazilian stock market is more efficient than the others but cannot confirm its weak form market efficiency. Some studies only confirm the WFEMH for a certain sector or size of firms. Whether trading rules can beat the Brazilian stock market to reject the WFEMH is still questionable.

In order to obtain a more convinced result for market efficiency, we employ various trading rules with different combinations of the most popular indicators in technical analysis to test the WFEMH in the Brazilian stock index (BOVESPA) over the period of 1996 to 2011. The empirical results show that all the buy-sell differences, under our 32 trading rules of single, double or triple-indicator combinations, are insignificant in t-test. That is, none of the trading model can beat the buy-and-hold strategy for superior gains. The results support strongly the WFEMH for the Brazilian stock market in a long period. Section 2 discusses a brief literature review. The data and methodology are shown in Section 3. Section 4 presents our findings and the final section concludes.

2. Literature Review

Early literatures of efficient market hypothesis (EMH) supported the futility of technical analysis in many financial markets around the world. However, since the mid 1980s, there have been numerous empirical studies supporting the predictability and profitability of technical trading rules in stock markets. The origin of this new found interest was from a few influential academic articles by Sweeney (1986), Lukac, Brorsen & Irwin (1988), and Brock, Lakonishok & Lebaron (1992). After these three studies, many academicians have pursued their works and published a myriad of papers in opposition to the efficient market hypothesis by constructing technical trading rules to beat the market rather than using the random walk testing. Applying the moving average trading rule in Brock et al. (1992), numerous studies such as Hudson, Dempsey & Keasey (1996), Rodríguez, Sosvilla & Andrada (1999) and Kwan, Lam, So & Yu (2000) proved the predictive power of technical analysis in the UK stock market, Madrid Stock Exchange and the Hang Seng Index Futures respectively. Since the twenty-first century, there were even more studies applying a variety of indicators to prove the profitability of technical analysis in stock markets around the world. For example, Kwon and Kish (2002) confirmed that technical trading rules can add a value to capture profit opportunities over a buy and hold strategy for the NYSE value-weighted index. Metaghalchi and Chang (2003) and Chang, Metgchalchi & Chan (2006) applied various moving average rules to conclude the profitability of technical trading in the Italian and the Taiwanese stock markets. Wong, Manzur & Chew (2003) investigated the Singapore data to indicate that the moving average and the relative strength index (RSI) can be used to generate significantly positive return. Vasiliou, Eriotis & Papathanasiou (2006) supported the profitability of moving average convergence divergence (MACD) in the Athens Stock Market. Lento (2007) examined the effectiveness of nine technical trading rules, including filter rules (momentum strategies) in many Asian-Pacific stock markets and concluded that technical trading rules are more profitable in most of the markets except the Nikkei index. Metgchalchi, Chang & Marcucci (2008), Metgchalchi, Du & Ning (2009), Metgchalchi and Garza-Gomez (2011), and Chen, Metgchalchi & Garza-Gomez (2011) presented that the technical trading rules including directional movement system (DMS) and parabolic stop and reverse (PSAR), can beat the buy and hold strategy in the Swedish market, four Asian stock markets, the Abu Dhabi stock index, and the Danish stock market respectively. The Weak-Form Efficient Market Hypotheses (WFEMH) has been rejected successfully by the profitability of trading rules with a variety of indicators in several relatively developed counties.

For the emerging economies such as the BRIC countries, most previous studies in the market efficiency use the past return series or price information to determine the existence of predictability by random walk testing. McGowan and Ibrihim (2009) investigated the Russian stock index in the period of 1995 to 2003 and confirmed the day-of-the-week effect to reject its weak-form market efficiency. Chong, Cheng & Wong (2010) also found that the Russian market is the most insufficient of market efficiency among BRICs. For India, Poshakwale (1996) provided evidence of the day-of-the-week effect in Bombay Stock Exchange over a period of 1987-1994. Both Gupta and Yang (2011) and Kumar and Kumar (2012) applied random walk test for the period of 1997 to 2011 in the major equity markets BSE and NSE in India to reject the weak-form efficiency for daily data. Mitra and Mitra (2011) analyzed the profitability of moving average based trading rules and concluded that profit opportunities from technical analysis continue to remain an interesting and debatable issue in the Indian stock market. For China, Lim, Habibullah & Hinich (2009) mitigated the confounding effect of thin trading on return autocorrelation to examine both the Shanghai and Shenzhen Stock Exchanges. The weak-form market efficiency is rejected in certain time periods. Liu (2011) employed unit root test and autocorrelation function to examine the period over 2000 to 2008. Again, the weak-form efficiency in the Chinese stock market is rejected.

Interestingly, the empirical studies for the Brazilian stock market presented relatively ambiguous results for market efficiency. Guttler (2008) employed both co-integration analysis and a variety of Granger causality tests to reject the

semi-strong market efficiency for the Brazilian stock index (BOVESPA) in the period from 1995 to 2005. It was found to be inefficient in line with most results for other emerging markets. Chong et al. (2010) compared the stock market efficiency of all the BRICs over the period of 1995 to 2008 to test the profitability of trading rules. It found that the Brazilian market is the most efficient among the BRICs but the WFEMH is still not supported. Ely (2011) grouped stocks by sector and firm size with data from 1999 to 2008 in the Brazilian stock market to examine the market efficiency by conducting an automatic variance ratio test. Stocks from the industrial sector are found highly predictable and stocks from small firms tend to be more predictable than the ones from large firms. The Brazilian stock market shows an increase of efficiency since 1994. However, there is still lack of strong evidence to support or reject the weak-form market efficiency for the Brazilian stock market.

3. Data and Methodology

We obtained the daily price data from the DataStream, including close, high, low and open, for the Brazilian stock index (BOVESPA) from 5/1/1996 to 3/1/2011, or 14.83 years. The period is the longest among all recent studies related to the Brazilian stock market efficiency. For the interest rate adjustment, we also used the DataStream's Brazilian overnight rate. A number of technical trading rules with two or three popular indicators in technical analysis are applied into the BOVESPA. When a trading rule emits a buy signal, then we will be in the market (buy days); otherwise we will be out of the market (sell days).

3.1 Technical Analysis Indicators

Similar to Chen et al. (2011), the following six popular indicators are used in our trading rules: Moving Average (MA), Relative Strength Index (RSI), Directional Movement System (DMS), Parabolic Stop and Reverse (PSAR), Moving Average Convergence Divergence (MACD) and Stochastic indicator.

1) Moving Average (MA): Only MA20 and MA50 are chosen. A buy signal is emitted when the price is above MA and a sell signal is emitted when the index goes below MA.

2) Relative Strength Index (RSI): The RSI indicator was developed by Wells Wilder (1978). It is generally constructed by using 14 day, 9 day or 3 day period. The calculation of n -day RSI ($RSI-n$) is described as the following:

AU_n = Average of n days' up closes

AD_n = Average of n days' down closes

$$RSI - n = \frac{AU_n}{AU_n + AD_n} \times 100$$

Given the definition, every RSI ranges from 0 to 100. In our trading rules, a buy signal is emitted if RSI is above 50 (buy day). Otherwise, we will be out of the market and it will be a sell day.

3) Directional Movement System (DMS): The DMS is another widely used indicator developed by Wells Wilder (1978). It consists of two directional daily movements, positive directional index (PDI) and negative directional index (NDI), signifying the up and down movements respectively. The signals are constructed in the following:

Positive directional movement (PDM) = $H - H_p$

Negative directional movement (NDM) = $L_p - L$

H = the highest price today

H_p = the highest price yesterday

L_p = the lowest price yesterday

L = the lowest daily price today

If $PDM < 0$ and $NDM < 0$ or $PDM = NDM$, then $PDM = 0$ and $NDM = 0$.

If $PDM > NDM$, then $NDM = 0$.

If $NDM > PDM$, then $PDM = 0$.

We also define the True Range (TR) as the maximum difference of the following:

$TR = \text{Max} (|H-L|, |H-C_p|, |C_p-L|)$, where C_p is the closing price of previous day.

Similar to Wilder (1978), we also employ the exponential smoothing technique of 14-day to smooth PDM, NDM and TR. Finally, the positive directional index (PDI) and negative directional index are:

$PDI = \text{Smoothed PDM} / \text{Smoothed TR} = SPDM / STR$

NDI = Smoothed NDM/Smoothed TR= SNDM/STR

We will be in the market if PDI is greater than NDI (buy day); otherwise, we will be out of the market (sell day).

4) Parabolic Stop and Reverse (PSAR): It is the third indicator used in Wilder (1978). The value of PSAR serves as a benchmark for the up and down trend. In a bull (bear) market, it is below (above) the market price. The daily PSAR values are calculated as

$$SAR_{i+1} = SAR_i + AF*(EP_i - SAR_i),$$

where SAR_i is the PSAR value in the previous day and EP_i (Extreme Price) is the highest or the lowest price in the previous day. AF is the acceleration factor increasing by 0.02 whenever the EP is changing. Recommended in Wilder (1978), AF is capped at 0.20 for a better adjustment. When the index is above the PSAR value, we will be in the market (buy day) otherwise we will be out of the market (sell day).

5) Moving Average Convergence Divergence (MACD): This technical indicator, created by Appel (1974), shows the difference between exponential moving average (EMA) of 26 and 12 days. Then we construct a simple 9-day moving average of the MACD as the signal line and develop the histogram as follow:

$$MACD = EMA(CLOSE, 12) - EMA(CLOSE, 26)$$

Signal Line = Simple 9-day moving average of MACD

Histogram = MACD – Signal Line

Three trading rules are tested as follow: (i) a buy signal is emitted when the histogram is positive and we will be in the market (buy day) otherwise we will be out of the market as soon as the histogram becomes negative (sell day); (ii) a buy signal is emitted when the histogram is increasing and we will be in the market (buy day) otherwise we will be out of the market (sell day); and (iii) a buy signal is emitted when the histogram is increasing and greater than zero and we will be in the market (buy day) otherwise we will be out of the market (sell day).

6) Stochastic: The last popular indicator used in this paper is the stochastic indicator developed by Dr. George Lane in late 1950s, the Stochastic Oscillator. Two lines, the %K line and %D line, are constructed as the following to determine the signals:

$$\%K(\text{today}) = 100 \times \frac{\text{close}(\text{today}) - \text{lowest low of past } N \text{ days}}{(\text{high} - \text{low}) \text{ range of past } N \text{ days}}$$

%D = 3-day exponential moving average of %K

In practice, 5, 9 and 14-day periods are commonly used by technicians. In order to be consistent with our previous works, we use the 9-day stochastic in this paper for more significant results. Another line, the %D-slow line constructed by 3-day simple moving average of %D, separates the stochastic indicators into fast and slow for more trading models:

Fast stochastic (%K and %D lines)

Slow stochastic (%K and %D-slow lines)

A buy signal is emitted (for both fast and slow stochastic indicators) if %K is above %D and if %K is increasing (buy day); otherwise we will be out of the market (sell day).

3.2 Models for Testing

In this paper, we test 32 models based on different combinations of the six indicators. They are categorized in the following three groups with single, double and triple indicators:

3.2.1 Single-Indicator Models (1~13)

Model 1: MA20. The model emits buy when the price goes above MA20 (buy day) and emits sell signal when the index goes below MA20 (sell day).

Model 2: MA50. The model emits buy when the price goes above MA50 (buy day) and emits sell signal when the index goes below MA50 (sell day).

Model 3: PSAR. If the stock index level is above PSAR, then it is a buy day; otherwise, it is a sell day.

Model 4: RSI-14. If it is above 50 then it is a buy day; otherwise, it is a sell day.

Model 5: RSI-9. If it is above 50 then it is a buy day; otherwise, it is a sell day.

Model 6: RSI-3. If it is above 50 then it is a buy day; otherwise, it is a sell day.

Model 7: Fast Stochastic. If %K line is above %D line, then it is a buy day; otherwise, it is a sell day.

Model 8: Increasing Fast Stochastic. If %K line is increasing and above %D line, then it is a buy day; otherwise, it is a sell day.

Model 9: Increasing Slow Stochastic. If %K line is increasing and above the %D slow-line, then it is a buy day; otherwise, it is a sell day.

Model 10: DMS. If the value of positive DI is greater than that of negative DI, then it is a buy day; otherwise, it is a sell day.

Model 11: MACD. If histogram is greater than zero, then it is a buy day; otherwise, it is a sell day.

Model 12: MACD. If histogram is increasing, then it is a buy day; otherwise, it is a sell day.

Model 13: MACD. If histogram is increasing and greater than zero, then it is a buy day; otherwise, it is a sell day.

3.2.2 Double-Indicator Models (14~24)

Given the 13 single-indicator models, we are supposed to develop more than 100 combinations of double-indicator models. However, in order to explore the significant results efficiently, we focus on the single-indicator models which demonstrate a relatively significant difference between the mean returns of buy days and sell days shown in Table 1. As a result, we pick the moving average, RSI-9 and 14, increasing fast stochastic and DMS, to construct the combinations of double and triple-indicator models.

Model 14: Combination of Model 1 (MA20) and Model 7 (Fast Stochastic). If stock index is above MA20 and %K is above %D, then we are in the market (buy day); otherwise, it will be a sell day.

Model 15: Combination of Model 1 (MA20) and Model 10 (DMS).

Model 16: Combination of Model 1 (MA20) and Model 4 (RSI 14).

Model 17: Combination of Model 1 (MA20) and Model 13 (MCAD).

Model 18: Combination of Model 2 (MA50) and Model 8 (Increasing Fast Stochastic)

Model 19: Combination of Model 2 (MA50) and Model 10 (DMS).

Model 20: Combination of Model 2 (MA 50) and Model 4 (RSI-14).

Model 21: Combination of Model 2 (MA 50) and Model 13 (MCAD).

Model 22: Combination of Model 8 (Increasing Fast Stochastic) and Model 10 (DMS).

Model 23: Combination of Model 5 (RSI-9) and Model 10 (DMS).

Model 24: Combination of Model 8 (Increasing Fast Stochastic) and Model 12 (MCAD)

3.2.3 Triple-Indicator Models (25~32)

Model 25: Combination of Models 1, 8 and 10; a buy signal is emitted when price is above MA 20, and %K is increasing and above %D, and PDI is above NDI. Otherwise, we will be out of the market (sell day).

Model 26: Combination of Models 2, 8 and 10.

Model 27: Combination of Models 1, 8 and 12.

Model 28: Combination of Models 1, 8 and 4.

Model 29: Combination of Models 2, 8 and 5.

Model 30: Combination of Models 10, 8 and 4.

Model 31: Combination of Models 10, 8 and 5.

Model 32: Combination of Models 1, 8 and 5.

3.3 Hypothesis Testing

For each model, the mean buy and mean sell returns are defined as follows:

$$X(b) = \frac{1}{N(b)} \sum R_b \quad (1)$$

$$X(s) = \frac{1}{N(s)} \sum R_s \quad (2)$$

$N_{(b)}$ and $N_{(s)}$ are total number of buy and sell days; R_b and R_s are daily returns of buy and sell days for each model. We then test whether the mean returns of buy days and sell days are different than the mean return of buy-and-hold (B&H) strategy (h). In addition, we also test whether the mean buy is different than the mean sell. The three null and alternative hypotheses are expressed as:

$$\begin{aligned} H_{0b} : X(b) - X(h) = 0 & & H_{0s} : X(s) - X(h) = 0 & & H_0 : X(b) - X(s) = 0 \\ H_{Ab} : X(b) - X(h) \neq 0 & & H_{As} : X(s) - X(h) \neq 0 & & H_A : X(b) - X(s) \neq 0 \end{aligned}$$

$X(h)$ is the mean return for the buy-and-hold strategy. Following Kwon and Kish (2002), the test statistic for the mean buy returns over the mean buy-and-hold strategy is:

$$t = \frac{X(b) - X(h)}{\sqrt{Var(b)/N_b + Var(h)/N_h}}, \quad (3)$$

where $Var(b)$ and $Var(h)$ are the variances of buy, and B&H returns respectively. By replacing the appropriate variables, the above formula can be also used to test the mean sell returns over the mean B&H strategy, and the mean buy returns over the mean sell returns.

4. Empirical Findings

The summary statistics for the B&H strategy for the entire period is as follow: the mean daily return of the B&H is 0.00061 (0.061 percent per day) for an annual arithmetic average of 15.64 % (Sum of daily returns divided by 14.83). The daily standard deviation of return for the B&H strategy is 0.02196 and the number of observation are 3818 days.

Table 1 presents the results of our first 13 single-indicator models. The results are surprisingly weak compared with those for the other countries. No single model has a t-test statistic greater than 1.96 or less than -1.96, the critical t-values at 5 percent level for large number of observations for a two-tailed test. That is, none of single-indicator trading rules can beat the market buy and hold strategy. Column 2 displays the difference of mean returns between buy days and B&H; Column 3 displays the difference of mean returns between sell days and B&H; Column 4 reports the difference of mean returns between buy days and sell days; Columns 5 and 6 report the standard deviations of returns on buy and sell days. Finally, Columns 7 and 8 show the total number of buy and sell days; the numbers in the parentheses are the t-statistics (i.e. Equation (3)) testing the difference of the mean buy and mean sell from the mean of B&H, and buy-sell from zero.

Table 1. Single-indicator models

Models	$X(b) - X(h)$	$X(s) - X(h)$	$X(b) - X(s)$	$SD(b)$	$SD(s)$	$N(b)$	$N(s)$
1	0.00120 (1.18)	-0.00031 (-1.16)	0.00151 (1.90)	0.01733	0.02760	2315	1503
2	0.00087 (0.54)	0.00017 (0.53)	0.00070 (0.85)	0.01676	0.02855	2377	1441
3	0.00057 (-0.65)	0.00066 (-0.63)	-0.00009 (-0.11)	0.01793	0.02670	2248	1570
4	0.00099 (0.77)	0.00001 (-0.74)	0.00098 (1.22)	0.01681	0.02819	2330	1488
5	0.00096 (0.70)	0.00007 (0.67)	0.00089 (1.12)	0.01702	0.02783	2301	1517
6	0.00046 (-0.29)	0.00081 (0.27)	-0.00035 (-0.46)	0.01775	0.02661	2191	1627
7	0.00107 (0.78)	0.00015 (-0.72)	0.00082 (1.29)	0.02055	0.02330	1918	1900
8	0.00130 (1.11)	0.00014 (-0.78)	0.00116 (1.64)	0.02026	0.02303	1533	2285
9	0.00118 (0.89)	0.00028 (-0.56)	0.00090 (1.27)	0.01978	0.02313	1399	2419
10	0.00112 (1.03)	-0.00004 (-0.86)	0.00116 (1.54)	0.01643	0.02733	2119	1699
11	0.00060 (-0.01)	0.00062 (0.01)	-0.00002 (-0.02)	0.01875	0.02508	2018	1800
12	0.00076 (0.25)	0.00046 (-0.23)	0.00030 (0.41)	0.02103	0.02282	1856	1962
13	0.00103 (0.62)	0.00046 (-0.27)	0.00057 (0.79)	0.01806	0.02321	1009	2809

$X(b)$ and $X(s)$ are the mean returns of the buy and sell days. $X(h)$ is the mean return for the buy-and-hold strategy. $N(b)$ and $N(s)$ are the number of buy and sell days. $SD(b)$ and $SD(s)$ are the standard deviation of buy and sell days. The numbers in the parentheses are the t-statistics testing the difference of the mean buy and mean sell from the mean of buy and hold, and buy-sell from zero.

In order to illustrate the meaning of numbers in Table 1, let us choose the row of Model 1 which reports the results of moving average 20 (MA20) model as an example. We will be in the market (buy days) if the BOVESPA index is greater than MA20 and out of the market (sell days) if the BOVESPA index is less than or equal to MA20. The mean return difference between buy days and B&H strategy for Model 1 is .00120 (Or 0.120 % per day). To test whether this mean buy day return is different from the mean of the buy and hold strategy, we use Equation (3) to calculate the estimated t-statistic as 1.18. Since 1.18 is less than the critical value of 1.96, we therefore conclude that we cannot reject the null hypothesis that the mean buy returns equal the mean of the buy and hold strategy, in other words, this rule does not beat the market buy and hold strategy. The same conclusion for the mean return difference between sell days and B&H strategy is also reached, since -1.16 is greater than -1.96. We cannot reject the null hypothesis that the mean sell returns equals the mean of the buy and hold strategy. The t-stat for the mean buy minus mean sell is 1.90 which is less than 1.96. We also conclude that the null hypothesis of the equality of the mean buy days and mean sell days cannot be rejected. Columns 5 (SD (b)) and 6 (SD(s)) report the standard deviation of buy and sell days. Because SD(s) is greater than SD(b), it implies that the BOVESPA market is more volatile when the market is going down. Finally the number of buy days and sell days are reported in the last two columns. The next step is to investigate whether the double-indicator trading rules can beat the market or not.

Table 2. Double-indicator models

Models	$X(b) - X(h)$	$X(s) - X(h)$	$X(b) - X(s)$	$SD(b)$	$SD(s)$	$N(b)$	$N(s)$
14	0.00176 (1.84)	0.00020 (-0.71)	0.00156 (2.28)*	0.01626	0.02364	997	2821
15	0.00116 (1.09)	0.00001 (0.083)	0.00115 (1.59)	0.01609	0.02693	1989	1829
16	0.00118 (1.14)	-0.00012 (-0.96)	0.00130 (1.72)	0.01651	0.02736	2138	1680
17	0.00096 (0.53)	0.00050 (0.19)	0.0046 (0.65)	0.01683	0.02329	886	2932
18	0.00117 (0.94)	0.00042 (-0.33)	0.00075 (1.15)	0.01501	0.02385	959	2859
19	0.00114 (1.05)	0.00000 (-0.83)	0.00114 (1.56)	0.01639	0.02695	2036	1782
20	0.00109 (0.97)	-0.00003 (-0.83)	0.00112 (1.47)	0.01647	0.02759	2175	1643
21	0.00136 (1.14)	0.00041 (-0.36)	0.0095 (1.37)	0.01567	0.02336	805	3013
22	0.00157 (1.57)	0.00034 (-0.47)	0.00123 (1.87)	0.01425	0.02363	821	2997
23	0.00114 (1.04)	0.00001 (-0.82)	0.00113 (1.54)	0.01642	0.02685	2020	1798
24	0.00190 (1.63)	0.00030 (-0.56)	0.00160 (1.95)	0.01906	0.02258	727	3091

$X(b)$ and $X(s)$ are the mean returns of the buy and sell days. $X(h)$ is the mean return for the buy-and-hold strategy. $N(b)$ and $N(s)$ are the number of buy and sell days. $SD(b)$ and $SD(s)$ are the standard deviation of buy and sell days. The numbers in the parentheses are the t-statistics testing the difference of the mean buy and mean sell from the mean of buy and hold, and buy-sell from zero. Asterisks denote statistical significance at the 5% level for a two-tailed test.

The results of Table 2 are again very weak. All the t-statistics for both the mean buy days and mean sell days are insignificant. We cannot reject the null hypothesis of the equality of mean buy returns or mean sell returns with the mean of buy and hold returns. There is only one exception, Model 14, the combination of Model 1 (MA20) and Model 7 (Fast Stochastic). The t-statistic of the difference between mean buy days and mean sell days is 2.28 greater than 1.96. We reject the equality of the mean buy returns with the mean of sell returns. One possible explanation for the significant result is from the observation of numbers of days. When we use double-indicator trading rules, the numbers of buy days are significantly lower than the numbers of sell days. The longer period out of the market will certainly reduce the annual return even if the traders decide to be in the money market on those days. The overall results of Table 2 are still very weak to suggest that even using double-indicator trading rules the BOVESPA market, the weak form efficiency is still confirmed in the Brazilian stock market.

Table 3. Triple-indicator models

Models	$X(b) - X(h)$	$X(s) - X(h)$	$X(b) - X(s)$	$SD(b)$	$SD(s)$	$N(b)$	$N(s)$
25	0.00158 (1.58)	0.00035 (-0.46)	0.00123 (1.86)	0.01429	0.02357	797	3021
26	0.00148 (1.43)	0.00038 (-0.41)	0.00110 (1.68)	0.01409	0.02360	795	3023
27	0.00128 (0.87)	0.00049 (-0.23)	0.00079 (1.00)	0.01657	0.02281	592	3226
28	0.00170 (1.76)	0.00028 (-0.58)	0.00142 (2.11)*	0.01500	0.02364	879	2939
29	0.00171 (1.82)	0.00030 (-0.55)	0.00141 (2.15)*	0.01428	0.02365	831	2987
30	0.00153 (1.49)	0.00036 (-0.44)	0.00127 (1.76)	0.01431	0.02359	806	3012
31	0.00157 (1.56)	0.00035 (-0.46)	0.00122 (1.84)	0.01431	0.02356	795	3023
32	0.00166 (1.70)	0.00027 (-0.59)	0.00139 (2.07)*	0.01542	0.02366	923	2895

$X(b)$ and $X(s)$ are the mean returns of the buy and sell days. $X(h)$ is the mean return for the buy-and-hold strategy. $N(b)$ and $N(s)$ are the number of buy and sell days. $SD(b)$ and $SD(s)$ are the standard deviation of buy and sell days. The numbers in the parentheses are the t-statistics testing the difference of the mean buy and mean sell from the mean of buy and hold, and buy-sell from zero. Asterisks denote statistical significance at the 5% level for a two-tailed test.

The triple-indicator trading rules are slightly better than the results of Tables 1 and 2. However, the overall results are still very weak. Similar to Tables 1 and 2, none of the mean buy and mean sell returns show significant t-statistics to beat the market buy and hold strategy. Although the t-statistics in Models 28, 29 and 32 show the significance for the difference between mean buy and mean sell returns, considering the much less days in the market compared with those out of market days, we are only 23%, 22 % and 24 % respectively in the market. If a trader does not choose any other alternative investment when out of the market, those out of the market days will contribute zero returns and will bring the annual returns lower.

In order to obtain unambiguous results to support weak form efficiency in Brazilian stock market, let us reconsider the four models, Model 14, 28, 29 and 32, showing significant t-test statistics in the difference of mean by days and mean sell days. When the models emit sell signal, a trader can be in the money market and earn money market interests. That is, when the model emits buy signal then we are in the stock market; when the model emits sell signal, we are in the money market. We can test whether this stock-money market strategy (SMM) beats the buy and hold strategy (B&H) or not.

We define the daily difference return (DDR) as the difference between the daily return of SMM strategy and the daily B&H return. The money market interest rates for SMM strategy are obtained from the DataStream's Brazilian overnight rate. The hypothesis testing for the mean of DDR, $X(DDR)$, is constructed as the following:

$$H_0 : X(DDR) = 0$$

$$H_A : X(DDR) \neq 0$$

$$t = \frac{X(DDR)}{\sqrt{\frac{Var(DDR)}{N}}}, \quad (4)$$

where $Var(DDR)$ is the variance of daily difference returns and N is the total number of days. Table 4 reports the testing results for Models 14, 28, 29 and 32.

Table 4. Mean of daily difference returns

Models	$X(DDR)$	$SD(DDR)$
14	0.00022 (0.66)	0.02031
28	0.00017 (0.49)	0.02074
29	0.00015 (0.46)	0.02092
32	0.00017 (0.51)	0.02060

$X(DDR)$ and $SD(DDR)$ are the mean and the standard deviation of daily difference between the return of stock-money market strategy and the buy-and-hold strategy. The numbers in the parentheses are the t-statistics testing the equality of average daily difference from zero.

As we can see from Table 4, all the t-stats from Equation (4) are well below 1.96, the critical value of 5% significance. We cannot reject the null hypothesis that the mean return of the stock-money market strategy is different from the mean return of buy and hold strategy. All the four trading rules with multiple indicators still cannot beat the market. The weak form market efficiency is solidly confirmed in the Brazilian stock market.

5. Concluding Remarks

This paper confirms solidly the Weak-Form Efficient Market Hypotheses (WFEMH) for the Brazilian stock index (BOVESPA) over the period 5/1/1996 to 3/1/2011. We apply a variety of trading rules with single, double and triple indicators to support the non-predictive power of technical analysis. None of the trading rules can beat the buy and hold strategy, even the possible money market earning is considered while the investors are out of stock market. As Chong *et al.* (2010) noted, compared with the other BRIC countries, Brazil has a much longer history of stock market as one explanation of market efficiency. Our study also provides a better methodology to investigate the statistical results. When some trading rules show the predictive power to beat the buy and hold strategy, we need to adjust their mean returns by considering the possible interest earning from money market when the investors are out of the stock market. After doing so, the original profitable trading rules are very unlikely to perform better than the buy and hold strategy, especially for the multi-indicator models with a much shorter period in the stock market.

The limitation of our study is that the transaction costs are not considered. However, it will not alter the support of WFEMH in the Brazilian stock market. Transaction costs will even lower the mean returns of all kinds of trading rules to eliminate the predictive power. The future studies can be based upon our methodology to investigate the other emerging stock markets in a longer period. When the money market interest rates are relatively higher, the trading rules with multiple indicators are more unlikely to beat the market to confirm the WEFMH in countries like India, Russia and China. The efficiency of those emerging markets will assume greater importance in global investments as a result of regulatory reforms and removal of other barriers for the international equity investments.

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Theoretical Discussion of the Financial Liberalization: The Political Economy of a Policy's Paradox

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Abstract

This paper argues the paradox that industrial countries and international financial organizations recommended less developed countries (LDCs) to reinforce their financial liberalization progressions. However, due to the current financial crisis, developed economies have to admit not taking the necessary policies themselves to circumvent the worst period of unbridled risk-taking by financial institutions. During the 1980s, industrialized economies feared LDCs fragile financial systems and their potential policy mismanagement given their lack of familiarity. Incongruously, markets have taken revenge on the “rentiers” and empirical evidence has shown that technocrats running the international financial system are also prone to big mistakes with adverse economic consequences.

Keywords: financial liberalization, economic growth, developing and industrial countries, banking system

1. Background

The current global financial crisis, which began with the US housing bubble burst in December 2007 but whose effects still are now being felt worldwide, has substantiated the need to put in place a new international system of regulation akin to the Breton Woods Conference after World War II. Although the huge global growth and reach of financial systems meant that markets, economies and bank systems were increasingly interdependent, the need for better banking supervision had been recognized since the Asian market crisis in 1997 (Chang, 2000). Nevertheless, the world failed to set up an early warning system so that international monetary flows were properly monitored and countries were alerted from a crisis under development.

The paradox refers to the fact that industrial countries and international financial institutions advising less developed countries (LDCs) to strengthen their financial liberalization processes now have to admit not taking the necessary measures themselves to avoid the worst period of unbridled risk-taking by financial institutions. Industrialized economies feared LDCs weak financial systems and potential policy mismanagement given the lack of experience in the 1980s. Ironically, markets have taken revenge on the rentiers and reality has shown that technocrats running the international financial system are also prone to big mistakes with adverse economic consequences (Palma, 2009).

As per the necessary reforms needed for the world economy's recovery, industrial countries have been advocating greater international policy regarding transparency and exposure. These procedures include ensuring national financial regulators stay in close touch with their counterparts in other countries and setting standards for financial institutions around the world on transparency and corporate governance. Also, reforming banker's pay and rewards to encourage responsible, long-term risk-taking rather than quick profit.

Since financial liberalization stands still as a central policy prescription to LDCs almost along the same lines as when the neoliberal economic model was put forward approximately three decades ago, this paper returns to the so-called ‘renewed’ debate on financial liberalization which was in place in the 1980's just when the LDCs were being pressed by the main multilateral funding institutions, such as the International Monetary Fund (IMF) and the World Bank, to abandon their centrally controlled (repressed) systems and transform them into liberalized entities. For instance, in Latin America not only the financial reform but also the new development strategy as a whole was set up after a series of negative external and domestic shocks in the 1980s. Later on, when the Washington Consensus' set of first-best policies was implemented, the region did not put any resistance at all (Palma, 2010).

Afterwards, this discussion considers bank-lending behavior under risk situations. It also deals with more operative

matters. This paper argues that financial markets are subject to implicit market imperfections because of the nature of the 'goods' they deal with. Credit is not a normal good, but a 'promise' of payment, which gives credit markets special characteristics.

2. Theoretical Framework

There are two main economic approaches to the nexus between financial development and overall economic growth and development: the prior-saving approach and the investment-led approach. The prior-saving approach argues that financial development encourages economic growth by increasing the amount of lendable funds, increasing credit, and thus increasing investment (McKinnon, 1973; Shaw, 1973). This model stresses the significance and necessity of rules leading to increase saving levels, which would help find investment outlets (Thirlwall, 1989).

According to the complementary hypothesis between money and capital, potential investors must accumulate money balances prior to their investment expenditure (MacKinnon, 1973). In turn, money (broadly defined) accumulation is encouraged by higher rate of interest offered on deposits; so the money function can thus be expressed as a function of income, investment and the real interest rate. This approach also stressed the importance of a liberalized financial system as a means of increasing saving, investment and the productivity of investment. It strongly opposed any kind of government intervention in the financial system and criticized the argument that market forces do not work in LDCs (Shaw, 1973). In the investment-led approach, a post-Keynesian argument concerning the financial liberalization model is that investment is not supply determined but, on the contrary, the level of investment is what determines savings via the income multiplier effect (Burkett, 1991; Davidson, 1986; Dutt, 1991). They argue that high real interest rates negatively affect economic performance by discouraging both aggregate consumption and investment, therefore reducing the level of aggregate demand.

There is another approach, the Neo-Structuralist, which remains within the prior saving analytical framework. Its main criticism is confined to the argument that financial liberalization might reduce the amount of loanable funds for the whole financial system, including those of the 'curb' market, an unofficial money and capital market (World Bank, 1989). Although the discussion of the causality between financial development and economic growth still remains unsolved (Patrick, 1966; McKinnon 1988), most LDCs undertook a financial liberalization process in the 1980s and even early 1990s under prior-saving approach (World Bank, 1989).

LDCs were motivated by the need to increase the internal sources of finance but also appealed those looking to enlarge the role of the private sector in the economy. The underlying assumption is that the larger the reliance of the economy on the private sector, the greater the need for an efficient financial sector. The implications of this economic policy shift were clear and direct enough. LDCs had to direct their economic policy towards the liberalization of their financial sector in order to restrict the regulation imposed by the government on the financial system. It also encouraged the participation of the private sector and allowed a free operation of the market forces.

As established in the current literature, such an economic policy was not set up entirely due to Latin America's own volition but under the pressure caused by its sovereign debt crisis in the 1980s which, incidentally, almost brought the US financial system to its knees. Since loans to LDCs during 1982, accounted for more than twice the capital base of US banks, the crisis threatened to become a crisis for US financial crisis itself. The point is that both debtors and creditors are to be blamed for such a problem. On the one hand, the 1980s was a defining decade for Latin America because it saw many profligate countries shut out of the international markets and default after they took on unsustainable amount of debt. But, on the other hand, the debt crisis followed a sustained period of easy credit. In the late 1970's, the US and other Western European banks recycled abundant petrodollars through irresponsible loans to Latin American countries with limited conditionality.

As evidence, neither debtors nor creditors were prepared to manage the crisis, but what stands out is the turmoil inside the OECD governments and multilateral-financial institutions following the so called 'lost decade' of falling incomes in the region during the 1980's. On the one hand, although the loan syndication (as 500 banks were involved) was meant to reduce risk, it did not accomplish this goal. Additionally, the Federal Reserve chairman Paul Volker jacked up US interest rates to 20%. A year later, Mexico announced it had nearly run out of reserves and could no longer service \$80 billion of foreign debt after the lenders refused to rollover short-term loans except at exorbitant rates. On the other hand, the initial answer to the Latin American debt crisis in 1982 was deemed to be economic growth, which would eventually allow countries to pay down debt. It was considered, that all they needed was the space to do so, via a series of official-emergency bailout packages.

It took several years to realize that deflating wages and shrinking economies were inconsistent with being able to fully pay off debts. What a first sight appeared to be a liquidity problem was an issue of solvency, as became clear in 1987 when Brazil said it would stop paying interest. Therefore, the answer was debt write-offs in 1989 under the Brady plan, which was designed to lessen these risks by gradual trimming allowing creditors to absorb the losses and

recapitalize. In return for debt relief, bank debt was turned into tradable 'Brady bonds' backed by US treasuries as collateral, which reassured investors the restructured debt had real value. There were two broad types of Brady bonds, the par bonds with the same face value as the original debt but longer maturities and lower interest rates and the discount bonds with smaller face values but also shorter maturities and higher interest rates. The debt crisis did not stop with the Brady plan, however, this discussion is beyond the scope of this paper.

Meanwhile, debtor countries committed to a series of economic reforms as recommended by the Washington Consensus. The Brady plan was followed by hyperinflation first, then by draconian measures to stop it such as dollarization or currency boards as well as neoliberal reforms in developing economies. Those measures opened again the gates to western funds, only to lead to even more serious crisis and catastrophic defaults 10 year later. The sequel in Latin America was that growth was finally resumed by exporting commodities to the rising and industrializing East, essentially decoupling from a decaying and over-financed west.

From the Washington consensus' perspective, financial repression was understood as a situation in which government and Central Bank regulations tend to distort financial markets. These regulations mainly refer to reserve requirements on commercial banks, interest rates ceilings and compulsory credit allocations with or without subsidized interest rates. It was argued that the consequences of financial repression constrained the growth of savings, investment and economic performance. Financial repression causes the flow of lendable funds to decrease in the formal financial sector, forcing potential investors to rely more on self-finance. It distorts credit allocation and causes inefficiencies in the productive sector. It encourages wealth holders to acquire physical assets instead of financial assets, causes capital flight and the process of self-finance is impaired. If the real yield of deposits is not attractive, firms cannot accumulate liquid assets to undertake investment.

Due to these arguments, the de-repression of the financial sector in LDCs (Singh, 2011) was heralded as a major breakthrough in economic policy. The financial liberalization reform was understood as a substantial reduction of government intervention in setting interest rates and allocating credit either by doing away entirely with the interventionist regime or by gradually reducing it. The objectives of financial liberalization were mainly to increase both the total level of savings and financial savings, with the aim of making the latter available for productive investment purposes. Market forces were supposed to maximize the availability of savings for investment as well as its allocative efficiency that is a 'logical consequence' of the neoclassical assumption that 'the market mechanism is the best instrument for an efficient allocation of resources' (Fitzgerald, 1993).

In the process of financial liberalization, one of the elements that became central to conduct the deregulation process further and that, eventually, turned out to be the main source of risks for the financial market, was that of the Financial Deepening Hypothesis (FDH). This approach argues that accumulation of financial assets at a pace faster than the accumulation of non-financial wealth will increase real savings. 'Measures to raise the real rate of return on financial assets, to reduce the variance of returns, and to improve the financial technology, along with allied non-financial areas, extend the saver's time horizons over both space and time' (Shaw, 1973, p.72). A positive and significant relationship between the size of the financial sector (measured by the ratio M3 to GDP) and the domestic rate of saving would be expected.

However the interpretation of the financial intermediation ratio (M3/GDP) in explaining real savings remains ambiguous and the difficulty with this variable lies in the explanation of the coefficient itself (Gupta, 1997). Under the lack of a proper regulation and supervision, the transformation of the banking economics in the financial system prompted the current financial system, which is now of public-policy attention everywhere as the flow of financial services need to be restored if economic growth is to be ignited again. This process was stimulated by both technology and a deregulation process implemented in the 1970s and 1980s, under the promise to take advantage from the opportunities through globalization and financial innovations.

Incidentally, the FDH was so intensively carried out in Latin America that led to a premature financialization of its economies that finding the way out in this conjuncture it requires to many adjustments elsewhere, not only in the financial system (see Palma 2009). Financialization is understood as the rise in size and dominance of the financial sector relative to non-financial sector, as well as the diversification towards financial activities in non-financial corporations. Actually, under such hypothesis LDCs decreed central bank freedom convinced that populist policymaking was the surest route to price stability and thus healthy economic growth. That is how LDCs adopted the holy writ in finance and economics that says monetary policy need to be free of political interferences and gave independence to central banks to focus only the control of prices. The growth of output will unfold as a simple after-effect.

3. Market Failures, Macroeconomic Stability and Bank Supervision

Because financial reforms in LDCs were inspired by the efficient capital market hypothesis (Palma, 2009), much of

the failure of financial liberalization has been explained in the current literature as the result of macroeconomic instability and weak bank supervision (McKinnon, 1988; Villanueva and Mirakhor, 1990; Sundararajan and Baliño, 1990). This hypothesis assumes that financial market prices at any point of time fully reflect all available information, so that there cannot be an endogenous gap between market prices and fundamentals, let alone a bubble. It also assumes that the stock markets would always correct themselves automatically, because stock prices are supposed to be a random walk. In stock markets, there is no scope for profitable speculation, especially under risk neutrality, because smart market players would simply force stock prices to become rational by taking the other side of trades if prices begin to develop a pattern, as this is bound to have no substance.

It has been argued that certain characteristics were common to the relatively successful countries that liberalized their financial sector such as an appropriate macroeconomic framework that included goals of low inflation and low public deficit, a judicious supervision of the banking system and a proper pace of deregulation. Countries in which these characteristics were present avoided sharp increases in interest rates, bankruptcies of financial institutions and loss of monetary control (Villanueva and Mirakhor, 1990). Singapore, South Korea and Taiwan were examples of these successful measures. The renewed debate on financial liberalization stated that the removal of credit and interest rates ceilings, rather than leading to a more efficient, healthy and dynamic financial system, will open up the possibility of greater market imperfections. Regulation imperfections are replaced by market imperfections such as asymmetric information and banking distress, which are implicit in the financial system.

3.1 Imperfect Information

In the credit market, borrowers have greater information about their own default risks than lenders do. Stiglitz and Weiss develop a model to show that this asymmetric information limits the rise in interest rates and the supply of loans (Gibson and Tsakalotos, 1991; and Villanueva and Mirakhor, 1990). In this analytical framework, the basic intuition of the model states that, while adequate rises in interest rate loans would produce sizeable lending, further increases beyond a certain rate would promote lower lending activity by negatively altering the quality of borrowers in favor of those in the high risk category (Villanueva and Mirakhor, 1990). In this context, banks seek to maximize their profits (net of defaults). Very high interest rates might lower overall banks' returns by triggering two effects: firstly, credit worthy borrowers would be discouraged, and, secondly, borrowers would be induced to choose projects with a higher probability of default because projects with higher expected profits are riskier.

There is a limit to the real interest rate charged on loans beyond which the bank's expected return of such loan declines. This limit is not necessarily the same as the market clearing level (see figure 1). As observed in figure 1, the loan supply L^s is a positive function of the real loan interest rate up to $r = r^p$. At this point banks maximize profits (Π). Profits are a function of the loan interest rate (r) and of the probability of loan repayment (Θ):

$$\Pi = f(r, \Theta) L$$

$$\Delta\Pi/\delta r > 0, \text{ if } r < r^p$$

$$\Delta\Pi/\delta r < 0, \text{ if } r > r^p$$

$$\Delta\Pi/\delta r = 0, \text{ if } r = r^p$$

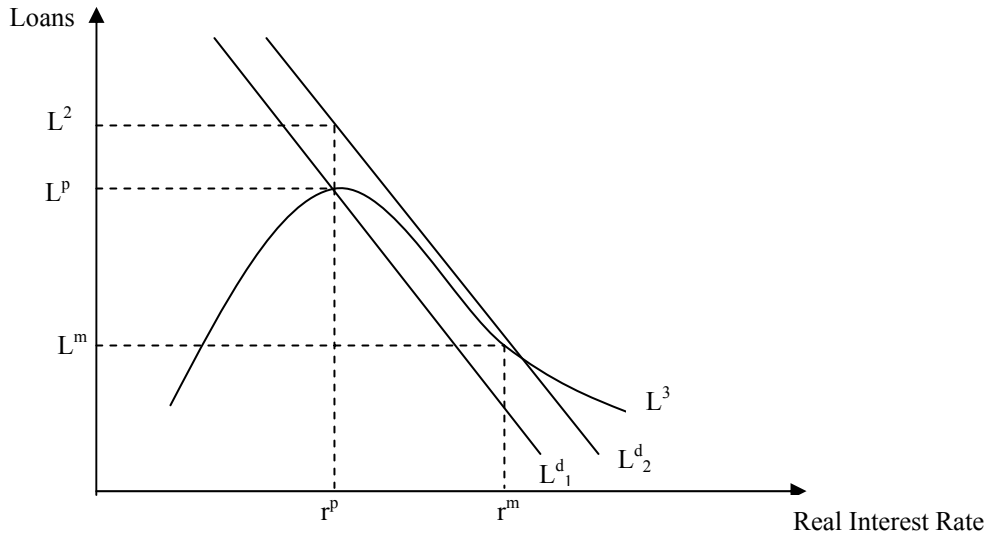


Figure 1. Market Clearing Level

The bank profit maximizing interest rate r^p might coincide with the market clearing interest rate if loan demand is L^d_1 . If, however, loan demand is higher, say L^d_2 , the market clearing rate r^m is higher than r^p . In this case, there will be an excess demand for loans equal to $(L^d_2 - r^p)$. The profit maximizing interest rate r^p is both ‘optimal and efficient, because bank profits are at a maximum level and because risky borrowers are rationed out’ (Villanueva and Mirakhor, 1990), even though it is below the market clearing level. ‘It therefore appears that although credit rationing is a potentially adverse effect of financial repression, it is also a problem in liberalized financial markets’ (Gibson and Tsakalotos, 1991).

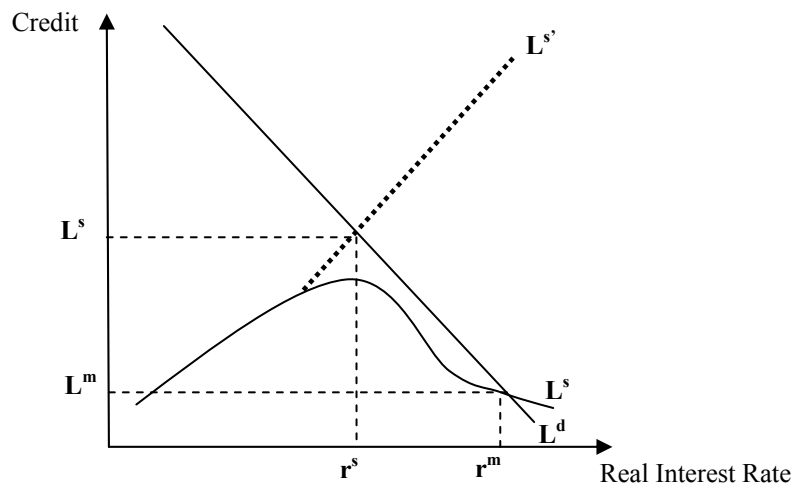


Figure 2. Market Failure in the Loan Market

The inverse U-shape of the supply of loans curve forces the market clearing interest rate r^m (see figure 2) to be higher than the equilibrium rate, if banks do not consider the probability of default (as in the traditional literature). The supply of loans L^s does not consider the probability of default by borrowers. In this case the real interest rate is lower ($r^e < r^m$) and the amount of loans is higher ($L^e > L^m$) at the market clearing level than if risk is considered in the loan supply function. Therefore market failures tend to constrain the supply of loans. Current studies (McKinnon, 1989; Villanueva and Mirakhor, 1990) do not mention the positive effect that high interest rates have on the productivity of investment projects, an argument that stands at the core of the financial liberalization models. It can be said that this

renewed debate deals with a more operative view of the functioning of credit markets.

3.2 Macroeconomic Stability and Bank Supervision

Financial liberalization implies a structural reform of the banking system. This reform has led several developing countries to financial or banking crisis such as Argentina, Chile, Hong Kong, Malaysia, Mexico, Philippines, Thailand and Uruguay. The failure of banking deregulation has been associated with an unstable macroeconomic environment, banking distress and weak bank supervision. When dealing with developing economies, the term financial and banking systems are used indistinguishably because of the predominance of banks in the financial system.

Several stylized facts characterize a banking crisis, such as an intense demand for reserve money that could not be satisfied for all parties simultaneously in the short run and the fact that credits which must be liquidated. By the same token, a condition where borrowers, who in other situations were able to borrow without difficulty, become unable to borrow on any terms (a credit market collapse) as well as a forced sale of assets due to liability structures that are out of line with market determined asset values and the consequent further decline in assets values. A final stylized fact is the sharp reduction of the value of banks' assets, which results in insolvency of many banks (Sundararajan and Baliño, 1990).

Banking distress, which might cause a banking crisis, is defined as the situation where the advent of deposit insurance or implicit guarantees has allowed an insolvent financial institution to stay in business so long as its liquidity position remains manageable, mainly because of Central Bank assistance. Continuing banking distress perpetuates situations in which banks alone could not stand without the intervention of the Central Bank. If banks do not behave efficiently, distress prolongs resource misallocations that might precipitate distress conditions. This provides incentives for further risk taking. The decision of banks to undertake risky lending in the presence of government guarantees of deposit insurance is sometimes referred to as moral hazard. If banks are insured, or otherwise protected by the government, they undertake riskier loans than if they were not. The larger the share of risky loans, the bigger the possibility of default and of bank crisis.

Inadequate bank supervision can lead to the moral hazard problem. A dilemma arises if the IMF stand ready to lend huge sums to countries that get into trouble, those countries are less likely to adopt the difficult measures that may be needed to stay out of it. In addition, once a country has fallen victim to a financial crisis, the avoidable harm caused by failing to help can be enormous. The role of banking supervision is to develop procedures for both creditors and supervising institutions to monitor financial fragility and vulnerability to shock, identify the exposure to moral hazard, and formulate standards for evaluating the appropriateness of particular levels of risk exposure (Sundararajan and Baliño, 1990).

The combination of an unstable macroeconomic environment and inadequate bank supervision can lead to a financial crisis when the financial sector is liberalized. Then, loan interest rates might rise to excessively high and risky levels, especially in an inflationary environment. Moreover, the institutional structure of the banking system emerging from regulatory changes could lead to monopolistic or oligopolistic structures. A liberalization of interest rates implies a change of instruments for monetary control. It is argued that central banks might lack acceptable monetary policy controls to affect interest rates or might follow a *laissez-faire* approach leading to belief that national rates would mechanically meet to global rates (Sundararajan and Baliño, 1990). If reserve requirements are not eliminated, forcing banks to hold low-yield reserves or government securities, credit to the private sector can be tightened and cause excessively high real lending interest rates. Furthermore, it is argued that the supervisory institutions might not be prepared to deal with a more liberalized financial system.

Therefore, the administrative infrastructure must be adapted to deal more with bank solvency and credit risk than with organizing selective credit regulations and maintaining interest rates ceilings. The current literature sustains that 'sound financial policies, vigilant bank supervision and well designed prudential regulations would limit financial crisis and help reduce the vulnerability of a financial system to the vagaries of the macro-environment' (Sundararajan and Baliño, 1990).

In Chile, for example, the combination of high inflation, high real loan rates and inadequate bank supervision resulted in defaults of outstanding bank credits that led to the bankruptcy of virtually all of Chile's financial intermediaries in 1982. Macroeconomic stability is concerned with sustained steadiness in the internal price level, a necessary condition for attaining high real financial growth without undue risk of financial fright or failure (McKinnon, 1988). Concerning bank supervision, the literature suggests that governments should implement limits on ordinary loan and deposit's rates of interest to overcome banks' tendency to provide risky loans at high interest rates in the expectation of government intervention through deposit insurance (McKinnon, 1988b).

Macroeconomic stability also implies a low and controlled public sector deficit. If financial liberalization takes place

when the public sector's internal debt is high and rising, the rise in real interest rates will increase the public deficit. This could lead to a vicious circle of rising public deficits and macroeconomic instability (Gibson and Tsakalotos, 1991). High interest rates paid on the domestic debt will cause inflation if money is created to pay the interest charges. The failure of financial liberalization in several countries has been attributed to market failures and to inadequate bank supervision. Under unstable macroeconomic conditions, firms will probably need to borrow credits no matter that the loan interest rate is, for instance to refinance maturing debts. When moral hazard is present and bank supervision is weak, banks are willing to lend at high and risky interest rates, because the government would rescue them from bankruptcy. Therefore, the policy to follow is, first, to liberalize the financial sector under a stable macroeconomic environment and second, to establish an adequate bank supervision scheme.

4. Conclusion

Assuming the causality between financial development and economic growth, this essay has portrayed the main theoretical models considered in the first generation of structural reforms induced by the international financial institutions and other parties involved in the strategies. This topic intended to leave behind the debt crisis in the 1980's: the Neo-classical, on the one hand, and the Post-Keynesian, on the other hand. Given the fact that the Neo-classical models were implemented in almost all the developing economies, this essay describes the models of McKinnon (1973) and Shaw (1973), in both of which financial liberalization is considered as a necessary condition for economic development, based on the classical assumption that prior saving was necessary to finance investment and economic growth.

The analysis of financial liberalization theories shows that credit markets are subject to imperfections that set limits to the loan rate of interest and to the amount of credit supplied. Therefore the hypothesis that increased savings and investment are a consequence of the liberalization of the financial system has been severely weakened. Furthermore, imperfect information and weak bank supervision do justify a government's intervention in the financial system to prevent a banking crisis. Independent central banks, such as it was argued, would prevent a return to the rampant inflation of the 1970s. And up until the credit crunch, the consensus of Washington seemed right. Inflation had stayed pegged at or near historically low levels, while economic growth remained remarkably stable. But the financial crisis changed all that.

It has become obvious that those same independent central bankers, captains of finance and the public stewards of the financial system, as a whole had failed to grasp the building-up of risk and missed out 'to see to come' the biggest private sector debt disorder in history, encouraged through moral hazard wholesale financial sector recklessness and fuelled sequential asset bubbles. Beside such a failure, all the culture of deregulation that believed wrongly that markets would always self-correct is in tatters as Chang (2010) put it forward.

There is no evidence that market forces will operate more efficiently than regulated financial systems because markets forces have to be supervised by an entity. Usually this entity is the Central Bank. Past and quite recent experiences from different countries show that the absence of regulation of the financial system leads to financial distress and to financial crisis under weak supervision and unstable macroeconomic scenario. In this sense, government intervention is more than justified in order to prevent a financial crisis that might trigger or aggravate an overall economic crisis in the near future.

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Information Content of Earnings and Operating Cash Flows: Evidence from the Tehran Stock Exchange

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Abstract

The main objective of this study is to evaluate the relative and incremental information content of earnings and operating cash flows in the companies listed in Tehran Stock Exchange. Moreover, the present study investigates the loss effect on the information content of earnings and operating cash flows. For this purpose, we investigate and analyze a sample of 475 firm-years from the companies listed in Tehran Stock Exchange during the years 2006-2010. The results indicate that, the earnings have more information content than operating cash flows in explaining stock returns. In addition, earnings model is preferable in explaining stock returns than operating cash flows model. Also, results show that earnings have positive effect and loss has negative effect on earnings information content and operating cash flows.

Keywords: relative information content, incremental information content, earnings, operating cash flow

1. Introduction

The purpose of accounting is to provide financial information relating to the business units for users in order to assist decision-making process, while the purpose of accounting research is to evaluate the usefulness of accounting information for investors and other users. Financial statements are very important sources of information that investors need while making investment-related decisions (Hadi, 2006).

Among accounting information, accounting earnings are considered as the most important source of information for evaluating the profitability and future cash flows. In the meantime, operating cash flows are not less important. According to the accounting standard No 2 of Iran (related to the Cash Flow Statements), the amount of cash flows from operating activities is one of the main indicators of evaluating the issue that to what extent business unit operations result in adequate cash flows in order for the reimbursement of loans, maintenance of operating power of business unit, and payment of stock returns and provides implementation of new investments without resorting to financing resources out of business unit. Providing information about elaboration of operating cash flow, along with other information, will be useful for predicting future cash flows (Iran's Accounting Standards, No. 2, 2007). Therefore, the ultimate purpose of accounting is to provide useful information for users in economic decisions.

The usefulness of information is one of the most important indicators of accounting systems projection and indicates that with regard to the different groups of accounting information users and their diverse information needs and due to lack of access to all the information needed for this groups, the above-mentioned index enables us to emphasize the types of information in accounting system that has been proved their effectiveness in providing decision makers' purposes (Tehrani and Faniasl, 2007). Given this, we can use the index "usefulness in forecasting" as a criterion to evaluate accounting information which has been used from this index in the formulation of accounting theory. According to this index, among different methods of accounting, a method that has the highest predictive power and relative advantage over other methods in a subject or a particular event may be selected as the best method. Thus accounting information includes the numbers that have information content and help users in forecasting economic events.

Information content of accounting items are related to forecasting some factors such as returns and dividends. Purpose of information content of an accounting criteria is the amount of use and its usefulness in decision-making process of capital market participants. In other words, information content of accounting item refers to the usefulness of that item in decision making process. Overall, the information content test is discussed in two formats, relative and incremental information contents. The studies on incremental information content of accounting investigate the issue that whether one or more accounting criteria add something more than other variables to them or not. But the topic of relative information content is when the researcher wants to find between two or more criteria of accounting which has information content more than other variables in order to achieve a ranking of the criteria. In fact, the relative information content indicates that whether the information content of X alone is larger, smaller or equal to information content of Y alone. But the incremental information content indicates that whether the information content of X and Y together are larger than a variable alone or not (Biddle *et al.*, 1995).

With regard to the mentioned material and also the fact that evaluating the stock returns of different companies are the most important issues for investors in capital markets, this research seeks to answer three following questions, which in fact are the objectives of research as well, and it can provide a measure to predict stock returns of different companies for investors and help them with confidence in making decisions about selection or purchase of companies' stock.

- 1) Do earnings have more relative information content than operating cash flows in explaining stock returns or vice versa?
- 2) Does loss affect the information content of earnings or the information content of operating cash flows?
- 3) Do earnings have more incremental information content than operating cash flows or vice versa?

In other words, the present study investigates the relative and incremental information content of earnings and operating cash flows in explaining stock returns for companies listed in Tehran Stock Exchange and are investigated by using the relationship between earnings and operating cash flows with stock returns. The study also uses the adjusted R² values, Akaike information criteria and Vuong's test to select the best model to explain stock returns. The background research and analysis methods and research findings are presented in the following.

2. Literature Review

Accounting earnings and operating cash flows were the subject of conducted research by some researchers. Following investigation and study, the research results related to the topic of this research are presented as follows.

Wilson (1986) in his study refers to investigation of relative information content of accruals and operating cash flows, but examined incremental information content of accruals and operating cash flows. He investigated 332 firm-years during the period of 1981-1982 in his study. The research results indicate that cash flows and accruals components of earnings have incremental information content than earnings itself, and also accruals components of earnings have more incremental information content than cash flows. In addition, obtained evidence shows that incurrent accruals have not more incremental information content than working capital from operations before earnings items.

Bowen *et al.* (1987) in their study Surveyed incremental information content of accruals versus cash flows. They use earnings and capital variables for accruals in working from operations and from cash flows variables from operations and cash flows result from investing activities for cash flows in the study. Their research results which covered a 10-year-old period and used econometrics models and also multivariable regressions and cross-sectional regression indicate that (1) Information related to cash flows has incremental information content than earnings; (2) information related to cash flows has incremental information content than simultaneously information of earnings and working capital from operations; and (3) Information related to accruals (earnings and working capital from operations) simultaneously and separately, has incremental information content than cash flows.

Ali (1994) in his study investigated the incremental information content of earnings, working capital from operations and cash flows of American companies between the years 1974-1988 with 8820 firm-years samples. He used linear and nonlinear models to test hypotheses in his study. The obtained results of the linear model test confirmed incremental information content of earnings than working capital from operations and cash flows, but the obtained results of nonlinear model test confirmed incremental information content of working capital from operations than earnings and cash flows. But concerning incremental information content of cash from operations than others were observed two modes. In the first mode, companies that have low changes in cash from operations were observed incremental information content than the others and in the second mode, companies that have a lot of changes in cash from operations, were not observed incremental information content than the others.

Cheng *et al.* (1996) Surveyed earnings permanence and incremental information content of cash flows from operations in the companies listed in New York Stock Exchange during the years 1988-1992. In this study, they selected 5120

firm-years observations as samples. Obtained results indicate that with decline of constancy or permanence of earnings, incremental information content of earnings decreased and incremental information content of cash flows from operations increased.

Charitou *et al.* (2000) in their study examined value relevance of earnings and cash flows in Japanese companies. In this research, they investigated 6662 firm-years observations among the companies listed in Japan Stock Exchange during the years 1984-1993. In this research, they used from stock returns as dependent variable and earnings and operating cash flows as independent variable. The research results show evidence that (1) cash flows have more information content than earnings in explaining stock returns and (2) cash flows play more important role in stock returns than earnings and have more significance when earnings have not permanency. And also their study show that Japanese investors use earnings and cash flows in selection of stock basket than American investors.

Haw *et al.* (2001) investigated the information content of earnings, operating cash flows and accruals in the companies listed in China's capital market during the years 1995-1998. In this study, they selected 1516 firm-years as samples. Obtained results indicate that earnings have more information content than operating cash flows. Also in this study, the incremental information content of discretionary accruals versus nondiscretionary accruals was confirmed.

Habib (2008) in his study surveyed the role of accruals and cash flows in explaining stock returns during the period 1994-2004 for New Zealand companies. In this study, he selected 705 firm-years observations as samples. The research results indicate that (1) earnings have more explanatory power than cash flows, and (2) both earnings and cash flows have incremental information content for stock returns.

Daraghma (2010) in his study investigated relative and incremental information content of earnings and operating cash flows for the companies listed in Palestinian Stock Exchange during the years 2004-2008 in 23 companies as samples. In this research, he used stock returns as dependent variable and the earnings and operating cash flows as independent variables. In the present study, the adjusted R^2 values, Akaike information criteria and Vuong's test for selecting the best model to explain stock returns were also used. The results indicate that (1) earnings have more relative information content than the operating cash flows, (2) incremental information content of earnings is more than operating cash flows, (3) earnings have positive effect on value relevance and operating cash flows but loss has negative effect on value relevance and operating cash flows, and (4) earnings model is preferable than operating cash flows in explaining stock returns.

3. Research Hypotheses and Objectives

With regard to the mentioned themes, this study pursues the following objectives:

- 1) To investigate relative information content of earnings and operating cash flows in the companies listed in Tehran Stock Exchange.
- 2) To test loss effect on the information content of earnings and operating cash flows.
- 3) To test incremental information content of earnings and operating cash flows.

Given the above objectives, to investigate the information content of earnings and operating cash flows of companies, the following hypotheses are designed:

H₁: Earnings have more relative information content than operating cash flows in relation to explaining stock returns.

H₂: Loss affects the information content of earnings.

H₃: Loss affects the information content of operating cash flows.

H₄: Earnings have more incremental information content than operating cash flows in relation to explaining stock returns.

4. Research Design

4.1 Statistical Society and Sample

Statistical society of this study includes all companies listed in Tehran Stock Exchange. To determine the sample size, first it must be examined that to what extent company information is available. After investigating into the selection of sample in the best situations for a 5-year-old period (2006-2010), 95 companies were selected as sample and for data collection. To select the desired sample, the following criteria are considered:

- 1) The end of financial period of companies lead up to December 31 of each year.
- 2) The operations are not interrupted during the study period.
- 3) It should not be investment and financing and leasing companies.

- 4) They were accepted before 2006 in Tehran Stock Exchange.
- 5) Financial period have not changed in the course of study.
- 6) The required data are available.

The desired sample is selected by elimination (purposive) method. Thus selected sample includes all companies which were the member of population and had above circumstances.

4.2 The Data Collection Method

In this study, we used documents analysis method to collect data. Therefore, the needed data about member companies of sample in study during the 2006-2010 have been collected by the site of Tehran Stock Exchange (Note 1) and CDs of financial data in companies listed in Tehran Stock Exchange.

4.3 Research Variables and Their Measurement Method

4.3.1 The Dependent Variable

Stock returns: at present, usually most important measure for performance evaluation of institutions is stock returns rate. This measure alone has information content for investors and is used for performance evaluation. When this measure is reduced, it is a warning for company and does not show good performance of the company. Return in investors' process is a driving force that will motivate and is considered a reward for investors. Return is the total income that an investor will gain during the period of investing. Return includes changes in the real capital (stock price) and receivable cash dividend. In the present study, the following equation is used to calculate the stock returns:

$$R_{it} = \frac{P_{it} - P_{i(t-1)} + D_{it}}{P_{i(t-1)}}$$

Where:

R_{it} : The stock return of company i in period t,

P_{it} : The stock market prices of company i at the end of period t,

$P_{i(t-1)}$: The stock market prices of company i at the beginning of period t,

D_{it} : Cash dividends belong to per share of company i in period t.

In this research, the stock returns of studied company are calculated according to above-mentioned equation for 12 months from beginning to the end of year t.

4.3.2 The Independent Variables

Earnings: A net operating earnings (loss) has been selected as representative of accounting earnings. The number of net operating earnings (loss) is extracted from audited annual financial statements of the studied companies. To calculate net operating earnings (loss) in different companies, this study used the net operating earnings to total assets ratio.

Operating cash flows: Operating cash flows refer to those inputs and output cash flows that result from operational activities of the company. Also those cash flows that naturally cannot be connected directly to the other classes of cash flows in cash flow statement are considered as cash from operations. The number of operating cash flows is extracted from audited annual financial statements of the studied companies. To calculate operating cash flows in different companies, the present study used the operating cash flows to total assets ratio.

4.4 Correlated Models with Hypotheses Testing

In the present study, to test hypotheses, three models are used to investigate the information content of earnings and operating cash flows:

$$R_{it} = \beta_0 + \beta_1 E_{it} \quad (1)$$

$$R_{it} = \theta_0 + \theta_1 OCF_{it} \quad (2)$$

$$R_{it} = \gamma_0 + \gamma_1 E_{it} + \gamma_2 OCF_{it} \quad (3)$$

In these models:

R_{it} : The stock returns of company i in period t,

E_{it} : The earnings of company i in period t,

OCF_{it} : Cash flows from operations of company i in period t.

β_0 , θ_0 and γ_0 are constant coefficients (intercept) and β_1 , θ_1 , γ_1 and γ_2 are variables coefficients. That B_1 and γ_1 are earnings response coefficients (ERC), θ_1 and γ_2 are operating cash flow response coefficient (OCFRC). Therefore, earnings or operating cash flows have information content when the reaction coefficient (i.e. ERC and OCFRC) be statistically significant. Also we classify companies in two subsidiary samples or two portfolios to test the effect of loss on information content of earnings (E) and operating cash flows (OCF). Those two portfolios are earnings portfolio (positive earnings) and loss portfolio (negative earnings).

4.5 Data Analysis Methods and Hypotheses Testing

To analyze data and test hypotheses, linear regression analysis and Pearson and Spearman correlation are used; i.e. first we calculated needed data for doing test and then performed regression tests for investigating relative and incremental information content of earnings and operating cash flows of companies. Also we used SPSS.18 and EXCEL software for data processing and statistical tests. To test the statistical hypotheses, first we investigated the accuracy of the obtained regression model assumptions and then we use adjusted R^2 values, Akaike information criteria (AIC) and Vuong's test to select the best model to explain stock returns. Based on Akaike information criteria (AIC), a model that has the lowest AIC will select the best model to explain stock returns (Akaike, 1974).

Vuong in 1989 presented a statistical test to determine which of the two models explains better the dependent variable (Foroghi and Mazaheri, 2009). In the present study, to determine which of these competing models can better explain stock returns, Z Vuong's statistic has been used. Z Vuong's statistic is calculated as the following equation:

$$Z_{Vuong} = \frac{[\log(\sigma_w^2) - \log(\sigma_x^2)]}{\left[n^{1/2} \sum_l \left(\frac{e_{w,i}^2}{\sigma_w^2} - \frac{e_{x,i}^2}{\sigma_x^2} \right) \right]^2}$$

σ_x^2 and σ_w^2 in the above equation are calculated as follows:

$$(\sigma_x^2) = \sigma_Y^2(1 - R_x^2)$$

$$(\sigma_w^2) = \sigma_Y^2(1 - R_w^2)$$

In this equation: σ_x^2 : residual variance for the first model, σ_w^2 : residual variance for the second model, σ_Y^2 : variance of the dependent variable, n: number of observations, R_x^2 : multiple correlation coefficient of the first model R_w^2 : multiple correlation coefficient of the second model (Dechow *et al.*, 1998). In Vuong's test, from the Model 1 and 2, a model that can explain better the stock returns may be selected. So in the above-mentioned equation, the X is accounting earnings (model 1) and W is operating cash flow (model 2) and Y is the stock return (dependent variable). With regard to what has been said above, the statistical hypotheses are proposed for Vuong's test (Z Vuong) as follows:

H_0 : the two models are equal to explain stock returns ($Z = 0$).

H_1 : One of the two models further explains stock returns ($Z \neq 0$).

According to the hypotheses of this test, if Z Vuong's statistic:

A) is positive; the first model is superior to the second model.

B) is negative; the second model is superior to the first model.

C) is zero, none of the two models are better than each other (Dechow, 1994).

Considering these, models and criteria to test used research hypotheses are as follows: (1) to test the relative information content of earnings and operating cash flows in explaining stock returns (hypothesis 1) used models 1 and 2, and also the values of three criteria, adjusted R^2 , Akaike information criteria (AIC) and Vuong's test (2) to examine the effect of loss on the information content of earnings and operating cash flow (hypothesis 2 and 3) have used models 1 and 2, and adjusted R^2 values. And finally, (3) to test the Incremental information content of earnings and operating cash flows in explaining stock returns (Hypothesis 4) used the Model 3 with Model 1 and 2, and adjusted R^2 values and Akaike information criteria (AIC).

5. Empirical Results

5.1 Descriptive Statistics

Descriptive statistics of dependent and independent variables to test the hypotheses are shown in Table 1 in which the numbers of observations equal 475 firm-years during the years 2006-2010. In order to reduce data heteroscedasticity, all independent variables are shrunk by total assets of studied companies. As can be seen in Table 1, earnings have the

lowest standard deviation. Also the highest mean is related to stock returns and the highest median is related to the earnings. These statistics show that sample has necessary diversity to generalize the results to the community.

Table 1. Descriptive Statistics Data

statistics / variable	Mean	Median	Maximum	Minimum	standard deviation
R	0.206	0.048	7.763	-0.972	0.878
E	0.118	0.106	0.610	-0.180	0.113
OCF	0.120	0.098	1.385	-0.409	0.140

R: stock returns, E: earnings per share, OCF: operating cash flows

5.2 Correlation Analysis

Pearson correlation coefficients (parametric test) and Spearman correlation coefficients (nonparametric test) of dependent and independent variables are shown in Table 2. Calculated coefficients according to both methods are similar. Part A shows that there is a significant positive correlation between earnings and stock returns at 1% level with a coefficient of 39.8%. Also this section indicates a significant positive correlation between OCF and stock returns at 1% level with a coefficient of 25.9%. This shows significant positive correlation between two independent variables of earnings and OCF at 1% level with a coefficient of 46.8%. In addition, Part B shows Spearman correlation coefficients that supports the Pearson correlation test (Part A).

Table 2. Correlation matrix (Pearson and Spearman correlation coefficients)

Part A: Pearson correlation coefficients			
Variable	R	E	OCF
R	1		
E	0.398**	1	
OCF	0.259**	0.468**	1
Part B: Spearman correlation coefficients			
Variable	R	E	OCF
R	1		
E	0.506**	1	
OCF	0.315**	0.481**	1

** Correlation is significant at 1% level.

5.3 Regression Analysis

5.3.1 Relative Information Content of Earnings and Operating Cash Flows Test

The first hypothesis of research indicated that earnings have more relative information content than operating cash flows in relation of explaining stock returns. To test this hypothesis, the simple regression is used to estimate the parameters model 1 and 2. As was mentioned previously, model 1 is used to test the value relationship of earnings and model 2 is used to test the value relationship of operating cash flows.

Table 3 shows the results from simple regression to test the information content of earnings. The only independent variable in this table is earnings. R^2 for the total sample is 15.8% and adjusted R^2 for the total sample is 15.6%. Earnings response coefficient (ERC) is 3.103 and statistically has a significant positive relationship at 1% level. The F statistic for the total sample and for each year is also significant. Annual regression results also provide similar pattern, but coefficients changed during different years and in all investigated years, ERS has a significant positive relationship at 1% level. But the power of explaining earnings in 1385 is more than other years. Therefore, the results indicate that earnings have information content.

Table 3. Results of testing the value relationship of earnings - $R_{it} = \beta_0 + \beta_1 E_{it}$

Year	Constant (β_0)	Earnings Response Coefficient (β_1)	F-Value	R ²	Adjusted R ²	AIC
2006	-0.279*	3.634**	34.007**	0.291	0.282	-1.540
	-2.180	5.832				
2007	-0.199**	1.669**	17.384**	0.180	0.170	-1.180
	-3.083	4.169				
2008	-0.234**	2.031**	15.842*	0.162	0.152	-4.060
	-3.334	3.980				
2009	0.342	2.200**	6.958**	0.082	0.070	-0.616
	1.808	2.638				
2010	0.077	2.559**	30.476**	0.292	0.282	-0.244
	-1.207	5.521				
Polled	-0.160**	3.103**	76.039**	0.158	0.156	-1.243
	-2.765	8.720				

** Correlation is significant at 1% level, * correlation is significant at 5% level.

Table 4 shows the results from testing operating cash flows model. The only independent variable in this table is operating cash flows. R² for the total sample is 6.7% and adjusted R² for the total sample is 6.5%. Operating cash flows response coefficient (OCFRC) is 1.621 and statistically has a significant positive relationship at 1% level. Also the F statistic for the total sample and for each year (except in 2008) is significant. Annual regression results are positive and in all studied years (except in 2008) are significant at 1% level and in 2008; OCFRC is not significant at conventional levels. The explanatory power of OCF in 2006 is located at the highest level. Thus, the results show that operating cash flows have also information content. Overall, with regard to the results, the regression of earnings has the higher explanatory power and coefficients than regression of operating cash flows. Therefore, the results indicate that the information content of earnings is more than OCF.

Table 4. Results of testing the value relationship of operating cash flows - $R_{it} = \theta_0 + \theta_1 OCF_{it}$

Year	Constant (θ_0)	OCF Response Coefficient (θ_1)	F-Value	R ²	Adjusted R ²	AIC
2006	0.118	2.731**	11.571**	0.122	0.112	-2.540
	0.708	3.402				
2007	-0.084	0.810**	7.261**	0.084	0.073	-0.067
	-1.516	2.695				
2008	-0.037	0.108	0.068	0.001	-0.011	-2.581
	-0.515	0.260				
2009	0.342	2.200**	6.958**	0.082	0.070	-0.768
	1.808	2.638				
2010	0.029	1.507**	9.914**	0.118	0.106	-1.787
	0.437	3.149				
Polled	0.010	1.621**	28.980**	0.067	0.065	-0.297
	0.186	5.383				

**Correlation is significant at 1% level.

In tables 3 and 4 the results of Akaike information criteria (AIC) test are shown, where the AIC value of the earnings model (model 1) is less than the AIC value of the operating cash flows model (model 2). As mentioned earlier, the model that has the lowest AIC are selected the best model to explain stock returns (Akaike, 1974). Therefore the earnings model is preferable than OCF model to explain stock returns. Table 5 shows the results of Z Vuong's statistic using the total sample data of five years studied companies. Where, Z Vuong's statistics calculated according to the

Vuong's test model which already explained. Results from Table 5 shows that Z Vuong's statistic is negative ($Z_{\text{vuong}} > 0$) and is equal to -3798.52. Based on Dechow, Lys and Sabino research (1998) If Z Vuong's statistic is smaller than zero (negative), earnings is preferable to OCF in explaining stock returns. Thus, accounting earnings in explaining stock returns is preferable to OCF.

Table 5. Results of Z Vuong's test for comparing earnings and operating cash flows models Z Vuong's statistic

$$Z_{\text{vuong}} = \frac{[\log(\sigma_e^2) - \log(\sigma_{\text{ocf}}^2)]}{\left[n^{1/2} \sum_1^n \left(\frac{e_{e,i}^2}{\sigma_e^2} - \frac{e_{\text{ocf},i}^2}{\sigma_{\text{ocf}}^2} \right) \right]^2}$$

The measure	
Residual variance for earnings model σ_e^2	0.65002
Residual variance for OCF model σ_{ocf}^2	0.72028
Natural logarithm for the variance of residual of earnings model $\log(\sigma_e^2)$	-0.18707
Natural logarithm for the variance of residual of OCF model $\log(\sigma_{\text{ocf}}^2)$	-0.14250
$\sum_1^n \left(\frac{e_{e,i}^2}{\sigma_e^2} - \frac{e_{\text{ocf},i}^2}{\sigma_{\text{ocf}}^2} \right)$	0.00017
$\left[n^{1/2} \sum_1^n \left(\frac{e_{e,i}^2}{\sigma_e^2} - \frac{e_{\text{ocf},i}^2}{\sigma_{\text{ocf}}^2} \right) \right]^2$	0.003425
Z Vuong's statistic	-3798.52

Based on Dechow, Lys and Sabino research (1998) decision making rules are: 1- If Z Vuong's statistic is equal to zero, E and OCF in explaining stock returns are not preferable to each other. 2- If Z Vuong's statistic is greater than zero (positive), OCF in explaining stock returns is preferable to E. 3- If Z Vuong's statistic is smaller than zero (negative), E in explaining stock returns is preferable to OCF.

Values obtained from Adjusted R^2 , information Akaike information criteria (AIC) and Vuong's test, all show the relative information content of earnings into the OCF. So we can conclude that the first hypothesis will be confirmed indicating the relative information content of earnings is preferable to operating cash flows in explaining stock returns. Results are consistent with Daraghma's research results (2010).

5.3.2 Loss Affects Test on the Information Content of Earnings and Operating Cash Flows

In table 6, we have summarized the results from cross-sectional and collective regression about loss effect on the information content of earnings and operating cash flows. This section of article has been done for the first time for Iranian companies. To investigate loss effect on the information content and OCF, samples is divided in to two portfolios, portfolio of positive earnings (earnings) and the portfolio of negative earnings (loss).

Part A shows the simple regression results of earnings (Model 1) to test loss effect on the information content of earnings. In earnings portfolio, R^2 and adjusted R^2 for the total sample are 11.7% and 11.5% respectively. Earnings response coefficient (ERC) is 2.751 and statistically has a significant positive relationship at 1% level. Also F statistic value (F-Value) for the total sample and each of the studied years is significant at 1% level. In contrast, in the loss portfolio, R^2 and adjusted R^2 for the total sample are respectively 0.5% and -2.4%. Earnings response coefficient in this portfolio is -0.359 and statistically is not significant at conventional levels. Results indicate that portfolio of positive earnings (earnings), have a positive effect on the information content of earnings and statistically are significant. But the portfolio of negative earnings (loss) has a negative effect on the information content of earnings and statistically is not significant.

Part B shows simple regression results of operating cash flows (model 2) as a OCF positive portfolio (input operating cash flows) and OCF negative portfolio (output operating cash flow). In OCF positive portfolio, R^2 and adjusted R^2 for the total sample are 4.5% and 4.2% respectively. OCF response coefficient is 1.517, and statistically has a significant positive relationship. In contrast, in OCF negative portfolio, R^2 and adjusted R^2 for the total sample are respectively 0.3% and -2.1%. OCF response coefficient in this portfolio is -0.166 and statistically is not significant at conventional

levels. The results indicate that earnings have positive effect on the OCF value relationship and statistically are significant. But loss has negative effect on the OCF value relationship and statistically is not significant.

In general, earnings response coefficients and OCF for the loss are not statistically significant while earnings response coefficients and OCF for earnings are statistically significant. Remarkably, the results of this section are consistent with Daraghma's research results (2010).

Table 6. Results of loss affect test on the information content of earnings and operating cash flows

Part A: loss affect on the information content of earnings: $R_{it} = \beta_0 + \beta_1 E_{it}$										
Year	portfolio of positive earnings (earnings)					portfolio of negative earnings (loss)				
	β_0	β_1	F-Value	R^2	Adj. R^2	β_0	β_1	F-Value	R^2	Adj. R^2
2006	-0.341*	3.890**	29.798**	0.284	0.275	-0.229	-0.357	0.013	0.003	-0.197
	-2.233	5.459				-1.309	-0.003			
2007	-0.180*	1.570**	10.874**	0.131	0.119	-0.431	-1.119	0.119	0.029	-0.214
	-2.255	3.298				-2.009	-0.345			
2008	-0.206*	1.782**	8.868**	0.106	0.094	-0.465*	-1.439	0.383	0.060	-0.097
	-2.324	2.978				-2.567	-0.619			
2009	-0.099	5.756**	10.203**	0.126	0.113	0.197	2.125	1.417	0.221	0.065
	-0.334	3.194				0.924	1.190			
2010	-0.081	2.621**	16.872**	0.209	0.196	-0.258*	0.164	0.026	0.004	-0.139
	-0.884	4.108				-2.889	0.162			
Polled	-0.133	2.751**	48.920**	0.117	0.115	-0.274**	-0.359	0.165	0.005	-0.024
	-1.888	6.994				-3.667	-0.406			
Part B: loss affect on the information content of operating cash flows: $R_{it} = \theta_0 + \theta_1 OCF_{it}$										
Year	OCF positive portfolio (input operating cash flows)					OCF negative Portfolio (output operating cash flows)				
	θ_0	θ_1	F-Value	R^2	Adj. R^2	θ_0	θ_1	F-Value	R^2	Adj. R^2
2006	-0.135	2.806**	10.137**	0.115	0.104	-0.277	-5.565	1.120	0.272	0.029
	-0.807	3.184				-1.813	-1.059			
2007	-0.053	0.631	2.732	0.038	0.024	-0.402*	-1.413	1.118	0.123	0.013
	-0.720	1.653				-2.435	-1.058			
2008	0.048	-0.347	0.404	0.005	-0.008	-0.363*	-0.458	0.430	0.097	-0.129
	0.509	0.527				-2.808	-0.655			
2009	0.475*	1.777	3.344	0.048	0.033	0.015	3.816*	6.952*	0.436	0.373
	2.012	1.829				0.161	2.637			
2010	0.075	1.249	3.687	0.055	0.040	-0.249*	-1.732	1.919	0.161	0.077
	0.770	1.920				-2.814	-1.385			
Polled	0.035	1.517**	17.023**	0.045	0.042	-0.216**	-0.166	0.119	0.003	-0.021
	0.490	4.126				-4.346	-0.345			

** Correlation is significant at 1% level, * correlation is significant at 5% level.

5.3.3 Incremental Information Content of Earnings and Operating Cash Flows Test

Table 7 shows the results of multiple linear regressions to the incremental information content of earnings and operating cash flows test. In this regression, independent variables are earnings and OCF. R^2 and adjusted R^2 for the total sample are 16.5% and 16.1% respectively. Earnings response coefficient (ERC) is 2.765 and statistically has a significant positive relationship at 1% level. But operating cash flow response coefficient (OCFRC) is 0.581 and statistically is not significant at conventional levels. This shows that earnings have incremental information content than OCF, but the inverse is not true. With regard to the values of R^2 , adjusted R^2 and Akaike information criteria (AIC), which are shown in Table 7, the results indicate that the incremental information content of earnings is more than the operating cash flows. Thus we can conclude that the fourth hypothesis of this research will be confirmed indicating that earnings have more incremental information content than operating cash flows related to explaining stock returns. The result is consistent with the research results of Haw *et al.*(2001) and Daraghma (2010) but is not consistent with the results of Charitou *et al.* (2000).

Table 7. Results of value relationship test for earnings and operating cash flows - $R_{it} = \gamma_0 + \gamma_1 E_{it} + \gamma_2 OCF_{it}$

Year	Constant (γ_0)	γ_1	γ_2	F-Value	R^2	Adjusted R^2	AIC
2006	-0.277*	3.656**	-0.039	16.800**	0.291	0.273	-0.456
	-1.996	4.411	-0.041				
2007	-0.211**	1.450**	0.342	9.283**	0.192	0.172	-0.068
	-3.223	3.231	1.072				
2008	-0.193*	2.338**	-0.581	9.012**	0.182	0.162	-1.304
	-2.545	4.236	-1.411				
2009	0.023	3.780*	1.267	6.980**	0.153	0.131	-2.708
	0.105	2.552	1.431				
2010	-0.107	2.278**	0.615	16.233**	0.308	0.289	-0.227
	-1.581	4.473	1.304				
Polled	-0.191**	2.765**	0.581	39.854**	0.165	0.161	-1.069
	-3.164	6.885	1.801				

** Correlation is significant at 1% level, * correlation is significant at 5% level. γ_0 : intercept, γ_1 : Earnings response coefficient and γ_2 : operating cash flow response coefficient

6. Conclusion

While the results from hypotheses were different in studied years, it could be due to the different conditions dominated on society in studied years. Therefore we cannot provide an accurate judgment about the presented results. But what generally obtained from investigating the results of this research is that decision makers still consider accounting earnings in contrast with cash flows as the most important accounting variable in the financial and investment decisions in stock exchange market and often have information content than others.

This study has been carried out in line with Daraghma's research (2010). Three objectives which the present study have followed in this study are as follows: (1) Investigation of relative information content of earnings and operating cash flows; (2) Testing the loss effect on the information content of earnings and operating cash flows; and (3) Investigating the incremental information content of earnings and operating cash flows. In addition, this study has used statistical techniques such as, adjusted R^2 , Akaike information criteria (AIC) and Vuong's test to select the best model to explain stock returns to investigate the above-said objectives.

The present study investigated relative and incremental information content of earnings and operating cash flows in a sample of 475 firm-years among the Iranian companies listed in Tehran Stock Exchange during the years 2006-2010. The results from hypothesis test indicate that, (1) Earnings have more relative information content than operating cash flows in explaining stock returns. Also, according to Akaike information criteria (AIC) and Z Vuong's statistic values, earnings model is preferable to operating cash flows model. (2) Earnings has a positive and significant effect on the information content of earnings and operating cash flows but loss has a negative and non-significant effect on the information content of earnings and operating cash flows. (3) Incremental information content of

earnings is higher than operating cash flows in explaining stock returns. Also the results show that Iranian investors in the stock assessment process and financial decision making in the Iranian capital market rely on the earnings more than operating cash flows. Remarkably, the results obtained in this study are consistent with the results of conducted research by Daraghma (2010).

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Notes

Note 1. www.irbourse.com

Housing Starts, Forecaster Herding, and the Livingston Survey

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Abstract

Recent research shows that forecasts of housing starts provide evidence of forecaster anti-herding. Because this result is in contrast to the widespread belief that forecasters herd, we reexamined the question of forecaster anti-herding using data from the Livingston Survey. Using a novel empirical test developed by Bernhardt et al. (2006, *Journal of Financial Economics*, 80, 657-67), we found strong evidence that forecasters of U.S. housing starts anti-herd.

Keywords: housing starts, forecasting, (anti-)herding

1. Heading

Results of recent research indicate that forecasters of housing starts anti-herd (Pierdzioch, Rülke, & Stadtmann, *in press*). While evidence of forecaster anti-herding in the case of housing starts is in line with mounting evidence of forecaster anti-herding in other areas of economics (Bernhardt, Campello, & Kutsoati, 2006; Naujoks, Aretz, Kerl, & Walter, 2009), this evidence is at odds with the widespread belief that forecasters herd. Forecaster herding arises if forecasters follow the forecasts of others (Scharfstein & Stein 1990; Froot, Scharfstein, & Stein, 1992). Forecaster anti-herding, in contrast, arises if forecasters scatter their forecasts away from the forecasts of others (Laster, Bennett, & Geoum, 1999).

We reexamined forecaster (anti-)herding using data from the Livingston Survey. The Livingston Survey has a considerably long track record. It contains forecasts of housing starts for the United States that date back to December 1968. In addition, the Livingston Survey provides information on more than 14 000 forecasts published by 250 forecasters, for five different forecast horizons. Forecasts of housing starts are also available for various groups of forecasters (for example, academics, Federal reserve economists, forecasters working in the banking industry). In sum, the Livingston Survey is a particularly rich data set to study the issue of forecaster (anti-)herding.

We tested for forecaster (anti-)herding using a novel empirical test recently developed by Bernhardt et al. (2006), which also has been used in recent research (Pierdzioch, Rülke, & Stadtmann, *in press*). Our findings, thus, are directly comparable to results reported in recent literature. Upon applying the test to data from the Livingston Survey, we found strong evidence of forecaster anti-herding, corroborating the results of recent research. In order to assess the robustness of our findings, we also studied alternative specifications of the empirical test. For example, we tested for forecaster anti-herding among optimists and pessimists. Finally, we found that forecaster anti-herding is inversely correlated with forecast accuracy. Forecasters' loss function, therefore, seems to contain other arguments in addition to forecast accuracy as, for example, in the model developed by Laster et al. (1999).

2. A Simple Test

The test of forecaster anti-herding developed by Bernhardt et al. (2006) is easy to implement, and it has a straightforward economic interpretation. The intuition motivating the test can be illustrated by assuming that a forecaster, given some subjective distribution of future housing starts, forms an "efficient" private forecast. The efficient private forecast is unbiased because it is not influenced by the consensus forecast (that is, the average forecast made by others). The probability that an unbiased forecast overshoots or undershoots future housing starts should be 0.5.

Herding implies that a forecaster publishes a forecast that is tilted towards the consensus forecast. If the private forecast exceeds the consensus forecast, the eventually published forecast is closer to the consensus forecast than the private forecast. The probability of undershooting, thus, is smaller than 0.5. If the private forecast is smaller than the

consensus forecast, in turn, the published forecast exceeds the private forecast and the probability of overshooting is also smaller than 0.5.

Anti-herding implies that a forecaster publishes forecasts that deliberately scatter around the consensus forecast. A published forecast, thus, is farther away from the consensus forecast than the private forecast. If the private forecast exceeds the consensus forecast, the published forecast is larger than the private forecast, implying that the probability of undershooting is larger than 0.5. Similarly, if the private forecast is smaller than the consensus forecast, the probability of overshooting is also larger than 0.5.

Based on this intuition, under the null hypothesis that forecasters do not herd, the probability that an unbiased forecast (conditional on being above or below the consensus forecast) overshoots or undershoots the future realization of housing starts should be 0.5, regardless of the consensus forecast. Their test statistic, S , is simply the average of the two probabilities. In the case of unbiased forecasts, we thus should observe $S=0.5$. In the case of forecaster (anti-)herding, in contrast, we should observe $S<0.5$ ($S>0.5$). The test statistic, S , has an asymptotically normal sampling distribution.

3. Empirical Analysis

The Federal Reserve Bank of Philadelphia (2012) maintains the Livingston Survey. The survey data contain information on forecasts of various macroeconomic and financial data, including housing starts. The survey data of housing starts are available at a semiannual frequency for the sample period from December 1968 (depending on the forecast horizon) to December 2011. Forecasts are compiled during the first week of June and December and are available at five different forecast horizons: one month (1M), six months (6M), twelve months (12M), 18 months (18M), and 24 months (24M). Forecasts of housing starts are available for various groups of forecasters. In total, more than 14 000 forecasts are available.

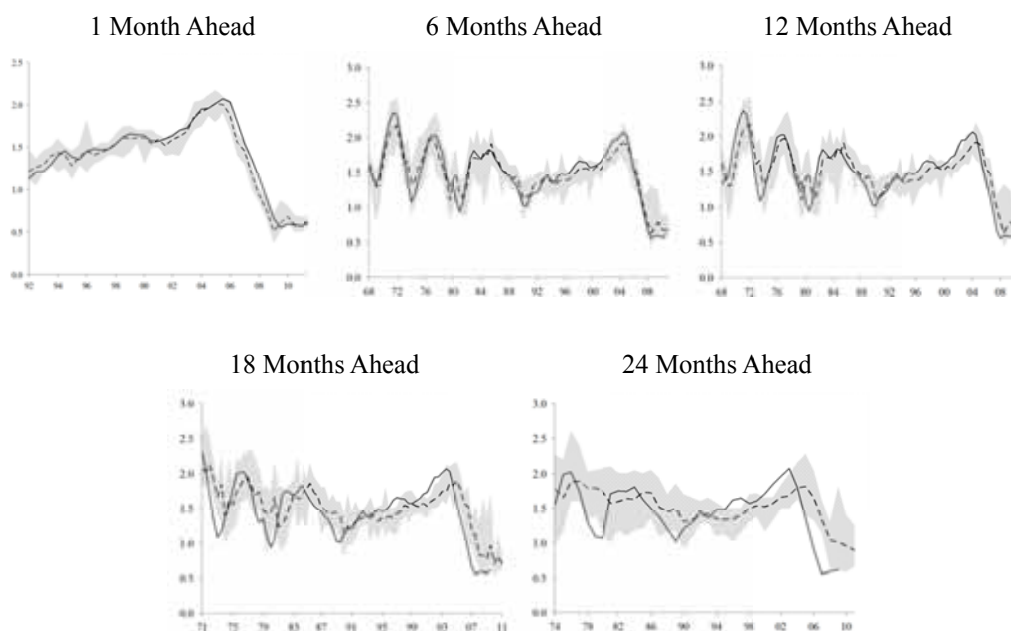


Figure 1. Forecasts and Actual Values

This figure shows the consensus forecast (dashed line), the range of the forecasts (shaded area), and the actual value (solid lines) for the housing starts in the United States (in mn. units per year).

Figure 1 shows the actual housing starts (solid lines), the consensus forecast (dashed line), and the range of forecasts (shaded area) of housing starts in the United States (in mn. units per year). While the general trend in the consensus forecast tracks the one of the actual value, the cross-sectional range of forecasts visualizes the cross-forecaster heterogeneity of forecasts. Forecaster anti-herding may be an important determinant of this heterogeneity of forecasts because such anti-herding behavior results in a scattering of forecasts around the consensus forecast.

Table 1 summarizes our empirical findings. The table shows the test statistic, S , its standard deviation, and the number of forecasts available for every forecast horizon and every group of forecasters. In the majority of cases, we find $S > 0.5$, where we cannot reject the null hypothesis of no forecaster (anti-)herding only for the categories "Consulting" and "Industry". For the category "Industry", however, the number of observations is relatively small as compared to the numbers of observations available for the study of the other groups of forecasters. Corroborating results of recent research (Pierdzioch, Rülke, & Stadtmann, *in press*), our empirical findings, thus, provide evidence of forecaster anti-herding.

Table 1. Empirical results

Category	Horizon	1M	6M	12M	18M	24M
Academia	S-statistic	0.69*	0.69*	0.65*	0.65*	0.59*
	Stand. Dev.	0.03	0.02	0.02	0.02	0.03
	Obs.	214	727	720	708	306
Commercial banking	S-statistic	0.65*	0.71*	0.68*	0.63*	0.64*
	Stand. Dev.	0.03	0.02	0.02	0.02	0.03
	Obs.	245	962	953	891	320
Consulting	S-statistic	0.59	0.59	0.55	0.58	0.43
	Stand. Dev.	0.05	0.04	0.04	0.05	0.06
	Obs.	119	119	129	123	60
Investment banking	S-statistic	0.67*	0.67*	0.71*	0.63*	0.56
	Stand. Dev.	0.03	0.02	0.02	0.02	0.04
	Obs.	357	602	579	581	183
Industry	S-statistic	0.57	0.71*	0.58*	0.52	0.48
	Stand. Dev.	0.06	0.05	0.06	0.05	0.08
	Obs.	82	85	82	91	35
Non-financial	S-statistic	0.70*	0.72*	0.70*	0.65*	0.62*
	Stand. Dev.	0.03	0.02	0.02	0.02	0.02
	Obs.	314	1 018	1 013	962	411
Federal Reserve	S-statistic	0.67*	0.69*	0.69*	0.69*	0.70*
	Stand. Dev.	0.06	0.04	0.04	0.04	0.06
	Obs.	84	157	156	145	63
Labor	S-statistic	0.72*	0.75*	0.65	0.67*	0.64
	Stand. Dev.	0.04	0.04	0.04	0.04	0.07
	Obs.	119	148	147	126	49
Total	S-statistic	0.68*	0.70*	0.68*	0.64*	0.60*
	Stand. Dev.	0.01	0.01	0.01	0.01	0.01
	Obs.	1 534	3 836	3 779	3 627	1 427

This table shows the herding statistic, S , and its standard deviation. * indicates whether the S -statistic is significantly different from 0.5 at a one percent level.

Table 2 reports the results of some robustness tests. First, we defined the consensus forecast in terms of the lagged longer-term forecast. For example, the lagged 12M forecasts have the same forecast horizon as the current 6M forecasts, and they are known at the time a forecast is being made. Upon defining the consensus forecast in this way, we accounted for the fact that forecasters may not know the contemporaneous consensus forecast when submitting their forecasts. Second, we examined whether optimism and pessimism among forecasters affects our empirical findings. To this end, we identified optimistic (pessimistic) forecasters who predict a higher (lower) real growth rate of output for the next six months than the average forecaster. Findings of both robustness tests provide evidence of forecaster anti-herding.

Table 2. Robustness tests

Model	Horizon	S-statistic	Stand. Dev.	Obs.
Lagged consensus	1M	0.60*	0.01	1 457
	6M	0.59*	0.01	3 678
	12M	0.56*	0.01	3 937
	18M	0.51	0.01	3 626
Optimists	1M	0.68*	0.02	761
	6M	0.71*	0.01	1 883
	12M	0.68*	0.01	1 847
	18M	0.65*	0.01	1 935
	24M	0.61*	0.02	778
Pessimists	1M	0.69*	0.02	694
	6M	0.69*	0.01	1 953
	12M	0.67*	0.01	1 932
	18M	0.63*	0.01	1 692
	24M	0.59*	0.02	649

This table shows the herding statistic, S, and its standard deviation. * indicates significance at the one percent level.

We further analyzed whether forecast accuracy correlates with forecaster anti-herding. To this end, we computed, for every forecaster i ($i = 1, \dots, 250$) a forecaster-specific S_i -statistic and a forecaster-specific root-mean-squared error, $RMSE_i$. In order to empirically assess the significance of the correlation, we estimated the following regression model: $RMSE_i = a + b S_i + e_i$, where e_i denotes a forecaster-specific disturbance term. Table 3 reports the estimation results. For three out of five forecast horizons, there is a clear-cut and statistically significant positive correlation between anti-herding and the root-mean-squared error implying that forecast accuracy is significantly negatively correlated with forecaster anti-herding. Forecast accuracy, thus, likely is not the only argument in the loss function of anti-herding forecasters. The correlation remains positive, but becomes insignificant at longer-term forecast horizons.

Table 3. Forecast accuracy and individual herding

Horizon	1M	6M	12M	18M	24M
a	0.41* (0.01)	0.78* (0.14)	0.17* (0.03)	0.44* (0.05)	0.33* (0.04)
b	0.08* (0.02)	0.11* (0.02)	0.14* (0.04)	<0.00 (0.08)	0.09 (0.06)
Obs.	112	248	250	236	147
R ²	0.13	0.11	0.06	<0.00	0.02

This table shows estimation results for the regression model $RMSE_i = a + b S_i + e_i$. Robust Newey-West standard errors are given in parentheses. * indicates significance at the one percent level.

To sum up, we found, based on data from the Livingston Survey, strong evidence of forecaster anti-herding. We could reject the null hypothesis of the S-statistic (unbiased forecasts) in favor of the alternative hypothesis of anti-herding using forecasts for different forecasting horizons (from one month to twentyfour months). Moreover, we found that our results are robust to several alternative specifications of the empirical test (lagged consensus, optimism and pessimism among forecasters). Finally, we found that the accuracy of forecasts and forecaster anti-herding are negatively correlated.

4. Concluding Remarks

Using an empirical test that has been applied in recent research to study forecaster anti-herding (Bernhardt, Campello, & Kutsoati, 2006; Pierdzioch, Rülke, & Stadtmann, *in press*), we found that forecasters who participate in the Livingston survey seem to anti-herd when it comes to forecasting housing starts. Anti-herding forecasters scatter their forecasts around a consensus forecast. Scattering of forecasts may reflect a "superstar effect" (Scharfstein & Stein, 1990, p. 476) and compensation effects (Laster, Bennett, & Geoum, 1999) that strengthen incentives to differentiate forecasts from the forecasts of others. Together with results of recent research, our findings imply that when researchers analyze forecasters' loss function it is interesting not only to account for forecast accuracy, but rather also to take into account the possibility that forecasters try to differentiate their forecasts from the forecasts of others.

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Critical Success Factors of Technology Parks in Australia

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Abstract

Given the potential importance of technology parks, their complexity in terms of the scope of required investment and the growing interest of governments to use them as tools for creating sustainable development there is a pressing need for a better understanding of the critical success factors of these entities. However, Briggs and Watt (2001) argued that the goal of many technology parks and the factors driving innovation success are still a mystery. It is also argued that the problem with analyzing technology parks is that recent studies analyze “the most celebrated case studies... to ‘explain’ their success”. This study uses intensive interviewing to explore critical success factors of technology parks. The study identified the following factors: a culture of risk-taking “entrepreneurism”, an autonomous park management, an enabling environment, a critical mass of companies, the presence of internationally renowned innovative companies, and finally a shared vision among the technology park stakeholders.

Keywords: success factors, technology parks, entrepreneurship, intellectual property, Australia

1. Introduction

The International Association of Science Parks (IASP) (2002) defined STPs as a property-based Initiative which: has operational links with universities, research centres and other institutions of higher education; is designed to encourage the formation and growth of knowledge-based industries or high value added tertiary firms, normally resident on site; has a steady management team actively engaged in fostering the transfer of technology and business to tenant organizations (Basile, 2011). While the Italian Association of Science and Technology Parks (APSTI) defines STPs as a "system for local development aimed at the promotion and support of: initiatives dedicated to scientific and technologic research; R&D linkages; new innovative firms; innovative and competition for those firms operating in the geographical range of action of the park (Basile, 2011). Technology parks and incubation programs provide a mechanism to promote and stimulate commercial and industrial innovation (Venckuviene and Snieska, 2010), encourage re-industrialization and ensure sustainable regional development (Fazlzadeh and Moshiri, 2010; Akçomak, 2009). In addition to providing space for knowledge-based products, science and technology parks can house centres for scientific research, technological innovation and incubation, training, forecasting, as well as facilities for fairs, exhibitions and market development. They are formally linked (and usually physically close) to centres of technological excellence, universities and/or research centres.

Science parks are set up to facilitate commercialisation of technologies, stimulate development of technology-based SMEs and promote regional development (Malairaja and Zawadie, 2008). Firms that are located on a technology park geographically closer to each other than rival firms outside therefore, promoting the transmission of knowledge due to the lower costs of communication in a dense environment (Chan, Oerlemans and Pretorius, 2009). Within the park knowledge can be shared by formal and informal interpersonal or employee-related contacts amongst these firms or knowledge may be dispersed through relationships with local universities or other institutions of higher learning and/or research (Wolfe and Gertler, 2003). Thus a host academic institution, usually an Higher Education Institute (HEI), is often formally associated with a park (Chan, Oerlemans and Pretorius, 2009). Castells and Hall (1994) identified three reasons for establishing STPs: reindustrialization, regional development, and synergy creation. STPs are also received as the appropriate place for SMEs' growth. Peng and Heath (1996) developed a three-stage-choice model of firms' growth. Stage one deals with firms need for networking which requires trust and mutual understanding. Stage two deals with establishing a long-term relationship with other firms in order to obtain and sustain a competitive advantage. In stage three these firms create clusters which is the final and most developed stage of all.

More importantly, small and medium enterprises (SMEs), especially technology-based firms, have become an integral part of the regional and world economy development (Somsuk, Wonglimpiyarat and Laosirihongthong, 2012). Start-ups or new ventures usually carry the paradigms liability of newness and resource poverty (Lendner, 2004; 2007). For example, start-ups often lack technical and marketing capabilities, besides they also suffer from

poor management, inability to find early stage financing, and high overheads (Hackett and Dilts, 2004). Thus, start-ups face the challenge of access to technology and financial resources and the commercialization capabilities necessary to bring a product to market (Lin *et. al.*, 2011). This again brings into light the importance of STPs as a mechanism that could create supportive and entrepreneurial environments for technology-based start-ups, helping them to increase their survival rates (Somsuk, Wonglimpiyarat and Laosirihongthong, 2012). STPs offer start-ups and SMEs the technological support and services, and a solution in bridging the knowledge gap (Lalkaka, 2006) to help them develop their own viable businesses, by providing a resource-base necessary for supporting their development in early and critical stage.

However, technology parks and incubation programs are not always successful (Sun, Ni and Leung, 2007). For example, Colombo and Delmastro (2002) pointed out that “in spite of the diffusion of science parks in Europe, whether they have been successful or not in supporting new technology-based firms still is unclear”. Some even concluded that technology parks in specific context might be a “technology fantasy” (Bakouros, Mardas, and Varsakelis, 2002). In addition, it is argued that the problem with analysing technology parks and cluster building is that recent studies analyse “the most celebrated case studies... to ‘explain’ their success” (Holbrook and Wolfe, 2002). Using intensive interviewing (Kvale, 1996; Reinhartz, 1992) of four Australian technology parks’ managers and managers of tenant firms this paper identified critical success factors for technology parks in Australia. The findings have practical implications for technology parks.

2. Success Factors of Technology Parks

The first and probably the most successful science park of all, the Stanford University Science Park in California, was founded in 1950 and in 1986 had already over 80 occupant companies employing over 26000 people (Basile, 2011). Business incubators diffused slowly between 1960 and 1970 in the US and were used a government tool urban economic revitalization (Somsuk, Wonglimpiyarat and Laosirihongthong (2012). However, between 1980 and 1990 there was an increase in the pace of diffusion of these incubators for three reasons: (Hackett and Dilts, 2004): the passage of the Bayh-Dole Act in the US Congress (in 1980), which stimulated the commercialization of university research (Rasmussen, 2008); an emphasis by the US legal system on the importance of innovation and intellectual property rights protection; and profit opportunities derived from the commercialization of basic research expanded (Somsuk, Wonglimpiyarat and Laosirihongthong (2012). In Britain the sector of property (specifically industrial/commercial property) which has become known as science parks has, since the early to mid-1980s, been one of near continuous growth (Gower and Harris, 1995). This growth of parks numbers in Britain was accompanied by an increase in their occupancy levels (Gower and Harris, 1995). Currently, the UNESCO estimates that there are more than 400 science parks worldwide and their number is still growing. The USA has the biggest number science parks - more than 150 science parks, followed by Japan with 111 science parks. China began developing science parks in the mid-1980s and now has around 100, 52 of which were approved by the national government and the remainder by local governments (UNESCO, 2012). The numbers will change if we consider the less general case of incubators. There are more than 4,000 incubators worldwide with more than 1,000 in the USA alone (Sun, Ni and Leung, 2007) with successful examples in almost all of developed countries.

However, some researchers questioned the assumed benefits of the science parks and incubation programmes (Chan and Lau, 2005). Colombo and Delmastro (2002) indicated that “in spite of the diffusion of science parks in Europe, whether they have been successful or not in supporting new technology-based firms still is unclear”. There is little systematic research and empirical study on the relationship between critical success factors and the performance of incubation programme. How to improve the technology parks success rate and rate of the technological incubated entrepreneurs has become a critical issue. In addition, despite the considerable amount of research on the performance of incubation programmes (Mian, 1996, 1997; Sherman, 1999; Lindelof, Lofsten, 2002; Siegel, Westhead, and Wright, 2003; Bigliardi, *et. al.*, 2005, Isaak, 2009); few studies examined related performance driven factors especially in Australia. For example, Smilor and Gill (1986) distinguished between success from the incubator and tenant firm perspectives. They identified ten critical success factors from the incubator perspective, and four from the tenant company perspective. Autto and Klofsten (1998) focused on configuration parameters such as: proximity to higher educational institutions, availability of on-site manufacturing facilities, competent science park management, accessibility of venture capital funding, and prudent tenant selection criteria. Others focused on the process aspect of STPs. Phan, Siegel and Wirhgt (2005) suggested that research should be analysed at four levels: the incubator level, the incubatee level, the entrepreneur level, and the system level. They also advocate connecting the four levels together for a comprehensive examination of success criteria.

Finally, economists argue that while Australia is a wealthy country (measured in GDP per capita) its position is declining relative to neighbouring Asian countries like Singapore and Hong Kong (Wood, 2003). Researchers cite

among numerous factors a lack of strategic planning to thrust Australia into a globally competitive knowledge-based economy and Australia's failure to invest adequately in knowledge and knowledge-based industries (Wood, 2003).

3. Methodology

The study used semi structured intensive interviews and analysis of documents of technology parks managers, business development managers and marketing managers and managers of tenant firms in the technology parks. In total 30 interviews were conducted. An interview is a directed conversation (Lofland and Lofland, 1984, 1995) that aims to gather information about the research topic and, as long as the discussion does not divagate too much, everything is permitted. Unlike structured interviews intensive interviewing relies on open-ended questions Bachman and Schutt (2007). Instead of asking the standard questions in a fixed order, intensive interviewers allow the specific content and order of questions to vary from one interviewee to another Bachman and Schutt (2007). The open and directed nature of intensive interviews allows the researcher to explore the participant's deep first-hand knowledge, focuses on lived experiences, and emphasises "making sense". It is an in-depth and intimate discussion beyond what ordinary conversational conventions and etiquette permit Hochschild (2009). The goal is to develop a comprehensive picture of the interviewees' background, attitudes, and actions, in their own terms; to "listen to people as they describe how they understand the worlds in which they live and work" (Rubin and Rubin, 1995: p. 3). It permits an in-depth exploration of a particular topic with a person who has had the relevant experiences (Charmaz, 2007: p.25) and therefore is a useful method for interpretive inquiry.

The process of data collection and analysis proceeded iteratively in accordance to the interpretive research tradition (Walsham, 2006). The study used thematic content analysis (Bardin, 2007) to analyse the data. Below are the discussion points:

1. How would you define success of a technology park? What makes one technology park more successful than another?
2. What factors influenced the success or failure of the technology park? What are the barriers to success? What are the enablers?

Hypotheses with regard to the determinants of success have been developed from the interviews and will be empirically tested using a survey instrument. This paper contains the findings from the interviews.

3.1 Profile of the Participants

There are four technology parks participating in this study. One is located in New South Wales and is the largest technology park in Australia with more than ninety tenant firms inhabiting the park. The second is located in Victoria and is considered to be one of the smallest technology parks in Australia with only numerous tenant firms. The other two parks were located in South Australia and one of them is the oldest technology park in Australia. In terms of management structures the parks varied in terms of reporting and management. Two parks reported to local government agencies, one reported to an Australian university and another had an independent management and was run as a private sector company.

3.2 Key Informants

The key informants in this study were: general managers, business development managers and marketing managers of the technology parks. Interviews were also conducted with managers of tenant firms located in the parks. A manager is contacted via phone and provided with a brief description of the study's rationale and objectives. The manager was assured that his/her identity and the identity of his organization were to remain confidential and that no one will have direct contact with the data collected except for the researcher.

4. Defining Technology Park Success

It is extremely difficult to quantify the financial and economic impact of a technology park, primarily because there is no established definition of success or a standard way to examine a company's effect on an economy (Drescher, 2001). Studies that have attempted to determine success or failure of technology parks tend to focus on two areas: benefits received by the park or the community and benefits received by businesses locating in the park. An even greater challenge, is defining success in a way that allows comparisons across different technology parks.

The interviews showed that the success of a technology park depends primarily on the body or the institution that is managing the park. That is the driving force behind the establishment and management of the technology park. In general, participants agreed that universities focused on: research, students training and creating intellectual property (IP) whereas government bodies focused: on technology transfer, job creation and economic development. In addition, participants noted that universities had little understanding of market mechanisms such the commercialization of IP and concept development and testing while government bodies treated technology parks as

real estate developments. When the control and management of a technology park shifted from government to autonomous, private firm-like management the perception of success of the technology park changed to reflect the different stakeholders of the park itself.

While the participants agreed on the five major indicators of technology park success their emphasis on the importance of the different indicators varied. This reflected the different stakeholders involved in the technology park and their differing interests. Following are the five indicators:

4.1 Technology Parks' Innovation and its Ability to Create IP

One of the numerous and major roles a technology park plays is creating linkages between universities, research centres, research and development departments in companies and technologically based start ups. These linkages work on different levels: first, they allow start ups to have access to established laboratories and research bases that are otherwise expensive to build or rent. Secondly, they allow university students to have access to companies for training and an opportunity to pursue projects that can create IP. Thirdly, when a critical mass of companies exists in the technology park synergies exist and more IP is created. However, while the number of IPs created per year has been traditionally used to measure innovativeness it should be noted that this measure may not be appropriate for newly established STPs since the number of IPs would be generally low.

4.2 The Ability of the Technology Park to Attract Funding

Participants agreed that the ability of a technology park to attract funding was detrimental to its success. The funds that are collected are usually used for diverse purposes. Some of the purposes mentioned by participants included: intellectual property enhancement and "freedom to practice" analysis, prototype development and testing, market research and commercial assessment, feasibility studies for production, determination of regulatory and reimbursement pathways and finally preliminary business plans. One park manager explained that:

Our focus is to provide the pivotal support needed to advance technologies and bring about public interest in the technology so the companies can attract more funding and market interest.

4.3 The Ability of the Technology to Create Value through Real Estate Development

Technology parks are essentially a property-based development with a high-quality, physical environment in a park-like setting. They take advantage of proximity to sources of significant intellectual capital, conducive infrastructure and policy environment, and supports technology-based firms and state institutes in a managed area, thus facilitates interaction, technology development and economic growth. All participants agreed that a technology park success can be measured by its ability to create and develop real estate value. From the technology parks' management view this is important because real estate development is one of the factors that prospective tenants consider when choosing a park. A manager of a technology park explains:

Aesthetics and beauty are a very important aspect. We have created natural spaces overlooking water front and developed a conference centre, fully serviced apartments that can be rented for variable periods of time. We are also attracting supporting services such as cafes and the likes.

From the tenants firms view it is important that apartments and other services are available so that it becomes easier to accommodate their employees and visitors.

4.4 Number of Jobs Created within the Immediate Community and the Country

This is a straight forward measure of the technology park success. However, it also reflected the ability of the technology park management to effectively link the different stakeholders together. That is the ability of the technology park management to link universities and local labour market with tenant firms. One technology park manager explains:

We have developed a mechanism by which we can link job seekers with the companies within the park. But the more important aspect is that of university students training which can be replaced by a formal job opportunity. The relationship between universities and the parks' tenant firms is assumed to exist and function smoothly. However, this is not the case. Universities are sometimes distant and may not be able to gain access for training in the parks' tenant firms. In our capacity as park management we bring the different parties together and make sure that they see what is in it for them.

4.5 Technology Transferred

Technology transfer can take place in different ways. The usual is that through the mingling of different tenant firms within the park. Technology park management arranges regular meetings to hook up employees and managers of tenant firms together. In these informal meetings managers and employees from different firms but related or close

industry can share experiences, discuss common obstacles and problems. This may lead to sharing of knowledge and technology. In many cases synergies are created and companies can benefit through the buying of services or product from other tenant firms in the park. One technology park manager explains:

We set up regular activities every month. We do it in a way that the activities are informal and apart in time. The idea is to put everybody in an environment where they can have a chat, discuss their work, goals problems and so on.

The second way a technology park assists in transferring technology is through the provision of jobs and training for students, young graduates and highly skilled employees. Employees may have the opportunity to work with leading Australian or foreign firms for short projects or long term contracts which provides them with new knowledge, technology and managerial skills. When these employees leave the tenant firm, and join the workforce in the market they participate directly or indirectly in transferring knowledge, technology and management styles. At the same time knowledge can be transferred from the workforce to tenant firms within the park making it a two way process. One manager comments:

Foreign companies are attracted to this park because this city has been traditionally known to host [name of industry removed] industry. Proximity to the sea has always attracted [name of industry removed] industry to this city which meant that with time we have created a pool of skilled labour in this realm.

5. Success Factors

The interviews revealed a variety of factors that influence the success of the technology parks. The researcher was able to triangulate perspectives and to develop a more robust assessment of each technology park by comparing different perspectives across technology parks' management and tenant firms' management. However, differences in perceptions of success naturally translated into differences in perceived determinants of success. Cross-case comparison was the most useful tool in the researcher's induction of the determinants of success. At a basic level, it was found that successful technology parks had: 1. a risk taking "entrepreneurial" culture, 2. an autonomous park management that is independent of both university officials and government bureaucrats, 3. an enabling environment, 4. a critical mass of companies that allows for synergies to arise within the technology park, 5. A shared vision among technology parks' stakeholders.

5.1 A Culture of Risk Taking "Entrepreneurism"

One of the major roles of a technology park is that of linking research, technology, capital and know-how to leverage entrepreneurial talent, accelerate the development of new technology-based firms, and speed up the commercialization of technology. Most managers interviewed believed that innovation required a risk taking culture that rarely exists in universities or local/regional government institutions. One researcher/technology park manager commented:

the university [name of university removed] does not understand what we do. We are involved in leading technology exploration which is very risky in nature but can be very rewarding at the same time. They [university management] perceive what we do as risky. When they undertake their risk assessment every year they put us at the top of the list. I think that they are worried about the resources and grants and how they are being used and the legal implications of the process. This is why universities should not manage the park!

Another explained:

Universities; like any other government institution are mainly concerned with efficiencies and playing it safe. If they are not sure of the outcomes then they are not willing to take a risk. However, private sector firms are more likely to undertake much higher risk.

Another researcher further elaborated that:

We do not advocate taking risk for the sake of taking risk. It is risk that is managed professionally by the people who truly understand its nature!

Furthermore, despite universities interest in generating income from patents and attracting funds the main focus of universities remain knowledge creation and its dissemination. One manager/researcher explained that:

Before the technology park became independent, some university deans, who were brilliant researchers, worked at the technology park as associated deans. Their compensation came from the university and they were not paid any extra money from the technology park. In exchange for each new patent they came up with; the university paid them 1 dollar! That is one dollar for each patent created! This is just an example of how universities lacked an understanding of the importance of motivating researchers to create patents that can be commercialized and bring huge amount of money. How can we motivate researchers under these conditions? How can researchers excel at

what they do? Now, since the park became independent of the university we utilise a totally different motivation system. Last year we sent some of our brilliant researchers on a two weeks payed vacation to an exotic resort overseas.

Government entities on the other hand tended to view technology parks as no more than real estate development. One technology park manager argued:

A very important distinction between the present management and the previous one (the present being market oriented and autonomous and the previous being the local government) is that the previous management treated the technology park as a real estate development. This meant that they were not concerned with the impact of the technology park on the economy, creating IP and knowledge, creating linkages between universities, research facilities and private companies whether start ups or international firms. The difference is enormous!

5.2 An Autonomous Park Management

In order to create a risk taking environment where participants have the freedom to try and fail managers agreed that technology parks' management should be independent from both the university and local/regional government bureaucrats. One manager commented:

Since the new management took lead of the technology park from the regional government things have changed dramatically. We operate on commercial basis just like any other firm in the market.

Another manager/researcher argued that:

Regional governments and universities cannot evaluate and manage the risks and potential benefits of establishing or funding technology-based start-ups. They inherently lack the knowledge to develop a rigorous appraisal system for a technology project. Because we understand the nature of what we do we can employ the right people and therefore can manage the risk effectively and efficiently.

This is not to say technology parks are totally independent from universities or the regional governments. In some cases universities undertook administrative support in the form of developing contracts and other HRM activities. This allowed the technology park management to focus on what is important. In addition universities are represented on the board of directors of the technology park so that the relationship is continued and an understanding of university interest is kept in consideration. One researcher argues that:

Technology based ventures often have social and environmental implications. They are inherently more risky than others and the management of risks calls for assessment techniques and vision.

5.3 An Enabling Environment

Most of the study participants agreed that an enabling environment in which the technology park operates can be detrimental to its success. According to the participants of the study there are numerous enablers to the success of a technology park which may include: the presence of knowledge workers and skilled labour in the immediate environment of the technology park, the availability of the right communication energy and real estate infrastructure, the availability of IP office within the technology parks.

With regards to skilled labour it is important that a pool of workers exists in the immediate environment and outer environment of the technology park. This was not a problem for any of the technology parks involved in the study despite the fact that Australia faces an extreme shortage in skilled labour. One technology park manager explains:

This city has been a traditional location for ship builders in Australia. This meant a pool of skilled labour in this industry and related industries which helped us a lot in attracting the kind of companies that we have in the park.

In other parks the labour consisted mainly of researchers who were attracted by universities and research companies that are themselves tenants in the park. One technology park manager comments:

We rely heavily on researchers from the university [this university is linked formally to the park]. We also rely on postgraduate research students who undertake their research under the university but at the same time use research facilities and labs in tenant companies. This provides us with a big pool of knowledge workers.

With regards to the right infrastructure, it is important that the necessary infrastructure such as communication and energy are made available to tenant companies. Technology parks involved provided developed infrastructure that was used to attract leading research and foreign companies to the park. One technology park business development manager explained that:

We have managed a major Australian communication firm to base its broad band internet services in the park. In exchange we promised them to be the official provider for the park and its tenant firms. Indeed we gave them big fish!

Foreign companies whose work required a high quality communication infrastructure and what can be better than a facility that is in the same vicinity of the firm (that is in the park).

5.4 A Critical Mass of Leading Foreign Companies

Participants agreed that a critical mass of companies in general and foreign companies specifically affords park and the region with a labour pool that is both broad and deep. This enables the region to draw more high-quality employers and companies that not only provide jobs but also increase the sophistication and expertise of the region's workforce through their research, use of technology, investment in employees and high standards. It also provides an environment in which company researchers, knowledge workers, and university professors can interact around ideas, creativity and entrepreneurship, thereby creating more knowledge, more innovation, and economic growth.

Another reason why the presence of internationally renowned firms is important is that these firms usually have established markets overseas therefore, guaranteeing availability of resources and markets for companies' outputs. One park manager commented:

The Australian market is limited in size, there is a shortage of skilled labour and more than 90% of Australian companies are SMEs. The presence of leading foreign companies guarantees that they will have their own established markets and will not rely totally on the Australian market. They bring in their capital, technology and managerial knowledge. At time they may even bring in their own employees.

This is not always the case however. To a certain extent it depends on the nature of the technology park and the rationale behind its establishment. For example, one of the smallest technology parks, which was not located in a major city and was located in a rural location focused on agricultural businesses and research. In this case the nature of Australian market, labour market reflected on the technology park. Australia faces a huge shortage in skilled labour in general and in agriculture specifically. The implication is that Australian agricultural businesses used capital investment and highly developed technology and highly productive workforce to compensate for labour shortage. The technology park itself was composed of mainly Australian SMEs that specialized in agriculture which managed to attract world class researchers from all over the world in order to solve the shortage problem.

5.5 A Shared Vision

Due to the nature of a technology park and the fact that numerous parties are involved in its creation and development; it is important that these parties have an agreement and understanding of what the technology park should do both in the short and long run. The aim is to link the strategies of the universities and the tenant firms with the city's/region's own self-vision of the future of the city/ region where the technology park resided. One manager argued that:

To seek a shared vision among senior stakeholders of what success in [city name] would look like in 3 years time and to begin the process of developing a strategy to achieve that vision.

Another manager noted that:

The direct involvement of senior stakeholders in strategy generation, created a motivation towards implementation of results that may have been lacking in a more extended but lower level process. In a way the process provided insights for all into how foresight approaches can be usefully adapted to a specific policy context to set in motion dynamic networking processes so vital for the regional innovation system.

6. Conclusions

This study used intensive interviewing of technology parks' managers and managers of tenant firms in these parks to explore critical success factors of four of Australia's technology parks. The study showed that the success of a technology park depends primarily on the body or the institution that is managing the park. In general, participants agreed that universities focused on: research, students training and creating intellectual property (IP) whereas government bodies focused: on technology transfer, job creation and economic development. In addition, participants noted that universities had little understanding of market mechanisms such the commercialization of IP and concept development and testing while government bodies treated technology parks as real estate developments. The study also found that while the participants agreed on the previous success indicators of technology parks success; their emphasis on the importance of the different indicators varied.

The study found that an autonomous, private firm like management of the technology park is more likely to reach a better success considering the multiple stakeholders involved in the technology park. This is in contrast to the situation when universities managed technology parks here they focused solely on research and IP creation and government entities where the technology park was treated as a real estate development. This is evident by the fact

that all four technology parks involved shifted from university and/or government control into an autonomous management that is independent from both the universities and the government.

The study found the following to be critical success factors of technology parks in Australia:

1. A culture of risk-taking “entrepreneurism”: a technology park that has a culture of risk taking and entrepreneurship is more likely to succeed and produce more innovation and IPs.
2. An autonomous park management that is independent of both university officials and government bureaucrats: a technology park that is managed by an independent, private firm-like management is more likely to adopt a risk taking culture and therefore produce more innovations and a higher commercialisation rate.
3. An enabling environment that encompasses some or all of the following: the presence of knowledge workers and skilled labour in the immediate environment of the technology park, the availability of the right communication energy and real estate infrastructure, the availability of IP office within the technology parks increase the likelihood of success of a technology park.
4. A critical mass of internationally renowned innovative companies, and finally
5. a shared vision among the technology park stakeholders.

7. Recommendations

Based on the previous conclusions the study makes the following recommendations:

1. To be able to succeed technology parks management should nurture a culture entrepreneurship (risk taking and the freedom to fail). Successful innovation and commercialisation of IPs involves risk taking that is usually lacking in universities and government institutions especially the commercialisation side. The nature of technology parks requires such risk taking. However, this is a calculated risk that is managed by a professional management.
2. Technology park management should be autonomous from both universities and the government. It should either be totally independent or has a very high degree of autonomy. A culture of risk taking that was described in the previous point can only be achieved if the technology park has a high degree of autonomy. If this autonomy can not be achieved then the motivational incentive systems used by universities and government bodies to manage the park should be substantially modified to match those of the private sector.
3. Technology parks should provide and strive to build an enabling environment that attracts prospective tenants to the park. Communication infrastructure, real estate development of the park, proximity services can all add value to the park and can be detrimental to the decision of entry of prospective tenants.
4. Technology parks should try and build a critical mass of tenants firms which may help in creating synergies between these firms and therefore add value. Technology parks' management can adopt specific and targeted entry policy for prospective tenants that allows the technology park to choose tenants that will add to value to the technology park's stock of firms. Further, leading foreign firm should be targeted since they bring in technology, capital and new managerial styles.
5. Technology park management should aim to build a consensus or at least an understanding among the park stakeholders so that the benefits and value are maximized and all interests are served. Successful technology parks' management should make regular meeting and gatherings among tents of the park, government officials, and the community to open communication channels in order to build relationships at the grass root levels and help create a comprehensive and sustainable development on the long run where technology parks become a major player in this process.

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The Size Distribution of Chinese Manufacturing Firms: From the Perspective of Industry Life Cycle

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Abstract

Using panel data of Chinese manufacturing firms between 2003 and 2008, this paper aims to examine the evolution of firm size distribution (FSD) as the industry goes through its life-cycle. The results reveal that during the life-cycle process, China's manufacturing firms' average size becomes larger then shrinks, and the degree of firm size heterogeneity and industry concentration increases all the time. Empirical results also indicate that the change rate of FSD is affected by firms' net entry rate into industry. When net entry rate is higher, average firm size's growth rate is smaller, while size heterogeneity and industry concentration rises more dramatically.

Keywords: firm size distribution, industry life cycle, manufacturing industry

1. Introduction

Firm size distribution (FSD) has attracted increasing focus of attention in the research of industry dynamics, as it can shed some light into the market structure of the industry, and aids in understanding the mechanism of industry evolution.

Researches on FSD are concentrated on developed countries. There exist two classical theories, which are the Gibrat's law and Pareto law (Gibrat, 1931; Simon, 1958). They respectively conclude that FSD will approach the lognormal distribution or a Pareto distribution in a long term. Many empirical studies using data of different counties are carried out to testify the above theories. Some suggest that the Pareto index is close to 1 in free competitive market, which called Zipf's distribution (Fujiwara, Di Guilmi, Aoyama, Gallegati, and Souma, 2004). However, recent empirical tests claim that the above facts does not hold true when taking more complete data and more sophisticated analyzing tools into consideration. Characteristics of firm growth are more complicated than a random walk process, and behaviors of firm entry and exit in industry evolution are influenced by many factors. Based on this, more and more elements affecting FSD is explored. Lotti and Santarelli (2004), as well as Reichstein and Jensen (2005), after investigating different industries in Italy and Denmark, both point out that convergence of FSD are significantly affected by features of industries. Cabral and Mata (2003), basing on the study of Portuguese manufacturing firms, argues that in the early period of industry development, growth of small firms are impeded by financial constrains, which leads FSD a deviation from the lognormal. However, the impact of financial constraints weakens gradually as the industry develops. Kang, Jiang, Cheong, and Yoon (2011) observe the FSD for Korean firms, and find that the upper tail of the Korean FSD can be described as power-law distributions, but it derives in financial crisis period. Thus the paper concludes that the FSD changes over time, and Zipf's law is not universal but does hold as a special case.

Due to data constraints, domestic studies about FSD appear only these years. Shi (2010) examines the size distribution of Chinese industrial firms, and indicates that the Chinese FSD is mostly belonged to lognormal, being consistent with the Gibrat theory. However, there shows new characteristics in China's FSD, like lacking of large firms, low degree of market concentration, and unbalance development between different industries. Yang, Li, and Fang (2010) estimate the Pareto index of FSD using different provinces' data in China. They suggest that FSD in China is significantly deviated from Zipf's Law, and the main reason is some large-scale stated-owned firms fostered by government distort market's competition mechanism. Using samples of China's large and medium size manufacturing enterprises (LMEs), Fang and Nie (2010) tests the size distribution of Chinese firms, and the results show that the FSD deviates Zipf's law, mainly owing to the existence of state-owned enterprises (SOEs). In detail, the entry and exit barriers set by government, the unfair competition between SOEs and private enterprises, together weaken the competition mechanism in industry, and lead to FSD a deviation from Zipf's law. Zhang and Meng

(2010), by using the data of all the listed companies from 1997 to 2008, study the Burr distribution and the generalized extreme value distribution, and find that the FSD of Chinese firm follows Burr distribution.

From the above studies, we find that the shape and convergence trend of FSD has been a focus of attention. However, most studies above only casually chose a period of time to observe FSD, and researches mainly assume that the industry has developed into a stable and mature stage, so testing the convergence shape of FSD statically is paid high attention on. Nevertheless, this is far from enough to describe the actual evolution of FSD during the whole life-cycle of an industry. In fact, the industry life-cycle theory clearly states that when the industry goes through stages of its life-cycle, firm behaviors and industry characteristics will show obvious periodic features, such as firm entry and exit behavior. Hence, by influencing the number of firms inside industry and firms' growth rate, these features will certainly lead to a significant evolution of FSD along with the general evolution of the industry. Thus it's necessary to observe the FSD from a dynamic perspective combining with the industry life-cycle theory. Dinlersoz and MacDonald(2009) analyzes the distribution of output and employment across firms in US manufacturing industries from 1963-1997, and confirm that the FSD evolve in a way that depends on the phase of the industry life cycle, and the evolution of the distributions are more dramatic when life cycle itself unfolds more dramatically. However, due to the different industry environment between developed and developing countries, this principle does not necessarily hold true in China. Therefore, this paper uses panel data from 2003 to 2008 of Chinese manufacturing firms to survey the evolutionary trend of FSD in China.

The rest of the paper is organized as follows. The methodology and data are described in section 2. Statistical results describing characteristics of FSD evolution is represented in section 3, and section 4 demonstrates an empirical test. In Section 5, we conclude with a discussion of statistical and empirical results with policy implications.

2. Data and Methodology

2.1 Data

This paper uses data of 4-digit industries according to "Industrial classification for national economic activities". Data of firm size are gathered from "China Industry Business Performance Database". This database contains a big range of data in firm level, such as output value, total assets, and employment number, which provides original data we need for our study.

However, because the "Industrial classification for national economic activities" was revised in 2002, the 4-digit industry classification was different after 2003. Hence, in order to retain more data and keeping data up-dated, samples from 2003-2008 are chosen for research. After excluding samples that lacking data or maintain illogical data, about 170,000 observations in 6 years are finally taken to use. In addition, some data in industry level, such as annual industrial output value, are directly collected from the National Bureau of Statistics of China.

2.2 Identification of the Industry Life-cycle Stage

Industry life cycle can be divided into 4 stages, including initial stage, growth stage, maturity stage and decline stage. However, it takes a long time for a single industry to go through all these stages, and it's difficult to get data for such a long duration. With the aim of solving this problem, the article adopts the method used by Dinlersoz and MacDonald (2009), which divides all samples in to 4 groups including initial, growth, mature and decline group according to the life-cycle stage the industries are experiencing during the sample period, then characteristics showed by different groups are used to represent the features when industry goes through this stage. Electronic computer industry is used to test the robustness in Dinlersoz and MacDonald's article, and it has confirmed that the method gives reasonable results while solving the problem of lacking data for a long duration.

Identification of industries' life-cycle stage refers to Fan (2002), recognizing industry life-cycle stage by relative output growth rate. In detail, from 2003 to 2005 and from 2006 to 2008, average annual growth rate of each 4-digit industry sample' output is compared to that of national total industrial output respectively. If an industry's output grows more slowly than total national industry output in the first 3 years, then faster in the last 3 years, it can be recognized as in initial stage. On the opposite, if grows faster in first 3 years then grows more slowly later, in mature stage. If grows faster in both period, in growth stage, and if more slowly in both, in decline stage.

Average annual growth rate of national total industry output from 2003-2005 and 2006-2008 is 12.57% and 11.94% respectively. Average annual growth rate of samples are summarized in Table 1.

Table 1. Identification results of Chinese manufacturing industries' life-cycle stage

Stages Industries are in	Number of 4-digit Industries	Average annual growth rate of Chinese 4-digit manufacturing industries (%)					
		From 2003 to 2005			From 2006 to 2008		
		Mini	Max	Mean	Mini	Max	Mean
Initial	49	-30.13	11.69	1.47	13.77	191.97	36.15
Growth	268	12.14	204.90	38.99	12.72	115.55	31.56
Mature	22	15.40	83.39	41.01	-11.14	12.47	7.30
Decline	9	-21.46	7.18	-1.07	-2.07	10.97	7.01

Table 1 shows that, after removing some samples not in clear stage, 348 samples are ultimately available, including 49 in initial stage, 268 in growth stage, 22 in mature stage, and the rest 9 in decline stage. Industries in growth stage account for over 3/4 of all the samples, which hints characteristics of Chinese manufacturing industries in growth stage is worth of paying attention.

Apart from identifying by growth rate, another common identification method of industries' life-cycle stage is based on firm entry and exit. Behavior of firm entry and exit is considered as a significant feature in industry evolution, and firm number is expected to increase first and then decrease (Zhang, 2007). In order to further understand the characteristics of Chinese manufacturing industry, this paper, basing on the results of growth rate classification, calculates the average net firm entry rate from 2003 to 2008 for each group. Results are shown in table 2.

Table 2. Average net firm entry rate of Chinese manufacturing industries in different life-cycle stages

Industry Life-cycle Stage	Initial stage	Growth stage	Mature stage	Decline stage
Net Firm Entry Rate	63.40%	126.11%	55.19%	11.98%

Table 2 shows the average net firm entry rate of Chinese manufacturing industries is always above 0 in 4 stages. Entry rate of growth stage is 126.11%, which is the highest of all. That of initial and mature stage is between 55% and 65%, and that of decline stage is 11.98%. It's supervising to find that Chinese manufacturing industry attracts many firms to enter in when it goes through its decline stage, because traditional life-cycle theory claims that a large number of firms would exit the industry in this stage. Taking into the specialties of the samples into consideration, we think there are two possible reasons as follows: firstly, as shown in table 2, we only get 9 sample industries in decline stage, which only occupies 2.59% of all samples. In other words, samples in decline stage may be too little to reflect the characteristic of decline stage completely. Secondly, we can also discover from table 2 that, average growth rate of declining industries is -1.07% in the first 3 years and 7.01% in the last 3 year. Though declining industries always grow more slowly than national industry, they grow much faster in the last 3 years than the first. The increase of growth rate may profits from firms' innovative activities in order to maintain revenues. The innovation theory points out that the innovative activities may significantly postpone the arrival of decline stage, or may even help some industries get rid of recession and leap into a rapid growing stage again. Hence, an upward turning point of growth rate in declining industry is very likely to suggest that the industry will go into prosperity again, and thus may attracts a number of firms to enter in.

The above reasons make it possible for declining manufacturing industries in China has a positive net firm entry rate. However, comparing growth rate of 4 different stages, growth rate in decline stage is the least, so it is still consistent with the logic of relative decline.

2.3 Measurement of FSD

2.3.1 Measures of Firm Size

Common measurements of firm size can be classified into two categories. One is based on the production scale, like measuring firm size by employment number (Nkurunziza, 2008), total assets (Chen and Xing, 2003), or total production (Datta Mago and Dechenaux, 2009). Another is related to operating scale, like measuring firm size by sales (Zhu, 2006), revenue (Demirel and Mazzucato, 2009), or client numbers (Chowdhury, 2010).

As operating data is vulnerable to accidental factors and is easy to fluctuate in different years, it's not suitable to use operating index to measure comparatively stable firm size. Hence, we finally chose 3 production indexes to measure

firm size, which are total assets, total output value and employment number. Distributions of the three are observed one by one and compared to each other in analysis, which further ensures robustness of our conclusion.

2.3.2 Measures of Size Distribution

Generally, distribution curve map is the most direct way to observe the shape of FSD. However, distribution map is stationary, so it's not an ideal method to explore the evolution of FSD. Another way to demonstrate FSD is to use related statistical indicators. Statistical indicators can reflect tiny changes in FSD precisely, and are also helpful for revealing the essence of FSD. Thus 3 groups containing 2 statistical indicators each as follows are chosen to measure the shape of FSD.

The first group contains the mean (μ) and the median (M), together reflecting the average firm size of Chinese manufacturing industry. Details can be seen in formula (1) and (2), where n represents the number of firms inside industry, X_i represents the size of the i th smallest firm in the industry.

$$\mu = \frac{1}{n} \sum_{i=1}^n X_i \quad (1)$$

$$M = \begin{cases} X_{(n+1)/2} & \text{when } n \text{ is odd} \\ \frac{(X_{n/2} + X_{n/2+1})}{2} & ; \text{ otherwise} \end{cases} \quad (2)$$

The second group contains the standard deviation (σ) and coefficient of variation (CV), revealing the heterogeneity of firm size within industry. The bigger the σ or CV, the higher the degree of heterogeneity is. Details are as follows.

$$\sigma = \sqrt{\frac{\sum (X_i - \mu)^2}{n-1}} \quad (3)$$

$$CV = \frac{\sigma}{\mu} \quad (4)$$

The third group contains the coefficients of skewness (sk) and coefficient of kurtosis (kur). sk reflects the asymmetry of distribution. If the left tail is more pronounced than the right tail, the function is said to have negative skewness (or skew to left). If the reverse is true, it has positive skewness (or skew to right). A distribution with a greater sk is more tend to be skewed to right. kur is a measure of whether the data are peaked or flat relative to a normal distribution. That is, distribution with high kurtosis tends to have a distinct peak near the mean, decline rather rapidly, and have heavy tails. Combination of the two indicators well reflects the proportion of small or big firms within the industry, and further tells the degree of market concentration of the industry. Details can be seen in formula (5) and (6).

$$sk = \frac{1}{n} \sum_{i=1}^n \left(\frac{X_i - \mu}{\sigma} \right)^3 \quad (5)$$

$$kur = \frac{1}{n} \sum_{i=1}^n \left(\frac{X_i - \mu}{\sigma} \right)^4 \quad (6)$$

Take 2008 for example, we calculate these 6 indicators of FSD for all 2-digit manufacturing industries. Results of assets distribution are in table 3, and output and employment distribution are in table 7 and 8 in appendix.

Table 3. Asset Distribution of 2-digit Chinese manufacturing industries in 2008 (Assets: million RMB)

2-digit industries	μ	M	σ	CV	sk	kur
Agricultural and Sideline Products Processing	48.15	13.56	204.35	4.24	22.18	728.17
Food Manufacturing	64.68	17.24	247.01	3.82	16.14	374.61
Beverage Manufacturing	109.89	19.51	627.85	5.71	30.39	1218.32
Tobacco Processing	2838.78	199.63	7716.48	2.72	4.82	28.28
Textile Industry	46.29	13.38	314.95	6.80	107.08	15590.44
Textile Garments, Shoes and Caps Products	31.01	10.62	156.15	5.03	34.01	1538.39
Leather, Furs, Down and Relate Products	35.09	11.25	126.12	3.59	30.23	1519.18
Timber Processing, Bamboo, Cane, Palm Fiber and Straw Products	26.61	8.50	138.06	5.19	44.77	2854.61
Furniture Manufacturing	36.04	12.56	91.71	2.54	10.05	155.77
Papermaking and Paper Products	74.41	13.87	561.91	7.55	27.42	977.99
Printing and Record Medium Reproduction	40.78	14.00	113.21	2.78	11.92	213.77
Cultural, Educational and Sports Goods	33.26	12.23	84.36	2.54	10.71	476.24
Petroleum Processing, Coking and Nuclear Fuel Processing	480.67	33.04	2387.74	4.97	11.06	151.01
Raw Chemical Materials and Chemical Products	97.67	16.14	573.14	5.87	23.75	849.62
Medical and Pharmaceutical Products	120.81	36.39	405.14	3.35	14.73	332.40
Chemical Fiber	165.89	16.24	664.55	4.01	11.29	203.10
Rubber Products	71.05	13.84	371.14	5.22	13.29	209.21
Plastic Products	36.03	11.57	146.48	4.07	24.23	784.22
Nonmetal Minerals Products	58.73	16.48	254.26	4.33	24.09	937.43
Smelting and Pressing of Ferrous Metals	439.30	24.33	4210.93	9.59	25.23	805.70
Smelting and Pressing of Nonferrous Metals	171.68	20.06	1196.72	6.97	22.14	633.28
Metal Products	39.07	12.45	148.61	3.80	24.96	1054.97
General Equipment	52.71	12.76	410.70	7.79	63.41	5925.35
Special Purpose Equipment	68.78	16.30	406.72	5.91	26.89	973.54
Transport Equipment	155.67	18.21	1325.12	8.51	29.21	1156.32
Electric Equipment and Machinery	80.65	16.87	543.62	6.74	39.08	2115.66
Telecommunications, Computer, and Other Electronic Equipment	195.78	26.48	1476.71	7.54	43.27	2671.09
Instruments, Meters, Cultural and Clerical Machinery	67.88	17.57	229.19	3.38	12.66	243.12
Handicraft Article and Other Manufacturing	28.60	9.81	110.01	3.85	25.77	1080.53
Waste Resources and Materials Recovering	50.50	15.30	295.24	5.85	23.93	655.59

Remarks: because of data missing, data of "Smelting and Pressing of Nonferrous Metals" industry is replaced by data of 2007.

Table 3 shows 70% of the Chinese manufacturing industries have an average asset size between 2.5 million to 100 million RMB. Only 9 industries exceed 100 million in μ , and only 1 exceeds 100 million in M, which illustrates that Chinese manufacturing firms are too small in scale. As to σ , the minimum is 84.36 and the maximum is 7716.48. Three-fourths of the industries have σ between 100-1000, and most have a CV between 3 to 6, which demonstrates the heterogeneity of Chinese manufacturing industries. Sk and kur are all positive, and we find there exist some connections between the two indicators. The industry which has a higher sk tends to have a higher kur too, but a lower average size. As a high sk and a high kur together reflects a high degree of concentration, it confirms that an industry with a high degree of concentration contains many small-scaled firms inside. We can get similar conclusion when referring to output and employment distributions from table 7 and 8 in appendix.

2.3.3 Analysis Method of the Trend of Distribution Evolution

The goal of this paper is to reveal the evolution trend of FSD when the industry goes through its life cycle. Hence, in order to show the variation tendency directly, we further calculate the change rate of all the 6 FSD indicators from 2003 to 2008, and then make average of industries in the same group so as to describe the characteristic of the corresponding life-cycle stage. Details are as follows.

$$\overline{\Delta Y_k} = \sum_{i=1}^n \left(\frac{Y_{k,i}^{2008} - Y_{k,i}^{2003}}{Y_{k,i}^{2003}} \right) / n \quad (7)$$

Subscript k identifies different indicators of FSD. When k=1~6, Y represents μ , M, σ , CV, sk and kur respectively. The i identifies different 4-digit manufacturing industry. Superscript of Y indicates the year. $\overline{\Delta Y_k}$ finally represents the average growth rate of the kth indicator from 2003 to 2008.

3. FSD Evolution of Chinese Manufacturing Industry

With data of Chinese manufacturing industry from 2003 to 2008, taking assets, output and employment as measurement of firm size one by one, growth rate of 6 indicators in every life-cycle stage are calculated according to formula (1) to (7). The results are shown in table 4.

Table 4. Growth rate of 6 indicators in every life-cycle stage (%)

	$\Delta\mu$	ΔM	$\Delta\sigma$	ΔCV	Δsk	Δkur
Based on asset distribution						
Initial Stage	31.30	21.81	33.42	1.62	29.23	90.50
Growth Stage	50.81	31.85	71.83	13.93	43.73	124.79
Mature Stage	19.90	34.84	33.31	11.19	33.63	91.45
Decline Stage	-19.79	-0.37	8.64	35.44	35.60	46.03
Based on output distribution						
Initial Stage	69.85	55.30	63.19	-3.92	7.37	28.10
Growth Stage	104.92	90.05	125.56	10.07	45.45	153.06
Mature Stage	20.52	30.29	31.48	9.09	17.78	46.72
Decline Stage	-11.22	18.53	17.26	32.08	30.48	74.40
Based on employment distribution						
Initial Stage	19.84	-22.91	-20.19	-0.44	11.60	20.53
Growth Stage	-20.14	-30.84	-3.94	20.29	42.66	147.80
Mature Stage	-0.68	-25.22	14.59	15.38	31.68	78.06
Decline Stage	-25.89	-25.83	-6.98	25.52	23.34	75.25

3.1 Changing Trend of Average Firm Size

Average firm size measured by assets and outputs evolve in similar trend. Both demonstrate an upward trend in initial growth and mature stages and a downward trend in decline stage. Both μ and M increases fastest in the growth stage, especially $\Delta\mu$ of assets in growth stage is 104%, which means asset scale of firms in growing industry doubles in 6 years. We have mentioned in table 1 that most of Chinese manufacturing industries are in growth stage, so it means most of the industries have a rapid growth rate of firm size, which is a positive signal for China to resolve the problem of lacking large firms while crowded with too many small firms.

However, employment result is very different from the above two. μ only increases in initial stage, but decreases in all remaining stages. $\Delta\mu$ in growth and decline stage both exceeds -20%. ΔM is always negative for all stages. As China now is in a period of transition, we believe that this is related to the structure upgrading of China's manufacturing industry. Although traditional labor-intensive comparative advantage make Chinese manufacturing industry a rapid development in the last decades, we all believe that in the long term, only firms with high-technology and creativity will have a promising future. Hence, manufacturing firms begin to change from

labor-intensive to technology-intensive or even knowledge-intensive. Consequently, demand for talents or high-skilled employees will increase but the total number of employment may decline at the same time. Therefore, it's no more difficult to understand why Chinese manufacturing firms increase in assets and outputs size, but decrease in employment size.

3.2 Discrete Degree of FSD

Standard deviation (σ) and coefficient of variation (CV) describe the discrete degree of a distribution. Results of $\Delta\sigma$ measured by asset, output and employment differ significantly. σ of asset and output distribution continuously increases when Chinese manufacturing industry goes through its life cycle. Both rise fastest in the growth stage, showing a growth rate of 71.83% and 125.56% respectively. $\Delta\sigma$ in initial and mature stage maintain between 30% and 65%, and that in decline stage is the lowest, which bellows 20%. However, the result of employment is entirely different. σ of employment distribution always demonstrates negative change rate in initial, growth and decline stage, which are -20.19%, -3.94% and -6.98% respectively.

However, it's supervising to find that three sets of CV results are quite similar to each other. As compared to σ , CV excludes the influence of mean, so we conclude that difference of 3 sets of σ derives from unusual variation of average employment number.

Excluding uncommon variation of employment, rest σ s and CVs all maintain positive change rate, indicating the degree of firm size heterogeneity in Chinese manufacturing industry deepens continuously when it goes through its life cycle. Heterogeneity is an important topic in evolutionary economics, which concerns about the impact of heterogeneity on industry innovation. Nowadays, researches reach an agreement that heterogeneity encourages firms to invest in R&D, and will contribute to industry innovation and performance (Greunz, 2004; Sun, 2010). Therefore, it's appropriate to further stimulate and promote the deepening of the heterogeneity degree inside China's manufacturing industries.

In all life cycle stages, rising of heterogeneity is very fast in the second stage. It owes to two characteristics of this stage. First, industry in growth stage always has a promising prospect and attracts many firms to enter. Existing of a variety of firms makes it possible for a high degree of heterogeneity. Second, firms in growing industry are facing more and more fierce competition, so they pay increasing attention on process innovation and firm expansion so as to make most of benefits from economics of scale. During this time, a self-reinforcing mechanism appears. It means the firms beginning earlier to enlarge scale are prone to earlier get benefits which provide enough money to expansion further. Consequently, the big firm becomes large or huge while small firms remain still small. In other words, the gap between small and large firms widened gradually. The above reasons together lead to a rapid increase in degree of firm size heterogeneity when Chinese manufacturing industry in its growth stage. To the contrary, decline stage is considered to narrow down firm heterogeneity. In this stage, many firms are expected to exit the industry, while the survival ones are considered to be all the similar type, which are efficient and full of vitality. However, table 4 shows that Chinese manufacturing firms don't demonstrate negative change rate in standard deviation or coefficient of variation in decline stage. One possible explanation is that Chinese manufacturing industry doesn't show extensive firm exit in decline stage as usual which we have mentioned when explaining table 2, so it denies the premise of reducing heterogeneity. Another reason may be from the efforts of firms trying to increase heterogeneity of their products, service or firms in order to maintain competitive advantage in the decline stage.

3.3 Asymmetry of FSD

Both skewness and kurtosis of Chinese manufacturing FSD change in the similar trend. All results of Δsk and Δkur in four stages are above zero and the two indicators show certain of positive correlation. Both sk and kur grow fastest in growth stage, with Δsk at about 43% and Δkur between 120% and 155%. Change rate in initial stage is the smallest. Apart from Δsk of asset distribution, all rest 5 indicators are below 30%. Besides, mature and decline stage show a mild change rate, with Δsk at about 30%, and Δkur between 45% and 90%.

Kur and sk increase together means there are increasing small firms in the industry while the impact of few large or giant firms do not diminish, so the concentration rate of industry will increase accordingly. It's generally recognized that there are two modes for an industry to increase the degree of industry concentration. One is to let firms experience full competition, so under the survival of the fittest mechanism, the most outstanding firms develop and expand while the inefficient ones shrink or eliminates. This mode is considered to create a virtuous cycle in development of industry. On the other hand, under some circumstance, government support can also provide opportunities for some state-owned firms to expand quickly. However, this type is not expected to improve performance of the firms or industry, because when supported by government, these firms are no longer necessary to compete with others fiercely, and will lose motivation to reform or innovate. The second method to increase industry

concentration degree is certainly undesirable. In order to investigate the increasing mode of concentration degree of Chinese manufacturing industry, two groups of sample industries are chosen for comparison. The first group contains the industries having a high proportion of state-owned company in sales, which are Tobacco Producing; Petroleum Processing, Coking and Nuclear Fuel Processing; and Smelting and Pressing of Ferrous Metals. Another contains the industries in opposite condition, including Textile Industry; Leather, Furs, Down and Relate Products; and Furniture Manufacturing Industry. According to table 3, we calculate average u , sk and kur for each group. The average u , sk and kur of the first group are 1252.91, 13.70 and 328.33. But when it comes to the second group, the story is quite different. Average u of the second group is 39.14, much lower than the first group, while average sk and kur are 49.12 and 5755.13, much higher than the first group. It means that the highly-concentrated manufacturing industries in China are little invented by government. It confirms the increasing in concentration degree of Chinese manufacturing industry is mainly derived from healthy competition, which is good news for China that wishes to increase concentration degree of manufacturing industry further.

We find that the change trend of concentration degree in decline stage is different from the conclusion in USA (Dinlersoz and MacDonald, 2009), which says that in decline stage, degree of monopoly and concentration drop down. We still consider it relevant to abnormal entry of Chinese manufacturing firms into the industry in this stage.

4. Influence of Firm Entry and Exit to the Change Rate of FSD

From above, we have concluded that FSD evolves when the industry goes through its life-cycle. However, what will affect the evolution speed of FSD? As firm entry and exit is a significant feature in industry's life-cycle, and directly affects firm number of an industry, so we wonder will it have some impact on the change rate of FSD? When an industry has a higher firm entry rate, will it also has a greater change rate in FSD?

In order to clarify the relation between the two, this paper makes a regression described in formula (8). ΔN represents the net firm entry rate of the 4-digit industry from 2003 to 2008. ΔY indicates change rate of above 6 FSD indicators one by one, that are $\Delta\mu$, ΔM , $\Delta\sigma$, ΔCV , Δsk and Δkur . Samples include all 348 industries mentioned in section 2.

$$\Delta Y = b_1 \Delta N + b_0 + \mu \quad (8)$$

The descriptive statistics of the samples are in table 5:

Table 5. Descriptive Statistics

	$\Delta\mu$	ΔM	$\Delta\sigma$	ΔCV	Δsk	Δkur	ΔN
Obs	348	348	348	348	348	348	348
Based on asset distribution							
Mini (%)	-65.93	-69.53	-75.86	-70.14	-74.93	-950.06	-55.78
Max (%)	409.37	1128.28	1646.58	269.15	1116.37	194377.61	760.31
Mean (%)	31.73	24.54	74.63	26.42	63.05	813.18	120.54
S.D. (%)	52.14	72.73	136.53	49.58	109.18	10419.59	99.24
Based on output distribution							
Mini (%)	-49.96	-63.01	-78.82	-70.01	-66.77	-1091.17	
Max (%)	523.76	438.09	4122.32	576.92	1008.97	14617444.13	
Mean (%)	80.66	62.35	137.88	23.61	52.77	42222.09	
S.D. (%)	67.97	57.22	254.41	51.83	94.66	783565.70	
Based on employment distribution							
Mini (%)	-74.75	-91.73	-82.73	-52.44	-3786.21	-396.00	
Max (%)	312.49	75.76	563.77	231.00	636.64	4368.15	
Mean (%)	-18.73	-22.86	-1.16	17.91	40.83	208.66	
S.D. (%)	30.05	19.07	60.20	38.50	222.24	411.30	

Based on E-views 6.0, this paper uses OLS method to make regression one by one. When White heteroskedasticity test is made to avoid heteroscedasticity problem in cross-section regression, we find 5 sets of regression are bothered by the problem, which are $\Delta Y = \Delta\mu$, $\Delta\sigma$, ΔCV , Δkur (under assets distribution) and $\Delta Y = \Delta sk$ (under employment

distribution). Therefore, WLS method is used to modify these results, and the final regression results are shown in table 6.

Table 6. Regression Results

	$\Delta\mu$	ΔM	$\Delta\sigma$	ΔCV	Δsk	Δkur
Based on asset distribution						
ΔN	0.0269** (8.8591)	-0.0802* (-2.0475)	0.3685** (57.8064)	0.1482** (81.5833)	0.3891** (7.0339)	14.7663** (18.8088)
R^2	0.1849	0.0120	0.9062	0.9506	0.1251	0.5056
Based on output distribution						
ΔN	-0.0808* (-2.2095)	-0.1384** (-4.6010)	0.1208 (0.8778)	0.1090** (3.9684)	0.2613** (5.2984)	195.8434 (0.4615)
R^2	0.0139	0.0577	0.0022	0.0435	0.0750	0.0006
Based on employment distribution						
ΔN	-0.0498** (-3.1025)	-0.0297** (-2.9138)	-0.0320 (-0.9834)	0.0320 (1.5375)	-0.4292** (-39.2683)	0.8904** (4.0916)
R^2	0.0271	0.0240	0.0028	0.0068	0.8167	0.0462

Notes: Standard deviations in parentheses, significance levels: *<5%, **<1%.

In table 6, 12 groups of regression get effective results under significance level of 5%. Conclusions based on asset, output and employment are similar, and consistent with our expectation, revealing a particular relation between firm entry rate and FSD change rate. In detail, change rate of average firm size is negative to firms' net entry rate. The coefficients are between -0.15 and -0.02, indicating that the more the small firms enter into the industry, the slower the industry's average firm size grows. Second, coefficients of $\Delta\sigma$ and ΔCV are positive, which means an industry with a high firm entry rate, will enjoy a rapid increase in firm heterogeneity. Last but not the least, coefficients of Δsk and Δkur are all positive except Δsk of employment distribution. It suggests that the sooner the firm enters into the industry, the faster the increase of the degree of industry concentration.

5. Conclusion and Suggestions

With data of Chinese manufacturing industry from 2003-2008, this paper examines the evolution of firm size distribution (FSD) as the industry goes through stages of its life cycle. We find that Chinese manufacturing firms' average size increases and then fall down, the degree of firm size heterogeneity and industry concentration increases all the time. Chinese manufacturing industries are crowded with too many small firms but have a low degree of concentration, so it's cheerful to find that most Chinese manufacturing industries are in growth stage, during which, average firm size, firm heterogeneity and degree of concentration are expected to increase quickly. What's more, empirical results also indicate that the FSD change rate is influenced by firms' net entry rate into the industry. When net entry rate is higher, average firm size raises more lowly, while size heterogeneity and industry concentration increases more dramatically. Besides, characteristics of employment distribution are found different from asset and output distribution. It demonstrates new features in transition period when Chinese manufacturing industries are upgrading from labor-intensive to technology-intensive or even knowledge-intensive.

In order to further promote the development of Chinese manufacturing industry, relative measures should be taken by government. The first is to encourage innovation, especially to encourage process innovation of the firms in growing industry so that they can expand quickly and stimulate the increase of average firm size of Chinese manufacturing industry. The second is to reduce administrative barriers for firms to enter into Chinese manufacturing industry. The degree of heterogeneity and concentration will both increase soundly under a high net firm entry rate. The last is to pay attention on education, to foster high-skilled employees, because human-resources are of crucial importance for the upgrading of Chinese manufacturing industry.

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Appendix

Table 7. Output distribution of 2-digit Chinese manufacturing industries in 2008(Output:million RMB)

2-digit industries	μ	M	σ	CV	sk	kur
Agricultural and Sideline Products Processing	104.90	34.90	413.79	3.94	25.52	1009.96
Food Manufacturing	95.17	27.89	326.48	3.43	13.55	262.23
Beverage Manufacturing	115.51	28.07	495.85	4.29	27.45	1151.19
Tobacco Processing	2877.48	114.13	6618.37	2.30	3.36	12.52
Textile Industry	64.57	24.56	456.42	7.07	133.29	21355.90
Textile Garments, Shoes and Caps Products	51.74	20.62	190.63	3.68	32.92	1592.43
Leather, Furs, Down and Relate Products	68.10	25.12	175.37	2.58	12.52	251.71
Timber Processing, Bamboo, Cane, Palm Fiber and Straw Products	46.57	20.85	144.55	3.10	37.41	2037.07
Furniture Manufacturing	57.05	23.30	134.92	2.36	13.74	337.76
Papermaking and Paper Products	78.65	24.21	343.51	4.37	23.20	775.09
Printing and Record Medium Reproduction	41.43	15.42	96.68	2.33	9.55	136.18
Cultural, Educational and Sports Goods	52.08	20.60	129.78	2.49	12.72	503.28
Petroleum Processing, Coking and Nuclear Fuel Processing	936.56	63.37	5058.40	5.40	10.24	123.10
Raw Chemical Materials and Chemical Products	120.31	30.22	650.93	5.41	37.29	2072.09
Medical and Pharmaceutical Products	120.71	38.51	398.16	3.30	17.84	520.73
Chemical Fiber	195.67	34.03	797.60	4.08	12.00	200.67
Rubber Products	90.96	22.98	437.32	4.81	17.50	396.19
Plastic Products	50.80	19.47	146.48	2.88	22.22	883.49
Nonmetal Minerals Products	68.61	26.60	176.78	2.58	15.59	416.55
Smelting and Pressing of Ferrous Metals	558.26	58.07	3577.26	6.41	19.16	505.81
Smelting and Pressing of Nonferrous Metals	269.64	50.76	1240.87	4.60	19.20	523.10
Metal Products	61.23	21.14	215.46	3.52	30.41	1599.50
General Equipment	66.87	20.15	339.44	5.08	45.72	3239.56
Special Purpose Equipment	75.92	20.61	395.19	5.21	29.92	1307.00
Transport Equipment	173.18	25.84	1502.79	8.68	35.88	1831.04
Electric Equipment and Machinery	118.28	26.06	753.02	6.37	58.68	5070.89
Telecommunications, Computer, and Other Electronic Equipment	323.23	31.73	2876.10	8.90	37.16	1965.81
Instruments, Meters, Cultural and Clerical Machinery	88.89	19.67	409.90	4.61	15.76	334.41
Handicraft Article and Other Manufacturing	52.27	18.09	174.54	3.34	17.83	456.38
Waste Resources and Materials Recovering	104.67	34.87	322.74	3.08	14.73	297.01

Remarks: because of data missing, data of "Smelting and Pressing of Nonferrous Metals" industry is replaced by data of 2007.

Table 8. Employment distribution of 2-digit Chinese manufacturing industries in 2008

2-digit industries	μ	M	σ	CV	sk	kur
Agricultural and Sideline Products Processing	138.19	63.00	395.92	2.87	27.95	1401.86
Food Manufacturing	190.64	86.00	457.31	2.40	13.88	313.28
Beverage Manufacturing	208.91	84.00	693.56	3.32	25.88	1007.14
Tobacco Processing	1267.44	430.00	2549.15	2.01	4.87	30.69
Textile Industry	196.80	89.00	931.31	4.73	119.15	18346.59
Textile Garments, Shoes and Caps Products	251.52	146.00	548.27	2.18	27.45	1312.08
Leather, Furs, Down and Relate Products	316.98	129.00	931.31	2.94	18.11	597.09
Timber Processing, Bamboo, Cane, Palm Fiber and Straw Products	127.30	80.00	251.26	1.97	25.67	1125.90
Furniture Manufacturing	193.85	95.00	383.53	1.98	8.68	118.99
Papermaking and Paper Products	151.76	75.00	347.81	2.29	13.31	276.90
Printing and Record Medium Reproduction	126.57	66.00	318.74	2.52	40.29	2453.86
Cultural, Educational and Sports Goods	276.67	120.00	654.10	2.36	12.09	185.87
Petroleum Processing, Coking and Nuclear Fuel Processing	352.52	68.00	1198.17	3.40	8.90	97.07
Raw Chemical Materials and Chemical Products	152.22	62.00	439.98	2.89	16.97	510.73
Medical and Pharmaceutical Products	231.07	109.00	604.55	2.62	17.65	476.84
Chemical Fiber	222.10	60.00	765.55	3.45	10.27	135.48
Rubber Products	209.26	85.00	551.40	2.64	11.42	193.21
Plastic Products	131.09	65.00	479.93	3.66	67.55	6276.66
Nonmetal Minerals Products	163.39	89.00	313.76	1.92	13.04	303.12
Smelting and Pressing of Ferrous Metals	391.29	81.00	2420.25	6.19	27.06	1058.60
Smelting and Pressing of Nonferrous Metals	233.68	70.00	1036.15	4.43	19.02	492.98
Metal Products	133.28	70.00	282.95	2.12	14.99	432.85
General Equipment	133.59	65.00	332.94	2.49	19.18	667.32
Special Purpose Equipment	154.87	70.00	502.55	3.24	27.13	1099.55
Transport Equipment	237.61	86.00	752.63	3.17	14.71	317.45
Electric Equipment and Machinery	205.15	80.00	699.40	3.41	33.33	1994.03
Telecommunications, Computer, and Other Electronic Equipment	488.16	135.00	2426.94	4.97	47.96	3516.99
Instruments, Meters, Cultural and Clerical Machinery	207.51	78.00	532.87	2.57	9.32	122.70
Handicraft Article and Other Manufacturing	186.21	96.00	342.03	1.84	9.91	192.24
Waste Resources and Materials Recovering	130.64	49.00	1049.94	8.04	31.71	1030.81

Remarks: because of data missing, data of "Smelting and Pressing of Nonferrous Metals" industry is replaced by data of 2007.

Does Financial Crisis Give Impacts on Bahrain Islamic Banking Performance? A Panel Regression Analysis

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Abstract

The 2007/2008 global financial crisis has given a significant impact on the performance of banking industry worldwide. The objective of this study is to see the impact of global financial crisis towards the financial performance of Islamic banking industry in Bahrain. Moreover, it also utilizes bank specific factors as predictors for Islamic bank performance in Bahrain. Panel regression is used to analyze the data. The result shows that LTA, LEQ, and LOHE are significant bank specific factors to influence Islamic bank performance in Bahrain. In addition, there is no significant impact of financial crisis upon the financial performance during the crisis period; however, it does affect the financial performance of Bahrain Islamic banking industry after the crisis period.

Keywords: financial crisis, Islamic banking, bank performance, panel regression, Bahrain

1. Introduction

The 2008 global financial crisis that started in the U.S. in late 2007 has given a wide array of impacts to the operating and financial performance of many banks all over the world (Ellaboudy, 2010; Smolo and Mirakhor, 2010; Kassim and Majid, 2010). As a result, many banks across the world reported financial loss on their financial report due to their connections with subprime mortgage in the U.S. or were simply affected by economic recession in their own countries. The impact of the crisis have even forced around 123 banks in the U.S. to file for bankruptcy in the year, including American giant bank Lehman Brother that was never been expected to fail.

As one of the results, the financial crisis has raised public's interest on Islamic banks since they are said to be relatively much less affected by the crisis. A number of experts and officials of Islamic banks have even claimed that Islamic banks are either not or less affected by the global financial crisis than conventional peers due to the nature of Islamic banking in which all financial transactions must be trade-based and asset-linked (Smolo and Mirakhor, 2010; Kassim and Majid, 2010; Ahmed, 2010).

It is even argued that if the principles of Islamic finance had been followed, the financial crisis would have been prevented (Ahmed, 2009). Consequently, there is a general belief that the financial intermediaries in the interest-free banking system are more stable compared to the conventional banking system (Kaleem, 2000; Kia and Darrat, 2003; Samad, 2004). Even though the claims need to be empirically proven, it is becoming a trend now that after the crisis more people are interested to know Islamic finance and its principles as applied in Islamic banks than ever before. For an example, the Vatican has called for reliance upon Islamic finance principles in financial dealings (Totaro, 2009)

After almost forty years, Islamic banks are currently spread all over the world both in Muslim and non Muslim countries. One of the countries which has a significant role towards the development of Islamic banking and finance is Bahrain which has started Islamic banking industry since 1979. Bahrain is notably considered as the most developed country in term of Islamic finance infrastructure within the Gulf Cooperation Council (GCC) (Wilson, 2009). The kingdom actively promotes itself as an international hub for Islamic finance. In order to achieve this goal, the Central Bank of Bahrain (CBB), through its comprehensive regulatory framework, opens its gate to local and international Islamic financial institutions to operate within the country. Bahrain is also the host to several organizations central to the development of Islamic finance i.e. the Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI), Liquidity Management Centre (LMC), the International Islamic Financial

Market (IIFM), and the Islamic International Rating Agency (IIRA).

With a long history of banking industry, particularly Islamic banking industry, this paper is aimed at investigating the impact of financial crisis towards Islamic banking performance in Bahrain. This study is expected to give a significant contribution towards the existing literatures on the relationship between financial crisis and banking financial performance, particularly in the Islamic banking industry of Bahrain.

2. Literature Review

2.1 Bahraini Banking Sector

Bahrain is a tiny island-kingdom in the Middle East. Beside the oil and gas sector, the financial services sector is among the highest contributors to the country's overall GDP. According to the Central Bank of Bahrain's (CBB) annual report 2011, the sector contributed 25% to GDP of the country in 2010. Up to June 2011, the number of financial institutions in the country is 411 and the total financial sector workforce is 14,137. The banking system in the Kingdom of Bahrain is considered as being the largest component of the financial system. Bahrain's banking sector has remained to be a cornerstone for growth of the domestic economy. The banking sector represents over 85% of total financial assets (El-Quqa et.al, 2007). Furthermore, the banking system comprises both Conventional and Islamic banks. The Conventional sector includes retails banks, specialized banks, wholesale banks and representative offices of overseas banks. On the other hand, the Islamic sector consists of retail banks and wholesale banks which offer as host of Sharia compliant products and services. The sole regulator for financial system in Bahrain is the CBB.

Up to December 2010, there are 6 Islamic retail banks and 18 Islamic wholesale banks operating in the kingdom (Hidayat, 2010). The high numbers of Islamic banks shows high profile of the country as the leading Islamic financial center in the region. In 2011, Islamic banks accounted for around 12% of Bahrain's banking sector (Winton, 2011). Table 1 below summarizes Bahraini financial sector.

Table 1. Bahrain Financial Sector

The Key Economic Indicators:	Banking Sector:
GDP (Current) US\$21.9 billion (2010) <i>Growth -13.5%</i>	Assets US\$197.5 billion (May 2011) No. of institutions 134 (May 2011)
GDP (Constant) US\$13.6 billion (2010) <i>Growth 4.6%</i>	Retail banks 30 <i>Locally incorporated 15</i>
Financial Sector contribution to GDP 25%	Branches of foreign banks 15
Sovereign rating :	Wholesale banks 77
BBB (S&P Dec 2010) with negative watch	Representative Offices 27
BBB (Fitch Dec 2010) with negative outlook	Islamic Banks (included in above):
Population 1,106,509 (2008)	No. of banks 27 (May 2011)
	Assets US\$24.5 billion

Source: Central Bank of Bahrain Report (2011).

The importance of Islamic banking can be further substantiated with the increasing contribution of Islamic banking assets to the total banking system. The total assets of the Islamic banks have grown at a much faster rate than the Bahrain banking system assets. As a result, the contribution of Islamic banking to total assets increased from 4.1% in 2003 to 6.5% in 2006. Going forward, it is believed that Islamic banks will continue to grow at a faster pace than the conventional banking assets, as many investors are migrating from conventional banking to Islamic banking (El-Quqa et.al, 2007).

2.2 The Impact of Financial Crisis on Banking Performance

Based on the authors' observations, there are relatively few numbers of studies that compare the impacts of financial crisis into Islamic and conventional banking performance. Kaleem (2000) analyzes the Malaysian data over the period of January 1994 to December 1999 in order to investigate the performance of Islamic and conventional banks in pre and post global financial crisis 1997-1998. The study concludes that the Islamic banking system is more crises-proofed compared to the conventional banking system due to its asset-linked nature. Although the study

claims that the analysis is for pre and post crisis, the time period used in the study is not reflecting the post crisis since the impacts of the 1997/1998 global financial crisis still lasted until beyond the year of 1999.

Kassim and Majid, (2010) conduct a study aimed to arrive at empirical evidences on the impact of financial shocks (the 1997 and the 2007 financial crises) on the Islamic banks vis-a-vis the conventional banks in Malaysia. The study finds mixed evidences on the impact of the macroeconomic shocks on the Islamic and conventional banks. While the results based on the descriptive statistics indicate that the Islamic banks are relatively resilient to the financial shocks, the results based on the more robust econometric analysis reveal otherwise. The results based on the IRF analysis show that the Islamic financing responded significantly to macroeconomic shocks in non-crisis and 2007 crisis periods. The VDA results suggest that both Islamic and conventional banks are vulnerable to financial shocks.

Hassan and Dridi (2010) compare the performance of Islamic banks (IBs) and conventional banks (CBs) during the recent global crisis by looking at the impact of the crisis on profitability, credit and asset growth, and external ratings in a group of countries where the two types of banks have significant market share. The study suggests that IBs have been affected differently than CBs. Factors related to IBs' business model helped limit the adverse impact on profitability in 2008, while weaknesses in risk management practices in some IBs led to a larger decline in profitability in 2009 compared to CBs. IBs' credit and asset growth performed better than did that of CBs in 2008–09, contributing to financial and economic stability. External rating agencies' re-assessment of IBs' risk was generally more favorable.

Beck et al (2010) compare the performance of conventional and Islamic banks during the recent global crisis by looking at the impact of the crisis on business orientation, efficiency, asset quality, and stability in countries with data on at least four banks. The study suggests that Islamic banks seem more cost-effective than conventional banks in a broad cross-country sample. On the other hand, conventional banks seem more cost-effective than Islamic banks in a sample of countries with both Islamic and conventional banks. However, conventional banks that operate in countries with a higher market share of Islamic banks are more cost-effective but less stable. There is also consistent evidence of higher capitalization of Islamic banks and this capital cushion plus higher liquidity reserves explain the relatively better performance of Islamic banks during the recent crisis.

Based on the above previous studies, it is clear that none of the above studies that compare the impacts of financial crisis in Bahrain and other GCC countries. Therefore this study tries to fill the gap by investigating empirically the impact of financial crisis towards the banking performance for both Islamic and conventional banking industry in Bahrain. In general, like other GCC banks, banks in Bahrain were not as much directly exposed to the securitized and structured financial products (Ellaboudy, 2010). Therefore, Bahraini banks are expected to be generally less impacted by the recent global financial crisis than other emerging economies. The abundance of financial resources for Bahrain and other GCC countries, in addition to the initial macro intervention policies taken by Bahraini government, should help to mitigate the adverse impact of the current global financial crisis (Ellaboudy, 2010).

2.3 Banking Performance Determinants

In order to investigate the impact of financial crisis towards the banking performance, it is very important to understand the determinants of banking financial performance. Literatures reveal that banking financial performance is influenced by internal and external determinants (Bashir, 2000; Haron, 2004; Al-Kassim, 2007; Zantioti, 2009). Literatures also reveal that ROA and ROE are very important indicators of banking financial performance (profitability) and normally used as the dependent variables (Bashir, 2000, Burhonov, 2006; Al-Kassim, 2007; Zantioti, 2009). Literatures also reveal that among the internal factors that influence banking performance are bank size, leverage, loans, short-term funding, overhead, and ownership (equity) (Bashir, 2000; Haron, 2004; Burhonov, 2006; Al-Kassim, 2007). GDP per capita is the external variable that is usually included in banking financial performance literatures (Bashir, 2000; Burhonov, 2006; Zantioti, 2009).

Bashir (2000) found that Islamic banks financial performance is positively related to equity and loans (financings). Consequently, if financing and equity are high, Islamic banks should be more profitable. The study also finds that leverage is positively related profitability. The results also indicate that favorable macro-economic conditions (GDP per capita) help profitability. Haron (2004) found that expenditures (expenses) and profitability measures have a positive relationship. The study also suggests that size of the Islamic banks only had a significant positive relationship with one of performance indicators but was not significant with other profitability measures. Burhonov (2006) found unclear relationship between short-term funding to the profitability indicators. The regression results also show that the impact of macroeconomic variables, GDP per capita on the profitability measures is not conclusive. Alkassim (2007) finds that ROA for Islamic banks in GCC has positive coefficients with total assets and total expenses. Zantioti (2009) found that equity/total assets and GDP per capita statistically give positive significant

impacts on Islamic bank profitability.

Based on the above previous studies, this study uses ROA and ROE as the dependent variables and bank size, leverage, loans, short-term funding, overhead expenses, ownership (equity) and GDP per capita as the independent variables. In order to examine the impact of the crisis into financial performance of Islamic and conventional banking in Bahrain, the study uses dummy variable for financial crisis where the financial crisis period takes 1 and other periods take 0. The study also uses dummy Islamic to capture the performance of Islamic banks where 1 is for Islamic and 0 is for conventional banks. The above literatures also reveal the following hypotheses (Table 2).

Table 2. Description of the Variables Used in the Regression Analysis

Variables	Description	Hypothesized Relationship with Profitability
ROA (Dependent)	The Return on Average Total Assets of Bank j in year t	NA
ROE (Dependent)	The Return on Average Shareholders' Equity of Bank j in year t	NA
LNTA (Internal Independent)	The logarithmic of total assets of j in year t	(+)
LEV (Internal Independent)	The leverage of bank j in year t	(+)
FIN (Internal Independent)	The loans/financings of bank j in year t	(+)
SF (Internal Independent)	The short-term funding of bank j in year t	(-)
OHE (Internal Independent)	The overhead expenses of bank j in year t	(+)
Equity (Internal Independent)	The total shareholders' equity of bank j in year t	(+)
GDPPC (External Independent)	The GDP per capita of country j in year t	(+)
DUMCRISIS (Dummy)	A dummy variable for financial crisis (1) and others (0).	(-)
DUMTRAN (Dummy)	A dummy variable for a period after financial crisis (1) and others (0).	(+/-)

3. Data and Method

3.1 Data

Based on the data available in Bankscope Bureau van Dijk database, in 2011, there are 14 conventional banks and 23 Islamic banks in Bahrain. However, only 8 Islamic banks had completely reported financial statements from 2005-2010 periods. Therefore, this study uses the available data as samples in order to investigate the impacts of the financial crisis upon the financial performance of Islamic banking in Bahrain.

To achieve the objective of this study, DUMCRISIS and DUMTRAN are included in the regression model. DUMCRISIS is dummy variable for the event of global financial crisis and DUMTRAN is dummy variable to capture the performance of Bahraini Islamic banking sector after the global financial crisis. Table 3 depicts the summary statistics of dependent and independent variables used in this study.

Table 3. Summary Statistics of Dependent and Explanatory Variables

	ROE	ROA	LGDP	LFIN	LTA	LLEV	LOHE	LEQ
Mean	1.405	0.182	10.01	4.959	6.898	6.164	3.539	5.715
Max.	61.02	53.09	10.26	9.215	9.673	9.516	6.429	7.506
Min.	-127.2	-45.31	9.795	-0.693	3.833	1.932	0.916	3.532
Std. Dev.	35.63	15.89	0.165	2.523	1.506	2.185	1.559	1.069

3.2 Econometric Specification

To test the relationship between Islamic bank performance and the bank specific and macroeconomic determinants described earlier, following is the estimated linear regression model:

$$y_{j,t} = \delta_t + \alpha_{jt}X_{ijt} + \beta_{it}X_{ejt} + \varepsilon_{jt} \quad (1)$$

where j refers to an individual Islamic bank; t refers to year, $y_{j,t}$ refers to the return on asset ($r=1$) and return on equity ($r=2$) and is the observation of bank j in a particular year t; X_i represents the internal factors or determinants of a bank; X_e represents the external factors or macroeconomic determinants; and $\varepsilon_{j,t}$ is a normally distributed random variable disturbance term.

The two main approaches to the fitting of models using panel data are known as fixed effects regressions and random effects regression. Basically, random effects model is more attractive because observed characteristics that remain constant for each individual are retained in the regression model. In fixed effects estimation, they have to be dropped. Also, with random effects estimation we do not lose n degrees of freedom, as is the case with fixed effects. However, if either of the preconditions for using random effects is violated, we should use fixed effects instead (Dougherty, 2007). One precondition is that the observations can be described as being drawn randomly from a given population. The other precondition is that the unobserved effect be distributed independently of the X_j variables.

By extending equation (1) to reflect the variables, as described in Table 1, the baseline model is formulated as follows:

$$ROA_{jt} = \delta_0 + \alpha_1LTA_{jt} + \alpha_2LFIN_{jt} + \alpha_3LLEV_{jt} + \alpha_4LOHE_{jt} + \alpha_5LEQ_{jt} \\ + \beta_1LGDP_{jt} + \beta_2DUMCRISIS_{jt} + \beta_1DUMTRAN_{jt} + \varepsilon_{jt} \quad (2)$$

and,

$$ROE_{jt} = \delta_0 + \alpha_1LTA_{jt} + \alpha_2LFIN_{jt} + \alpha_3LLEV_{jt} + \alpha_4LOHE_{jt} + \alpha_5LEQ_{jt} \\ + \beta_1LGDP_{jt} + \beta_2DUMCRISIS_{jt} + \beta_1DUMTRAN_{jt} + \varepsilon_{jt} \quad (3)$$

4. Empirical Findings

4.1 Pooled OLS Regression

Pooled OLS regression is when we put all the data together and do not make any distinction between cross section and time series and then run a regression over all the data using ordinary least squares. Pooled OLS is often used as a rough and ready means of analyzing the data. It is a simple and quick standard to which more sophisticated regressions can be compared.

Table 4. Summary of Pooled OLS Output

Dependent Variable	ROA			ROE		
	Coefficient	t-Statistic	Prob.	Coefficient	t-Statistic	Prob.
C	-155.163	-0.497	0.621	-568.920	-0.950	0.347
DUMCRISIS	-6.469	-0.586	0.561	-12.947	-0.611	0.545
DUMTRAN	-14.629	-1.498	0.142	-33.477	-1.786	0.082*
LGDP	12.129	0.380	0.706	50.484	0.825	0.415
LFIN	-0.798	-0.369	0.714	5.334	1.287	0.206
LTA	-11.811	-1.499	0.142	-40.129	-2.655	0.011**
LLEV	5.798	1.367	0.179	11.695	1.437	0.159
LEQ	19.552	2.649	0.012**	55.811	3.942	0.001***
LOHE	-6.643	-1.827	0.075*	-18.571	-2.662	0.011**
R-squared		0.251			0.451	
Adjusted R-squared		0.098			0.339	
F-statistic		1.634			4.008	
Prob(F-statistic)		0.147			0.002***	

Note: * significant at $\alpha=10\%$; ** significant at $\alpha=5\%$; *** significant at $\alpha=1\%$;

Table 4 shows the summary of the pooled OLS results. For model one, whereby ROA is the dependent variable, none of the bank-specific explanatory variables are significant except for LEQ and LOHE. Variable of LEQ is significant at 5 percent alpha and positively affecting ROA. However, variable of LOHE is significant at 10 percent alpha and negatively affecting ROA. It can also be seen that global financial crisis and macroeconomic performance give no significant impact towards Bahraini Islamic banking ROA. Unfortunately, the probability of F-statistic of the model shows that overall the model developed in model one is not significant, thus it is not suggested for this study to rely upon this model.

In model two, with ROE as dependent variable, there are four explanatory variables which are significantly affecting the ROE i.e. LOHE, LEQ, LTA and post crisis situation (DUMTRAN). While LTA and LOHE are both significant at 5 percent alpha and negatively affecting Islamic banking ROE, the role of LEQ in affecting ROE is significant at 1 percent alpha and positively related. Interestingly, although the global financial crisis did not give any significant impact during its time, but it is shown in the model that the crisis impact upon Islamic banking ROE takes place after the crisis period.

The next step is to run the Breusch-Pagan Lagrangian Multiplier (LM) test in order to confirm whether it is enough with pooled OLS or needs to go for random and fixed effects panel data analysis. The LM test formula is as given below:

$$LM = \frac{NT}{2(T-1)} \left[\frac{\sum_{i=1}^N \left(\sum_{t=1}^T \hat{\epsilon}_{it} \right)^2}{\sum_{i=1}^N \sum_{t=1}^T \hat{\epsilon}_{it}^2} - 1 \right]^2$$

where N is the number of Islamic banks included in the analysis and T is the time period used in this study. The epsilon ϵ is the residuals produced by the pooled OLS regression. In this test, LM is following the chi-square distribution with one degree of freedom under the null hypothesis.

The calculated LM statistics for model one and model two are 1.641 and 2.087 respectively. Since those values are greater than the tabulated chi-squared value with one degree of freedom and 5 percent alpha which is 0.003, thus it is recommended in this study to further analyze the data, in both models, using random effects model in panel data

analysis.

4.2 Random Effects Model

After confirming that the Breusch-Pagan LM test shows that random effects model is preferable than pooled OLS model, the next step is to build the random effects model for the same dependent and independent variables. Interestingly, every time we run the analysis, the results are always insignificant until we drop the variable of DUMCRISIS. Thus, the variable of DUMCRISIS is not included in this random effects model. Table 5 shows the results of random effects model.

Similar to model one in pooled OLS model, the significant independent variables in model one using random effects model are also LEQ and LOHE. But still, from the F-statistic value resulted, it indicates that overall the model is not significant. In model two, whereas ROE is the dependent variable, the significant bank-specific variables are LTA, LEQ, and LOHE and significant macroeconomic variable is the post-crisis situation. The F-statistic resulted in model two shows that overall the model is significant in 1 percent alpha. The model confirms that the profitability of Islamic banks in Bahrain is reducing after the crisis event. The industry might have resilient during the crisis but it is not after the crisis. The impact is felt by Islamic banks after the crisis.

Based on table 5 below it is found that LTA is significantly negatively correlated with ROE. One possible reason why LTA has negative correlation with ROE can be explained by Dupont analysis. Dupont analysis decomposes ROE into three components namely net profit margin (NPM), total assets turnover (TATO) and equity multiplier (EM). TATO is computed by dividing sales with total assets. It is clear that as higher the total assets given the same amount of sales as lower the TATO. As a result of lower TATO, the ROE is also lower. Therefore, higher asset which is not followed by the increase in sales and profitability results in lower ROE. On the other hand, LEQ has significant and positive correlation with ROE. This finding surprisingly contradicts ROE formula itself. Based on ROE formula, the equity should have negative correlation with ROE. However, the positive correlation might be found when the utilization of equity funds is very efficient leading to much higher net income than the increase in equity.

Table 5. Summary of Random Effects Output

Dependent Variable	ROA			ROE		
	Coefficient	t-Statistic	Prob.	Coefficient	t-Statistic	Prob.
C	6.169	0.042	0.967	-246.065	-0.854	0.398
DUMTRAN	-10.159	-1.654	0.106	-24.533	-2.048	0.047**
LGDP	-4.254	-0.275	0.785	17.695	0.586	0.561
LFIN	-0.841	-0.387	0.701	5.249	1.239	0.223
LTA	-12.294	-1.559	0.127	-41.095	-2.673	0.011**
LLEV	6.094	1.438	0.158	12.286	1.486	0.145
LEQ	19.908	2.690	0.010**	56.523	3.915	0.001***
LOHE	-6.803	-1.865	0.069*	-18.891	-2.654	0.011**
R-squared	0.244			0.446		
Adjusted R-squared	0.112			0.349		
F-statistic	1.848			4.599		
Prob(F-statistic)	0.105			0.001***		

Note: * significant at $\alpha=10\%$; ** significant at $\alpha=5\%$; *** significant at $\alpha=1\%$;

The Hausman test is done in order to see whether random effects are okay in some sense and equally consistent with fixed effects. Under the null, both are consistent, but one is more efficient; under the alternative, the more efficient of the two becomes inconsistent but the less efficient remains consistent. Thus if the null is okay, the two estimators should be similar; divergence indicates rejection of the null. The Hausman test probability values for both models are greater than 0.05 which indicates that random effect is preferable than fixed effects. Thus, fixed effects model is not tested.

5. Conclusion and Suggestion

This study is aimed to investigate the impact of the changes in internal bank-specific variables and external macroeconomics variables towards Islamic banks' financial performance in Bahrain during and after the global financial crisis. The results depict that those independent variables are good predictor for ROE but not for ROA. The Breusch-Pagan Lagrangian Multiplier and Haussman test show that random effects model is better than pooled OLS and fixed effects model respectively. The random effects model shows that total assets, equity, and overhead expenses are significant predictors for Islamic banks' financial performance. In addition, DUMTRAN is also significantly affecting the financial performance. This shows that Islamic banking industry is not totally crisis-proof. Financial crisis does give an impact upon the Islamic banking performance, particularly in Bahrain, but the effect comes after the crisis period.

This study is not without limitation. There are at least two limitations in this study, which are: (i) samples are only taken from Bahrain, and (ii) it does not include the analysis on conventional banking. Thus, suggestions for future researches are; (i) apply similar study to other countries which have Islamic banking industry and (ii) incorporate also the analysis on conventional banking so that we can compare the impact of crisis to both types of bank.

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Impacts of Local Government Land Leasing Revenue on House Price - Based on National and Regional Panel Data Analysis

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Abstract

The purpose of this paper is to analyze the impacts of local government land leasing revenue on house price. Econometric analysis was employed. The results show that: (1) there was a positive correlation between local government land leasing revenue and house price, namely local government land leasing revenue has positive effects on house price; (2) impacts of local government land leasing revenue on house price have regional differences and time differences; (3) regional differences are mainly reflected in the differences of regional economic development level, time differences are mainly reflected in the differences of government policies at different stages. It is concluded that: local government land leasing revenue plays a very important role in the process of housing prices. In order to stabilize housing prices, it is not enough to reduce the local government land leasing revenue, and it is necessary to make comprehensive use of various control policies.

Keywords: local government land leasing revenue, house price, fixed effect model

1. Introduction

In recent years, with swift development of real estate industry in China, housing prices rose rapidly. As the whole country, the average sales price of house rose 128% in 1999-2009. Analysis of survey showed that local government land leasing revenue has become one of factors that affect housing prices in the process of housing prices because of the land supply market is a non-market (XU Xiaohua & Wu Renshui, 2010). As we all know, the government is the virtual monopoly of land ownership and the only provider in land market in China. Thus, the monopoly characteristic of land supply determines the changes in the land prices have a huge impact on house prices. In other words, the local government is a interest subject which can not ignore their own interest in the policy formulation and implementation process of the real estate market in current system of government administration (DING Jun, 2010), so how to ensure the positive interaction between land leasing revenue and house prices were received great attention. Therefore, the paper study on impacts of local government land leasing revenue on house price should be based on national and regional panel data.

Now, many scholars in world have done lots of fruitful work to the relationship of land leasing revenue and house prices. Since land price was one of the elements of housing prices, a rise in land prices will boost the long-run supply cost of houses, thereby pushing up housing prices. (BAO Zonghua, 2003) and (Bostic et al. 2007). On the contrary, research by MIAO Qihu and WANG Fanghua (2004) pointed out that the house prices driven by rising land prices, meanwhile, the variation of land supply and land supply policy had great influence on house prices.

Empirical analysis on this subject report mixed findings for different countries and regions. WANG Yuelong and ZHANG Yu (2010) pointed out that there was an interaction between land prices and house prices in China whether in the long term or in the short term. KUANG Weida (2005) also pointed out that the variation of land prices are priority to the variation of house prices in the long term and the interaction between land prices and house prices in the short term. Meanwhile, DU Hongyan, MA Yongkai, and AN Yunbi (2011) pointed out there is unidirectional Granger causality between housing and land prices in the short run: housing prices are Granger caused by land prices, while the reverse does not hold in China. Ooi and Lee (2006) pointed out that the housing and land prices are integrated in Singapore. Kim, Park, Shilling, and Cho (2008) find a bidirectional causality relationship between housing prices and land values in the U.S. market.

To sum up, most scholars in China study on relationship between land prices and house prices or Granger causality

of the land supply based on year (quarter) macro-data, because of the test results were related to selection of lag phase and the non-stationary time series were very sensitive to research methods, so there are various conclusions. As the determinants of house prices and influence mode and size of land prices to house prices in different regions are different because of the real estate market is a regional market, so the study on year (quarter) macro-data can not reflect the heterogeneity of different regions in China, which is a major flaw in the research methods (WANG Yuelong & WU Peng, 2009). Therefore, this paper makes the empirical analysis on the panel data of 31 different countries in period of 1999-2009 related to the land leasing revenue and house prices by using the co-integration theory, try to establish their relational model, and provide policy basis for the government to control the real estate industry.

2. Descriptive Analysis of Local Government Land Leasing Revenue and House Price in China

Table 1. The Descriptive Statistics of Variables

Name of Component	Local Government Land Leasing Revenue (yuan /square meter)	House Prices (yuan /square meter)
Mean Value	344.34	2963.82
Median Value	346.65	2778.00
Maximum Value	778.00	4681.00
Minimum Value	113.31	2053.00
Standard Deviation	219.57	880.78
Sample Number	341	341

As shown in Table 1, the average land leasing revenue was 344.34 yuan in 1999-2009, almost 11.62% of house prices, and the standard deviation of land leasing revenue and house prices is also great, so it means that there is a huge fluctuation in the land leasing revenue and house prices.

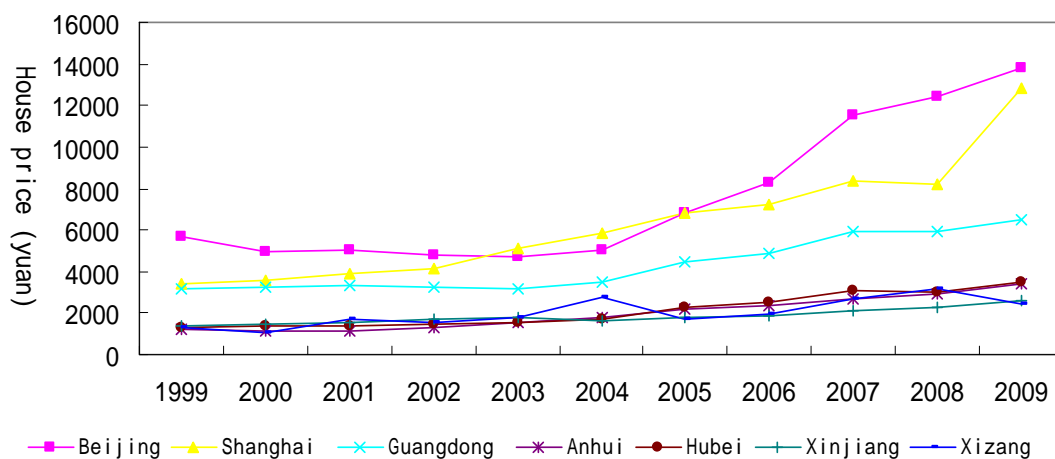


Figure 1. Typical Areas House Prices

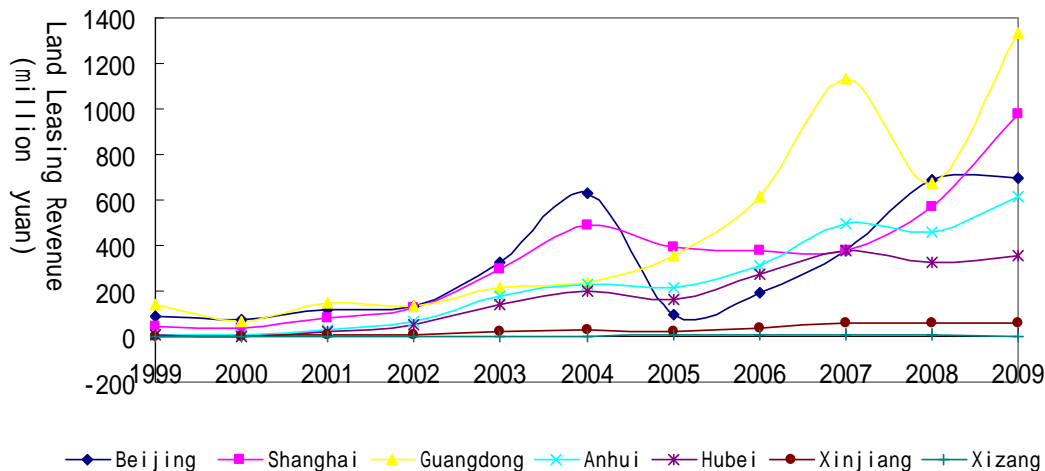


Figure 2. Typical Areas Local Government Land Leasing Revenue

As shown in Figure 1 and Figure 2, applying the approaches of graphing analysis to study the representative provinces: Beijing, Shanghai and Guangdong in the east of China, Anhui and Hubei in the center, and Xinjiang and Xizang in the west, show that the housing price and the land leasing revenue increased with the lapse of time, even though there is a slight fluctuation in the land leasing revenue. The housing price and the land leasing revenue in east areas varies greatly, prices of house and land in west areas have no obvious change and the result in middle areas fell between the prices of the former two groups. So it is necessary to make a study on house price by adopting panel data model in China where regional differences are very obvious.

3. Research Methods, Variable Selection and Data Sources

3.1 Research Methods

The co-integration theory is an extension of the traditional econometric methods which aiming at the development of cross-sectional data, so if the sequences are not smooth, it would be prone to make spurious regression in the analysis of time series data. However, we can make these variables to the linear combination and eliminate the stochastic trend when some non-smooth vector has the same stochastic trend, which indicates that the long-term equilibrium relation between these variables. On this basis, the error correction model and the Granger causality test can be constructed to analyze the relationship between these variables.

The article makes the empirical analysis on the panel data of land leasing revenue and house prices by using the stationary and co-integration test of co-integration theory and to explain the relationship between land prices and house prices through regress analysis. At first, the paper uses unit root test for panel data to carry on stationary test and to lay a foundation for co-integration analysis. In order to overcome the deviation by using only one test method and the reality of cross-section of individual heterogeneity, so the paper uses various kinds of methods, such as LLC, Breitung, IPS, Fishier ADF and Fisher PP. Secondly, the paper explores the long-term equilibrium relation between land leasing revenue and housing prices by using Johansen co-integration test. Finally, this paper presents the correction model based on the balanced relationship between land leasing revenue and housing prices are not exist. Of course, the regressive analysis of panel data will be applied to study on impacts of regional differences and time differences based on the relationship between land leasing revenue and house prices if the long-term equilibrium relation between land leasing revenue and house prices can be defined.

3.2 Variable Selection

This study examines the impacts of local government land leasing revenue on house price. Therefore, taking the average sales price of house (Y) as the explained variable and representing the levels of house prices in different region and assumed that the variation of house prices can be completely attributed to the local government land leasing revenue, the local government land leasing revenue of per square meter sales of house (X) as the explanatory variable.

3.3 Data Sources

The study depends on the publication data from China Statistical Yearbook and China Land and Resources Statistical Yearbook 2000-2010. The researcher use the annual data series from 1999-2009 for land leasing revenue

and house prices in 31 regions in China. The paper also makes a treatment for all panel data by using natural logarithm method.

4. Panel Data Analysis and Establishment Model

4.1 Unit Root Test

In order to ensure the reliability of conclusions, the research try to make the time series of land leasing revenue (Y) and house prices (X) to stable by using Eviews6.0 software which includes various kinds of methods.

Table 2. Unit Roots Test of Housing Price

Name of Component	National Area		Eastern Area		Middle Area		Western Area	
	Y	ΔY	Y	ΔY	Y	ΔY	Y	ΔY
LLC	-7.4362***	-13.7515***	-2.5018***	-5.2169***	-2.7455***	-8.7120***	-6.7930***	-9.6149***
Breitung	3.0885	-4.3900***	1.2096	-3.1799***	1.4809	-3.2206***	2.4625	-1.3789*
IPS	-0.4705	-3.2273***	0.4291	-1.0465	0.5829	-2.7291***	-1.4540*	-1.9005**
Fisher ADF	69.5182	137.1660***	18.7563	36.6289**	15.5531	53.0995***	35.2088**	47.4373***
Fisher PP	81.2528*	187.1430***	23.2378	36.8375**	15.1548	96.5801***	42.8602***	53.7251***

Note: Δ Variable time difference, inspection original hypothesis are put in unit root. Lag selection using Schwarz standard automatic selection, inspection form include constant and trend, *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 3. Unit Roots Test of Land Leasing Revenue

Name of Component	National Area		Eastern Area		Middle Area		Western Area	
	Y	ΔY	Y	ΔY	Y	ΔY	Y	ΔY
LLC	-10.8989***	-16.6281***	-6.8158***	-10.9899***	-8.8926	-9.2290***	-1.0906	-8.4926***
Breitung	-1.0003	-2.9368***	-1.0312	-3.6583***	-0.1697	-4.3074***	-0.6417	-0.5054
IPS	-8.5511	-3.6504***	-1.6370*	-2.4398***	-0.8463	-2.3677***	0.8232	-1.4975*
Fisher ADF	73.3925	151.0650***	37.3072**	60.1463***	25.4088	49.5089***	10.6764	41.4102***
Fisher PP	76.6472*	291.1830***	60.4595***	90.2081***	6.0678	64.8093***	0.1200	64.1658***

Note: Δ Variable time difference, inspection original hypothesis are put in unit root. Lag selection using Schwarz standard automatic selection, inspection form include constant and trend, *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

As shown in Table 2 and Table 3, the result of empirical analysis showed that all samples or the samples of various regions could not reject the existence of unit root null hypothesis while the regression equation included constant and trend, so the sequence of land leasing revenue and house prices were not smooth. But the series of house prices (Y) and land leasing revenue (X) showed their first-order difference stationary, I (1) process, by the unit root test.

4.2 Co-integration Test

The series of house prices (Y) and land leasing revenue (X) showed their first-order difference stationary, I (1) process, by the unit root test. On the basis of the result unit root test, we had practiced Johansen Fisher co-integration test and analyzed the long-term equilibrium relation between the series of house prices and land leasing revenue.

Table 4. Results of Johansen Fisher Co-integration Test on Panel Data

Name of Component	National Area		Eastern Area		Middle Area		Western Area	
	Trace Test	Max-Eign Test	Trace Test	Max-Eign Test	Trace Test	Max-Eign Test	Trace Test	Max-Eign Test
Hypothesized No. of CE(s)								
None	272.20***	250.10***	99.68***	95.37***	117.20***	104.40***	55.35***	50.32***
At most 1	115.60	115.60	36.08	36.08	45.42	45.42	34.07	34.07

Note: Inspection form choice sequences are deterministic trend, and co-integration equation with constants and trend, the brackets to estimate the amount of concomitant probability, *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

As shown in Table 4, all samples or the samples of various regions refused the existence of co-integration at the 1% significant level. That means the long-term equilibrium relation between the series of house prices (Y) and land leasing revenue (X) can be defined.

4.3 Establishment Model

The result of co-integration test showed that the long-term equilibrium relation between the series of house prices (Y) and land leasing revenue (X) can be defined, so we can use regressing analysis directly because the phenomenon of spurious regression does not exist. There are three empirical models can be chosen according to the differences in different regions and times, such as the mixed effect model, fixed effect model and random effect model. F test and Huasman test showed that we should study on impacts on local government land leasing revenue and house prices in different regions and times by using the fixed effect model. So either all samples or the samples of various regions of panel data are made the fixed effect variable intercept model which includes constant individual and time. The fixed effect model is as follows:

$$Y_{it} = m + \beta X_{it} + \alpha_i^* + \gamma_t + v_{it} \quad (i=1,2,\dots,N; t=1,2,\dots,T) \quad (1)$$

In the formula, Y_{it} is as house prices in different regions and times, X_{it} is as the land leasing revenue in different regions and times, α_i^* is as variables of regional differences, which reflect individual differences impact on house prices, γ_t is as variables of time differences, which reflect time differences impact on house prices, v_{it} is as stochastic error, I is as the number of individual, t is as the time advance.

5. Analysis of Results

5.1 Analysis of Results in the Whole Country

The house price is the explained variable and the local government land leasing revenue of per square meter sales of house is the explaining variable in the regression model.

Table 5. Estimated Impacts of Local Government Land Leasing Revenue on House Price

Name of Component	National Area	Eastern Area	Middle Area	Western Area
Influence Coefficient of C	7.4685***	7.5016***	7.3383***	7.4328***
Influence Coefficient of Local Government Land Leasing Revenue	0.0370***	0.0794***	0.0193	0.0135
Adjusted R ²	95.12	96.22	93.57	84.40
F Statistics	162.6349***	152.9837***	76.0521***	30.4837***

Note: *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

As shown in Table 5, the results of analysis shows that the local government land leasing revenue has positive effects on house prices and the coefficients of effect of land leasing revenue on house prices is 0.037, namely the land leasing revenue increases one percentage point, the house prices will rise by 0.037 percentage points.

Table 6. Coefficients of Individual and Time Fixed Influences

$\alpha_i(i=1,2,\dots,31)$		$W_t(t=1,2,\dots,11)$					
Eastern Area		Middle Area		Western Area		National Area	
Liaoning	0.1630	Shanxi	-0.2537	Shanxi	-0.1621	1999	-0.3283
Beijing	1.1093	Neimenggu	-0.2988	Gansu	-0.2902	2000	-0.3042
Tianjin	0.4446	Jilin	-0.1668	Qinghai	-0.2357	2001	-0.2607
Hebei	-0.2029	Heilongjiang	-0.0356	Ningxia	-0.1137	2002	-0.2327
Shandong	-0.0881	Anhui	-0.2011	Xinjiang	-0.1883	2003	-0.2018
Jiangsu	0.1545	Jiangxi	-0.4666	Chongqing	-0.1277	2004	-0.0922
Shanghai	0.9454	Henan	-0.2944	Sichuan	-0.1709	2005	0.0728
Zhejiang	0.4024	Hubei	-0.1200	Guizhou	-0.3132	2006	0.1549
Fujian	0.2670	Hunan	-0.3383	Yunnan	-0.0426	2007	0.3087
Guangdong	0.6090			Xizang	-0.1390	2008	0.3686
Guangxi	-0.0761					2009	0.5150
Hainan	0.2306						

As shown in Table 6, the paper also considered the factor of period and the time fixed effects coefficient in order to make further analysis of the impact of land leasing revenue on house prices. There is a tendency for time effects coefficient to show a gradual increase in 1999-2009. All these indicated that the land leasing revenue plays an increasing important role in house price and it also increasingly becoming the main source of local government revenue. At the same time, that is also consistent with the realism of local government revenue sources in our country.

5.2 Analysis of Results in Different Regions

According to the division of geographical area, the paper analyzes the impact of local government land leasing revenue on house price in each area respectively. On one hand, the impact of local government land leasing revenue on house price has significant regional differences, while the effects shows a gradual decrease from east to west. This is because the east area is the most economic developed districts in our country with rapid industrialization and urbanization which have attracted many people to come to settle, so all these lead to increased demand for housing. However, housing construction is always built on the basis of land and the land resources in east area are much less than those in other areas, so it raises the land prices once more.

On the other hand, the individual fixed effects coefficient is positive number in east area except individual provinces, while the individual fixed effects coefficient is negative number in middle area and west area. The results of analysis indicated that the impact of land leasing revenue on house prices in east area is much stronger than that in other areas at the same period. However, the impact of land leasing revenue on house prices in middle area and west area is not obvious, this is because there are many people in middle area, and the land resources are much less than those in west area, so there is little land for selling. Meanwhile, the function of economic fundamental of Sichuan and Chongqing in west area also plays an important role in promoting housing prices. Therefore, the differences of impact of land leasing revenue on house prices in middle area and west area are not very obvious, as table 5 shows.

6. Conclusion and Suggestion

6.1 Conclusion

The article makes the empirical analysis on the panel data of land leasing revenue and house prices by using the stationary and co-integration theory and explains the relationship between land prices and housing prices through regress analysis. The results show that: (1) there is a positive correlation between local government land leasing revenue and house price, namely local government land leasing revenue has positive effects on house price; (2) impacts of local government land leasing revenue on house price have regional differences and the differences are mainly reflected in the differences of regional economic development level, namely the impacts of local government land leasing revenue on house price in east area are larger than those in middle area and west area; (3) impacts of local government land leasing revenue on house price have time differences and the differences are mainly reflected in the differences of government policies at different stages.

6.2 Suggestion

The results of study on impacts of local government land leasing revenue on house price have important reference meaning to reform the local government revenue in China and develop the real estate market in different regions. It is concluded that:

(1) The rising house prices are caused by over-reliance on land financial of local government, so In order to stabilize housing prices, we should standardize the behavior of land sale or establish the Land Fund to change the behavior of local government which overdraft land and blind planning ,but not only reduce the local government land leasing revenue We also can make comprehensive use of various control policies to stable house prices, such as improving the real estate taxation system and increasing tax category in the house holding link, so we can reach the goals which fight against behavior of house and increase the sources of local financial.

(2) The results of analysis show the unbalanced development in real estate market in different regions in China. On one hand, we should encourage local government to make developing financial revenue policy and to make fiscal expenditure plans conform to reality. On the other hand, in order to make the coordinated development of real estate in different regions come true, the central government should increase investment in local public services through financial transfer payment in middle area and west area.

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The Cointegration Analysis on the Spot Prices of the Malaysian Crude Palm Oil Futures Market

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Abstract

Futures markets play an important role in the price discovery and forward pricing of agricultural commodities. The analysis of this study has mainly focused on the empirical test of the effect of production, stock and export variables on the prices of the Malaysian Crude Palm oil futures market. For the empirical work, correlation analysis, multiple regression and recent econometric analysis were conducted to determine the price relationships of the Malaysian Crude Palm oil futures markets with the production, stock and export variables. Order of integration for all the variables was checked using Augmented Dickey-Fuller and Phillips-Perron tests of unit root. The Johansen approach was used to test cointegration in multivariate system that involved long run and short run estimations. The Vector Error Correction Model was used to test for causal relationships. The empirical evidence obtained from the study shows there exist a significant long run and short run relationships between the cash and future prices of the Malaysian Crude Palm oil futures market with the production, stock and export variables. The results of the causality test also shows that there is a strong relationship between the Malaysian Crude Palm oil futures market with the production, stock and export variables. This means that any information flow regarding the price movement of the Malaysian Crude Palm oil futures market will affect the production, stock and export variables and vice-versa.

Keywords: price discovery, hedging, cointegration

1. Introduction

Palm oil is currently the second most important vegetable oil in the world oils and facts market, accounting for 14.35% of world production of seventeen major oils and facts, ranking only behind soya bean oil, which contributed 20.23% of world output. In terms of world exports of oils and facts, palm oil is currently leading with a market share of 32% while soya bean oil has a share of 16.2%. Palm oil and palm kernel oil have become the production growth leaders in the oils and facts complex since the early seventies (Mielke, 1991).

The volume of crude palm oil (CPO) futures on the Kuala Lumpur Commodity Exchange (KLCE) or now on MDEX is slightly more than the production of the Malaysia palm oil. As the price of a palm oil is dependent on its consumption and the level of the stock, it is important to analyze these two variables simultaneously. The world stock/usage of palm oil usually higher than that of Malaysia, not only because of the large stocks in transshipment centers such as Singapore and Rotterdam, but also because some consuming countries prefer to keep relatively large stocks (Mielke, 1991). It has become a common practice among major industrialized countries to use buffer stocks to stabilize the prices of agricultural commodities in the world market (Sarasorro, 1988), including palm oil.

Studies in agricultural economics have shows that the fluctuation of commodities prices is significant and persistent (Wilkinson, 1976) (Brendt,1985). According to Mad Nasir and Fatimah (1992), two of the salient features of agricultural commodities are the volatility and variability in prices. As far as volatility and variability of prices are concerned, the impact is more remarkable in the vegetable oils and fats market, notably palm oil, which is the most widely consumed edible oil in the world. If producers are in fact using futures prices as expected output prices when allocating resources, an assessment of the quality of the prices is important. Thus studies on the efficiency of futures markets have important implications on the issue of whether economics resources are being optimally allocated in the agricultural sector.

It is particularly important to assess the Malaysian Derivatives Exchange (MDEX) market since it is the only futures market for palm oil and producers and other market intermediaries use it as a price indicator. The existence of pricing efficiency in the markets will assume that futures prices move in lines with cash prices in the long-term and that they do not deviate from cash prices for long periods of time.

The major objective of this studies is to examine empirically the price relationships and the direction of information flow between the Malaysian crude palm oil futures market and the production, stock, export variables.

1.1 Review of Related Literature

There has been substantial empirical work, which has investigated the efficiency issue by testing the random walk model. Some of this work rejected the random walk hypothesis, for example, Stevenson and Bear (1970), Cargill and Rausser (1975), and Barnhart (1984); other studies accepted the hypothesis, for example, Larson (1960). Kamara (1982) noted that most of these studies found some evidence of serial correlation in futures prices in the short-run, but the evidence is not strong, and the result depend heavily on the technique as well as the sample period of the studies

Fatimah and Zainalabidin (1991) compared the forecasting performance of crude palm oil (CPO) futures on the KLCE to forecast generated from several other models, i.e., moving average, exponential smoothing, Box-Jenkins and econometric models. They concluded that the futures market does not show any significant inefficiency. Using the RMSE, RMPE and U-statistic to compare the performance of the various models, they found that the futures market fared fairly well in comparison with other models. Only the Box-Jenkins model outperformed the futures market, but the main weakness of this method was its inability to provide an economic explanation for its forecasts.

As cited by Liew and Brooks (1995) that Kok and Goh's (1994) study the random walk hypothesis in the Kuala Lumpur crude palm oil futures market, their results fail to find strong evidence against the random walk hypothesis.

Mohammad Haji Alias and Jamal Othman (1997) used bivariate cointegration technique to determine the long-run relationship of palm oil price and the soybean oil price. Using quarterly data from 1980 through 1995 and Dickey-Fuller and augmented Dickey-Fuller to test for stationarity. The results showed that the time series on palm oil and soybean oil prices are cointegrated and each time series is non-stationary.

A.D Owen et al (1997) examine five major international traded oils: coconut, palm, palm kernel, soybean and sunflower to investigate the price interrelationships in the vegetable and tropical oils market whether they are cointegrated or not. Using monthly data from 1971 through 1993, a vector autoregressive approach to test for cointegration and augmented Dickey-Fuller and Phillips-Perron to test for unit root. The results showed that the relationships were not found to be strong enough to label them as cointegrated series.

Mukesh Chaudhry and Rohan Christie-David (1998) investigates the long-run stochastic properties of informationally linked futures contracts in diverge groups such as soft commodities, grain and oil seeds, livestock, precious metals, energy, foreign currencies, and interest-rate instruments. Using the Phillips-Perron test for unit root and Johansen's test for cointegration to analyse the monthly data covers the period July 1986 through March 1995. The results showed that most futures in the sample exhibit the presence of non-stationarity. The test for cointegration within groups provides strong evidence for soft commodities, precious metals, energy, and short-term interest rates. Weaker evidence for grains and oil seeds and livestock while foreign currency and long-term interest rate futures show evidence of segmentation.

2. Methodology

There are several unit root tests available in the literature to determine the order of integration of the individual series. However, the most widely used methods are Augmented Dickey Fuller test (ADF) which was proposed by Said and Dickey (1984) and Phillips and Perron test (PP) by Phillips and Perron (1988). In this study both the ADF and the PP are utilised in the analysis since Schwert (1987) has noted that the ADF statistics may reject the null hypothesis of unit root too often in the presence of the first order moving average process. However, recently Campbell and Perron (1991) have also shown that the ADF class of statistics has better small-sample properties.

Once we determine the order of integration of each series, the next step is to test for cointegration relationships among the series. The Johansen-Juselius is based on maximum-likelihood estimation is designed to test a number of linearly independent cointegrating vectors existing among the variables. The model also utilises the likelihood ratio test statistic that has an exact limiting distribution, which can be used to estimate cointegration relationships among a group of two or more variables. Besides it can estimate a number of linearly independent vectors, Perman (1991) pointed out that the advantage of Johansen-Juselius approach over E-G approach is that the procedure allows testing for linear restriction on the cointegrating parameters. The test statistic in the Johansen and Juselius also can be compared to known critical values.

The likelihood-ratio test of the null hypothesis is obtained by the trace test defined as;

$$\text{Trace Tests} = -T \sum_{i=r+1}^p \ln(1 - Q_i^2) \quad (1)$$

where T is the number of time period available in the data. The null hypothesis for trace test is that whether there are r or less cointegrating vector. The null of $r = 0$ is test against the general hypothesis of $r \leq 1$, $r \leq p$. Equivalently we can also use the maximal eigenvalue test. The test is that there are r -cointegrating vectors in a set of p variables against $r+1$. In other words, the null of $r = 0$ is test against the specific hypothesis of $r = 1$, $r = p$. It is defined as;

$$\text{Maximal Eigenvalue Tests} = -T \ln(1 - Q_{r+1}^2) \quad (2)$$

The test statistics of the trace and maximum eigenvalues may be compared with the critical values provided by Osterwald-Lenum (1992).

$$\begin{pmatrix} \Delta SPT \\ \Delta PROD \\ \Delta STOCK \\ \Delta EXPORT \end{pmatrix} = \sum_{i=1}^k (\Gamma_i) \begin{pmatrix} \Delta SPT \\ \Delta PROD \\ \Delta STOCK \\ \Delta EXPORT \end{pmatrix} + (\Pi) \begin{pmatrix} SPT \\ PROD \\ STOCK \\ EXPORT \end{pmatrix} + \begin{pmatrix} \mu_1 \\ \mu_2 \\ \mu_3 \\ \mu_4 \end{pmatrix} + \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \end{pmatrix}$$

Attaining the long run estimates of the cointegration relationships is only half of the whole process of cointegration in multivariate systems. Estimating the short run model of spot prices of Malaysian crude palm oil and the international competing oils market is another important part of the analysis in order to capture the short run adjustment behaviour of economic variables, which is quite relevant to policy implications. The number of cointegrating vectors, which is revealed from the results of Johansen's tests, will determine the approach of estimating the short run model of spot prices of Malaysian crude palm oil futures market and spot prices of international competitive oils. When there is only one cointegrating vector, the short run dynamics of spot prices of Malaysian crude palm oil and the international competing oils functions can be estimated using the (single equation) general to specific procedure. The technique departs from the general autoregressive distributed lag representation with error correction term(s) or EC obtained from the relevant estimated cointegrating vector(s):

$$A(L)\Delta SPT_t = \alpha_0 + B(L)\Delta LPROD_t + C(L)\Delta LSTOCK_t + D(L)\Delta LEXPORT_t + \alpha_1 EC_{t-1}$$

where SPT_t is spot price while $A(L) \dots D(L)$ are lag polynomials. The equation can be estimated using ordinary least square (OLS) if all of the independent variables are weakly exogenous, however, when one or some of the independent variables are not weakly exogenous, the function needs to be estimated using Instrumental Variables (IV) technique.

2.1 Data Used in the Study

The data in this study consist of the spot prices of the Malaysian crude palm oil are collected from MPOB (Malaysian Palm Oil Board) for contracts maturing at each month from Jan 1998 to Dec. 2010, providing a total of 192 observations. Consecutively, the fundamental factors i.e; the closing stock (STOCK), production (PROD), export (EXPORT), and the spot prices (SPT) of the Malaysian crude palm oil futures market are gathered from the same period from PORLA Update Report.

3. Empirical Results

Results of unit root test in level and first difference are presented in Table 1. The computed values of statistics in both time periods are all insignificant at the five percent significance level for both ADF and PP tests. The results fail to reject the null hypothesis of unit roots in their level form in the autoregressive representation of the price series, that is, they are all not $I(0)$. Thus, implying that there is no possibility of the series to be stationary around a constant mean or around deterministic linear trend.

Unit root tests on the first difference on all series were also conducted. Table 1 shows the values of statistics for both sub-periods are significant at the one percent level. Indicating the rejection of null hypothesis of the existence of a unit root for each of the price series in their first difference. Thus all the prices series needed to be differenced once in order to achieve stationarity and they are confirmed to be integrated of order one. The standard cointegration model requires that all variables included in the regression must be of the same order of integration.

Table 1. Results of Phillips-Perron and (Augmented) Dickey Fuller Unit Root Tests for Spot Prices of Malaysian Crude Palm Oil Futures Market, Production, Stock, Export

	Phillips-Perron		Aug. Dickey –Fuller	
	Levels	1st diff	Levels	1st. diff
LSPT	- 1.5408	- 10.0254**	- 1.5980	- 5.1102**
LEXPORT	- 3.3239	- 23.5092**	- 2.4859	- 7.5692**
LPROD	- 2.7922	- 9.3309**	- 2.8498	- 8.1670**
LSTOCK	- 3.0888	- 9.1018**	- 3.3082	- 6.7378**

Note:

** denotes significant at 1 % level

* indicates significant at 5 % level

¹ Significant at 10 % level

The above Phillips-Perron and Aug. Dickey-Fuller test statistics are compared to the MacKinnon (1990) critical values for rejection of hypothesis of a unit root. Unlike the ADF test, there are no truncation lagged difference terms. Instead of specifying the number of lagged difference terms, the truncation lag for the Newey-West correction is specified, that is, the number of periods of serial correlation to be included. The equation is estimated using ordinary least squares (with the optional inclusion of constant and time trend) and then the t-statistic of the coefficient is corrected for serial correlation in t.

The results of the application of the Johansen technique to the identification of long run relationships between the Spot price of the Malaysian crude palm oil futures market and export, production and stock level can be seen in Table 2. We assume that there is no deterministic trend in data, no intercept or trend in the cointegrating equation. Result of Johansen's test suggests that one cointegrating vector exists based upon the λ_{\max} test at 1 % level (Panel I). The trace statistic suggests rejection of one cointegration vector at 1 % level. The cointegrating vector was estimated with a provision for 10 lags and we found no serious serial correlation and no normality problem with the inclusion of this number of lags except for production variable (Panel V). The estimated cointegrating vector has theoretically plausible coefficients (Panel II). The results of tests for weak exogeneity are consistent with the information on the values of alpha (α) or speed of adjustment's coefficients and their respective standard errors in Panel III (Note 1). The test of weak exogeneity reveals that production appears to be weakly exogeneous at a marginal level of significant at 66.24% (Panel VI). Imposing restrictions on the independent variables do not seem to be valid. Thus our restricted cointegrating equation remains similar to the unrestricted one. The following is the estimated of the long run Spot prices of the Malaysian crude palm oil futures market and production, stock and exports function;

$$LSPT_t = 159.46LEXPORT_t - 130.34LPROD_t - 9.42LSTOCK_t$$

The above equation indicates that export is positively impact with estimated elasticity of 159.46. It is also shown that in the long run is negatively influenced the production and stock variables estimated elasticities of -130.34 and -9.42 respectively.

Since the outcome of Johansen's test shows that there is only one cointegrating vector, we estimate the short run model using the single equation generalized unrestricted model (GUM) applying the instrumental variable (IV) technique. The short run parsimonious Spot price of the Malaysian crude palm oil futures market and the production, stock and exports function can be seen in Table 3. Estimate of attached error correction term indicates that the speed of adjustment to long run changes are quite slow (-0.0315) is significant at 5 % level. Despite the significant reduction in the parameters (from 46 to 31 variables) our final specifications still maintain superiority over the initial largely parameterized model in terms of standard error of regression and explanatory power. Generally, the estimated coefficients are significant and except for the χ^2 values of the Breusch-Godfrey serial correlation LM test (lag 4), the estimated equations could pass the battery of diagnostic tests for autocorrelation, autoregressive conditional heteroscedasticity (ARCH test), normality of residuals, tests for functional form misspecifications and joint significance of all the explanatory variables.

Table 2. Results of Johansen Procedure for Cash Price of Malaysian crude palm oil futures Market, Export, Production and Stock, VAR with 10 lags. Sample period: 1998-2010 (192 observations)

Eigenvalues: 0.302 0.095 0.025 0.003

Test Statistics For The Number of Co-Integrating Vectors:

Ho:rank= r	λ_{max}			Trace		
	T	T-nk	95%	T	T-nk	95%
r = 0	52.4**	38.05**	27.1	171.19**	51.68**	47.2
r ≤ 1	14.58	10.59	21.0	18.78	13.64	29.7
r ≤ 2	3.75	2.72	14.1	4.20	3.05	15.4
r ≤ 3	0.44	0.32	3.8	0.44	0.32	3.8

II. Estimated Co-Integrating Vector

LSPT	LEXPORT	LPROD	LSTOCK
1.0000	-159.46	130.34	9.42

III. Estimated Adjustment Matrix

LSPT	LEXPORT	LPROD	LSTOCK
0.0077	-0.0008	0.0078	0.0034
{0.0017}	{0.0023}	{0.0021}	{0.0026}

IV. Restricted Co-Integrating Vector

LSPT	LEXPORT	LPROD	LSTOCK
1.0000	-120.78	98.56	6.94

V. Test for Appropriate Lag Length (10)

Serial :	LSPT	LEXPORT	LPROD	LSTOCK
CORRELATION				
$\chi^2(7)$	10.95[0.14]	11.11[0.13]	31.05[0.00]**	12.95[0.07]
F(7,98)	1.13[0.34]	1.15[0.33]	3.78[0.00]**	1.36[0.22]
Normality:				
$\chi^2(2)$	0.76[0.68]	0.98[0.60]	21.25[0.00]**	9.18[0.01]*
ARCH $\chi^2(7)$				
	3.58[0.82]	2.86[0.89]	12.59[0.08]	12.62[0.81]
ARCH (7,61)				
	0.34[0.93]	0.27[0.96]	1.29[0.26]	1.29[0.26]

Exogeneity Tests (Lprod Weakly Exogenous)

Ho: $\alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = 0$	$\chi^2_{0.05}$ with 3 d.f. =	40.902 [0.0000]**
Ho: $\alpha_2 = 0$	$\chi^2_{0.05}$ with 1 d.f. =	14.072 [0.0002]**
Ho: $\alpha_3 = 0$	$\chi^2_{0.05}$ with 1 d.f. =	0.190 [0.6624]
Ho: $\alpha_4 = 0$	$\chi^2_{0.05}$ with 1 d.f. =	10.024 [0.0015]**

Note:

** denotes significant at 1 % level.

*indicates significant at 5 % level.

Figures in square parentheses [] refer to marginal significance level.

Figures in { } refer to standard errors of alpha's (speed of adjustment) coefficients.

Table 3. Results of Short Run Reduced Form GUM -TSLs for Cash Price of Malaysian Crude Palm Oil Futures Market, Export, Production and Stock

I. D(LSPT) = 0.008-0.031ECM(-1)-0.142 D(LSPT(-3)) +0.198 D(LSPT(-4))
0.147 D(LSPT(-5)) + 0.223 D(LSPT(-6)) + 0.241 D(LSPT(-7)) + 0.192 D(LSPT(-10)) + 0.506D(EXPORT(-1)) + 0.455D(EXPORT(-2))
+ 0.408D(EXPORT(-3)) + 0.417D(EXPORT(-4)) + 0.311D(EXPORT(-5)) + 0.289D(EXPORT(-6)) + 0.214D(EXPORT(-7)) +
0.234D(EXPORT(-8)) + 0.189D(EXPORT(-9)) + 0.163D(EXPORT(-10)) - 0.385 D(LPROD(-1)) - 0.246 D(LPROD(-2)) - 0.161
D(LPROD(-3)) - 0.078 D(LPROD(-4)) - 0.101 D(LPROD(-6)) - 0.127 D(LPROD(-10)) - 0.150 D(LSTOCK(-1)) - 0.215 D(LSTOCK(-2))
- 0.124 D(LSTOCK(-3)) - 0.144 D(LSTOCK(-4)) - 0.205 D(LSTOCK(-5)) - 0.109 D(LSTOCK(-6)) - 0.114 D(LSTOCK(-9))

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.008420	0.007421	1.134606	0.2589
ECM(-1)	-0.031500	0.015005	-2.099291*	0.0380
D(LSPT(-3))	-0.142182	0.095574	-1.487668	0.1396
D(LSPT(-4))	0.198438	0.099019	2.004033*	0.0475
D(LSPT(-5))	0.147076	0.090684	1.621854	0.1076
D(LSPT(-6))	0.223142	0.092493	2.412523*	0.0175
D(LSPT(-7))	0.241702	0.093094	2.596312*	0.0107
D(LSPT(-10))	0.192757	0.084235	2.288322*	0.0240
D(EXPORT(-1))	0.506682	0.126687	3.999488**	0.0001
D(EXPORT(-2))	0.455055	0.125987	3.611925**	0.0005
D(EXPORT(-3))	0.408716	0.120958	3.378979**	0.0010
D(EXPORT(-4))	0.417245	0.107926	3.866037**	0.0002
D(EXPORT(-5))	0.311241	0.089851	3.463977**	0.0008
D(EXPORT(-6))	0.289117	0.084074	3.438825**	0.0008
D(EXPORT(-7))	0.214494	0.074779	2.868364**	0.0049
D(EXPORT(-8))	0.234083	0.071595	3.269543**	0.0014
D(EXPORT(-9))	0.189997	0.065608	2.895936**	0.0045
D(EXPORT(-10))	0.163238	0.061101	2.671618**	0.0087
D(LPROD(-1))	-0.385499	0.106664	-3.614130**	0.0005
D(LPROD(-2))	-0.246129	0.100663	-2.445080*	0.0160
D(LPROD(-3))	-0.161272	0.094131	-1.713271	0.0894
D(LPROD(-4))	-0.078244	0.077487	-1.009765	0.3148
D(LPROD(-6))	-0.101888	0.069897	-1.457684	0.1477
D(LPROD(-10))	-0.127918	0.066792	-1.915174	0.0580
D(LSTOCK(-1))	-0.150768	0.071668	-2.103697*	0.0376
D(LSTOCK(-2))	-0.215719	0.071899	-3.000317**	0.0033
D(LSTOCK(-3))	-0.124402	0.072017	-1.727398	0.0868
D(LSTOCK(-4))	-0.144155	0.072234	-1.995669*	0.0484
D(LSTOCK(-5))	-0.205246	0.073889	-2.777755**	0.0064
D(LSTOCK(-6))	-0.109448	0.067764	-1.615134	0.1091
D(LSTOCK(-9))	-0.114968	0.061020	-1.884111	0.0621
Adjusted R-squared	0.2594	S.E. of regression	0.0662	
F-statistic	2.6703**	Prob(F-statistic)	0.0000	

III. Autocorr (Breusch-Godfrey Serial Correlation LM Test):
 $\chi^2(1) = 0.6911 [0.405]$ $\chi^2(2) = 1.4778 [0.477]$

$\chi^2(3) =$	1.4778 [0.477]	$\chi^2(4) =$	11.8052 [0.018]*
F(1) =	0.5401 [0.463]	F(2) =	0.5754 [0.564]
F(3) =	0.5754 [0.564]	F(4) =	2.4334 [0.051]
Normality:	$\chi^2(2) = 0.1622 [0.5727]$		
ARCH:	$\chi^2(1) = 3.3395 [0.067]$	$\chi^2(2) = 4.3209 [0.115]$	
	$\chi^2(3) = 4.5617 [0.206]$	$\chi^2(4) = 2.6318 [0.621]$	
	F(1) = 3.3716 [0.068]	F(2) = 2.1812 [0.116]	
	F(3) = 1.5268 [0.210]	F(4) = 0.6466 [0.630]	
Functional Form:	Number of fitted terms = 1:		F-statistics 0.4264 [0.5150]

IV. Instruments: C ECM(-1) D(LPROD) D(LSPT(-1)) D(LSPT(-2)) D(LSPT(-3)) D(LSPT(-4)) D(LSPT(-5)) D(LSPT(-6)) D(LSPT(-7)) D(LSPT(-10)) D(LEXPORT(-1)) D(LEXPORT(-2)) D(LEXPORT(-3)) D(LEXPORT(-4)) D(LEXPORT(-5)) D(LEXPORT(-6)) D(LEXPORT(-7)) D(LEXPORT(-8)) D(LEXPORT(-9)) D(LEXPORT(-10)) D(LPROD(-1)) D(LPROD(-2)) D(LPROD(-3)) D(LPROD(-4)) D(LPROD(-6)) D(LPROD(-10)) D(LSTOCK(-1)) D(LSTOCK(-2)) D(LSTOCK(-3)) D(LSTOCK(-4)) D(LSTOCK(-5)) D(LSTOCK(-6)) D(LSTOCK(-7)) D(LSTOCK(-9)) D(LSTOCK(-10)) D(LPROD(-11)) D(LSTOCK(-11)) D(LSPT(-11))

V. Information On The Full Unreduced Model: (46 parameters)

Adjusted R-squared	0.0379	S.E. of regression	0.0755
F-statistic	1.5161*	Prob (F-statistic)	0.0455

Note:

** denotes significant at 1 % level.

* denotes significant at 5 % level.

Figures in square parentheses [] refer to marginal significance level.

This implies that there is a strong long-run relationship between the spot and the futures prices of the Malaysian crude palm oil futures market and the production, stock and export variables for the period under investigation. In other words, the price series are cointegrated. These imply that the Malaysian crude palm futures market are inefficient in relation to the production, stock and export variables.

The results also support the earlier findings of Mielke (1991) and Mad.Nasir and Fatimah (1992) that there are relationship between prices of palm oil with the level of stock, production and export.

To examine the nature of the direction of information flow and the lead-lag relationship between spot prices of the Malaysian crude palm oil futures market with the production, stock and export variables, the Granger causality and vector error correction model (VECM), are used.

Table 4. Causality Results Based on Vector Error-Correction Model (VECM) on Cash Price of Malaysian Crude Palm Oil Futures Market, Production, Export and Stock. 1998-2010

	LSPT	LPROD	LEXP	LSTOCK	ECT _[e,t-1]	A- R ²	SE
Dep. Variable	t-statistics						
LSPT	-	-2.9380*	2.2200*	-0.1836	-0.1061	0.0815	0.0357
LPROD	-3.4188*	-	-4.6847*	-1.3264	3.4495*	0.2180	0.0503
LEXP	-3.1737*	-1.4893	-	0.7743	-1.8738	0.2494	0.0557
LSTK	-0.2956	-0.3381	0.1956	-	-6.7920*	0.3603	0.1015

Note: All variables are in first differences (denoted by Δ). VECM was estimated including an optimally determined criteria [Akaike's FPE]. **, and * indicates significance at the 1percent and 5 percent level.

The VECM results in Table 4, shows that, there is evidence of one cointegrating vectors that signal one error correction term's (ECT) embedded in the system. Secondly, short-run channels of Granger-causality are statistically significant at 5 percent in the price series. These suggest, there is a causal relationship from the spot price to the production and export variables. Thirdly, we find that there is a bidirectional flow of information of between

production and export variables with the spot price. Meanwhile, we can see that there is a unidirectional flow of information from the export to production variables.

We can conclude from the evidence that the spot prices of the Malaysian crude palm oil futures market has a causal relationship with the export and production level variables.

4. Concluding Remarks

The study also proved that the spot prices of the Malaysian crude palm oil market has a stable long-run and short-run relationships with the production, stock and export from the results of Johansen's cointegration and vector error-correction model. This indicates that the production, stock level and export variables plays an important role in influencing the prices of the crude palm oil. These results uphold the previous studies that production; stock level and export variables do influence the prices of the Malaysian crude palm oil futures market and this indicates the existence of inefficient. The study of market efficiency of agricultural futures market has important implications for commodities exchange, policy makers, traders and producers. The most important implication is that a good price transmission system is essential to ensure that future prices do not diverge from fundamentals. The futures market has to be closely related to actual demand and supply conditions in order for futures prices to be good indicators for the cash market. Therefore the government should take great care on the policy of replanting of palm oil trees, so that the production of crude palm oil can be enhance to reflect the price of the crude palm oil. Stock level of palm oil should be maintained in order the supply of palm oil to the market are at a consistent to the needs of the market so that it can be justified to the demand in order to maintained the price of crude palm oils. Being the main producers of the crude palm oils, export of the goods should be monitors so that the stability of the prices can achieved through quotas and negotiations among producing counties like Indonesia, South African countries etc. The commodities exchange should be aware the signals from the production output, stock level and export numbers which can cause an effect on the spot prices of the crude palm oils. Any fluctuations on these variables, thus has to be monitor in order to maintain the market efficiency of the commodities.

The potential uses of these findings are numerous. Hedgers may benefit from this information when deciding upon the appropriate futures contract to be used. They should be aware that any information about the supply conditions of the crude palm oils will have an effect on spot prices, which make it more concern in identifying the appropriate tools to analyse it. The cointegration results imply that it may be possible to hedge whether in the long term or short term in the Malaysian crude palm oil futures market in order to reduce their risks. Investors also have to realise that by hedging in the futures market can benefit them not only reduce losses but can diversify the risk to it. On the other hand, the causal relationships discovered in the studies may be useful to both traders and speculators in using their arbitrage opportunities between the cash (spot) and futures contracts.

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Notes

Note 1. Then t-value of the alpha (speed of adjustment) coefficient calculated as a ratio of the coefficient over the standard error can be used as an initial indicator whether an independent variable is weakly exogenous or not. Lower t-value is normally associated with the independent variable being weakly exogenous and vice-versa.

What Does the EU Crisis Mean for the U.S. Economy?

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Abstract

The Europe economy is on the edge of a recession unlike anything since World War II. Many economies in the Euro zone have already been confronted with the sovereign debt crisis, and there is little hope for a recovery in 2012. The EU crisis has important policy implications for the rest of the world, particularly for the United States, which is its main trade and investment partner. This paper emphasizes on trade, investment, stock, and monetary transmission channels of contagion from Europe to the United States and estimates the effects of the EU crisis on U.S. exports, the inflow of foreign direct investment (FDI), the stock market, the U.S. banks' claims on the European banks, and the U.S. foreign-owned assets in the EU. The results of this study indicate that the U.S. economy will be severely affected by the EU crisis.

Keywords: Sovereign debt crisis, EU crisis, monetary transmission channel, U.S.-owned foreign assets, Foreign Direct Investment (FDI), Dow Jones Industrial, banks' claims

JEL Classification: E44, F14, F31, G15

1. Introduction

The European Union's summit after summit faded the hopes of reaching an agreement that would rescue the whole union. The sovereign debt crisis of Greece, the severity of the fiscal crisis in Spain and Italy, the result of new presidential election in France that heralds signs of schism among European core economic powers, and the dichotomy around the role of the European Central Bank (ECB) as the lender of last resort threaten the integrity and unity of the Euro zone. Indeed, the euro parity has slumped substantially against major currencies during the past few months due to concerns about the ability of the EU to tackle its sovereign debt crisis, and to keep its single currency surviving.

The European economy is currently experiencing the deepest recession since WWII. The public debt in the Euro area is projected to reach 100% of GDP by 2014 (note 1). While the Greek economy teeters on the edge of a default, Italy and Spain are suffering from unprecedented budget deficits of more than 100% of GDP, which has led to unsustainable level of yields on their debts.

While the public debt has contributed to the Euro zone crisis, many argue that the roots of the crisis may be attributed to the lack of competitiveness, particularly in peripheral countries. The adoption of the euro, which was accompanied by a fall in interest rates, triggered the demand and increased exports from core countries, while hindering the exports from peripheral countries. With the rise in the government expenditures and stagnated exports to GDP, the current account deficit soared in many peripheral countries; with high level of foreign debt already in place, countries like Greece, Spain, and Portugal were confronted with sovereign debt crises. Indeed, the single monetary policy of the euro was too loose for these peripheral countries, and fiscal policy was not in tandem with core European countries. These features plus the lack of the role of a lender of last resort for the European Central Bank (ECB) inflamed the sovereign debt crisis in many countries in the continent.

Indeed, not only the European countries but also many other countries around the globe will be affected by this crisis; the U.S. economy is no exception. Given its close trade and investment relationships with Europe, the EU crisis would affect the U.S. economy through different transmission channels: exports, FDI, availability of credit to U.S. households and businesses, equity markets, and foreign-owned assets. According to Goldman and Sachs forecasts the crisis will shave off 1% of the U.S. GDP growth (note 2); however, the results of this study, which captures the effects of the EU crisis on the U.S. economy by using econometric technique, suggest that the effect of the EU crisis on the U.S. economy is enormous.

The rest of the paper is organized as follows: the transmission channels of contagions are discussed in section 2. The literature review is discussed in section 3. The relations between the U.S. and European economies are discussed in

section 4. The list of the variables, data sources, and the results of the econometric models are presented in section 5. Finally, policy options that could help the U.S. economy weather the adverse impacts of the EU crisis are discussed in section 6.

2. Transmission Channels

The U.S. economy will certainly suffer from the contagions of the Euro zone crisis through five transmission channels: (i) a lower GDP growth in Europe will reduce the demand for the U.S. exports, and a weaker euro against the U.S. dollar will lead to the loss of competitiveness for U.S. tradable goods; (ii) with a weaker euro against the dollar, capital will flow to emerging markets rather than the United States; (iii) stock market indices in the U.S. will slump because the U.S. stock market is closely tied to the European markets; (iv) the crisis will also affect the U.S. foreign-owned assets abroad, particularly those in the EU; (v) and finally, the EU crisis could undermine the U.S. banks' claims on EU banks and financial institutions.

Europe is a market for 20% of the U.S. exports and holds more than 50% of the U.S. overseas assets. The European flow of direct investment (FDI) constitutes 20% of total FDI to the United States (note 3). A severe recession and a fragile financial market in Europe could hamper the economic recovery in the U.S., and push it toward the edge of a double-dip recession. Many economists agree it is very likely that the Euro zone will experience a recession in 2012, which will have severe adverse consequences for the U.S. economy, especially in sectors such as exports, banking, and financial services. A weaker euro not only hinders U.S. exports to the European Union but also to the rest of the world, because many currencies are pegged to the euro or have used euro as their main reserve currency. The fall in exports would exacerbate the U.S. current account deficit.

Another important channel that will affect the U.S. economy is through financial institutions, particularly through banks. Though the exposure of the U.S. banks to most vulnerable countries in Europe is limited to \$176 billion, or 5% of its total exposure, the indirect exposure, which will operate through all international banks and intermediaries, would be much higher.

3. Literature Review

Douglas Elliot (2011) argues that a recession in Europe would trigger a recession in the U.S. through a number of links across the Atlantic. He conjectures that the U.S. economy will lose a lot of trade in Europe as Europe is in a deep recession. The second channel he discusses is the investment channel. The U.S. firms have over \$1 trillion of direct investment in the EU, which would drop substantially due to the decline in profits. He emphasizes on financial flows as the third channel: U.S. banks and corporations have \$2.7 trillion in loans and other commitments to European governments, banks, and financial institutions, which will be adversely affected by the EU crisis.

John Makin (2011) underpins the reasons for the rapidly growing debt crisis in Europe, which threatens the global financial system and the global economy. He argues that the rise in interest rate on Italian, French, and Spanish bonds has led to a drop in the market value of trillions of dollars held by European households and banks. The stock indices have dropped sharply, while the borrowing cost in the interbank markets has risen dramatically. Slowing economic growth and rising interest rates not only has led to a vicious circle in the EU, but also has created the biggest threat to the U.S. economy and its financial system.

Cari Chastain et al. (2011) investigate the effects of European debt crisis on the U.S. economy. They argue that as investors became more wary of the European markets' instability, they invested their capital in more stable markets, such as the United States Treasury bond market. The rise in demand for the U.S. Treasury bonds drove the yields down considerably. They argue that we can link the European debt crisis to the overall slump in the yields on U.S. Treasury securities. However, they conjecture that the debt crisis in Europe doesn't seem to have a significant impact on the U.S. GDP. They argue that the U.S. banking system will not be hurt since most of the Greece debt is tied up to European countries.

Rebecca M. Nelson et al. (2012) indicate that the Eurozone crisis could impact the U.S. economy through a number of different channels. One possible channel is the exposure of the U.S. financial institutions to the Eurozone. They refer to a report from the Bank for International Settlements (BIS), which points out that the direct and potential U.S. bank exposure to Greece, Ireland, Italy, Portugal, and Spain amounted to \$717 billion in September 2011. However, those data do not capture the exposure of non-bank financial institutions (such as money market, pension, or insurance funds). They argue that another channel through which the Eurozone could impact the United States is trade and investment. There has been concern that austerity measures would slow down economic growth in Europe, and depress the demand for U.S. exports. In addition, the crisis would erode consumers' confidence in the Euro zone, leading to depreciation of the euro against the U.S. dollar, which makes U.S. exports more expensive overseas. However, they argue that there is no indication of sustained depreciation of the euro relative to the U.S. dollar.

Likewise, slower economic growth rate in Europe could cause U.S. investors to look increasingly toward emerging markets for investment opportunities. On the other hand, a weaker euro could make European stocks and assets look cheaper and more attractive for U.S. investors, attracting more U.S. capital to the Eurozone. They conclude it is not clear how the crisis will shape long-term U.S.-EU investment flows. As they emphasize, the U.S. Federal Reserve (Fed) announced the re-establishment of temporary reciprocal currency agreements, known as swap lines in May 2010 to minimize exchange rate and credit risk. The swap lines have been extended a number of times, allowing the Federal Reserve to reduce the borrowing rate for the swap lines in order to further ease the strains on financial markets. As of February 15, 2012, the outstanding on swap lines amounted to \$109 billion compared to a high of \$583 billion during the global financial crisis in December 2008.

Catherine Rampell (2011) measures the potential effects of the Euro crisis on the U.S. economy. She discusses three main channels that could hurt the U.S. economy: exports, stock market, and debt. She argues if a severe recession explodes in Europe, U.S. export would fall substantially. Moreover, the fall in demand for European products due to high unemployment and low economic growth means less demand for euro and a stronger dollar, which leads to lower exports from the U.S. She also argues the two stock markets are strongly correlated, and movement in Europe stock market is leading the U.S. market. Therefore, any drop in EU stock markets means less valuable portfolio for Americans (wealth effect). The third channel is the debt exposure and contagious credit channel. As she argues American banks own a huge amount of French debts, and French banks own enormous amount of Italian banks' debts. If Italy defaults French banks are in trouble, and if French banks default, American banks will be subject to debt crisis. Such a scenario can seriously damage U.S. financial markets because banks will stop lending or initiate tightening the standards for those borrowers who have significant exposure to Europe; this will lead to lower economic growth in the U.S.

Tim Christensen (2012) investigates the global effects of the European sovereign debt crisis. He argues that throughout the European sovereign debt crisis, investors have retained confidence in the U.S. economy. The U.S. dollar has become stronger against the euro. This has led to a reduction in U.S. exports and slower economic growth. In January 2012, the U.S. saw its overall trade deficit widen to a 3-year high of \$52.7 billion. Specifically, exports to the Eurozone were down by 11% (\$1.32 billion) from the previous month. Exports to the Eurozone have also decreased because of lower demand in the Eurozone. In addition, the crisis has adversely affected European investment in the U.S. In 2010, the EU companies invested more than \$131 billion in the U.S., bringing the cumulative total of EU investment in the U.S. to \$1,484 billion (accounting for 63.3% of all EU foreign direct investment). However, in 2011, EU companies only invested \$105.07 billion in the U.S. Despite declining exports from the U.S. and lower foreign direct investment from the EU, the U.S. economy grew by 3% in 2010 and 1.7% in 2011. Although the economic growth rate slowed in 2011 due to the effects of the European sovereign debt crisis, it exceeded the 3.5% economic contraction in 2009. European banks experienced a shortage of U.S. dollars as U.S.-based money market funds began to pull out of the European banks, threatening the European banks to pay back their dollar-denominated loans and defaulting on their debt. The lack of dollars in European banks would potentially increase the costs of borrowing and would exacerbate the crisis as banks, companies, and individuals all over the world would find it more difficult to obtain affordable loans. They argue that, though the U.S. has managed to continue its economic recovery from the global financial crisis, the European crisis has prevented a robust recovery from happening. Concerns about a rising dollar, a weaker euro, and lower European investment in the U.S. could hinder the U.S. recovery, as investors and consumers' confidence remains fragile. Another concern is that if banks fail in Europe due to overexposure to European sovereign debt crisis, those banks will not be able to repay their debt to the U.S. banks, which could tighten credit to businesses and consumers, delaying economic recovery.

4. Stylized Facts on the U.S. Economic Ties to the European Union

This section underpins the U.S. economy's ties to the European Union, with an emphasis on exports, FDI, stock markets, and financial assets held abroad. Amazingly, more than one-fifth of U.S. exports are directed to the European Union and more than 50% of the FDI that flows to the U.S. originates from the EU. The questions are to what extent the EU crisis can affect the U.S. economy? To what extent FDI from the EU to the U.S. will be affected? And, finally how much exports of the U.S. to the EU will drop as a result of financial crisis in Europe? These questions will be answered in the econometric section of this paper.

The data on FDI flow from different regions to the United States indicates that Europe's FDI in the U.S. has exceeded those of other regions since 2000, except for 2001 (Figure 1). Therefore, any change in the flow of FDI from Europe to the United States will have a huge impact on the total flow of FDI to the U.S., which can potentially affect different sectors of the U.S. economy, and have important consequences for investment and GDP growth.

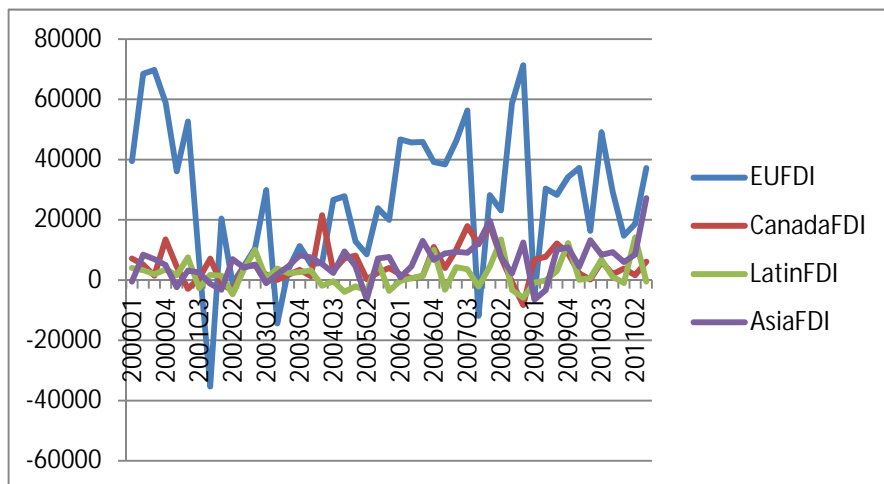


Figure 1. The FDI flow to the United States from different regions (in million dollars)

Source: Bureau of Economic Analysis (BEA) at <http://www.bea.gov/iTable/iTable.cfm?ReqID=6&step=1>, Table 12. U.S. Transactions by Area.

The second transmission channel that will affect the U.S. economy is exports; interestingly enough, more than 20% of the U.S. exports are directed to the European Union. Indeed, U.S. exports to the European Union stand above its exports to Canada and Latin America (Figure 2). Though the amount of U.S. exports to the EU and the Asia-Pacific region has been closely moving together since 2000, the former has been left behind with the emergence of recession in the Eurozone since 2009.

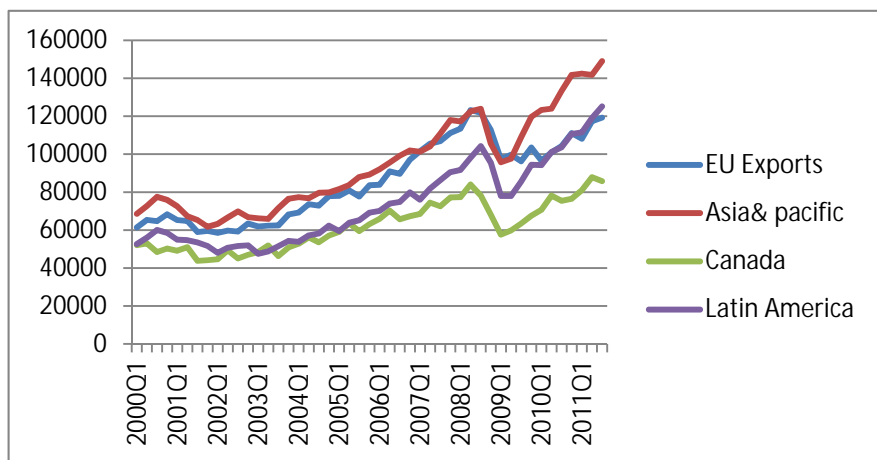


Figure 2. The United States' exports to different regions (in millions dollars)

Source: Bureau of Economic Analysis (BEA) at <http://www.bea.gov/iTable/iTable.cfm?ReqID=6&step=1>, Table 12. U.S. Transactions by Area.

Indeed, U.S. exports to the Euro area is not only affected by the shrinkage in the European GDP, but also by the euro/dollar exchange rate parity (Figure 3); with a weaker Euro and stronger dollar, U.S. exports are expected to fall, not only due to lower demand from the EU but also due to a stronger dollar, which weakens the competitiveness of U.S. products and services around the globe.

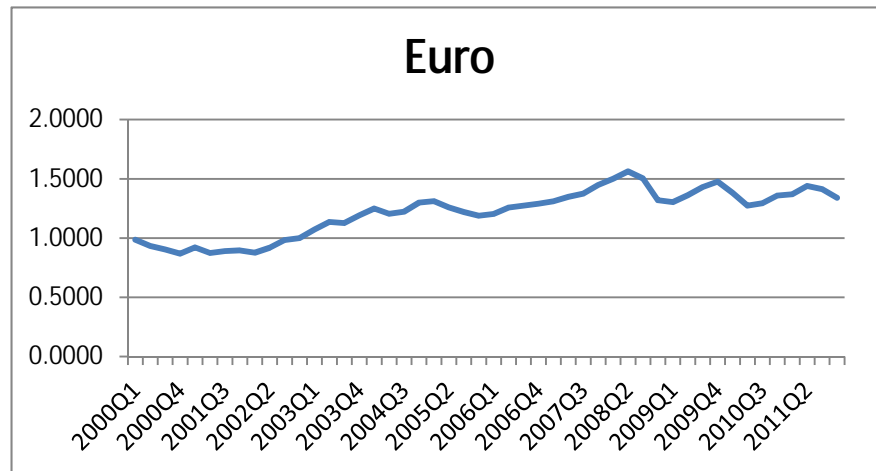


Figure 3. The Euro-dollar exchange rate parity since the first quarter of 2000

Source: Federal Reserve Bank of St. Louis, at <http://research.stlouisfed.org/fred2/series/DEXUSEU/downloaddata?cid=94>.

The third transmission channel that threatens the U.S. economy is through the stock market; the EU and U.S. stock markets are highly correlated (Figure 4); the correlation between the U.S. Dow Jones Industrial and the European Dow Jones is 60% (as indicated in the econometric section). Since the two stock market indices move very closely, any drop in the EU stock market could have severe consequences for the U.S. economy.

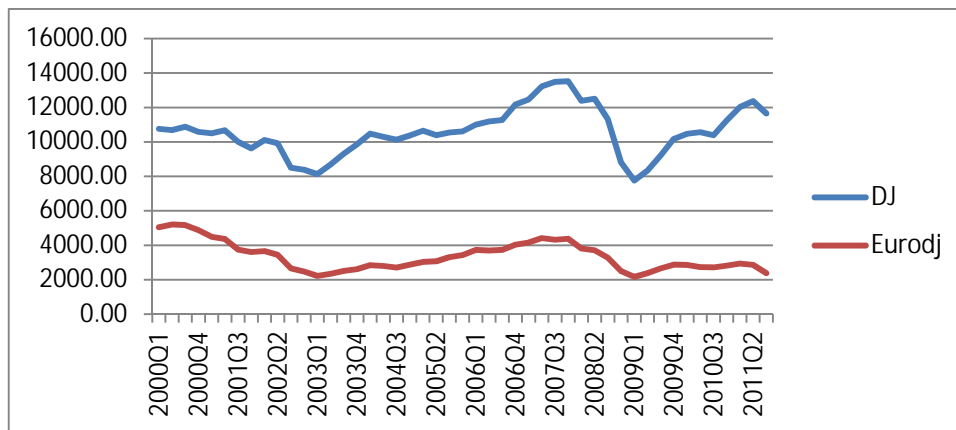


Figure 4. The U.S. Dow Jones Industrial and the EU Dow Jones

Source: Federal Reserve Bank of St. Louis, at <http://research.stlouisfed.org/fred2/series/DJIA/downloaddata?cid=32255>, and the European Central Bank at <http://sdw.ecb.europa.eu/>.

The fourth transmission channel is the impact on the U.S. banks' claims on EU banks and financial institutions. The U.S. banks' claims on the European banks and financial institutions jumped substantially after 2008, dropped back in 2010, but have recovered again in 2011 (Figure 5). The U.S. banks and securities brokers' claims on the EU financial institution will certainly be affected not only through a weaker euro, but also due to the contraction of the European GDP.

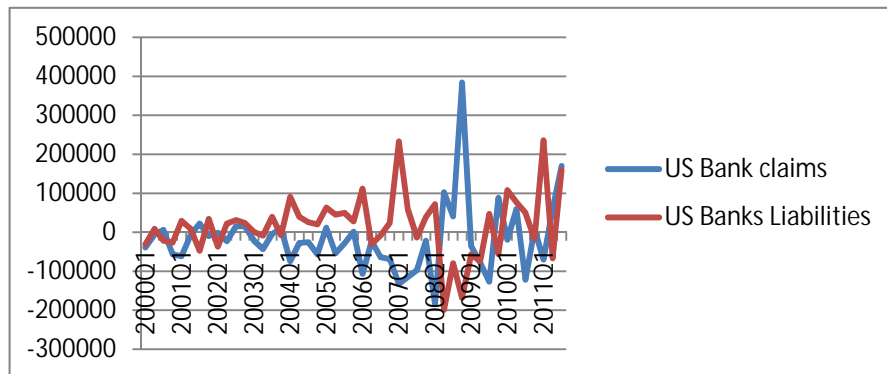


Figure 5. United States banks' claims and liabilities to European banks

Source: Bureau of Economic Analysis (BEA) at <http://www.bea.gov/iTable/iTable.cfm?ReqID=6&step=1>, Table 12, US Transactions by Area.

Fifth, the euro crisis will likely shrink the value of U.S. foreign-owned assets in the Eurozone through a weaker euro. Indeed, it is likely that the U.S.-owned assets in the European Union will drop substantially as a result of the drop in euro parity against the dollar. This assertion will be investigated in the econometric section of this paper. The U.S.-owned assets in the EU have been relatively volatile due to dollar/euro fluctuations and the interest rate differential; however, a substantial rise was observed in 2011 (Figure 6).

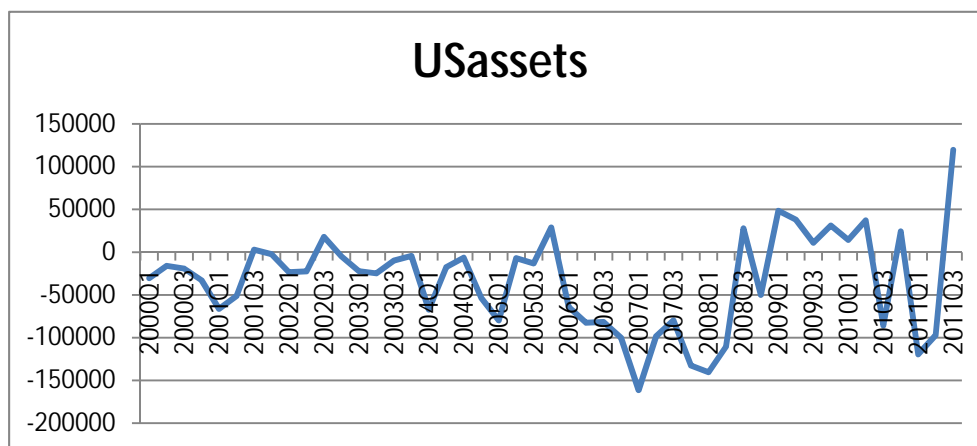


Figure 6. U.S.-owned assets in the EU

Source: Bureau of Economic Analysis (BEA) at <http://www.bea.gov/iTable/iTable.cfm?ReqID=6&step=1>, Table 12, U.S. Transactions by Area.

5. Data and Econometric Results

We use quarterly data from 2000Q1 to 2011Q3 to capture the impact of the EU crisis on the U.S. economy in different sectors, including exports, FDI, stock markets, U.S.-owned foreign assets in the EU, and the banking system claims on the European banks. The U.S. economy is already struggling to recover from a mild recession; if precautionary actions are not implemented there is the possibility that the U.S. economy may slide back in to a double-dip recession. Therefore, it is very important to quantify the effects of the Eurozone crisis on the U.S. economy. An econometric technique is used to measure the impact of the abovementioned transmission channels on the U.S. macroeconomic variables.

The list of variables, their summary statistics, and sources are provided in Table 1. The data on exports, FDI to the United States, U.S.-owned assets in the EU, U.S. banks' claims and liabilities to European financial institutions, income receipts, and payments to the EU are from Bureau of Economic Analysis (BEA). The data on EUGDP, EU

interest rate, EU Dow Jones, and Eurobond interest rate are from the European Central Bank (ECB). The CPI in the U.S., 1-year swap interest rate, U.S. Dow Jones Industrial, U.S. bond interest rate, and U.S. GDP are from the Federal Reserve Bank. Finally, European CPI is retrieved from the World Bank.

Table1. Data, summary statistics, and their resources

Variable	Definition	Mean	Max	Min	Std. Dev.	Source
Exports	US exports of goods and services to EU (in million dollars)	85709.5	123265	58546	20893.1	BEA
EUGDP	Euro area Gross Domestic Product	2058054	2367320	1668417	221694	ECB
EUGDPG	Euro area GDP growth	1.44	4.47	-5.29	2.13	Author's calculation
USCPI	U.S. CPI index (1984=100)	197.64	226.21	170.1	17.05	Federal Reserve
EUCPI	E.U. CPI Index	101.20	113.48	89.17	7.22	World Bank
DCPI	Relative CPI of the U.S. to the EU	0.99	1.01	0.96	0.01	Author's calculation
USint	1-year swap interest rate in the U.S.	2.83	6.93	0.39	1.90	Federal Reserve
EUint	Euribor 1-year historical close interest rate	3.08	5.38	1.21	1.26	ECB
Dint	Interest rate differential between the U.S. and EU	0.183	2.43	-2.05	0.18	Author's calculation
Euro	Euro parity versus U.S. dollar	1.21	1.56	0.86	0.20	Federal Reserve
FDI	U.S. foreign direct investment in the Euro area	1113016	1818951	810307	276482.6	BEA
DJ	U.S. Dow Jones Industrial	10587.5	13516.9	7757.77	1375.9	Federal Reserve
EUDJ	Euro Dow Jones	3352.81	5200.81	2166.43	837.2	ECB
EUbondint	Euro bond interest rate	4.31	5.61	3.26	0.58	ECB
USbondint	U.S. bond interest rate	4.31	6.48	2.74	0.85	Federal Reserve
USassets	U.S.-owned assets in European Union, excluding derivatives (million dollars)	-33587.5	119804	-161394	57027.9	BEA
USGDP	U.S. GDP in billions of dollars	12589.4	15176.1	9709.5	1733.86	Federal Reserve
USGDPR	U.S. GDP in chain 2005 billion dollars	12415.23	13331.6	11033.6	749.02	Federal Reserve
USTreasury	Treasury securities and bonds in million dollars	535891.3	1401619	391031	218298.5	Federal Reserve
Claims	U.S. banks and securities brokers' claims on the EU (in million dollars)	-17149.7	383746	-184727	87884.7	BEA
Liab	U.S. bank liabilities to the EU (in millions of dollars)	17589.8	235789	-198998	79417.8	BEA
Banknet	U.S. banks' net claims and liabilities on the EU (in millions of dollars)	440.10	329241	-152716	86623.27	Author's calculation
Derivative	Financial Derivatives (in millions of dollars)	-621.18	5455	16236	5582.8	Federal Reserve Bank
CA	U.S. Current account with EU (in millions of dollars)	-6081.9	32925.19	-58837.05	22869.1	Federal Reserve Bank
Openness	Imports plus exports to EU ratio to GDP percent)	14.83	18.34	12.31	1.407	Author's calculation
Loans	Sum of primary credit, secondary credit, primary dealers and other broker dealer credit, asset-backed commercial paper, money market mutual fund, facility extended to American International Group, term asset-backed securities loan facility, and other credit extensions (in millions of dollars)	33393.9	309925	14	62491.7	Federal Reserve Bank

Source: Data retrieved from Bureau of Economic Analysis (BEA), Federal Reserve Bank of St Louis, European Central Bank (ECB), and the World Bank.

The following section represents the econometric results of the estimated models on the effects of Euro crisis on the U.S. economy in different sectors including exports, FDI, stock market, U.S. foreign-owned assets, and banks and securities brokers' claims on the EU financial institutions.

5.1 U.S. Exports to the EU

As many economists including Behrman and Hanson (1979) have argued, exports are a function of GDP growth, exchange rate parity, and relative Consumer Price Index (CPI). We use the same model (equation 1) to measure the impact of the EU crisis on U.S. exports. Based on the estimated model, 94% of the U.S. exports to the Euro area can be explained by three independent variables: euro/dollar parity, which affects the purchasing ability of buyers of U.S. products; EUGDP as a measure of demand for the U.S. exports; and relative CPI (DCPI) as a measure of relative competitiveness. The results indicate that U.S. exports to the Eurozone are completely elastic to relative prices, EUGDP, and euro parity. To measure the impact of the crisis on U.S. exports we consider two main transmission channels here: (i) the shrinkage in the Euro GDP (ii) and the fall in the parity of the euro against the U.S. dollar.

$$\text{Exports} = a_0 + a_1 \text{Euro} + a_2 \text{EUGDPG} + a_3 \text{DCPI} \quad (1)$$

Based on IMF predictions, the growth rate in the Euro area will drop to 1.1% in 2012 from 1.6% in 2011 (note 4); however, OECD and the EUROFRAME forecasts show a more dramatic drop. They conjecture that the EU growth rate will drop from 0.9% in 2011 to 0.6% in 2012 (note 5). Therefore, a drop of 33% in the EUGDP growth, based on OECD forecasts, will lead to at least 0.9% lower exports from the U.S. to the Eurozone ($0.027 * 33\% = 0.9\%$). But this effect is only with respect to the European GDP growth; U.S. exports to other regions will also be affected because many Asian countries' currencies are pegged to the euro or have the euro as their main reserve currency, which will affect their ability to buy from the U.S. Therefore, the total impact on the U.S. exports is expected to be much higher.

Another channel that will adversely affect U.S. exports is the parity of the euro against the U.S. dollar. A weaker euro will lead to lower exports from the U.S. to Europe; a drop of 10% in euro parity against the U.S. dollar as a result of EU crisis will lead to a drop of U.S. exports by 4.5% ($0.45 * 10\% = 4.5\%$). Therefore, in sum, U.S. exports to the EU are expected to fall by at least 5.4%, all else equal. But the real impact on U.S. exports will be much higher because many currencies are pegged to the euro, and a stronger dollar against those currencies reduces the competitiveness of the American products and services in the global market.

Table 2. Elasticities of the U.S. exports to euro parity and other economic fundamentals

Variable	Coefficients	Robust Standard Error	P
Euro	0.45	0.086	0.000
EUGDPG	0.027	0.007	0.001
DCPI	-10.76	0.859	0.000
Constant	11.16	0.015	0.000
No of Obs.	42		
R-squared	0.95		
F-statistics	246.79		

5.2 FDI Flow from the EU to the U.S.

The U.S. economy will also be affected by the shrinkage of Europe FDI in the U.S. As many economists, including Bogacz (2005) and Jaumotte (2004), have argued, FDI is a function of demand in the host country, measured by EUGDP here, exchange rate parity (Euro), stock market index (DJ), and interest rate differentials (Dint). Therefore, equation (2) has been used to measure the effects of the EU crisis on the flow of FDI from the European Union to the U.S.

$$\text{FDI} = a_0 + a_1 \text{Euro} + a_2 \text{DJ} + a_3 \text{EUGDPG} + a_4 \text{Dint} \quad (2)$$

Interestingly enough, 73% of the FDI from the EU to the United States can be explained by the above independent variables. The results indicate that the European FDI flow to the U.S. economy is completely elastic to Europe GDP growth. A 33% drop in the EU GDP growth will lead to 1.6% drop in the flow of FDI to the U.S. ($0.05 * 33\% = 1.6\%$). But this is not the whole impact. A 10% drop in the euro parity against the U.S. dollar will lead to a drop of 8.1% in the FDI from the EU to the U.S. ($0.81 * 10\% = 8.1\%$); therefore, the FDI from the EU to the U.S. is expected to fall by 9.7%.

Table 3. Elasticities of FDI from EU to the United States to euro parity and other economic fundamentals

Variable	Coefficients	Robust Standard Error	P
Euro	0.81	0.14	0.00
DJ	0.66	0.25	0.01
EUGDPG	0.05	0.02	0.05
Dint	0.03	0.02	0.09
Constant	7.65	2.31	0.00
No of Obs.	25		
R-squared	0.73		
F-statistics	17.64		

5.3 U.S. Stock Market

The U.S. stock market is closely correlated with the European markets; therefore, any change in the EU stock market can have severe adverse effects on the U.S. stock market. Following De Medeiros (2005) and Kalbasi (2009), the EU Dow Jones, EU and US bond interest rates, and US and EU and 1-year swap interest rates in the host and origin country are used as independent variables (equation 3).

$$DJ = a_0 + a_1EUDJ + a_2EUbond\ int + a_3USbond\ int + a_4US\ int + a_5EU\ int \quad (3)$$

The estimated results suggest that more than 80% of changes in Dow Jones Industrial can be explained by the abovementioned independent variables, and the correlation between the two stock markets is 0.61. Put differently, a 10% drop in the EU Dow Jones will lead to a drop of 6.1% in the U.S. Dow Jones Industrial, which will have huge impacts on the U.S. pension funds and 401(k) plans, as they are closely linked to the U.S. stock market.

Table 4. Elasticities of the U.S. Dow Jones Industrial to Euro Dow Jones and euro bond interest rate

Variable	Coefficients	Robust Standard Error	P
EUDJ	0.61	0.078	0.000
EUbondint	-0.85	0.109	0.000
USbondint	0.15	0.095	0.113
USint	-0.18	0.028	0.000
EUint	0.28	0.046	0.000
Constant	5.15	0.570	0.000
No of Obs.	44		
R-squared	0.80		
F-statistics	42.51		

5.4 U.S. Foreign-Owned Assets in the EU

Another transmission channel that will likely hit the U.S. economy is through U.S. foreign-owned assets in the EU. Since the U.S. assets are in the form of stocks, derivatives, and treasury bonds, therefore, DJ Industrial, EU Dow Jones, financial derivatives (Derivatives), and U.S. Treasury securities and bonds are used as independent variables to estimate the changes in the U.S. foreign-owned assets (equation 4).

$$USassets = a_0 + a_1DJ + a_2EUDJ + a_3Derivative + a_4USTreasury \quad (4)$$

The estimated results indicate that more than 79% of the U.S.-owned assets can be explained by aforementioned independent variables. Contrary to previous models, this model is estimated in the linear form because the data on the U.S. assets held in the EU are negative from some observations; in other words the U.S. has been a net receiver of foreign assets in some years. The estimated elasticity of the U.S.-owned assets to European DJ is -16.1; therefore, a 10% drop in the EUDJ means 161% drop in the value of U.S. foreign-owned assets in Europe, which is a huge impact and represents the most important transmission channel.

Table 5. Regression results of the U.S.-owned assets

Variable	Coefficients	Robust Standard Error	P
DJ	33.00	16.05	0.05
EUDJ	-161.25	40.36	0.001
Derivative	6.15	0.87	0.000
USTreasury	-0.20	0.05	0.002
Constant	236369	35038.26	0.000
No. of Obs.	22		
R-squared	0.79		
F-statistics	33.5		

5.5 The U.S. Banks' Claims on the EU Banks and Financial Institutions

The U.S. banks and securities brokers' claims on the EU financial institutions are likely to be affected with the Eurozone crisis. These claims are affected by many factors including the euro parity against the U.S. dollar (the weaker the euro, the lower the value of the foreign-owned assets in EU), U.S. exports to the EU (the lower the U.S. exports, the lower the U.S. banks' claims), and U.S. and Euro bond interest rates as Dornbusch (1989) argues interest rate differential is the main factor in the flow of capital. The U.S. banks' liabilities to the European banking system also affect the amount of U.S. claims. The EUGDP is another main factor (the higher the level of GDP in the host country the more FDI from the U.S. will flow to the EU and therefore, the higher the banks' claims would be). The stock market indices, the EU Dow Jones, and the U.S. Dow Jones Industrial also affect the banks' claims because the higher the EU stock market index, the more capital will flow to the EU, which in turn affects the U.S. banks' claims on the EU banks. Finally, the amount of loans to other banks (total loans extended to primary and secondary credit markets, mutual funds, American International Groups, and other credit extensions) can affect the claims of the U.S. banks and brokers on the European banks because many of these mutual funds or international banks work as intermediaries for European banks and can affect their claims or liabilities on the U.S. banking system. Therefore, equation (5) is used to measure the impact of the EU crisis on the US banks' claims.

$$\begin{aligned}
 \text{Claims} = & a_0 + a_1 \text{Euro} + a_2 \text{Exports} + a_3 \text{USbond int} + a_4 \text{EUbond int} + a_5 \text{Liab} + \\
 & a_6 \text{EGDP} + a_7 \text{EUDJ} + a_8 \text{DJ} + a_9 \text{Loans}
 \end{aligned} \quad (5)$$

The model is estimated in the level form because the claims are negative for some observations. Therefore, the elasticities have been calculated. The elasticity of the U.S. banks' claims to euro parity is 2.12; in other words, a 10% drop in euro parity against the U.S. dollar will lead to 21% drop in the U.S. banks' claims on the EU. The elasticity of banks' claims to exports is 0.39, which means a 10% drop in the U.S. exports to the EU as a result of the EU crisis leads to 3.9% drop in the value of U.S. banks' claims on EU banks. The elasticity to EUDJ is 0.42; therefore, a 10% drop in the EUDJ implies 4% drop in the U.S. banks' claims on EU banks and financial institutions. In sum, the U.S. banks' claims on EU banks and financial institutions as a result of the crisis is expected to drop by 29%, which will substantially reduce the ability of the U.S. banks and financial institutions to lend to domestic consumers and entrepreneurs, worsening the sluggish economic recovery and hindering a fragile job market.

Table 6. Regression results of U.S. banks' claims on EU banks and financial institutions

Variable	Coefficients	Robust Standard Error	P
Euro	-301762.9	152705.1	0.060
Exports	7.81	2.88	0.012
USbondint	98961.98	32513.72	0.006
EUbondint	-74963.73	30816.7	0.023
Liab	-0.363	0.10	0.002
EUGDP	0.869	0.264	0.003
EUDJ	-216.80	43.32	0.000
DJ	95.20	15.09	0.000
Loans	1.58	0.15	0.000
Constant	1031486	445064.9	0.029
No of Obs.	34		
R-squared	0.85		
F-statistics	269.4		

6. Discussion

This study suggests that the European sovereign debt crisis will have enormous impacts on the U.S. economy through five main transmission channels: (i) exports from the U.S. to the EU; (ii) FDI flow from the EU to the United States; (iii) stock market correlation; (iv) U.S.-owned foreign assets in the EU; (v) and finally U.S. banks and securities brokers' claims on the EU banks and financial institutions.

The econometric results of this paper suggest that U.S. exports are expected to fall by 5.4%. This is only the direct impact, but exports to other regions could also fall because many currencies are pegged to euro or have euro as their main reserve currency, which dramatically reduces their demand for U.S. exports due to a weaker euro. The FDI flow from the EU to the United States is expected to fall by at least 9.7% due to the shrinkage in the EU GDP growth and a weaker euro against the U.S. dollar. The correlation between the U.S. and the EU stock markets suggests that the EU crisis will hit the DJ Industrial by at least 6%, which will have severe, adverse effects on U.S. pensions and 401(k) plans. And the most important effect is an enormous drop in the value of U.S. foreign-owned assets in the EU—by 160%. Finally, the banks and securities brokers' claims on EU banks are expected to drop by 29%.

In sum, the results of this study suggest that the EU crisis will have huge potential costs for the U.S. economy, which could reverse the recovery process or, in the best scenario, delay a robust economic recovery. To prevent these adverse effects, policymakers should adapt immediate, prudential measures. Diversifying the exports destinations, particularly, enhancing trade with Canada and Latin America should be a priority for the U.S. administration. Currently, despite the North America Free Trade Agreement (NAFTA) the U.S. exports to Canada and Latin America are lower than exports to any other regions around the globe. Though the establishment of a free trade zone (FTZ) with Southeast Asia has been initiated, facilitating the process and eliminating legal impediments, simplifying the tax system, and removing the non-tariff barriers can help neutralize the adverse effects of the EU crisis on the U.S. economy. Deregulation of financial markets is among the necessary measures that should take place to foster the capital flow to the United States from other regions, replacing those of the European Union. Finally, it would be helpful to reduce the exposure of the U.S. banking system to the European sovereign debt, not only by diversifying transactions among regions, but also by introducing different products and services.

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Catastrophe in Stock Market in Bangladesh - A View of Investors and Financial Analysts of Chittagong Stock Exchange

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Abstract

The indispensable part of an economy is Stock Market which acts as an intermediary for movement of funds between surplus units and deficit units. Well-functioning capital markets play an important role in mobilizing savings and investments for organizing the production of goods and services, creating employment opportunities, and enhancing economic development. But any sorts of disorder in the same may negatively affect the economy as a whole. The present study is an endeavor to justify the present conditions based on a chronological analysis of the history of stock market in Bangladesh identifying the reasons of the recent catastrophe, to measure the impact of the surge and fall on the investors simultaneously identifying their expectations from the regulatory bodies and to provide recommendations to overcome the present conditions.

Keywords: Catastrophe, Stock Market, regulatory bodies, syndicate, investors

1. Introduction

The indispensable part of an economy is Stock Market which acts as an intermediary for movement of funds between surplus units and deficit units. It is a place to raise capital by means of issuing share and hence transacting it on a regular basis among the participants. Thus, a share is just like a commodity sold in the stock market through stock exchange. By purchasing shares of a company an investor become the owner of that company up to the intrinsic value of his shareholding and also become entitled to the profit or loss of the company proportionate to his share.

In a market economy, the capital market plays a vital role in the efficient allocation of scarce resources. Well-functioning and developed capital markets augments the process of economic development, efficiency welfare through different ways such as encourage savings, draw more savers and users into the investment process, draw more institution into the intermediation process, help mobilization of non financial resources, attract external resources, discipline sick organization and investments organizing production of goods and services and creating employment opportunities (Chowdhury, T.A., 2005). There is a saying that the stock market is the pulse of the economy. In the developed western world, how the stock market is doing is not only a matter for prime-time news bulletin but also a matter of public interest on an hourly-basis. Keeping conspiracy theory aside, instability or extreme volatility of a capital market may suggest weaknesses in the market. Further, this is an indicator of looming economic uncertainty (Monem, R., 2011).

There is no doubt that a vibrant capital market is likely to support a robust economy but two major catastrophes in the capital market of Bangladesh within one and half decades do not indicate the existence of a vibrant market; rather these show a highly risky and unstable capital market. The recent surge in the capital market has shaken the whole country as millions of people became insolvent within a very short span of time. It was observed in 2010 that the DSE (Dhaka Stock Exchange) general index was the highest ever which made it Asia's top performer after China (Islam, 2011), while the reverse scenario was scaring investors in the 1st quarter of 2011 as the lowest down ever in the index was observed during that period.

The present study is an endeavor to justify the present condition of the stock market identifying the reasons of the catastrophe, to measure the impact of the surge and fall on the investors simultaneously identifying their expectations from the regulatory bodies and to provide recommendations to overcome the present conditions.

2. Objectives of the Study

The main objective of the study is to analyze the reasons and impact of the recent catastrophe in the stock market in Bangladesh. To achieve the main objective, the study sets the following specific objectives:

- i) To depict the present scenario of the stock market and the recent catastrophe of the stock market in Bangladesh through a chronological analysis of the history of stock market in Bangladesh.
- ii) To find out the reasons of the recent catastrophe in the stock market in Bangladesh.
- iii) To evaluate the impact of the recent catastrophe in the stock market in Bangladesh.
- iv) To identify the expectations of the investors regarding the role of regulators and future prospects of the stock market in Bangladesh.
- v) To provide some recommendations to overcome the present scenario of the stock market in Bangladesh.

3. Methodology of the Study

The present study is done based on the following methodology:

3.1 Data Sources

Both secondary and primary data were used for completion of the study. Secondary data were taken from different relevant studies, national and international dailies, websites of SEC, Bangladesh Bank, DSE, and CSE. Data regarding present market conditions, change in rules and regulations (SLR, CRR, etc.) and change in market index, etc. were collected from secondary sources.

Primary data were collected through a structured questionnaire survey. Relevant opinion market condition, investment, loan, loss on investment, roles of regulatory bodies, syndication, investigation report and expectation from regulators were collected from primary sources. Total 350 questionnaires were distributed out of which 255 (78.95%) investors, 11 (3.41%) financial analysts, 6 (1.86%) executives of regulatory bodies and 51 (15.80%) employees of brokerage houses totaling of 323 (100%) respondents responded correctly. The respondents were chosen randomly from Chittagong Metropolitan area because of the convenient of the researchers. Because the working place of the researchers is in Chittagong.

3.2 Demographic Characteristics of the Respondents

Here an account of the demographic characteristics of the respondents is provided to understand the investors and overall capital market conditions of Bangladesh. The demographic characteristics are representing the overall demographic distribution of the population of Bangladesh. Based on age of the respondents were classified as: 136 (42.11%) respondents fall in 20-29 years, 169 (52.32%) respondents falls in 30-39 years and 18 (5.57%) respondents fall in 40-49 years (Please See Table 1). As per profession, 15 (4.64%) are businessmen, 265 (82.04%) are service holders, 9 (2.79%) housewives, 34 (10.53%) are others (Please See Table 1). According to the educational background, 44 (13.62%) respondents are undergraduate, 17 (5.26%) respondents are graduate, 238 (73.68%) respondents are post graduate, 24 (7.43%) more or others (Please See Table 1). Based on the duration of involvement with the stock market, 68 (21.05%) respondents are involved for less than 2 years, 85 (26.32%) for 2-3 years, 51 (15.80%) for 3-4 years and 119 (36.84%) for more than 4 years (Please See Table-2). Based on the reason or objective of involvement or investment in stock market the respondents can be classified as: 66 (20.43%) to create self dependency, 36 (11.15%) to upgrade social status, 119 (36.84%) to earn higher return, 37 (11.46%) easy to invest and 65 (20.12%) other reasons (Please See Table-3). Based on the role of the respondents in the capital market, they can be divided into few groups as: 255 (78.95%) Investors, 11 (3.41%) Financial Analysts, 6 (1.86%) Regulators and 51 (15.80%) Stock Brokers (Please See Table 4). Finally according to the sources of capital the respondents can be divided into few groups as: 161 (52.96%) investors invested only own money, 31 (10.20%) investors invested taking fund from husband or father or relatives, 41 (13.49%) investors invested taking bank loan, 24 (7.90%) investors invested taking margin loan from broker, 47 (15.46%) investors invested both own fund & taking loan (Please See Table 8).

Table 1. Age, Profession and Educational Status of Investors in capital market

Age	20-29	30-39	40-49	Above 50	Total
Frequency	136 (42.11%)	169 (52.32%)	18 (5.57%)	-	323 (100%)
Profession	Business	Service	Housewife	Others	Total
Frequency	15 (4.64%)	265 (82.04%)	9 (2.79%)	34 (10.53%)	323 (100%)
Education	Undergraduate	Graduate	Post Graduate	More	Total
Frequency	44 (13.62%)	17 (5.26%)	238 (73.68%)	24 (7.43%)	323 (100%)

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

Table 2. Duration of involvement with stock market

Duration in Years	Less than 2 years	2-3 years	3-4 year	More than 4 years	Total
Frequency	68 (21.05%)	85 (26.32%)	51 (15.80%)	119 (36.84%)	323 (100%)

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

Table 3. Why have you invested in stock market/ Reason of involvement?

Opinion	To create self dependency	To upgrade social status	To earn higher return	Easy to invest	Others	Total
Frequency	66 (20.43%)	36 (11.15%)	119 (36.84%)	37 (11.46%)	65 (20.12%)	323 (100%)

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

Table 4. Involvement with the stock market as

Involvement as	Investor	Financial Analyst	Regulator	Broker	Total
Frequency	255 (78.95%)	11 (3.41%)	6 (1.86%)	51 (15.80%)	323 (100%)

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

After collecting data, simple statistical techniques like frequency distribution, percentage of frequency were used to analyze the collected data primary data and information.

4. Limitations of the Study

The present study is a self funded work and therefore it was not possible to collect opinion of all types of people relating to the stock market. It could be much more representative and comprehensive, if opinion could be collected from other parts of the country.

5. Present Scenario of Stock Market and Recent Catastrophe

5.1 Capital Market at Present

As on July 24, 2011 the number of active listed companies in the two stock exchanges are 270 (236 A-Category, 9 B-Category, 5 N-Category and 20 Z-Category (Note-1)) and 212 respectively while there are 54 companies in the OTC Market. Among those the number of mutual funds traded is 32 in both the stock exchanges and that of bond traded in both DSE and CSE is 3. The market capitalization in the two stock exchanges is TK.3, 135,133,167,493 and Tk.2, 543,976,851,118 respectively. The number of B/O Account holders at present is about 3.3 Million. Among them about 0.6 million are women. In the month of June, 2011 average daily turnover in DSE was 500 crore and in CSE it was 60 crore. Again the turnover has been showing an increasing trend as it stood at Tk.1958 crore in DSE and Tk.199 crore in CSE as on July 24, 2011.

5.2 A Chronological Analysis of the History of Stock Market Catastrophe in Bangladesh

The Stock Market of Bangladesh has got its origin from the then Pakistan through inheritance. Eight promoters have established the then East Pakistan Stock Market in between 1954-56. It was renamed as Dhaka Stock Exchange in 1964. The revolution of stock market has been initiated in 1976. A remarkable trade trend has been observed since 1986. The new General Index of Dhaka Stock Exchange has been established in 1993 by following the formula of International Finance Corporation (IFC) of World Bank. In the same year Security and Exchange Commission has been established as the regulatory body of Stock Market by the Parliament.

From the year 1993 to 1994 market capital increased from Tk.178 crore to Tk.408 crore. Observing the high growth rate, the government introduced Lock-in period of one year for IPO to sponsors in the year 1995. In 1995, another stock exchange named Chittagong Stock Exchange was established. The year 1996 is marked as the worst year for the capital market of Bangladesh. In that year the capital market of Bangladesh has observed a big plunge in December after a bang having the market capital of Tk.2100 crore. Before the sag in December 1996, DSE General Index raised up to 3600 points through the “Pump and Dump Manipulation Scheme” of some dishonest stock brokers. After that the Index has declined by about 83.44% in three years from 1996 to 1999.

Since no criminal responsible for that big plunge of 1996 has been punished, the sock market took long time to come to a stable position even though the Government had taken different initiatives. Such measures of the Government included the followings: Both the stock exchanges have started online trading since 1998. In 1999-2000, Government allowed black money to enter into the capital market (National Budget, 1999-2000). In 2000-2001, companies paying dividend 25% and above have been declared to get 10% tax rebate while tax deducted at source on bonus shares has been withdrawn by the Government. Permissions to the bank to open Merchant Bank wings and enhancement of minimum taxable income were other motivating effort during that period. But such efforts could not bring expected results as no mentionable progresses were found.

The slow and steady progress has been observed from 2002 to 2006. In 2007 the capital market of Bangladesh has got its momentum and it turned around with a rapid but stable growth which was a real booster for the investors. Market capital, index, average turnover and all other phenomena of stock market were showing a positive trend. Thus the period of 2007 to 2009 was the best period of Bangladesh Stock Market so far. In the 1st three quarters of 2010 investors have found a completely mysterious and unusual growth in capital market the ultimate consequences of which is the historical crush of 2010-2011. Other factors like economic situation, reduction of investment in other sectors, unemployment situation of the country and finally the encouragement of regulators for investment in stock market also played important role for unusual growth of stock market.

5.3 Surge and Fall in Capital Market in 2010

In 2010 the market reach at its peak and on 13th October, 2010 DSE regulators warned of a looming collapse of stock market as all flurry cooling measures failed to end a record breaking bull run. While the DSE general index doubled from a lower of 1318 in 2003-2004 to 3010 in 2008-2009 in five years, it hiked double in single fiscal year 2009-2010 to 6153. It had hit new highs consecutively five months reaching 8602 in 30th November, 2010 followed by a 290 points drop to 8290 in one month followed by a series of drop before the market crash on 10th January, 2011 to 6499. With a rebound on 12th January, 2011 to 7690 the index again fell on 19th January, 2011 following by a single day 587 points fall leading to a second crash. The capital market had to suffer another crumple in ten days while on 20th January, 2011 trading was halted at a loss of 587 points or 8.5% plunge within five minutes of start although it crossed the circuit breaker threshold of 225 points by a huge margin (Please See Table 5). The SEC has introduced the new circuit breaker a day earlier although it did not work at all (Akkas, 2011).

Table 5. DSE General Index and its change from November 2010 to May 2011

Date	DSE General Index	Change in General Index	Date	DSE General Index	Change in General Index
29/11/10	8599.411	--	20/02/11	6389.625	+810.120
05/12/10	8918.514	+319.103	28/02/11	5203.085	-1186.540
19/12/11	7654.405	-1264.110	10/03/11	6639.181	+1436.096
02/01/11	8304.589	+650.184	27/03/11	6094.639	-544.542
05/01/11	7948.431	-356.158	10/04/11	6556.520	+461.881
10/01/11	6499.436	-1449.000	26/04/11	5806.309	-750.211
12/01/11	7690.690	+1191.254	03/05/11	5865.709	+59.400
20/01/11	6326.345	-1364.350	08/05/11	5611.471	-254.238
30/01/11	7572.610	+1246.265	11/05/11	5482.874	-128.597
07/02/11	6394.531	-1178.080	12/05/11	5612.519	+129.645

Source: Collected and rearranged based on data from www.bloomberg.com (Access date: 12-05-2011)

From that slump to till now the stock market in Bangladesh is continuing its lame run having some small crack and bounce. DSE General Index has shown a peculiar trend since 29th November. It declined from 6389.625 as on 29th November 2010 to 5612.519 as on 12th May 2011 with many sharp ups and downs as shown in the following graph:

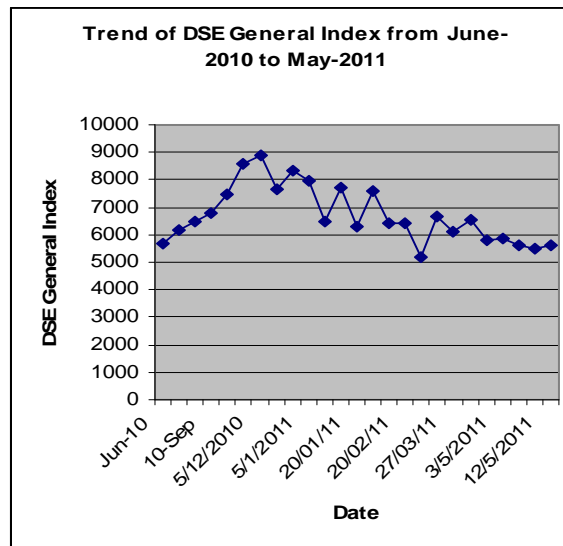


Figure 1. Showing the Movement of DSE General Index from June-'10 to May-'11

6. Reasons of Recent Catastrophe in Stock Market

6.1 Role of Regulatory Bodies and Their Failure

6.1.1 The Government

It is natural from micro point of view that an individual will plan his investment on the basis of fiscal policy of the government which is expressed through the annual budget in the Parliament. Similarly from the macro point of view, it is important to through light on future national economic policy by means of budget. So, it is obvious that everybody will look for a clear indication of the government plan regarding the activities of a fiscal year including its thinking about capital market. Thus, government plays an important role in the growth of capital market. But unfortunately, the government failed to do so in the recent years which brought the mighty blow on the stock market. In the fiscal year 2010-2011 the government has taken some risky decisions which helped to create a bubble in the market. Such decisions included the reduction of interest rate, imposing tax on Government Saving Certificates, providing facilities to enter black money in the stock market and so on. It is worth mentioning that both of the big plunges of 1996 and 2010 have been followed by the permission of whitening the black money through stock market. Moreover, the government has changed several regulations through SROs and other ways which brought the ailing fruits.

6.1.2 Bangladesh Bank

Bangladesh Bank as the regulatory body of financial market has the responsibility to materialize the plan of the government regarding financial market through controlling the activities of Banks and other financial institutions (Merchant Banks, Insurance Companies, Mutual Funds and Non-Banking Financial Institutions). Paradoxically Bangladesh Bank has failed to control the activities of financial market throughout the 2010-2011 fiscal year. During that period, most of the banks and their merchant banking wings invested in the stock market without following any rule. Even in some cases they invested money in capital market which they ought to invest in other industrial sectors. Bangladesh Bank did not take steps to abstain them from such activities up to the last month of 2010. But all on a sudden it realized the results of such unproductive investments and in December, 2010 it forced the banks to readjust its investments. Through a circular in December 2010, Bangladesh Bank increased Cash Reserve Requirements (CRR) from 5.5% to 6.00% and Statutory Liquidity Ratio (SLR) from 18.5% to 19.00% the obvious result of which was the liquidity crises. As a result a huge sales pressure helped the acceleration of the pace of the slump of capital market. "The small investors think that the Bangladesh Bank and the Securities and Exchange Commission are responsible for the stock market crash in an unholy alliance with the corporate culprits and the bankers believe the central bank is holding back and creating the liquidity pressure in the market. Some bankers feel the central bank is more interested in dabbling in 'esoteric banking' and has touch with the real world" (Ali, M.A, 2011).

6.1.3 Security and Exchange Commission (SEC)

Security and Exchange Commission (SEC) is the supreme regulatory body of capital market. So, it must have a formal plan of actions to regulate the activities of stock market. But ironically its failure in doing so is a matter of

shame. Though it needs to impose rules considering the future growth, it became a kind of joker by frequently changing its own decisions because in 2010, the SEC issued 81 notifications, circulars and directives, of which 32 were related to the changing of margin loan ratio. The regulator revised the loan ratio from time to time although the changes in the ratio were made following the unusual rise and fall (Mufazzal, 2012). Even it has record of changing own decision within an hour of making it. It had to undergo a lot of criticism when its members made some very sensitive decision whimsically. The main reasons of such meaningless decisions are the lack of coordination among the members and involvement of many of them in share trading in others' name. Moreover, the manpower required to operate such an organization is not sufficient in SEC. It is unfortunate that SEC has no software of its own. Even it does not have any Chartered Accountant to ensure accurate audit report.

6.1.4 DSE and CSE

Dhaka Stock Exchange (DSE) and Chittagong Stock Exchange (CSE) play vital role in monitoring the activities of brokerage houses as well as the smooth functioning of stock market through giving permission of listing companies, delisting a certain company for violation of rules and other reasons, placing a company in a specific category (e.g. A, B, Z, N) and queering unusual price hike of a particular script. It is a matter of sorrow both of the stock exchanges failed to ensure proper monitoring. Especially two activities of DSE played pivotal role behind the recent surge and plunge in the capital market. The first one is the circulation of news that within a very short period of time a huge number of Beneficiary Account (B/O) has been opened which was an indicator of the confidence of investors towards the capital market and can be compared with the provocation for investing money in the capital market. Thus it worked as a catalyst of price hike. Again DSE called for a press conference on 13th October, 2010 through which it urged people not to invest in the stock market as it became a risky sector according to them. It was a clear indication of upcoming crash. Thus it spread threat among the investors and they put a huge sell pressure even the institutional investors were also involved in force sell and trigger sell considering all the negative factors. Such a panic situation even provoked people to sell fundamentally strong shares.

6.1.5 Credit Rating Agencies

Investors get a clear picture of a company through its credit rating because such rating indicates the financial strength, management efficiency and growth potential of a company. At present there are four credit rating agencies in Bangladesh namely, (a) Credit Rating Agency of Bangladesh (CRAB), (b) Credit Rating Information and Services Limited (CRISL), (c) National Credit Rating Limited (NCRL) and (d) Emerging Credit Rating Limited (ECRL). But most of the listed companies are being rated by none of the above mentioned credit rating companies. As a result, investors are deprived of proper information about those companies which is one of the major obstacles of making informed investment decision.

In our research, which is conducted through a survey among 323 people from different areas including 255 investors, 11 Financial Analysts, 6 of different regulatory bodies and 51 brokers, it is found that 173 (74+43+56) or 53.65% (17.34%+23%+13.31%) of the investors surveyed believe that the role of the regulatory bodies are the main reason behind the recent catastrophe in Stock Market (Please See Table 6).

Table 6. Most serious cause of the recent catastrophe in the stock market

Opinion	Lack of Govt. awareness/ control over the stock market	Role of SEC	Role of Bangladesh Bank in controlling the investment of commercial Banks	Syndicate in Stock Market	Lack of proper knowledge/ skill of investors	Total
Frequency	56 (17.34%)	74 (23%)	43 (13.31%)	117 (36.22%)	34 (10.53%)	323 (100%)

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

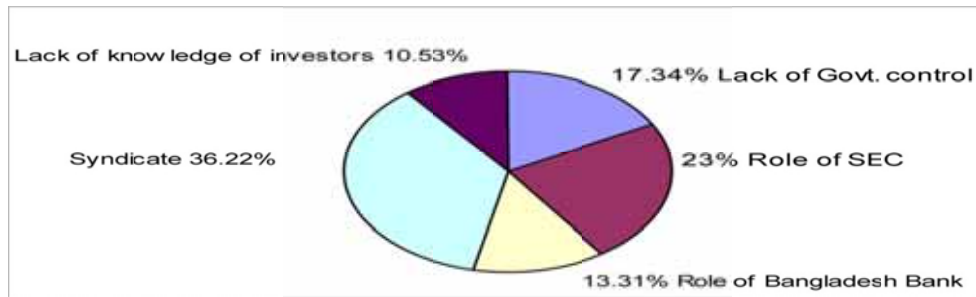


Figure 2. Most serious cause of the recent catastrophe in the stock market

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

Again, 151 (46.75%) of the investors surveyed strongly agreed and 172 (53.25%) agreed that the role of the regulators of stock market (SEC, DSE, CSE) is the main cause of the recent catastrophe. Most importantly, none of the respondents opined neutrally or negatively in this regard (Please See Table 7).

Table 7. Role of the Regulators (SEC, DSE & CSE) is the cause of the recent catastrophe

Opinion	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
Frequency	151 (46.75%)	172 (53.25%)	-	-	-	323 (100%)

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

6.2 Syndicate

Like other market in Bangladesh, Syndicate is very much active in our capital market which is also found in the report of the Government Probe Committee report led by Khondkar Ibrahim Khaled. In their report they said that the stability of the stock market would not be achieved without political commitment at the highest level, only which is capable of eliminating the 'vicious cycle' ruling the market. The comment comes after the probe body has identified a myriad of corruptions committed by a section of powerful businessmen, politicians, stakeholders, key officials, and individual investors through syndication in the stock market.

The probe body identified a number of corrupt practices involving window-dressing of Balance Sheets, loop wholes in book building method, direct listing, private placement, share split, dividend declarations, preference shares and price manipulations in the secondary market and syndication among the above mentioned parties can be blamed for these manipulations.

In our study it is eminent that about 117 investors think syndication stock market is the main responsible factor for the recent catastrophe. The percentage of investors who thought so is 36.22% which is the highest weight among probable reasons as identified by the surveyed respondents (Please See Table 6).

6.3 Education and Skills of Investors

Though the number of B/O Account Holders is huge (About 33 lakh) in our stock market, but their education and skills in investment in stock market is not that good. In our study we found some investors who do not know even the ABC of stock of market. While talking with such investors we learned that they invest in the market either by taking others' advices or on the basis of rumor. Though unfortunate, it also came out that often they buy and sell shares seeing other big investors in the broker houses. When big parties buy shares, they also do so with the expectation of increase in price and vice-versa. From the study it is evident that 10.54% of the total respondents thought that lack of knowledge of the mass investors in the stock market about the appropriate way of analysis and investment decision is the main reason of the recent slump (Please See Table 6).

6.4 Brokerage Houses

Broker houses play important role in capital market operation as share trading are being facilitate through their participations. They sometimes violate different rules of DSE and CSE, for which the trading of six brokerage houses (namely, Securities arms of Dhaka Bank, NCC Bank, AIBL, PFI Securities, Alliance Securities & Management, and IIDFC Securities) were banned for 30 days for triggering collapse on 20th January, 2011 and few

top officials of those brokerage houses were given punishment. In our survey, about respondents 138 (42.72%) thought that they are also responsible for the recent crash (Please See Table 6).

6.5 Trading through Omnibus Account

An omnibus account is a stock holding account that involves more than 10,000 investors, although actual shareholders or individual investors don't have the accounts in their own names. In the probe report regarding the recent catastrophe, Khondkar Ibrahim Khaled has stated that most big traders made transactions through the omnibus accounts of the ICB during the sessions of gain or loss. The committee held 30 big players responsible including the ICB for the recent plunge and all of these big players traded through omnibus accounts.

7. Impact of the Recent Catastrophe

From the study it is found that the sources of capital of the investors are different. Out of 304 investors surveyed 161 (52.96%) investors invested only own money, 31 (10.20%) investors invested taking fund from husband or father or relatives, 41 (13.49%) investors invested taking bank loan, 24 (7.90%) investors invested taking margin loan from broker, 47 (15.46%) investors invested both own fund & taking loan (Please See Table 8).

Table 8. Sources of capital of the investors in stock market

Sources of Capital	Own money	Husband or father	Bank loan	Margin Loan from broker	Combination of own & loan	Total
Frequency	161 (52.96%)	31 (10.20%)	41 (13.49%)	24 (7.90%)	47 (15.46%)	304 (100%)

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

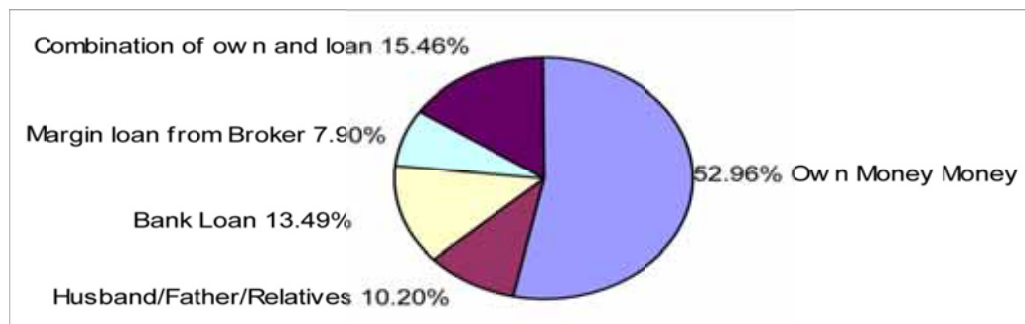


Figure 3. Sources of capital of the investors

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

7.1 Loss of Own Capital

The investment of 151 (49.67%) investors surveyed was in the range of Tk. 1 lac to Tk.5 lac, 82 (26.97%) investors surveyed was in the range of Tk. 5 lac to Tk.10 lac and only 12 (3.95%) investors had investment of Tk.15 lac and above.

While 82 investors (26.97%) were in the investment range of Tk.5 lac to 10 lac and 31 (10.20%) in the investment range of 10 to 15 lac before the catastrophe, it came down to 62 (20.39%) and 19 (6.25%) respectively showing a decline of 24% and 38% respectively after the slump. Again, the number of persons having investment above 15 lac was 12 which is 8 now causing a decline of 50%. Among the surveyed investors 183 have suffered a loss ranging Tk.1 lac to Tk. 5 lac (Please See Table 9).

Table 9. Comparison of original investment and investment after catastrophe

Class of Investment	Below 1 lakh	1-5 lakh	5-10 lakh	10-15 lakh	Above 15 lac	Total
Before Slump	28 (9.21%)	151 (49.67%)	82 (26.97%)	31 (10.20%)	12 (3.95%)	304 (100%)
After Slump	46 (15.13%)	169 (55.59%)	62 (20.39%)	19 (6.25%)	8 (2.63%)	304 (100%)
Change	5.92%	5.92%	-6.58%	-3.95%	-1.32%	-

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

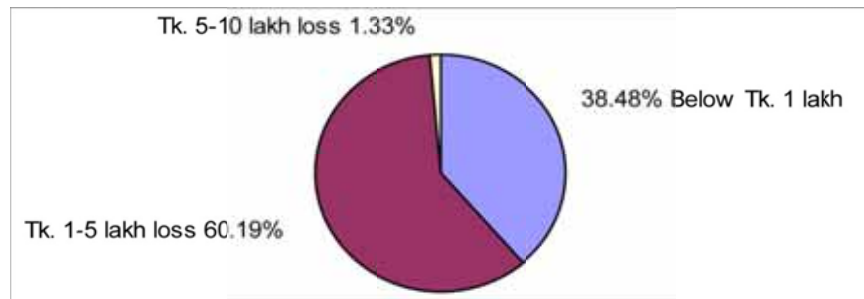


Figure 4. Own Capital loss due to recent catastrophe

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

More specifically, it can be observed from the above table that 117 (38.48%) investors under survey lost below Tk. 1 lac, 183 (60.19%) investors under survey lost Tk. 1 lac to Tk. 5 lac and 4 (1.33%) investors under survey lost Tk. 5 lac to Tk. 10 lac (Please See Table 10).

Table 10. Own capital loss for the recent catastrophe in the stock market

Own capital loss	Below 1 lakh	1-5 lakh	5-10 lakh	10-15 lakh	Above 15 lakh	Total
Frequency	117 (38.48%)	183 (60.19%)	4 (1.33%)	-	-	304 (100%)

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

7.2 Loss of Borrowed Capital

The investors also invested taking loan from banks and brokerage houses. Among the investors under survey, 43 (14.14%) investors have took loan of below Tk. 1 lac, 57 (18.75%) investors took loan in the range of Tk.1 lac to Tk. 5 lac, 23 (7.57%) investors took loan in the range of Tk.5 lac to Tk. 10 lac, 13 (4.28%) investors took loan in the range of Tk.10 lac to Tk. 15 lac, while only 7 investors (2.30%) took loan above Tk. 15 lac (Please See Table 11).

Table 11. Amount of investment taking loan from different sources

Class of loan	No loan	Below 1 lakh	1-5 lakh	5-10 lakh	10-15 lakh	Above 15 lakh	Total
Frequency	161 (52.96%)	43 (14.14%)	57 (18.75%)	23 (7.57%)	13 (4.28%)	7 (2.30%)	304 (100%)

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

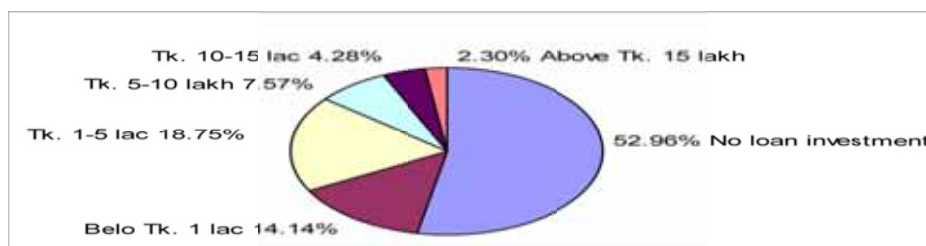


Figure 5. Loan/Borrowed capital investment in capital market

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

It is revealed from the study that the impact of the catastrophe is severe, especially on those who have taken loan. Out of 143 investors who have invested taking loan from different sources, 105 of them lost below Tk. 1 lac of their loan, 33 of them lost Tk. 1 lac to Tk. 5 lac of their loan, 5 of them lost Tk. 5 lac to Tk. 10 lac of their loan which are now to be paid from their personal assets (Please See Table 12).

Table 12. Borrowed capital loss for the recent catastrophe in the stock market

Borrowed capital loss	No Loan lost	Below 1 lakh	1-5 lakh	5-10 lakh	10-15 lakh	Above 15 lakh	Total
Frequency	161 (52.96%)	105 (34.54%)	33 (10.86%)	5 (1.64%)	-	-	304 (100%)

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

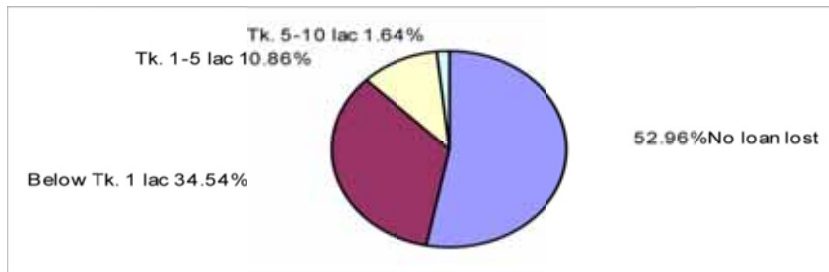


Figure 6. Borrowed capital loss due to recent catastrophe

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

7.3 Interest Expense during the Period of Catastrophe

The investors who have taken loan suffered not only for the loss of loan but also for interest payment on their loan which made the condition even worse. The study shows that 192 (63.16%) investors have no interest expense because they have no loan or they invested taking loan from husband or father or relatives. 23 (7.57%) of the investors require paying interest expense of Tk. 40,000 or above (Please See Table 13).

Table 13. Interest expense on the borrowings during this situation in the stock market

Interest Expense	No interest Expense	Below 10,000	10,000-20,000	20,000-40,000	40,000-60,000	More than 60,000	Total
Frequency	192 (63.16%)	51 (16.78%)	27 (8.88%)	11 (3.62%)	10 (3.29%)	13 (4.28%)	304 (100%)

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

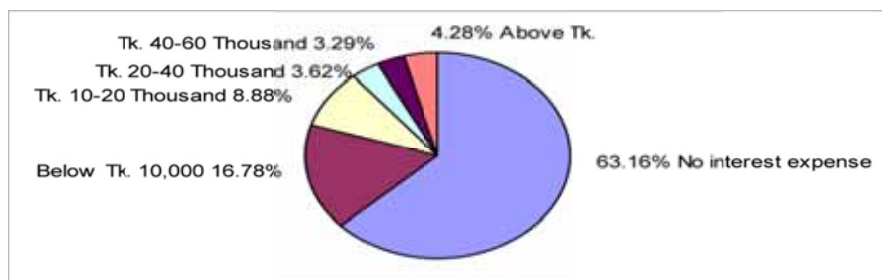


Figure 7. Interest Expense of the investors due to recent catastrophe

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

7.4 Loss of Income Earned before Catastrophe

It is also found that 128 (42.11%) investors out of 304 have lost their earned money of Tk.1 lac to Tk. 2 lac, and 97 (31.91%) have lost their earned money of more than Tk. 2 lac, which they earned before the recent catastrophe. The least number of investors fall in the range of less than Tk. 50,000, which indicate a heavy loss of investors for the recent catastrophe (Please See Table 14).

Table 14. Loss of income for the recent catastrophe in the stock market

Loss of income	Less than 50,000	50,000-1 lakh	1-2 lakh	More than 2 lakh	Total
Frequency	28 (9.21%)	51 (16.78%)	128 (42.11%)	97 (31.91%)	304 (100%)

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

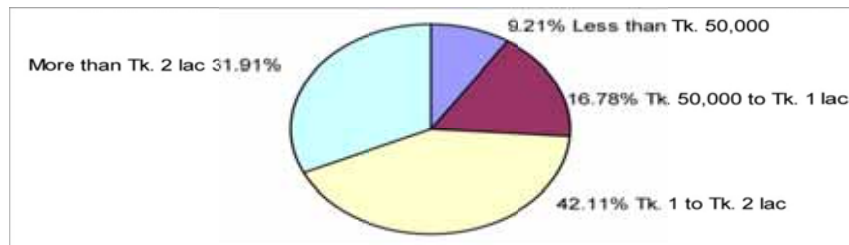


Figure 8. Loss of income due to recent catastrophe

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

Investors in the stock market not only lost their past earnings but also losing the current income. Many unemployed and retired persons also invested their last resorts in the capital market to earn something for living in a better way; but they are also suffering much due to this catastrophe in the stock market.

8. Confidence on Investigate Report and Expectations from Regulators or Government for Changing the Present Scenario

The highest number of the respondents have confidence on the report given by the Probe Committee led by Khondkar Ibrahim Khaled which is reflected in the result of the survey where 209 (64.71%) of them believe that the report is either most accurate or accurate while only 28 (8.67%) think it as inaccurate (Please See Table 15). It is revealed from the study that respondents, especially the investors want exemplary punishment of the criminal who were directly or indirectly involved with the recent catastrophe.

Table 15. Opinion regarding investigation report (By Mr. Ibrahim Khaled)

Opinion	Most Accurate	Accurate	Inaccurate	Most Inaccurate	No Comment	Total
Frequency	36 (11.15%)	173 (53.56%)	28 (8.67%)	-	86 (26.63%)	323 (100%)

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

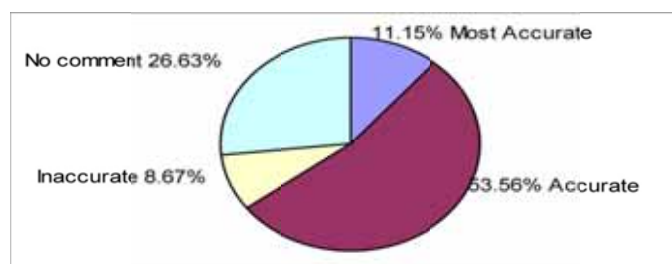


Figure 9. Opinion regarding investigation report (By Mr. Ibrahim Khaled)

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

From the study it is also found that investors think bounce back of capital market is possible and they intensely observed the appointment of the new members and chairman of Security and Exchange Commission (SEC). It is important to mention that most of the respondents are hopeful about the newly appointed body as 169 (52.32%) respondents are either very optimistic or optimistic of getting the scenario change but they should be let free to work independently (Please See Table 16).

Table 16. Expectation that present scenario will change due to re-structuring of SEC

Opinion	Very Optimistic	Optimistic	Pessimistic	Very Pessimistic	Total
Frequency	31 (9.60%)	138 (42.72%)	117 (36.22%)	37 (11.46%)	323 (100%)

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

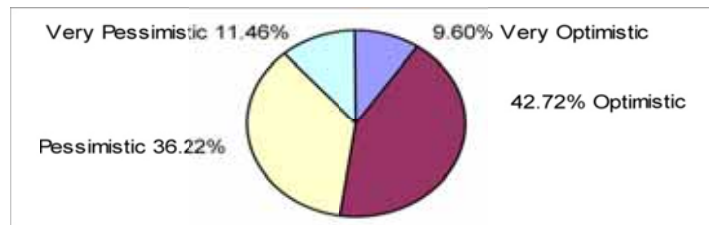


Figure 10. Expectation that present scenario will change due to re-structuring of SEC

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

As per the survey, the highest number of the respondents 124 (38.39%) surveyed believe that the elimination of syndication and 34.67% of the investors expect the appointment of skilled, honest and efficient personnel in the regulatory bodies as the key to get the market changed. Moreover, action against the culprits behind the slump (17.65%) and creation of awareness among the investors by arranging more training and skill enhancement programs (21.05%) along with strong government control over the stock market (16.41%) were also emphasized by the respondents (Please See Table 17).

Table 17. Expectations from regulators /Govt. for developing stock market in future

Opinion	More control of Government over stock market	Organize more training, seminar and awareness programs	Appoint more honest and skilled person in the regulatory bodies	Taking immediate action against the liable person for the catastrophe	Elimination of Syndicate from the stock market	All
Frequency	53 (16.41%)	68 (21.05%)	112 (34.67%)	51 (17.65%)	124 (38.39%)	102 (31.58%)

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

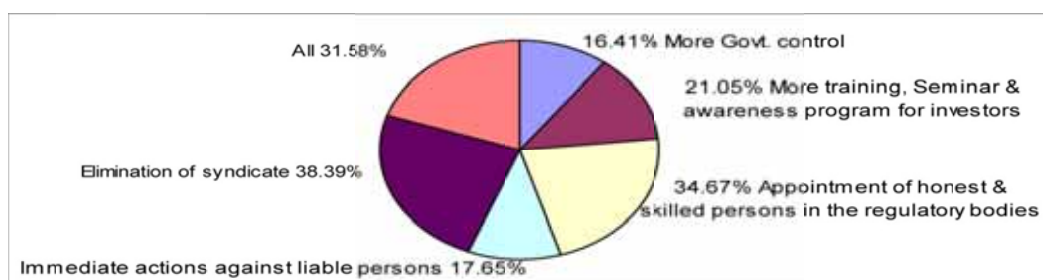


Figure 11. Investor's Expectations from Regulators/Govt.

Source: Own Survey on Investors, Brokers and Regulators in Chittagong during March-May, 2011.

9. Recommendations of the Study

It is crystal clear that for the sustainable development of stock market all the parties concerned must work in a harmony as failure of any of them may lead the market to a further long decline towards a deep dark tunnel. So, we would like to suggest a few recommendations for different stakeholders of capital market.

9.1 Recommendations for the Government

There is no doubt that the failure of the government in making various decisions regarding capital market played role behind the recent crash which was also admitted by the Planning and Finance Minister in his different speech. Thus, the govt. should ensure the followings:

- i) The responsible persons of the Government should refrain from delivering irrelevant, irresponsible and sensitive speeches which many of them did before.
- ii) Government should delegate all power to the SEC to take legal actions against the criminals. Even if necessary, new Act may be passed in the Parliament in this regard.
- iii) Flow of black money in the capital market must be restricted as it can never bring any good results in the long run other than creating bubble in the stock market the blast of which nothing but a disaster.

9.2 Recommendations for Securities and Exchange Commission (SEC)

SEC as the guardian of capital market should play significant role in its forward march. It must ensure the followings:

- i) SEC must ensure that neither of its members nor any of its officials is involved either direct or indirectly with the transactions in the stock market.
- ii) The monitoring and surveillance should be strengthened so that none can get chance to gamble.
- iii) SEC must have its own certified Chartered Accountants to ensure the accuracy of the Financial Statements of the listed companies and they should give punishment if the books of accounts are not accurately audited.
- iv) SEC must rethink about the rule of disclosure of quarterly financial reports by the companies because many of the companies misused it as a vehicle of misguiding the investors. In fact, it became a common practice of most of the listed companies to show high quarterly EPS in its un-audited quarterly report to bring down P/E ratio. In some cases, it is seen that a few companies' annual audited EPS for the year ended 2010 was lower than its accumulated EPS of three quarters.

9.3 Recommendations for DSE and CSE

Both Dhaka and Chittagong Exchanges have important role to play as the monitoring authority of the Broker Houses. So, they need to play vital role by ensuring the followings:

- i) They must ensure proper monitoring of the brokerage houses for which more skilled manpower should be appointed in the Monitoring and Surveillance Team.
- ii) Any sort of irregularities in case of trading should be identified promptly and immediate action should be taken.
- iii) To aware investors having no or insufficient skills about the investment in stock market should be trained through different training programs, seminars and motivating fair.
- iv) They should not make any public comment about the future of stock market which may create bubble and crash as we found in case of recent catastrophe.

9.4 Recommendations for Bangladesh Bank

Though Bangladesh Bank is the regulatory body of Money Market; but its decisions are also reflected in the capital market as the money market and capital market are interrelated. In this regard it has the following roles to play:

- i) It must ensure that the Banks and Other financial institutions' exposures do not exceed the limit from the very beginning. But in the recent slump it failed to do so as it could not monitor the involvement in the early periods while it put pressure on the banks to readjust their capital market exposures at the eleventh hour which accelerate a huge sale pressure from their side.
- ii) It must ensure the proper functioning of the Merchant Banks through arranging money from the parent company to mitigate liquidity crisis.
- iii) It should keenly monitor the loan of the commercial banks to industrial sector and take regular feedback so that no industrial loan may flow to the capital market. It is found that in case of recent catastrophe, it failed to do so as about 72 crore taka taken for industrial loan has directly been invested in capital market according to the report of newspapers published in most of the dailies as on 5th December, 2010. Moreover, Bangladesh Bank has identified a Ready made Garments Exporter to take loan of Taka 36 crore and 74 lac for his business purpose and to invest in the capital market while a Berth Operating Organization of Chittagong port did the same amounting to Tk. 5 crore and 1 lac. According to a report published in the Daily Prothom-Alo on 5th November, a listed company has taken loan from a Government owned bank and invested in the stock market. There are many other such examples which urge for proper monitoring of Bangladesh Bank on time.

9.5 Recommendations for Institutional Buyers

Institutional Buyers (Mutual Funds, Merchant Banks etc.) ensure balance in capital market through reacting according to the interaction between demand and supply. But in recent past they completely did the opposite as

when there was huge sales pressure in the market instead of buying, they also sold shares in a large scale resulting further decline. Their behavior in that case was not different from individual investors. Hence, they need to act in the way mentioned below:

- i) They must show mature behavior to ensure balance in the stock market by buying shares when there is sale pressure and vice-versa.
- ii) At the time of huge decline they should not be involved in forced/trigger sale of clients' shares without giving them any chance to adjust their loan.
- iii) All sorts of transactions through omnibus accounts should be restrained.

9.6 Recommendations for Individual Investors

No matter what is the reason of a crash, individual investors are the ultimate losers. Hence, it is their own duty to take care of their own money and they ought to consider the following things while taking investment decisions.

- i) Before investing in a particular script they must analyze the key factors of that company to justify whether the company is fundamentally strong. Such factors include EPS, P/E Ratio, NAV, future growth, industry average etc.
- ii) In analyzing financial strength of a company they must consider the audited annual reports instead of quarterly un-audited report as often these information is not accurate or do not reflect the real position of the company.
- iii) They must restrict themselves from buying junk shares and taking whimsical investment decision.
- iv) Instead of being traders, the retail investors need to think of being investors and they should not buy on the basis of rumor or following advices of the persons who do not possess sufficient knowledge about capital market investment.
- v) They ought to participate in different seminars and training programs relating to stock market to enhance their knowledge and skill in making stock market investment decisions.
- vi) They must know that both gain and loss are the indispensable parts of stock market. Instead of looking for gain, sometimes they must accept loss with patience so that they may recover the loss in future through higher gain. And above all, they must understand that perseverance and patience is the key to success in investing in capital market.

10. Conclusion

As an important part of the economy of the country, well-functioning of the capital market is a must for the industrialization process of a un-industrialized country like Bangladesh but un-stability in the same may negatively affect the total financial system. Therefore, all related corners including Government, Regulatory bodies, Listed Companies, Brokerage houses, institutional investors, and retail investors should act rationally to maintain the stability in the capital market for the greater interest of the country.

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Note

Note 1. A-Category: companies which both declare dividend at least 10% and hold AGM regularly; B-Category: companies which either declare dividend at least 10% or hold AGM regularly; Z-Category: companies which don't declare dividend at least 10% and not hold AGM regularly; and N-category: companies which are new that not yet complete one year of listing in the market.

Price Adjustment in Taiwan Retail Gasoline Market

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Abstract

This paper uses weekly data over a sample research period of 2002M4 - 2011M11 to estimate the impact of crude oil price on pre-tax retail gasoline price in Taiwan. We found that there is a significant, long-run equilibrium relationship between crude oil price and retail gasoline price. In the asymmetric ECM framework, this paper finds that there was distributed lag effect symmetry (DLES) between oil price and retail gasoline price. By the cumulated adjustment function, we show that retail gasoline price in Taiwan respond more quickly to reductions in crude oil price.

Keywords: crude oil price, retail gasoline price, asymmetric adjustment, error correction model

1. Introduction

A high degree of fluctuation in crude oil prices during 2007-2009 had a powerful impact on gasoline prices worldwide. For example, in the period spanning Jan 2007 to July 2008, the pre-tax retail price of 95 octane unleaded gasoline in Taiwan increased from NT3990 to NT5740 per barrel. By December 2008, the price had plummeted to NT3362/barrel, before sharply increasing to NT4928/barrel (December 2009). The public is extremely sensitive to changes in the retail price of gasoline; therefore, these fluctuations sparked considerable controversy regarding the pricing policies of petroleum companies.

Galeotti, Lanza, & Manera (2003) described the reliance of modern society on the flexibility and mobility afforded by motor vehicles, which makes the demand for gasoline relatively inelastic. While the public reacts favorably to any reduction in gasoline prices, increases are met with strong displeasure. Whether in Taiwan or abroad, public opinion is generally of the mind that an increase in oil prices leads directly to an increase in gasoline prices, while reduction in oil prices correspond to a slower decline in the prices of gasoline. (Note 1) Price fluctuations in the gasoline market described above represent price asymmetry, which has long been a topic of significance to both economists and the general public (see, for example, Manning, 1991; Borenstein, Cameron, & Gilbert, 1997; Eltony, 1998; Reilly & Witt, 1998; Godby, Lintner, & Wandschneider, 2000; Bachmeier & Griffin, 2003; Radchenko, 2005; Radchenko & Shapiro, 2011).

Figure 1 shows the price of crude oil (per barrel) in NTD. Dubai Crude and Brent Crude comprise the majority of crude oil imported in Taiwan. As Taiwan's main petroleum company, CPC Corporation bases its adjustment of gasoline prices on changes in marker crude price. The marker crude price is Dubai and Brent Crude prices calculated at weights of 70% and 30%, respectively. The price shown in Fig. 1 was obtained through a conversion of the marker crude price described above from USD to NTD. The trend of gasoline price in Taiwan is largely similar to that of crude oil price; however, it does not show immediate adjustment to oil price fluctuations, but appears to exhibit asymmetry and lag (Bettendorf, van der Geest, & Varkevissier, 2003). Additionally, the relatively large fluctuations in crude oil prices after 2007 caused more frequent adjustments to gasoline prices in Taiwan. These phenomena appear consistent with the viewpoint of Radchenko (2005).

Price asymmetry reveals differing degrees of adjustment to output price in response to cost impact. It also shows lag and rigidity in price adjustment. Theoretically, the causes of this type of input-output price asymmetry are categorized as follows: the trigger or focal point pricing strategies of oligopolistic sellers (increase in oil prices diminishes profit on retail gasoline, which immediately drives gasoline prices up; however, a reduction in oil prices does not produce the same inhibitory effect); adjustment to storage and production costs; menu costs, and consumer search costs (Reagan & Weitzman, 1982; Thurman, 1998; Borenstein, 1991; Pindyck, 1993, 1994; Ball & Mankiw, 1994; Borenstein & Sheperd, 1996; Damania & Yang, 1998). However, Borenstein & Shepard (2002) felt that the international crude oil market is an efficient open market, without factors such as menu costs or incomplete information. (Note 2)

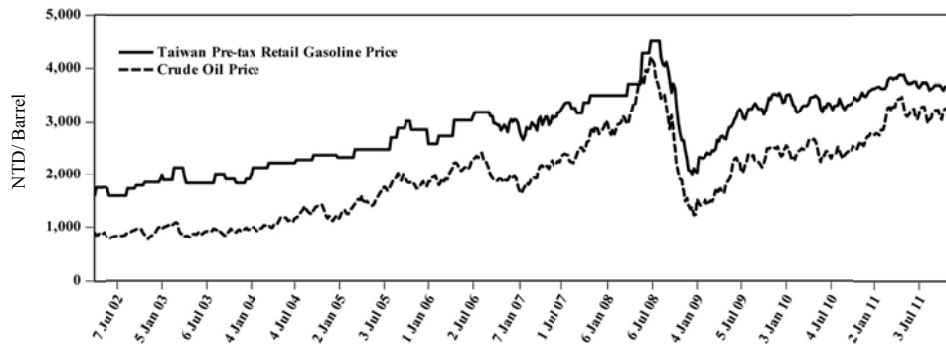


Figure 1. Crude Oil Price and Taiwan Pre-tax Retail Gasoline Price

1. Crude oil price is substituted by marker crude price, which is Dubai and Brent Crude prices calculated at weights of 70% and 30%, respectively. Retail gasoline price is average announced retail price (before taxes).
2. Data are weekly. Crude oil price and retail gasoline price have been obtained from Bureau of Energy and Central Bank of Taiwan for the period from 2002M4 to 2011M11.

Kirchgassner & Kubler (1992) proposed another reason for short-run price asymmetry in wholesale gasoline: The politico-economic reaction of wholesalers. When crude oil prices increase, gasoline wholesalers are hesitant and unwilling to immediately raise their prices, for fear of being accused of abusing market power and engaging in consumer gouging. These reservations, however, do not come into play when crude oil prices decrease. Thus, gasoline prices are adjusted to a lesser extent when oil prices rise, as compared to when oil prices decrease. Kirchgassner & Kubler (1992) described this type of price asymmetry as “politico-economic asymmetry”. They demonstrated that this phenomenon was observable in Germany during the 1970’s but was no longer evident following the 1980’s. (Note 3)

Viewpoints on asymmetric or incomplete pricing in the gasoline market generally refer to two types of price adjustment: short-run and long-run. The emphasis of long-run price adjustment is whether cost changes can fully pass-through into the retail price. Short-run adjustment is mainly expressed through the length of time or extent of the adjustment process (Godby et al., 2000). This study used the asymmetric error correction model (asymmetric ECM) to estimate how positive and negative oil price shocks influence the retail gasoline price in Taiwan. We found that there is a significant, long-run equilibrium relationship between crude oil price and retail gasoline price. In the short-term, the test results rejected the null hypothesis of distributed lag effect symmetry (DLES) between oil price and retail gasoline price. However, there is a lack of clear evidence to prove the existence of contemporaneous impact asymmetry (COIA), cumulated impact asymmetry (CUIA), and equilibrium adjustment path asymmetry (EAPA). On the cumulated adjustment to gasoline price, it is interesting to note that in the first two weeks, gasoline price was adjusted more rapidly in response to positive oil price shock. After the third week, gasoline price was adjusted more rapidly in response to negative oil price shocks. Maximum asymmetry (difference of 0.22%) was evident after the sixth week. When oil price increased by 1%, gasoline price increased by approximately 0.61% after a quarter. Conversely, when oil price declined by 1%, gasoline price decreased by approximately 0.69% after a quarter. This shows that gasoline price in Taiwan respond more quickly to reductions in crude oil price.

This paper is structured as follows. In Section 2, we describe the model and the data adopted in this paper. In Section 3 compile the empirical results of the symmetric and asymmetric ECM. In Section 4 we discuss the gasoline price asymmetries of Taiwan. Section 5 recapitulates the conclusions.

2. Models

In recent years, error correction models (ECM) have become the standard tool for researching dynamic price adjustment (Bettendorf et al., 2003), as well as the primary method of constructing models of cointegrated series (Bachmeier & Griffin, 2003). (Note 4) Error correction models connect the short-run dynamics and long-run equilibrium of such series. Engle & Granger (1987) stated that any cointegrated series can be expressed in error correction form. The absence of a cointegrating relationship indicates misspecification. Therefore, although crude oil price and gasoline price are non-stationary, a cointegrating relationship can still be found between the two variables, as shown below:

$$rg_t = \beta_o + \beta_1 o_t + u_t \quad (1)$$

where rg_t indicates retail gasoline price, o_t indicates crude oil price (in NTD), and u_t is the error term. All variables are expressed as natural logarithms. Equation (1) shows the equilibrium relationship between variables of output price and costs. If there were a stable industry structure, changes in costs would not affect this equilibrium relationship (Johnson, 2002). A super-consistent coefficient estimator (β_0, β_1) can be obtained using OLS.

The retail price of gasoline in Taiwan is substituted for by the pre-tax retail price of 95 octane unleaded gasoline (average announced price). Crude oil price is indicated by marker crude price (in NTD). All prices are expressed as unit price per barrel, obtained from the website of the Bureau of Energy of Taiwan (<http://www.moeaboe.gov.tw/oil102/>). Information on the Taiwan-U.S. exchange rate was obtained from the Central Bank of Taiwan. Weekly data was collected over a sample research period of 2002M4 - 2011M11 (sample size = 504).

If the price series in Equation (1) were I(1) series and showed a cointegrating relationship, the short-run dynamic model expressed in error correction form would be as follows:

$$\Delta rg_t = \alpha_0 + \sum_{i=1}^m \alpha_i \Delta rg_{t-i} + \sum_{i=0}^n \gamma_i \Delta o_{t-i} + \lambda EC_{t-1} + \varepsilon_t \tag{2}$$

where Δ indicates the first difference; ε_t is the error term; γ_i measures the short-run impact of oil price fluctuation, and γ_0 indicates the immediate effect of variation in oil price. $\gamma_i, \forall i = 1, \dots, n$ denotes the distributed lag effects of oil price variation; α_i measures the short-run impact of lagged gasoline prices; EC is the error correction term, and λ is the adjustment coefficient of long-run equilibrium.

The ECM tells us that if crude oil price were unchanged and long-run equilibrium between gasoline and oil prices was attained, then there would be no further change to gasoline price. β_1 measures the long-run equilibrium relationship of permanent change to the price of oil. Even if asymmetric adjustment responses are plausible, the long-run cointegrating relationship between gasoline and oil prices must be identical for price increases or decreases (Bachmeier & Griffin, 2003).

To explore the asymmetric short-run response to price changes, we must now extend the basic ECM to an asymmetric ECM (Granger & Lee, 1989), as shown below:

$$\Delta rg_t = \alpha_0 + \sum_{i=1}^m \alpha_i \Delta rg_{t-i} + \sum_{i=0}^n \gamma_i^+ \Delta o_{t-i}^+ + \sum_{i=0}^n \gamma_i^- \Delta o_{t-i}^- + \lambda^+ EC_{t-1}^+ + \lambda^- EC_{t-1}^- + \varepsilon_t \tag{3}$$

The above equation differentiates changes in oil prices and the error correction terms as positive and negative variations. Δo_t^+ is defined as $\max\{\Delta o_t, 0\}$ and Δo_t^- as $\min\{\Delta o_t, 0\}$; EC_t^+ and EC_t^- are also similar definitions. Equation (3) retains the basic concept of ECM but allows for more flexible adjustment of gasoline price in response to oil price.

Table 1 shows the annual number of adjustments to retail gasoline prices in Taiwan. During the sample period of this study, retail gasoline prices were adjusted a total of 224 times (123 of these adjustments were increases in price (55%) while 101 were reductions (45%)). Retail gasoline prices were not adjusted on a weekly basis (for example, prices were adjusted roughly once every 3.55 weeks at 2002 on average); particularly during the pre-2006 period, prices were adjusted roughly once every 5.16 weeks. Following 2007, however, price adjustment occurred approximately once every 1.45 weeks. Table 2 shows the distribution of adjustments (by value) to retail gasoline prices in Taiwan. It is evident that most price adjustments were on a relatively small scale ($-2 \leq x \leq 2$).

Table 1. Number of Taiwan Retail Gasoline Price Adjustments

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total	Average
Increases	8	4	5	3	9	17	6	27	25	19	123	4.09
Decreases	3	5	1	2	8	13	17	18	18	16	101	4.98
Total	11	9	6	5	17	30	23	45	43	35	224	2.25
Average	3.55	5.78	8.67	10.6	3.06	1.73	2.26	1.16	1.21	1.49	2.25	-

Data are weekly, spanning from 2002M4 to 2011M11. There are 39 weeks and 48 weeks in 2002 and 2011, respectively. Retail gasoline price is average commended retail price (before taxes). The data have been obtained from Bureau of Energy of Taiwan and this study.

Table 2. Distribution of the Size of Taiwan Retail Gasoline Price Adjustments (x%)

$x < -5$	$-5 \leq x < -4$	$-4 \leq x < -3$	$-3 \leq x < -2$	$-2 \leq x < -1$	$-1 \leq x < 0$	$0 < x < 1$	$1 < x < 2$	$2 < x < 3$	$3 < x < 4$	$4 < x < 5$	$x > 5$
7	6	6	17	28	33	38	38	26	8	10	7

Data are weekly, spanning from 2002M4 to 2011M11. There are 39 weeks and 48 weeks in 2002 and 2011, respectively. Retail gasoline price is average commended retail price (before taxes). The data have been obtained from Bureau of Energy of Taiwan and this study.

3. Empirical Findings

To analyze the symmetrical (Equation 2) and asymmetrical (Equation 3) pass-through effects of retail gasoline price caused by oil price shocks, we first determined whether there was a stationary equilibrium relationship between rg_t and o_t . If rg_t and o_t were integrated of order one and exhibited a cointegrating relationship, this would imply an equilibrium relationship between rg_t and o_t . This facilitated the construction of an ECM (Engle & Granger, 1987). The results of ADF (augmented Dicky-Fuller) and PP (Phillips-Perron) unit root tests (including both the constant term and the time trend) showed that the null hypothesis with a unit root was not rejected for either rg_t or o_t . After obtaining the first-order difference for the variables, we applied the same test process and found that the null hypothesis with a unit root was significantly rejected for both Δrg_t and Δo_t . The test results are as shown in Table 3, which indicate that rg_t and o_t are I(1) series.

Table 3. Unit Root Tests

Variable	Levels		First difference	
	ADF	PP	ADF	PP
o_t	-2.622	-2.412	-10.500***	-17.793***
rg_t	-2.458	-3.034	-19.270***	-19.956***

The autoregression models include both constant term and time trend, and the optimal lags are determined using AIC (maximum lags = 12). The ADF test and PP test are based on the null hypothesis of a unit root. ***, **, and * indicate that the null hypothesis is rejected at the 1 %, 5 %, and 10 % significance levels.

Next, we used OLS to estimate Equation (1) and applied ADF and PP unit root tests to the residual. The results strongly rejected the null hypothesis with a unit root, indicating a cointegrating relationship between rg_t and o_t . The results of the Johansen cointegrating tests also showed that, with regard to both trace eigenvalue and maximum eigenvalue statistics, the null hypothesis of no cointegrating relationship was rejected (see Table 4). This outcome supports the results of the unit roots to the residual. Equation (1) implies that fluctuation in crude oil price lead to changes in the retail gasoline price and not vice versa. The results of Granger causality tests suggest the null hypothesis that the crude oil price does not Granger cause the retail gasoline price was rejected. However, the null hypothesis of that the retail gasoline price does not Granger cause the crude oil price was not rejected.

Table 4. Johansen Cointegrating Tests on Oil Price and Retail Gasoline Price

Null Hypothesis	Eigenvalue	$\lambda - trace$	$\lambda - max$
$r = 0$	0.054	29.693***	27.651***
$r \leq 1$	0.004	2.043	2.043

1. The optimal lags of VAR system are determined using AIC (maximum lags = 12).
2. $\lambda - trace$ refers to the trace eigenvalue statistics; $\lambda - max$ refers to the maximum eigenvalue statistics; and r in the null hypothesis refers to the number of cointegration relationships in the VAR system; and ***, **, and * indicate that the null hypothesis is rejected at the 1 %, 5 %, and 10 % significance levels.

Under the premise that rg_t and o_t are I(1) series and have a cointegrating relationship, we were able to construct the ECM for Equation (2) or Equation (3). We utilized Akaike information criterion (AIC) to determine the optimal lags of m and n in Equation (3), and used Schwarz criterion (SC) as the basis to identify minimum lags. The purpose was to avoid an overly short lag phase, which would prevent full expression of the data form. Under the premise of maximum lags = 13 (a quarter), we set $m=6$ and $n=9$.

Table 5 shows the estimation results of the cointegrating relationship, and demonstrates that there is a significant long-run equilibrium relationship between retail gasoline price and crude oil price. The long-run pass through effect

of oil price into retail price is 0.563. When oil price increased by 1%, which will be passed 0.563% into retail gasoline price. Table 6 shows the coefficient estimation results for Equations (2) and (3). The standard deviation of the coefficients was calculated using Newey-West HAC covariance matrix estimation. With regard to both symmetric and asymmetric ECM, it is evident that the immediate effect of oil price shocks is not significant. In the symmetric ECM, oil price shocks showed significant distributed lag effects (lags of 1, 2, 7, and 9). In asymmetric ECM, positive oil price shocks showed significant distributed lag effects in lags of 1 and 7; negative oil price shocks showed significant distributed lag effects in lags of 1, 2, and 7. Although oil price shocks appear to have an asymmetric pass-through effect, positive shocks do not necessarily produce a greater response. The adjustment coefficients of error correction were estimated to have negative values, which imply that the system is converging to equilibrium. Negative disequilibrium, however, was responded to with more rapid adjustment.

Table 5. Cointegration Relationship

Variable	Coefficient	Std Deviation
Constant	3.703***	0.038
o_t	0.563***	0.005

***, **, and *, which indicate significance at the 1 %, 5 %, and 10 % levels.

4. Gasoline Price Asymmetries

Frey & Manera (2007) proposed a clear definition and categorization of price asymmetries, which we have interpreted using Equation (3) as follows:

1. γ_0^+ and γ_0^- measure the contemporaneous impact of Δo_t^+ and Δo_t^- on $\Delta r g_t$. Therefore, if test results reject $H_0: \gamma_0^+ = \gamma_0^-$, this is defined as contemporaneous impact asymmetry (COIA); the opposite is defined as contemporaneous impact symmetry (COIS).
2. If test results reject $H_0: \gamma_i^+ = \gamma_i^-, \forall i = 1, \dots, n$, then this indicates the existence of distributed lag effect asymmetry (DLEA); if the null hypothesis is not rejected, then this indicates distributed lag effect symmetry (DLES).
3. The third type of price asymmetry is the cumulated impact asymmetry (CUIA) of Δo^+ and Δo^- with regard to $\Delta r g_t$ (in the past n periods). If the test results reject $H_0: \sum_{i=0}^n \gamma_i^+ = \sum_{i=0}^n \gamma_i^-$, this type of price asymmetry is known as CUIA; if the null hypothesis is not rejected, the phenomenon is termed cumulated impact symmetry (CUIS). Interestingly, COIS and DLES were established as sufficient but non-required conditions for CUIS. The simultaneous establishment of COLA and DELA does not necessarily imply CUIA or CUIS.
4. Because λ^+ and λ^- respectively measure the adjustment speed when $EC_{t-1} > 0$ and $EC_{t-1} < 0$, if the test results reject $H_0: \lambda^+ = \lambda^-$, this is defined as equilibrium adjustment path asymmetry (EAPA); the reverse is defined as equilibrium adjustment path symmetry (EAPS).

Finally, although the coefficients of the error correction term are labeled adjustment speeds, the actual paths of adjustment are also determined by other coefficients in the model. In other words, when Δo_t^+ or Δo_t^- occurs, the cumulative adjustment function must be used to calculate the scale of cumulated adjustment to gasoline price. When crude price is assumed to increase by 1% at time t , then C_i^+ indicates the cumulated adjustment process of the retail gasoline price at time $t+i$. The cumulative adjustment function can be expressed as follows:

$$\begin{aligned}
 C_0^+ &= \gamma_0^+ \\
 C_1^+ &= C_0^+ + \gamma_1^+ + \lambda^+(C_0^+ - \beta_1) + \alpha_1 C_0^+ \\
 C_2^+ &= C_1^+ + \gamma_2^+ + \lambda^+(C_1^+ - \beta_1) + \alpha_1(C_1^+ - C_0^+) + \alpha_2 C_0^+ \\
 &\dots \\
 C_n^+ &= C_{n-1}^+ + \gamma_n^+ + \lambda^+(C_{n-1}^+ - \beta_1) + \sum_{i=1}^m \alpha_i (C_{m-i}^+ - C_{m-i-1}^+)
 \end{aligned}
 \tag{4}$$

The cumulated adjustment process involved in the reduction of oil prices is similar to Equation (4). The cumulated adjustment function measures the persistent influence of increases (or decreases) in oil price on gasoline price.

Table 6. Error Correction Models

Regressor	Symmetric ECM		Asymmetric ECM	
	Coefficient	Std Deviation	Coefficient	Std Deviation
<i>Constant</i>	0.000	0.001	0.001	0.004
Δrg_{t-1}	0.019	0.041	0.022	0.043
Δrg_{t-2}	-0.053	0.047	-0.059	0.045
Δrg_{t-3}	-0.005	0.050	-0.007	0.052
Δrg_{t-4}	0.102**	0.049	0.102**	0.048
Δrg_{t-5}	0.069	0.042	0.065	0.046
Δrg_{t-6}	-0.154***	0.047	-0.149*	0.046
Δo_t	0.046	0.028		
Δo_t^+			0.083	0.053
Δo_t^-			0.019	0.041
Δo_{t-1}	0.212***	0.042		
Δo_{t-1}^+			0.221***	0.058
Δo_{t-1}^-			0.182***	0.068
Δo_{t-2}	0.084**	0.034		
Δo_{t-2}^+			0.004	0.043
Δo_{t-2}^-			0.186***	0.063
Δo_{t-3}	0.059	0.041		
Δo_{t-3}^+			0.080	0.062
Δo_{t-3}^-			0.045	0.056
Δo_{t-4}	0.019	0.032		
Δo_{t-4}^+			-0.020	0.058
Δo_{t-4}^-			0.043	0.058
Δo_{t-5}	0.001	0.033		
Δo_{t-5}^+			-0.030	0.051
Δo_{t-5}^-			0.034	0.052
Δo_{t-6}	-0.013	0.031		
Δo_{t-6}^+			-0.045	0.045
Δo_{t-6}^-			0.009	0.050
Δo_{t-7}	0.131***	0.033		
Δo_{t-7}^+			0.095*	0.050
Δo_{t-7}^-			0.154**	0.069
Δo_{t-8}	0.017	0.024		
Δo_{t-8}^+			0.071	0.043
Δo_{t-8}^-			-0.042	0.056
Δo_{t-9}	0.048**	0.024		
Δo_{t-9}^+			0.045	0.043
Δo_{t-9}^-			0.044	0.047
EC_{t-1}	-0.114***	0.024		
EC_{t-1}^+			-0.071	0.048
EC_{t-1}^-			-0.149***	0.051

1. The optimal lags of asymmetric ECM are determined using AIC (maximum lags = 12). ***, **, and *, which indicate significance at the 1 %, 5 %, and 10 % levels. Since it is impossible to eliminate the presence of correlated and heterogeneous variable in the residuals, the standard derivation is calculated using the Newey-West HAC covariance matrix estimation.

2. Data are weekly, spanning from 2002M4 to 2011M11 (sample size = 504). The data have been obtained from Bureau of Energy and Central Bank of Taiwan.

Table 7 shows the test results of price asymmetries (COIA, DLEA, CUIA, and EAPA). Regarding the adjustments of gasoline price in response to oil price changes, the null hypothesis of DLES was rejected at a 10% significance level. The other null hypotheses relating to the existence of COIS, CUIS, and EAPS were not rejected, even at a 10% significance level. In other words, the gasoline price only shows DLEA.

Table 8 shows the process involved in the cumulated adjustment of gasoline price in response to changes in crude

oil price. Oil price shocks were categorized as symmetric, positive, and negative. The effects of symmetric oil price shocks on retail gasoline price are calculated from symmetric ECM (equation (2)). It is interesting to note that in the first two weeks, gasoline price was adjusted more rapidly in response to positive oil price shock. After the third week, gasoline price was adjusted more rapidly in response to negative oil price shocks. Maximum asymmetry (difference of 0.22%) was evident after the sixth week. When oil price increased by 1%, gasoline price increased by approximately 0.61% after a quarter. Conversely, when oil price declined by 1%, gasoline price decreased by approximately 0.69% after a quarter. This shows that gasoline price in Taiwan respond more quickly to reductions in crude oil price. We have also illustrated C_i^+ , C_i^- , and $C_i^+ - C_i^-$ in Figure 2, demonstrating this unique phenomenon.

Table 7. Asymmetric Tests

	$H_0: COIS$	$H_0: DLES$	$H_0: CUIS$	$H_0: EAPS$
F-Statistics	0.678	1.721*	0.678	0.813

1. ***, **, and * indicate that the null hypothesis is rejected at the 1 %, 5 %, and 10 % significance levels.
2. COIS denotes contemporaneous impact symmetry; DLES denotes distributed lag effect symmetry; CUIS denotes cumulated impact symmetry; EAPS denotes equilibrium adjustment path symmetry.

Table 8. Cumulative Responses

	Period after Crude Oil Price Shock (Week)												
	0	1	2	3	4	5	6	7	8	9	10	11	12
Symmetry	0.046	0.318	0.432	0.494	0.520	0.554	0.565	0.666	0.661	0.689	0.674	0.666	0.659
Positive	0.083	0.341	0.361	0.440	0.436	0.442	0.413	0.488	0.569	0.600	0.590	0.591	0.607
Negative	0.019	0.241	0.453	0.498	0.534	0.591	0.630	0.762	0.680	0.708	0.704	0.701	0.685

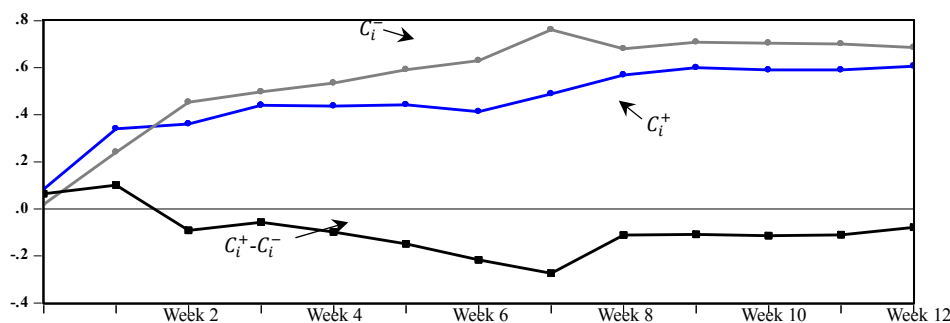


Figure 2. Cumulative Adjustment Function

5. Concluding Remarks

This paper collects weekly data over a sample research period of 2002M4 - 2011M11 to estimate the impact of oil price on pre-tax retail gasoline price in Taiwan. In this study, the crude oil price is substituted by marker crude price, which is Dubai and Brent Crude prices calculated at weights of 70% and 30%, respectively. We found that there is a significant, long-run equilibrium relationship between crude oil price and retail gasoline price. In the asymmetric ECM framework, the test results rejected the null hypothesis of distributed lag effect symmetry (DLES) between oil price and retail gasoline price in the short-run. However, there is a lack of clear evidence to prove the existence of contemporaneous impact asymmetry (COIA), cumulated impact asymmetry (CUIA), and equilibrium adjustment path asymmetry (EAPA). On the cumulated adjustment to gasoline price, it is interesting to note that in the first two weeks, gasoline price was adjusted more rapidly in response to positive oil price shock. After the third week, gasoline price was adjusted more rapidly in response to negative oil price shocks. Maximum asymmetry (difference of 0.22%) was evident after the sixth week. When oil price increased by 1%, gasoline price increased by approximately 0.61% after a quarter. Conversely, when oil price declined by 1%, gasoline price decreased by

approximately 0.69% after a quarter. This shows that gasoline price in Taiwan respond more quickly to reductions in crude oil price. In Taiwan, CPC Corporation is the market leader with a market share of 75%. But CPC Corporation is also attached to the Ministry of Economic Affairs in Taiwan. This would explain why the adjustment of Taiwan retail gasoline prices in response of shocks to oil price is “politico-economic asymmetry”.

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Notes

Note 1. Bacon (1991) has described this type of asymmetrical adjustment in gasoline prices as “rockets and feathers effects”.

Note 2. Johnson (2002), Kaufmann & Laskowski (2005), and Radchenko (2005) also indicated that there are no menu costs with regard to the price announcements of retail gasoline.

Note 3. Kirchgassner & Kubler (1992) indicated that this change may be associated with markets becoming more competitive.

Note 4. Von Cramon-Taubaded (1998) posited that only error correction models are suited to testing asymmetric price response.

An Empirical Investigation of the Day-of- the-Week Effect on Stock Returns and Volatility: Evidence from Muscat Securities Market

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Abstract

This paper investigates the anomalous phenomenon of the day-of-the-week effect on Muscat securities market. The study uses a sample that covers the period from 1 December 2005 until 23 November 2011. It also utilizes a nonlinear symmetric GARCH (1,1) model and two nonlinear asymmetric models, TAR(1,1) and EGARCH (1,1). The empirical findings provide evidence of no presence of the day-of-the-week effect. However, unlike other developed markets, Muscat stock market seems to start positive and ends also positive with downturn during the rest of the trading days. In addition, the parameter estimates of the GARCH model (α and β) suggest a high degree of persistent in the conditional volatility of stock returns. Furthermore, the asymmetric EGARCH, and TAR models show no significant evidence for asymmetry in stock returns. The study concludes that Muscat securities market is an efficient market.

Keywords: day-of-the-week effect, volatility, stock market anomalies, GARCH, TAR, EGARCH, muscat securities market

JEL Classification: D53, G14, G15

1. Introduction

The efficient market hypothesis (EMH) is considered one of the most debated and investigated issue in finance literatures. It states that a market is considered to be efficient if it reacts and responds quickly and accurately to all available information. Fama (1970) classified market efficiency into three forms: weak-form EMH, semi-strong form EMH, and strong form EMH. According to the weak-form EMH, everything is random and past historical sequences of data on stock prices are of no use in predicting future stock prices. As for the semi-strong form, it asserts that abnormal large returns cannot be earned consistently by investors using public information. On the other hand, the strong form of the EMH states that no information whether it is public or private will allow investors to consistently achieve abnormal high returns. However, the efficient market hypothesis was contradicted by some anomalies such as: calendar anomalies, fundamental anomalies and technical anomalies. Calendar anomalies refer to the tendency of securities to behave differently on a particular day-of-the-week, or month-of-the-year. However, this paper will concentrate only on the analysis of the day-of-the-week effect on returns and volatility of Muscat stock market. The results of previous researches on this phenomenon provided mixed conclusions. For instance, Cross (1973), French (1980), Gibbons and Hess (1981), Lakonishoke and Levi (1982), Rogalski (1984), Kim and Stambaugh (1984), and Balaban (1995) found a presence of the day-of-the-week effect on stock market returns in their studies. On the other hand, contradicting results were found by Santemases (1986), Marashdeh (1994), Pena (1996), Davidson and Peker (1996), Brooks and Persaud (2001) and Demirer and Karan (2002) where no significant evidence of the day-of-the-week effect were discovered.

The objective of this study is to examine the day-of-the-week effect on stock returns and volatility of Muscat securities market. This paper contributes to finance literature in several ways. First, it fills the gap created by the scarcity of researches that investigated this phenomenon on Muscat stock market. Second, it employs updated data for approximately the end of 2011. Third, it will lead to a conclusion regarding the efficiency of Omani stock market that is of value to decision makers.

This study is organized into six sections as follows: section 2 provides a brief overview of Muscat securities market, while section 3 introduces previous studies. Data and research methodology are addressed in section 4. Section 5 reports the empirical findings and discusses the related results. Finally, concluding remarks are provided in section 6.

2. Overview of Muscat Securities Market

Muscat securities market (MSM) was established as a public institution in 1988 and commenced its operations one year later in 1989. The main objective of MSM is to participate in the economic development of the country and strengthening the financial sector of Oman. In addition, its mission is to work tirelessly toward achieving market efficiency and providing investors with attractive investing environment. Thus, it increased investment awareness among investors and encouraged the listing of new securities. In 1998, MSM went through restructuring process that led to the establishment of two separate entities, the exchange (MSM) where all trading of listed securities must take a place, and the capital market authority (CMA) which regulates and supervises Muscat stock market. Currently, there are 123 companies listed on MSM classified according to their activities into three sectors: financial, industrial and services sectors.

MSM 30 index is the only available index that Muscat securities market has. It serves as a benchmark to investors in tracking the performance of the Omani stock market. It was established in 1992 with a base value of 1000 set in the year 1990. It is a value-weighted index of 30 high capitalized most liquid and profitable companies that are listed on MSM (13 financial, 11 industrial, and 6 services). This paper uses the MSM 30 index to analyze the day-of-the-week effect on return and volatility of Muscat securities market. The data covers approximately six years of market performance that spans from 1 December 2005 till 23 November 2011. However, examining the data uncover that MSM exhibited a strong volatility following in the footsteps of most Gulf Cooperation Council (GCC) countries. Thus, MSM witnessed positive returns until mid-2008 due to the increase in energy prices. However, the global financial meltdown drove the market downward until early 2009 where the market started to recover its losses slightly. (<http://www.msm.gov.om>)

3. Literature Review

There are extensive studies that investigated the anomaly of the day-of-the-week effect for different stock markets around the world. This section will shed some light on some of these studies.

Starting with most recent studies, Abdalla (2012) used ordinary least squares (OLS) and GARCH models to investigate the day-of-the-week effect on stock market returns and volatility of Khartoum stock exchange (KSE). His findings reveal no evidence of this phenomenon in KSE. On the other hand, Mbululu and Chipeta (2012) analyzed the day-of-the-week effect on a nine listed sector indices of South Africa stock market (JSE). Their findings exhibited also no evidence of the day-of-the-week effect for eight of the nine sector indices of JSE. However, Monday effect was found in the materials sector only.

Similar results were obtained by Hussain, Hamid, Akash, and Khan (2011) who tested the Karachi stock exchange (KSE-100) using a sample from January 2006 to December 2010 employing regression analysis. Their findings reveal that Tuesday returns were positive, significant and high compared to other days. On the other hand, Abdullah, Baharuddin, Shamsudin, Mahmood, and Sahudin (2011) examined the day-of-the-week effect on Malaysia shariah-compliant market. They utilized OLS on a data covering the period from 21 May 2007 to 19 September 2008. Their findings show a presence of the day-of-the-week effect in Kula Lumpur shariah index (KLSI). However, no presence of this phenomenon was found for FBM Emas shariah and FBM Hijrah Emas Shariah. Furthermore, KLSI exhibited a significant return on Monday while positive significant return was noticed on Friday. Also, Ulussever, Gurm Yumusak and Kar (2011) studied the Saudi stock exchange using the GARCH model. Their findings provide evidence of the presence of the day-of-the-week effect in the daily return of the Saudi stock market (TADAWUL).

Similarly, Al-Mutairi (2010) found evidence of presence of the day-of-the-week effect in Kuwait stock exchange. His findings show that Saturday returns were positive and higher than other days of the week except for Wednesday, suggesting that Kuwait stock market is inefficient. Also, Sutheebanjard and Premchaiswadi (2010) concluded that the stock exchange of Thailand (SET) showed a significant evidence of the day-of-the-week effect, where Monday and Friday found to have the highest and lowest percent of prediction error respectively.

Testing the Russian stock market using ARCH/GARCH models, McGowan, Jr., and Ibrihim (2009) found a presence of the day-of-the-week effect. They concluded that returns were the positive in everyday except on Wednesday where they were the lowest; the highest returns were observed on Friday. Similarly, Al-Barrak (2009) tested the day-of-the-week effect in some of the Gulf Cooperation Council (GCC) stock markets including the markets of Saudi Arabia, Kuwait and UAE (Dubai). He concluded that this anomaly is existed in Kuwait stock market only and the highest returns were observed on Saturday while the lowest returns were achieved on Sunday. Also, Rahman (2009) employed the regression analysis and the GARCH (1,1) model to examine the anomaly of Dhaka stock exchange (DSE). His results showed that returns were negative and significant on Sunday and Monday while positive significant returns were achieved on Thursday.

As for the Australian stock market, Marrett and Worthington (2008) utilized the regression analysis on a data covering the period from 9 September 1996 to 10 November 2006. Their findings showed no seasonality for the overall stock market. On the other hand, small cap showed higher returns on Thursdays and Fridays. The analysis of different sectors of the market provided a partial supportive evidence of the day-of-the-week effect. Also, Baker, Rahman and Saadi (2008) investigated the day-of-the-week effect and the conditional volatility on the S&P/TSX Canadian returns index. They found that the day-of-the-week effect is sensitive in both the mean and the conditional volatility and that the using of the regression analysis is a better way to investigate this effect. On the other hand, Agathee (2008) found the stock exchange of Mauritius exhibited support of this phenomenon and returns were higher on Friday. However, the mean returns of the five week days were jointly insignificant and differ from zero.

In Turkey, the Istanbul stock exchange indices were investigated by Dicle and Hassan (2007). Their findings showed that returns on Mondays were negative and significant while returns on Thursdays and Fridays were significantly positive. Similar results were obtained by Chukwuogor-Ndu (2007) where he found a presence of the day-of-the-week effect in some East Asian financial markets. Also, insignificant daily returns and volatility were existed in most of these markets. Apolinario, Santana, Sales, and Caro (2006) used the GARCH and T-GARCH models to examine 13 European stock markets. Their findings revealed a normal behavior of returns is present in these markets.

On the other hand, Gregoriou, Kontonikas and Tsitsianis (2004) used the GARCH model to measure the volatility of stock returns of the UK stock market utilizing the FTSE 100 index. Their results provide evidence of the day-of-the-week effect. However, when transaction costs are considered, no presence of this phenomenon was found, concluding that the UK stock market appears to be weak-form efficient. Moving to Egypt stock market, Aly, Mehdian, and Perry (2004) found that returns on Mondays were significant and positive but they were not significantly different from the other days of the week. Therefore, they concluded that no evidence of any daily seasonality is present in the Egyptian stock market. Contrary results were obtained by Al-Rajoub (2004) where he investigated this anomaly in Amman stock exchange. He found that returns on Thursday, the end of the week, were positive and the highest, while returns on Monday were negative and the lowest.

Also, Kiyamaz and Berument (2003) found evidence of the day-of-the-week effect in both returns and volatility for major stock market indexes. The highest volatility was occurred on Mondays for Germany, and Japan; Fridays, for Canada and the United States; and Thursdays for the UK. On the other hand, the Korean stock market was tested by Kamath and Chusanachoti (2002) using the OLS and the GARCH model. They found conflicting results where a strong evidence of the day-of-the-week effect was found during the 1980's, however, the presence of this phenomenon disappeared in the 1990's. Similarly, Al-Loughani and Chappell (2001) utilized the GARCH model on Kuwait stock market and found that returns were higher on Friday and Lower on Monday providing supportive evidence of the day-of-the-week effect. On the other hand, Choudhry (2000) analyzed this phenomenon on seven emerging Asian stock markets to include India, Indonesia, Malaysia, The Philippine, South Korea, Taiwan, and Thailand. His findings proved a presence of the day-of-the-week effect on both returns and volatility. Similar results were concluded by Poshakwale (1996) regarding the Bombay stock exchange (BSE) in India. The findings showed that returns on Fridays were significantly higher compared with other days of the week.

4. Data and Research Methodology

4.1 Data

Daily data of Muscat securities market index 30 were obtained from the website of Muscat securities market (<http://www.msm.gov.om>). The data covers the period from 1 December 2005 to 23 November 2011. The logarithmic returns of trading days have been calculated, and the daily rate of change is computed as the natural logarithmic first difference of the daily closing price of the MSM:

$$R_t = \ln[p_t/p_{t-1}] \quad (1)$$

Where R_t represents the continuously compounded rate of return of MSM, p_t is the closing price in day t , while, p_{t-1} represents the closing price in the day before.

4.2 Research Methodology

For the model specification, two important issues must be considered. First, as it has been long pointed that the autocorrelation problem resulted from the violation of the assumption of no autocorrelation, which may result in misleading inferences. This problem can be addressed by including the lagged values of proper lagged values of returns as independent variables. The second issue is that the error variances may not be constant over time (heteroscedasticity problem). This can be handled by allowing variances of errors to be time dependent to include a conditional heteroskedasticity. Thus, error terms will have a mean of zero and a time-varying variance of h_t , i.e. ε_t

$\varepsilon_t \sim (0, h_t)$. Different models for conditional variances were developed. Engle (1982) allows the forecasted variances of return to change with the squared lagged values of the error terms from the previous periods, which is known as Autoregressive Conditional Heteroskedastic Model (q) (ARCH (q)). The generalized version of ARCH (q) is suggested by Bollerslev (1986) and makes the conditional variance, h_t , a function of lagged values of both h_t and ε_t^2 . This specification is known as GARCH (p, q) modeling. However, it is possible that the conditional variance, as a proxy for risk, can affect stock market returns.

The GARCH model that previously discussed is symmetric and does not capture the asymmetry effect “leverage effect”. However, asymmetry effect is a common characteristic inherent in most stock returns time series. In financial time series analysis, the asymmetry effect refers to the characteristic of times series on asset prices and implies that bad news tends to increase volatility more than good news (Black, 1976).

To absorb the possible asymmetry effect of the stock market behavior, the threshold ARCH or TARARCH (advanced by Zakoian, 1994) and the Exponential GARCH or EGARCH (proposed by Nelson, 1991) models are also used in the current research. The general model used in this study may be expressed as:

$$R_t = \varphi_1 + \sum_{i=2}^5 \varphi_i D_{it} + \sum_{i=1}^n \theta_i R_{t-1} + \varepsilon_t \quad (2)$$

In this equation R_t as defined before represents the continuously compounded rate of return, where φ_1 is the constant term; φ_i Coefficients 2 to 5 denotes the difference of mean returns of Monday to Wednesday with the mean returns of Sunday; R_{t-1} is the series of lagged explanatory variables; θ_i are the coefficients of the lagged return terms; D_{it} is the matrix with dummies for Monday, Tuesday, Wednesday, and Thursday. Saturday dummy is excluded to avoid the dummy variable trap. Values of one and zero are assigned to these dummy variables. The variable D_{it} is assigned value of “one” if return for that day is there. A value of “zero” is assigned for returns of rest of the week days. ε_t denotes the disturbance term.

The three specifications of the model, i.e., GARCH, TARARCH and EGARCH deviated from each other in the way they specified the conditional variance h_t . The three conditional variance equations fit into daily returns to model the MSM data are:

Conditional Variance Equation GARCH:

$$h_t = \omega + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1} \quad (3)$$

Conditional Variance Equation TARARCH:

$$h_t = \omega + \alpha \varepsilon_{t-1}^2 + \gamma \varepsilon_{t-1}^2 I_{t-1} + \beta h_{t-1} \quad (4)$$

Conditional Variance Equation EGARCH:

$$\log(h_t) = \omega + \alpha \left[\frac{|\varepsilon_{t-1}|}{\sqrt{h_{t-1}}} - \sqrt{\frac{2}{\pi}} \right] + \gamma \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} + \beta \log(h_{t-1}) \quad (5)$$

Specification allows the conditional variance to be dependent on past information, which will induce variability over time. More specifically, the conditional variance is explained by past shocks and past variances.

According to equation 3, the conditional variance is stated as a function of past shocks and past variances. The ARCH term, α , indicates the short-run persistence of shocks, while the GARCH term, β , stands for the contribution of shocks to long-run persistence.

It is worth mentioning that the GARCH model assumes a symmetric response of volatility to past shocks. This implies that both good and bad news have the same impact on the market. Whereas in reality, it is commonly observed in the context of stock market returns, there is the possibility of leverage effects. In that case negative shock has more impact on volatility than the positive shock of the same magnitude (Christie, 1982; Zakoian, 1994). Thus, it would be more useful to re-investigate the calendar anomalies in Muscat stock market by taking asymmetrical market reactions into account.

In equation 4, TARARCH model, the specification of the conditional variance equation has ω as intercept, α , β and γ are parameters and I is a dummy variable that takes the value 1 if $\varepsilon_{t-1} < 0$ and zero otherwise. Where $\varepsilon_{t-1} < 0$ stands for the bad news and $\varepsilon_{t-1} > 0$ represents the good news, under the assumption that bad news and good new have different impact on the conditional variance. In this model, good news has an impact of α , while bad news has an impact of $(\alpha + \gamma)$. Hence, if γ is significant and positive, negative shocks have a larger effect on h_t than positive shocks (Hill, Griffiths and Lim, 2007). The parameter γ , which captures the asymmetric effect, is expected to be positive.

The EGARCH specification in equation 5 ensures that the conditional variance is always positive even if the parameter values are negative. Thus, there is no need for imposing a non negative constraint as was the case in TARARCH model. In this model, the presence of leverage effects can be tested by the hypothesis that $\gamma > 0$, whereas if $\gamma \neq 0$ positive and negative shocks have the same effect on volatility.

The null hypothesis as mean returns of all the day of a week are equal to each other and are equal to zero which means that there is no calendar anomaly effect:

$$H_0: \varphi_0 = \varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = 0$$

Against the alternative that all the coefficients $\varphi_0 : \varphi_4$ are not equal and are not equal to zero. If the null hypothesis is rejected then the stock returns must display some form of the day-of-the-week anomaly, since the returns differ from each trading day.

5. The Empirical Results

Table 1 reports the descriptive statistics for the returns of the entire studied period as well as the return for each day of the week. The average return for the entire studied period is 0.00006. The standard deviation of the return is 0.0130, and the skewness is -0.91. The kurtosis is 14.530, different from 3 and statistically significant at the 1 percent level. The Jarque-Bera normality test rejects the normality of returns at the 1 percent significant level. A closer look at each day statistics shows that two out of five days have mean return of negative signs. In addition, all-days, but not Thursday, summary statistics are likely to be shaped by those of Sunday. In comparison to the remaining weekday, Monday has the highest return, In comparison to the remaining weekdays; Thursday has the highest return, kurtosis as well as the sum return and almost the standard deviation.

Table 1. Descriptive statistics of continuously compounded daily returns of MSM

	Sunday	Monday	Tuesday	Wednesday	Thursday	Overall
Mean	0.0010	-0.0007	-0.0021	4 E-05	0.0021	6. E-05
Median	0.0005	-6. E-05	0.0005	0.0010	0.0010	0.0005
Maximum	0.0629	0.0517	0.0804	0.0572	0.2961	0.0804
Minimum	-0.0865	-0.0774	-0.3080	-0.0748	-0.0591	-0.0870
Std. Dev.	0.0134	0.0124	0.0226	0.0132	0.0223	0.0130
Skewness	-0.6166	-1.4297	-8.5367	-1.5011	9.2945	-0.9096
Kurtosis	13.416	14.594	115.83	12.748	123.57	14.530
Jarque-Bera	1443.9	1847.8	162247	1265.9	152551.0	8350.7
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sum	0.3160	-0.2230	-0.6181	0.0138	0.5921	0.0965
Sum Sq. Dev.	0.0566	0.0473	0.1519	0.0508	0.1223	0.2500
Observations	300	297	293	295	287	1472

Furthermore, the overall data as well as those of particular days all are not normally distributed as tested by Jarque-Bera. The empirical distribution confirms the presence of a non-constant variance or volatility clustering.

We now discuss the empirical findings of the complete model incorporating GARCH process for the conditional variance, as specified in equations (3) to (5). It is worth noting that the three models were estimated, under the assumption of Generalized Error Distribution (GED) since the errors are not normally distributed as it was shown by Jarque-Bera test. In testing for the optimal lag length using Akaike Info Criterion, as well as the significance of the estimated parameter. However, the results reveal that one lag is the most appropriate.

Table 2. Parameter estimates for the GARCH models with generalized error distribution

	ESTIMATED MODELS					
	GARCH		EGARCH		TARCH	
Mean Equation						
<i>Coefficient</i>	<i>Value</i>	<i>Z-stat.</i>	<i>Value</i>	<i>Z-stat.</i>	<i>Value</i>	<i>Z-stat.</i>
<i>C</i>	0.00035	1.23882	0.00034	1.21418	0.00043	1.53853
<i>Monday</i>	-0.00067	-1.68156	-0.00064	-1.63545	-0.00076	-1.90400
<i>Tuesday</i>	-0.00027	-0.67089	-0.00026	-0.65047	-0.00036	-0.88838
<i>Wednesday</i>	-0.00003	-0.08730	-0.00002	-0.04091	-0.00002	-0.06036
<i>Thursday</i>	0.00057	1.43119	0.00059	1.53342	0.00048	1.20075
θ	0.31016	21.3069*	0.30858	20.653*	0.31221	21.4195*
Variance Equation						
ω	0.00000	4.26941*	-0.76742	-6.5823*	0.00000	4.26933*
<i>ARCH</i> (α)	0.27930	7.12158*	0.42599	9.82221*	0.30741	5.69901*
<i>GARCH</i> (β)	0.72305	24.41916*	0.951237	88.97674*	0.72318	24.4527*
γ			0.00755	0.28006	-0.05107	-0.82978
<i>AdjR</i> ²	0.044491		0.044024		0.050002	
<i>AIC</i>	-0.831931		-6.829108		-6.841017	
<i>SIC</i>	-6.7690003		-6.789587		-6.791496	
<i>F-test</i>	8.620832		7.783381		7.700272	
<i>F-test</i>	(0.0000)		(0.0000)		(0.0000)	
<i>LL</i>	5045.133		5044.052		5045.459	
<i>D.W</i>	2.122301		2.119445		2.125762	

Notes: * and ** imply significance at 1% and 5% levels respectively. AIC and SIC refer to Akaike info criterion and Schwarz criterion; LL is Log likelihood and D.W refers to Durbin-Watson stat.

Table 2 shows that in the three models, AR (-1) coefficients are all significant at $\alpha=1\%$. It also reveal that in the three models Monday, Tuesday and Wednesday have negative signs, only the opening and the closing days of the week are positive. However, all the parameters turn to be insignificant. The ARCH variable is positive and statistically significant at 1% significant level, in the three models. This means that the returns on a particular day are affected by the returns on the previous day. Therefore, high return in day t is followed by high return in day t+1.

The estimated GARCH term β is always positive and significant. Also, in all models, the sum of the coefficients on the lag of squared residuals and lag of the conditional variance close to unity implying that the shocks to the conditional variance will be highly persistent. The significant of ARCH and GARCH coefficients indicate that news about volatility from the previous period have an explanatory power on current volatility.

Asymmetric (leverage) term in the EGARCH model is positive but insignificant while it is, unexpectedly, negative and insignificant in TARCH model. This indicates that negative and positive news has the same impact on volatility. The results of the GARCH models for the parameters of the dummy variables indicate the non existence of any patterns of the day-of-the-week effect.

6. Conclusion

This study examined the day-of-the-week effect on stock returns and volatility of Muscat securities market. It utilized the MSM 30 index from 1 December 2005 to 23 November 2011, and employed a nonlinear symmetric GARCH (1,1) model and nonlinear asymmetric models of TARCH (1,1) and EGARCH (1,1). The empirical findings reveal that in the three models, Monday, Tuesday and Wednesday have negative signs while the opening and the closing day of the week have a positive signs, but all parameters are insignificant. Therefore, the study

concluded that the day-of-the-week effect is not present and MSM is an efficient stock market. Furthermore, the asymmetric EGARCH, and TARARCH models show no significant evidence for asymmetry in stock returns, confirming the absence of the leverage effect in the returns series.

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Trend of Technological Change in Iran's Petrochemical Industry

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Abstract

Nowadays, using appropriate technologies in order to make production economic and increase productivity of producing factors can be resulted optimized factors employing and also production enhancement in factories. Technological change is considered as one of the main factors of productivity growth. In this paper we have studied on the trend and bias of technological change in Iran's petrochemical industry by econometric approach from 1979 to 2008. We estimated a translog cost function in addition to equations system of cost share, using Seemingly Unrelated Regressions (SUR) approach. The results show that the rate of technological change has been -0.974 percent during the studied years. It means that there is a decrease in rate of cost of productive units during that period. Furthermore, the results indicate that technological change has been biased towards the use of more labor and material, while capital and energy have been saved.

Keywords: productivity, technological change, Translog function, petrochemical industry, Iran

1. Introduction

The first petrochemical factory in Iran was established in 1964 and it was a fertilizer factory in Marvdasht region. In the following years, with the installation of other factories and the application of different technology indices, petrochemical industry developed, in away that, this industry has reached to 1.2 percent of Iran's Gross Domestic Product (GDP). Although number of petrochemical factory has increased but for many reasons, resources were not been used efficiently and as a result many potential capacities has been unutilized.

A study on volume of production and number of factories in Iran's petrochemical industry shows that the problem is not the number of factories, but the problems are low factor productivity, old production methods, using modern technology incorrectly, management weakness, lack of cognition of effective elements on production and their comparative importance, etc. Thus it is inevitable to have researches on technological change analysis and to enhance productivity in petrochemical industry to optimize usage of resources. The studies on different sections of economy posed that the role of technological change to improve productivity has been significant. After Second World War, the studies on technical change have expanded in economics. Some of the famous studies are mentioned as Solow (1957, 1962), Intriligator (1965), McCarthy (1965), Jorgenson (1966), Diewert (1971), Binswanger (1974), Stevenson (1980), Romer (1990), Kant and Nautiyal (1997), Rasmussen (2000), Napisintuwong and Emerson (2002,2003), Datta and Christoffersen (2004), Hyunbae and Nadiri (2008), etc. Tendency to such researches have two main reasons: Firstly, supply increasing in industrial products in comparison to their demand caused decreasing in prices and also in industrial section's revenue. It also caused troubles in this section. This attracted economists to discover the reasons of the growth, while one of the main reasons or the most important one was technical change. Secondly, there was a shortage of industrial materials in developing countries. Therefore, according to the aforesaid reasons, technical change was considered as a major reason of productivity growth (Hayami and Godo, 2005).

Technological change in petrochemical industry is also one of the main elements of productivity growth. In this respect, it is necessary to recognize the technology of petrochemical industry, bias and rate of growth to modify and reinforcement of mentioned industry condition. So, the goal of this study is analysis of different aspects of technological change in Iran's petrochemical industry during the years 1979-2008.

2. Method

2.1 Methodology

In production process, production technology is the relation between inputs and output, which can be illustrated by production function (Chambers, 1988). The production structure and technological change can be surveyed by production function or dual cost function; it is in any industry such as petrochemical industry. Direct estimation of

production function will be appropriate if amount of output is determined endogenously, while for exogenous amount of output cost function is preferred (Kant and Nautiyal, 1997).

In order to choose the most proper functional form among all functional forms, translog functional form has been chosen. Because it is widely used in similar researches and also is flexible enough. Furthermore, it has some special theoretical and statistical characteristics like derivation of factor demand functions easily.

General form of cost function regarding time trend (T) variable is as follow (Rasmussen, 2000):

$$C = f(P_l, P_k, P_e, P_m, Q, T) \quad (1)$$

In which P_l, P_k, P_e and P_m are prices of labor, capital, energy and material respectively. Q is value of product and C is cost. So, translog cost function is written as follow:

$$\begin{aligned} \ln C = & v + \sum_i a_i \ln P_i + a_q \ln Q + \frac{1}{2} \sum_i \sum_j b_{ij} \ln P_i \ln P_j \\ & + \sum_i b_{iq} \ln Q \ln P_i + \frac{1}{2} b_q (\ln Q)^2 + b_t T + \frac{1}{2} b_{tt} (T)^2 \\ & + \sum_i b_{it} (\ln P_i) T + b_{qt} (\ln Q) T \end{aligned} \quad (2)$$

$$i, j = k, l, e, m$$

Factor cost shares can be obtained by partial derivation of translog function with respect to i-th input price .So:

$$\frac{\partial \ln C}{\partial \ln P_i} = \frac{\partial C}{\partial P_i} \frac{P_i}{C} = \frac{x_i P_i}{C} = S_i \quad (3)$$

$$S_i = a_i + \sum_j b_{ij} \ln P_j + b_{iq} \ln Q + b_{it} T \quad (4)$$

In which, $C = \sum P_i X_i$, S_i is cost share of i-th input and X refers to amount of factor.

In order to ensure that the underlying cost function is well-behaved, the cost function must be homogeneous of degree one in input prices, given output. Then, liner homogeneity in factor prices and symmetry imposes the following restrictions:

$$\sum a_i = 1 \quad \sum b_{ij} = 0 \quad \sum b_{iq} = 0 \quad b_{ij} = b_{ji} \quad (5)$$

Rate of technological change can be obtained by derivation of cost function with respect to time (Datta and Christoffersen, 2004 and Kant and Nautiyal, 1997):

$$\overset{\circ}{C} = \frac{\partial \ln C}{\partial T} = b_t + b_{tt} T + \sum b_{it} \ln P_i + b_{qt} \ln Q \quad (6)$$

It shows that technological change can be divided in three elements:

- 1- pure technical change ($b_t + b_{tt} T$)
- 2- non-neutral technical change ($\sum b_{it} \ln P_i$)
- 3- scale-augmenting technical change ($b_{qt} \ln Q$)

The first element – pure technical change- has no relation with inputs, amount of output and factor prices. It is a fixed part of function and its change causes cost function moving towards up or down. If it is negative, cost function goes down and it indicates positive technological change.

Interaction of factors during time is in second element. In other words, it shows the effects of technological change on factors during the time. It shows any substitution or saving factors. Changing this element results slope changing of cost curve.

Third element is the effect of technological change on capacity of institute. Clearly scale-augmenting technological change causes Economies of scale, because of increasing in production. It also decreases cost and leads to cost function shift.

In cost function, return to scale (scale elasticity) is determined as follow:

$$E = \left[\frac{\partial \ln C}{\partial \ln Q} \right]^{-1} = \left(a_q + b_q \ln Q + \sum_i b_{iq} \ln P_i + b_{qt} T \right)^{-1} \quad (7)$$

Returns to scale refers to changes in output subsequent to a proportional change in all inputs (where all inputs increase by a constant factor). If output increases by that same proportional change then there are constant returns to scale (CRS). If output increases by less than that proportional change, there are decreasing returns to scale (DRS). If output increases by more than that proportion, there are increasing returns to scale (IRS).

Stevenson (1980) believes that technological change may have bias to factor and scale characteristics of production. In case of technical progress, factor bias is as follow:

$$I_{bi} = \frac{\partial S_i}{\partial T} \quad (8)$$

If $I_{bi} > 0$, technological change results to use input i more. If $I_{bi} < 0$, technological change saves input i . If $I_{bi} = 0$ then it has no effect on using input i . Scale bias is calculated by derivation of the phrase in bracket:

$$SE_i = \frac{\partial^2 \ln C}{\partial \ln P_i \cdot \partial \ln Q} = \frac{\partial S_i}{\partial \ln Q} \quad (9)$$

If $SE_i > 0$, increasing of production scale, leads to use input i more. If $SE_i < 0$, it leads to use input i less. If $SE_i = 0$ it has no effect on using input i .

Anyhow, cost function system can be estimated if data and information is available. Although parameters of basic cost function are being estimated by Ordinary Least Squares (OLS) method, but it is not included cost share equations. A suitable method to estimate such systems is Seemingly Unrelated Regression (SUR). Since value shares sum to using, the sum of the disturbances across any three equations is zero at all observations (Baltagi, 2005). Hence, to avoid singularity of the covariance matrix any one of the four share equations can be dropped, i.e., three can be estimated and the fourth is automatically determined (Kant and Nautiyal, 1997). We drop energy share equation. Eventually, according to the methodology, technological change is being analyzed.

2.2 Sources of Data and Structure of Variables

The data were collected from various editions of the Iranian reports on industrial workshops and different volume of the Wholesale Price Index in Iran. We have adopted 1997 as base year to converting nominal data to real data. Output is the value of aggregate output produced during the year. This implies that no change in the stock of output has taken place. The capital expenditure is computed as the user cost of capital multiplied by the capital stock. In order to calculate the user cost of capital, we used $Puk = (r+P)P_i$, where r is the long run interest rate, P is the depreciated rate of capital assumed to be 5.5 % by year and P_i is the investment deflator.

Total cost is the sum of the cost of labor, capital, material and energy. For labor input, the number of persons employed and the wage calculated for emoluments per person employed have been used for model estimation. The price of labor is obtained as the ratio of total compensation to labor divided by the number of workers. Fuel cost is the cost of all types of fuel used for production. We add fuel cost to electricity cost to obtain energy cost. The price of fuel is obtained by taking a weighted average of all types of fuel prices. The price of energy is obtained by taking a weighted average of fuel and electricity price. The cost share of labor, capital, material and energy are obtained by dividing the corresponding cost by the total cost.

2.3 Test of Stationarity

To use time series data in estimation of model, we need to examine the series for stationarity. If a time series is stationary, its mean, variance, and autocovariance (at various lags) remain the same no matter at what point we measure them; that is, they are time invariant. If series are nonstationary, F and t statistics are not valid and estimated model is not reliable (Gujarati, 2004).

Results of the Augmented Dickey-Fuller (ADF) test shows that all variables have unit root and after first difference, they become stationary (table 1). Also the test shows stationarity of residuals. Thus, spurious regression is rejected and the results of estimation are reliable (table 2).

Table 1. Results of Augmented Dickey-Fuller Unit Root Test on Variables

Variable*	ADF Statistic	Mackinnon critical values		
		10%	5%	1%
D(LC)	-3.947	-2.638	-2.998	-3.752
D(LPL)	-3.646	-2.632	-2.986	-3.424
D(LPK)	-4.181	-2.632	-2.986	-3.424
D(LPE)	-5.753	-2.632	-2.986	-3.424
D(LPM)	-3.561	-2.635	-2.991	-3.737
D(SL)	-3.164	-2.635	-2.991	-3.737
D(SK)	-4.427	-2.632	-2.986	-3.424
D(SE)	-4.736	-2.632	-2.986	-3.424
D(SM)	-4.902	-2.632	-2.986	-3.424
D(LQ)	-4.044	-2.635	-2.991	-3.737

* Ln of variables in equations no.1 & 3

Table 2. Results of Augmented Dickey-Fuller Unit Root Test on Residuals

Variable	ADF Statistic	Mackinnon critical values		
		10%	5%	1%
RESID 01	-4.361	-2.629	-2.981	-3.711
RESID 02	-3.407	-2.629	-2.981	-3.711
RESID 03	-3.023	-2.629	-2.981	-3.711
RESID 04	-3.590	-2.629	-2.981	-3.711

3. Results

The parameter estimates of the translog cost function along with the associated cost share equations are presented in table 3. Many significant variables and high value of R^2 are signs of good estimation. Durbin Watson (D.W) statistic shows that there is no autocorrelation in estimated model.

Table 3. Results of Parameter Estimates

Parameter	Coefficient	t-Statistic	Parameter	Coefficient	t-Statistic
V	-113.199	-4.542	blm	-0.016	-0.625
al	0.992	1.834	bke	-0.050	-1.947
ak	-0.294	-0.855	bkm	-0.074	-4.309
ae	-0.590	-1/843	bem	-0.050	-1.744
am	0.304	0.426	btt	-7.051	-0.028
aq	14.978	4.969	blt	0.005	2.689
bt	-1.059	-4.396	bkt	-0.003	-1.701
bq	-0.811	-3.296	bet	-0.015	-2.070
bll	0.095	3.498	bmt	0.002	0.616
bkk	0.102	8.756	bqt	-0.070	-3.670
bee	-0.253	-0.358	blq	0.089	4.280
bmm	0.063	1.762	bkq	-0.068	-3.439
blk	-0.042	-3.426	beq	-0.114	-2.511
ble	0.057	1.834	bmq	0.162	4.774
1.74= 0.96		D.W =R 2	0.99		= R2

3.1 Rate of Technological Change

The study of technological change during the studied years clarify that by the passage of time and technology progress in petrochemical industry make decreasing in rate of cost change. According to equation 6, rate of technological change since 1979 to 2008 is -0.974. It means that rate of decreasing in cost of production has been 0.974 % in average each year. Though, rates of years are different in table 4, but negative sign means decreasing in cost rate during the time. So, calculations confirm that technology progress has decreased rate of cost change of petrochemical factories.

Table 4. Rate of Technological Change

Year	Rate of Technological Change (percent)	Year	Rate of Technological Change (percent)
1979	-0.988	1994	-0.968
1980	-1.023	1995	-0.974
1981	-1.032	1996	-0.970
1982	-1.036	1997	-0.948
1983	-1.024	1998	-0.947
1984	-1.023	1999	-0.939
1985	-1.029	2000	-0.928
1986	-1.042	2001	-0.926
1987	-1.034	2002	-0.918
1988	-1.038	2003	-0.908
1989	-1.014	2004	-0.898
1990	-1.009	2005	-0.898
1991	-1.017	2006	-0.885
1992	-1.018	2007	-0.883
1993	-1.004	2008	-0.881
Average of period= -0.974%			

3.2 Return to Scale

Study of return to scale indicates that it has been increasingly during the studied years in average it is 1.26. Thus, capacity increasing of productive units leads to Economies of scale.

Table 5. Return to Scale

Year	Return to Scale	Year	Return to Scale
1979	1.231	1994	0.988
1980	1.132	1995	1.108
1981	1.552	1996	1.164
1982	1.452	1997	1.165
1983	1.332	1998	1.027
1984	1.219	1999	1.090
1985	1.201	2000	1.138
1986	1.202	2001	1.193
1987	1.248	2002	1.385
1988	1.213	2003	1.482
1989	1.171	2004	1.664
1990	1.129	2005	1.556
1991	1.066	2006	1.608
1992	0.977	2007	1.662
1993	0.969	2008	1.683
Average of period= 1.267			

3.3 Factor and Scale Bias

The results of factor and scale bias (equations 8 & 9) are presented in table 6. Positive signs of bias of labor and material factors show that labor and material using has increased during the studied time. It means that if the prices of other factors are constant, the cost shares of labor and material increases during the time. On the other hand,

negative sign of bias of energy, indicates that using modern technologies causes less using of energy in productive units. Also, negative sign of capital shows that using advanced machineries leads to capital saving.

According to scale bias figures, increase in production scale will lead labor and material to be used increasingly. It means that expansion in size of productive units causes tendency to use more labor and material. Meanwhile, capital and energy factors have been used decreasingly.

Table 6. Factor and Scale Bias

Input	Factor Bias	Scale Bias
Labor	0.005	0.089
Capital	-0.003	-0.068
Energy	-0.015	-0.114
Material	0.002	0.162

4. Discussion

Estimation of cost function and cost share equations by SUR method, show that the aforementioned function explains the status of petrochemical factories accurately; because many of coefficients are significant and R^2 is high. The sign belongs to rate of technological change shows that during time, rate of cost in productive units has decreased. Therefore we see that using new and advanced technology cause better cost change during the studied time. So, it is expected to have more economic production process in petrochemical industry by using of this kind of technologies.

According to the results, scale elasticity statistic indicates increasing return to scale in Iran's petrochemical industry. In this respect, petrochemical production increases more than the proportional change in all inputs. Then, per unit cost will be decreased and as a result Economies of scale is appeared in petrochemical production process. So, it is recommended to use the ways to increase the capacity of productive units

In period of study, result assessment of factor and scale bias in petrochemical industry show adoption of research findings. Considering positive factor bias and also scale bias of labor and material, and on the other hand, high cost shares of these inputs out of total cost of inputs in productive units, managers ought to be encouraged to increase productivity of the mentioned inputs to decrease production cost. Moreover this kind of technological change diminishes dependence on capital and energy and related costs.

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Influence of Monetary Policy Variables on Loan Supply to Small and Medium Scale Enterprises in Nigeria

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Abstract

The study examined the influence of monetary policy variables on banks' credit supply to small and medium scale enterprises (SMEs) in Nigeria. Time series data which were collected on quarterly basis were elicited from the Central Bank of Nigeria (CBN) Statistical bulletin and financial statements for five commercial banks. The data covered a period of 1995-2010 and were analyzed using Fully Modified Least Squares (FMOLS). Considering the time series properties of the variables, unit root test was done with Philips Perron test to establish stationarity prior to actual analysis. The result of the FMOLS indicated that policies on interest rate and liquidity ratio were negatively and positively significant at 1 percent probability level respectively. Based on the results, it was recommended that government through CBN should strengthen existing policies on the adjustment of interest rates and liquidity ratio so as to increase and stabilize credit supply to SMEs.

Keywords: monetary policy, loan, small and medium scale enterprises, co-integration

1. Introduction

Small and medium scale enterprises (SMEs) have been recognised by economic policy makers as essential and veritable element in the process of industrialization of both developed and underdeveloped economies. They have significantly played seminal role in building a competitive private sector; providing employment for 70 percent of the population and contributing well over 50 percent to the gross domestic product (Rocha *et al.*, 2011 and Udechukwu 2003).

Nto and Mbanasor (2011) and Anyanwu (2003) noted that SMEs apart from increasing the per capita income and output also help in ensuring food security of poor countries such as Nigeria. Obamuyi (2007), Oyekanmi (2003) and Adelaja (2003) observed that SMEs, despite their roles in promoting economic growth in Nigeria, suffer acute capital formation and are more financially constrained than large firms in sourcing for credit from formal credit institutions such as banks and capital markets. Rocha *et al.*, (2011) supported that despite the increasing interest in the SMEs sector, lending volumes are still not very impressive. They queried how total lending to SMEs in an oil economy could only be 2 percent of banks total credit portfolio. CBN (2005) observed that traditional commercial banks have been experiencing aggregate credit growth to the domestic economy, yet the ratio of loan supply to small-scale enterprises has continued to decrease over the years. This is in spite of mandatory enforcement by the CBN to the commercial banks to increase lending to SMEs. This situation has been of great concern to government thus, has exacerbated concerted efforts and intervention through increased budgetary allocation, credit policy formulations and implementation of new programmes and schemes (Mbanasor and Nto, 2009).

Lemuel (2009), CBN (2009), Udechukwu (2003) and Anyanwu (2003) highlighted that such credit policies and schemes ranged from Mandatory Credit Guideline (1970), Small Scale Industries Credit Guarantee Scheme (1971), Agricultural Credit Guarantee Scheme (1973), Nigeria Agriculture and Co-operative Bank (1973), Nigerian Bank for Commerce and Industry (1973), Rural Banking Scheme (1977), the World Bank Assisted SME I (1985), African Development Bank – Export Stimulation Loan Scheme (ADB-ESL) in 1988 and the World Bank Assisted SME II (1990), Second – Tier Security Market (1985), Peoples Bank (1989), National Economic Reconstruction Fund (1992), Small and Medium Scale Enterprises Loan Scheme (1992), Family Economic Advancement Program (1997), Bank of Industry (BOI) - being merger of NIDB, NBCI and NERFUND) in 2001, Nigerian Agricultural Co-operative and Rural Development Bank (NACRDB) - being merger of NACB, Peoples Bank and Family

Economic Advancement Program (FEAP) in 2002 to Small and Medium Enterprises Development Agency of Nigeria (SMEDAN) in 2004.

Outside the multiplicity of interventions adduced supra, the CBN has continuously been reviewing monetary policy instruments such as cash reserve ratio (CRR) and liquidity ratio (LR) to ensure availability of credit by the banks. A case in point was the prompt response to the immediate past global financial crises which triggered the reduction of CRR from 4.0% to 2.0% on September 18, 2008 and subsequently to 1.0% on April 14, 2009. The aim was to improve liquidity in the banking system which would impact positively on banks' ability to increase credit supply to SMEs and thus, reduce the crippling effect on the crises on Nigerian economy. In a similar vein, (CBN, 2010); Obamuyi, (2007) and Ogujiuba *et al.*, (2004) added that the capitalisation of banks' to N25 billion which took effect from January 1, 2006 was expected to make banks maintain high capital adequacy hence minimum of 40 percent liquidity ratio of total deposit. As such, this development increases financial resources at the command of the banks to grant as credit to SMEs.

It is disheartening to note that upon all the special interventions by the Central bank of Nigeria (CBN) to induce banks credit supply to SMEs, the reverse seems the case as evidenced by reports of CBN (2010) that the percentage of total credit to SMEs still fell from 48.8% in 1992 to 9.0%, 8.6% and 2.7% in 2000, 2002 and 2005 respectively. A good analogy can also be drawn from the surveys conducted by Aremu and Adeyemi (2011) and Nto and Mbanasor (2009) which opined that more than 77 percent of SMEs in Nigeria do not have access to credit from external finance like banks while all the large firms sampled have access to credit from formal financial institutions.

With this ugly trend in credit supply to SMEs, the question to ask is, whether Nigeria (a rural based economy) still has the hope of becoming one of the leading economies in 2020? Nto and Mbanasor (2011) observed that the tendency of reducing poverty in line Millennium Development Goals (MDGs) specification seems an up-hill task given that these small and less privileged firms that are supposed to be important strategy for creating investments and job opportunities for the poor in Nigeria are under nourished in credit supply by formal financial institutions, hence, the need for policy intervention to forestall the financial crisis that may befall the sector.

It is on this premise that this paper intends to examine the influence of monetary policy variables on credit supply to SMEs in Nigeria, the outcomes of which will help government of Nigeria to put policies right in a manner that will help SMEs survive the intense competition arising from globalisation. This is so since finance is necessary to help them set up and expand their operations, develop new products and invest in new staff or production facilities. If this financing cannot be found, brilliant ideas may fall by the wayside and this represents a loss in potential growth for the economy (OECD, 2006)

Useful inspiration was drawn from prior studies but the major line of discrepancy emanated from the fact that the present study had a macroeconomic dimension and employed a model which gives general picture of the situation. The studies include:

Obamuyi (2007) in a study conducted in Ondo State of Nigeria, observed that, the major determinants of loan supply to SMEs are regulatory requirements such as Capital Adequacy Ratio (CAR), Reserve Requirements (RR), Liquidity Ratio (LR), Interest Rate Development (IRD) and lending policies of the banks. These determinants have varied degrees of influence on the amount of money available for lending by the banks but failed to estimate the direction of the influence of identified policy instruments.

Rahji and Apata (2012) in a study on "Understanding the Credit Supply Decisions of Banks under the Small and Medium Enterprises Equity Investment Scheme in Nigeria" found that interest rate was positively related to credit supply to SMEs at 1% probability level. This implies that increase in interest rate will stimulate savings in banks thus improvement in credit availability to SMEs. The study adopted tobit model in the analysis of cross sectional data, collected from lending banks' staff. The findings of this analysis may be misleading considering that credit supply to SMEs may not respond to short run interest rate changes based on cross sectional data but on long run changes and time series approach.

As a remedy to the above shortcoming, the present study adopted a co-integration regression approach following Lutkepohl (2004) which opined that co-integration analysis is a better concept for modelling equilibrium or long run relations of economic and financial variables.

2. Methodology

The study was conducted in Nigeria which is one of the largest countries in Africa with a total geographical area of 923768 square kilometres and an estimated population of over 150 million. It lies wholly within the tropics along the Gulf of Guinea on the western coast of Africa. The country has a highly diversified enterprise system and agro-ecological condition (Nto and Mbanasor, 2011 and Manyong *et al.*, 2005).

The study employed co-integration regression (using fully modified least squares FMOLS) in the analysis of time series data obtained from CBN statistical bulletin, financial statements of five commercial banks. The data collected for fifteen years on quarterly basis covered 1995-2010 sub-periods.

Empirical research in financial economics is largely based on time series data which have two central properties ie non-stationarity and time varying volatility. Therefore, Philips (1986) reported that regression analysis with variables that contain such properties may produce misleading and spurious results thereby causing biased economic analysis. As such, the following steps were adopted to eliminate the problem.

The first step was the determination of the order of integration (stationarity) of the variables. The unit root test adopted to check whether the time series data were stationary or not was Philips Perron (PP) (Nto and Mbanasor 2011; and Peter and Philips, 1995). PP adopts nonparametric statistical methods to take care of the serial correlation in the error terms without adding lagged difference terms (Gujarati and Sangeetha, 2007). This explains the usage rather than Augmented Dickey-Fuller (ADF) test.

In the second stage, co-integration test was carried out in order to analyse whether the variables were co-integrated or moved jointly in the long run. This was done using parameter instability test following the procedures of Furuoka and Munir (2011); Geda *et al.*, (2006); Kungi-Vetenskapsakademien (2003); Gregory and Hansen (1996); Philips and Hansen (1990).

The last stage was the estimation of their parameters using fully modified least squares (FMOLS) after the number of co-integration relations was established. The superior FMOLS estimator is more reliable to account for serial correlation, potential endogeneity and multicollinearity problems and thus, is preferable to simple OLS.

Some other diagnostic tests (autocorrelation test, Jarque – Bera test etc) were also conducted to determine the presence of autocorrelation. The analyses were done with E-view software programs (Hendry and Juselius 2000; Ezirim and Muoghalu 2006)

Following the above procedures, the dependent variables (credit supply to SMEs) can be expressed as a function of cash reserve ratio; liquidity ratio, interest rate and lending rate of banks in Nigeria. Explicitly, the relationships can be specified as:

$$\ln CSUPP_t = \alpha_0 + \alpha_1 \ln CRR + \alpha_2 \ln ITR + \alpha_3 \ln LR + \alpha_4 \ln LD + U_{it}$$

($\alpha_1, \alpha_2 > 0$) elasticities.

Where:

α_{0-4} = Parameter to be estimated

CSUPP_t = Credit supply to SMEs by banks that is amount of loans lent to SMEs by bank over the period. (Naira)

CRR = Cash reserve ratio

ITR = Prevailing interest rate is that which banks accept deposit from customers (Percent)

LR = Liquidity ratio

LD = Lending rate is that which banks grant credits to SMEs (Percent)

U_{it} = Error term

Ln = Natural Logarithm applicable to each variables.

3. Results and Discussion

The results followed a systematic time series econometric approach to examine the influence of monetary policy variables on credit supply to SMEs in Nigeria. The results of unit root using Philips-Perron (PP) test are presented in Table I. From the Table 1, some of the variables: Credit supply (CSUPP), Cash reserve ratio (CRR), and interest rate (ITR) were non stationary at their level form and thus cannot be deemed to be integrated of order zero i.e. 1(0).

Table 1. Results of unit root test

Variable	Level Form		1 st Difference	
	T-statistics	P-value	T-statistics	P-value
Constant	-2.860611**	0.0644	-2.881370**	0.0084
CSUPP	-1.3754	0.577	-4.430574***	0.0020
CRR	-1.904286	0.3250	-4.9348***	0.0006
LR	-3.043719***	0.0444	-10.86056***	0.000
LD	-2.778259**	0.0757	-7.0782***	0.0000
ITR	-1.884945	0.3335	-5.5712***	0.0001

***, ** and * denotes the level of significant at 1%, 5% and 10% respectively.

Source: Output from E-Views 7.0 based on CBN data (2010).

The series were further taken to the first difference of the time series, the variables were found to be stationary [ie integrated of order 1(1)]. Following this, the dependent variable (CSUPP) was further regressed on the explanatory variables so as to find the residuals that come from the regression analysis at the level form.

Table 2. Test for unit root in the residual of the level for regression

Null Hypothesis: RES1 has a unit root			
Exogenous: Constant			
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel			
		Adj. t-stat	Prob.*
Philips-Perron test statistic		-2.650716	0.0967
Test critical values	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Source: Results from E-Views Package based on CBN Data (2010).

The result of the regression presented in Table 2 indicated that the series were not integrated of order zero i.e. 1(0) at 5% and below. The t-statistic (-2.651) showed there is existence of a weak relationship and hence cannot be used for further analysis. The series at first difference level gave residuals which were integrated of order one i.e. 1(1) as a result of the t-statistic of the PP (-16.248) which was significant at 1% probability level as shown in Table 3.

Table 3. Test for unit root in the residuals of the 1st difference

Null Hypothesis: D(RES1) has a unit root			
Exogenous: Constant			
Bandwidth: 21 (Newey-West automatic) using Bartlett kernel			
		Adj. t-stat	Prob.*
Philips-Perron test statistic		-16.24814	0.0001
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	
*Mackinnon (1996) one-sided p-values.			
Residual variance (no correction)		1.050635	
HAC corrected variance (Bartlett kernel)		0.112082	

Source: Results from E-Views Package based on CBN Data (2010)

Hence, using the 1% critical value, the null hypothesis of the unit root for any residual cannot be rejected. Subsequently, co-integration technique was used to confirm the long-run equilibrium relationship among the

variables (Gujarati and Sangeetha 2007; Nto and Mbanasor, 2011; Johansen and Juselius, (1990) Gregory and Hansen, 1996; Philips and Hansen, 1990). Co-integrating procedure which adopted parameter instability test was used. The result, summarised and presented in Table 4, indicated that the null hypothesis of no co-integration is rejected given the critical value of 0.6808 which was significant at 10% probability level. This shows that the series tested positive to the co-integration test.

Table 4. Test for co-integration

Co-integration Test-Hansen Parameter Instability				
Equation: UNTITLED				
Null hypothesis: Series are co-integrated				
Co-integrating equation deterministic: C				
	Stochastic	Deterministic	Excluded	
Lc statistic	Trend (m)	Trend (k)	Trend (p2)	Prob.*
0.680768	3	0	0	0.1004
*Hansen (1992b) Lc (m2=3, k=0) p-values, where m2=m-p2 is the number of stochastic trends in the systematic distribution.				

Source: Results from E-Views package based on CBN Data (2010)

Following the above result, it could be implied that there exists a long run equilibrium relationship among the variables. Co-integration regression using fully Modified Least Squares processed with E-Views Software was applied. The results of the regression are summarised and presented in Table 5.

Table 5 indicated that the co-integrating equation used has an intercept with t- statistic of -0.561 in the model and is deterministic. The model has an R^2 of 0.34, implying that 34% of the variation of the log of credit supply to SMEs was brought about by variation in the independent variables included in the model.

Table 5. Result of cointegration regression

Dependent Variable: CSUPP		
Method: Fully Modified Least Squares (FMOLS)		
Variable	Coefficient	T-Statistic
LNCRR	0.121236	-0.289453
LNITR	-4.663617***	3.780266
LNLR	8.714794***	5.162231
LNLD	1.052101	-0.341628
Intercept	-1.104808	-0.561449
R-Square	0.34	

NB: “***” = figures Significant at 1%, “**” = figures Significant at 5%.

Source: Output from E-Views Package based on CBN (2010) data.

The sign of the estimated slope coefficients of the model was negative, implying that the credit supply to SMEs is a decreasing function of the explanatory variables in the model. As such, log credit supply by banks to SMEs in Nigerian economy is on the decrease. This supports CBN (2010) that total credit available for supply to SMEs in Nigeria has been on the decreasing trend from 48.8% in 1992 to 2.7% in 2005. Nto and Mbanasor (2011) noted that both large and SMEs felt the sting of poor credit supply between 2007-2009 due to global credit crunch. However, SMEs faced disproportionate declines.

Table 5 further depicted that only two variables were significant namely log of interest rate and log of liquidity ratio. The coefficient of log of interest rate is negatively related to elasticity of credit supply to SMEs and implies that any policy aimed at reducing interest rate will increase credit supply to SMEs by 4.66%. This is contrary to a priori expectation that increase in interest rate should lead to increase in loan portfolio available to the bank to grant as

credit to SMEs. When interest rate is high, banks and other financial institutions tend to mobilise more savings from depositors, which will in turn increase the lending institutions' credit resources. Low interest rates discourage potential depositors and hence low credit availability and supply to SMEs in the economy. However, Rahji and Apata (2012) had a contrary result implying a positive relationship between interest rate and credit supply to SMEs in Nigeria.

The inverse relationship between interest rate and amount of credit supply to SMEs by commercial banks, obtained in this study may be attributed to other factors (eg. mandatory credit guidelines) which may induce banks to set aside more resources (from their annual profits) to grant as credit to SMEs even when interest rate may not impact on deposit potentials of the credit institutions. Furthermore, liquidity ratio is positively related to credit supply and significant at 1 percent probability level. This finding is in line with conventional view that when liquidity ratio is high, banks will set aside more quantum of resources to grant as credit to SMEs. It is generally expected that when liquidity ratio (i.e. total specified liquid asset/total current liabilities) is high, banks are more liquid, stable and comfortable to handle credit transaction with SMEs. It is under this principle that CBN (2010) and CBN (2009) asserted that the Central Bank of Nigeria has prescribed minimum liquidity ratio of 25.0 percent and has recently increased it to 30.0 percent below which banks cannot operate effectively in Nigeria.

More so, diagnostic tests were conducted on the residuals of the model to validate the model's parameter estimates. Other such tests included are normality of the residual's distribution and presence of serial correlation in the residuals. The results of the test as presented in Table 6 and fig 1 are satisfactory.

Table 6. Q-STATISTICS for autocorrelation test

Sample: 1995 – 2010						
Included observations: 20						
		Partial				
Autocorrelation		Correlation	AC	PAC	Q-Stat	Prob
.	**	1	0.269	0.269	2.0322	0.154
.	*	2	0.078	0.007	2.2123	0.331
.	.	3	0.041	0.020	2.2648	0.519
.	**	4	0.290	0.295	4.9630	0.291
.	.	5	-0.007	-0.186	4.9647	0.420
.	.	6	-0.050	-0.024	5.0537	0.537
.	*	7	-0.078	-0.047	5.2795	0.626
.	.	8	-0.035	-0.110	5.3292	0.722
.	.	9	0.066	0.199	5.5155	0.787
.	.	10	-0.042	-0.117	5.5962	0.848
.	.	11	0.022	0.104	5.6188	0.898
.	.	12	0.052	0.082	5.7581	0.928

Source: Output from E-Views Package based on CBN (2010) data.

Table 6 examined the presence of 1st order or 2nd order autocorrelation in the model. The test had insignificant Q-stat Values at 0.05 and 0.10 alpha levels which ruled out the threat of autocorrelation in the model. Therefore, the null hypothesis indicating the presence of auto correlation in the error term is accepted.

Figure 1 shows the Jarque-Bera statistic of 0.602 (which was not statistically significant at even 10 percent) and P-Value of 0.7396 ($P > 0.1$) while the skewness and kurtosis are -0.0357 and 2.243 respectively, indicating that the sample size and variables are normally distributed for the estimation of the parameters of the model. This follows the assertion of Gujarati and Sangeetha,(2007) that a normally distributed sample size and random variables should have skewness and kurtosis near zero and three respectively. Resultantly, the null hypothesis that the data are not sampled from a normal distribution is therefore rejected.

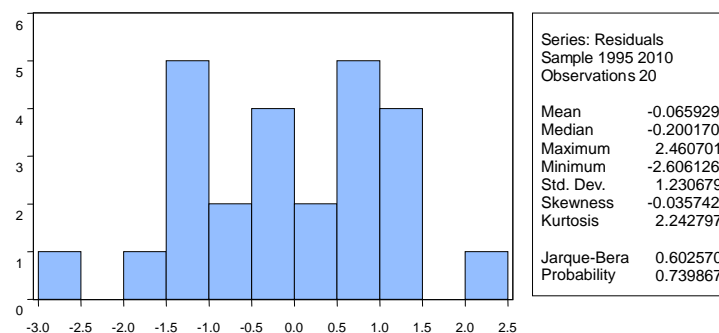


Figure 1. Jarque-Bera Test for normality of the residuals of the cointegration regression model

4. Conclusion

Having examined the influence of monetary policy variables on credit supply to small and medium scale enterprises in Nigeria, the results have shown that major determinants of credit supply to SMEs are policies directed on interest rate development and liquidity ratio. The implication is that the interplay of the duo is important to keep SMEs alive in Nigeria. Based on this, it was recommended that CBN should strengthen monetary policies that will adjust interest rate and liquidity ratio in a manner that will increase and stabilize banks' financial resources to enhance credit portfolio to SMEs.

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