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Theoretical Framework of Foreign Exchange Exposure, Competition and the Market Value of Domestic Corporations

Abubaker Alssayah[1] & Chandrasekhar Krishnamurti[1]

[1] School of Accounting, Economics and Finance, Faculty of Business and Law, University of Southern Queensland (USQ), Australia

Correspondence: Abubaker Alssayah, School of Accounting, Economics and Finance, Faculty of Business and Law, University of Southern Queensland (USQ), Australia. E-mail: alssayah1@gmail.com & Abubaker.Alssayah@usq.edu.au

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Abstract

The purpose of this study is to examine the foreign exchange rate exposure of domestic corporations in the United Arab Emirates (UAE) and the implications of that exposure for the market value of those corporations, considering the effect of competition as a determinant of exchange rate exposure. The justification for this study is that the UAE has an open economy with a high per capita income and a sizable annual trade surplus. In addition, the World Economic Forum issued its Global Competitiveness report for the year 2010-2011 in which the UAE was the only Arab country that was included in the elite club of countries that have shown an increment in endorsing new and improved methods for developing their economies. However, because of the indirect nature of foreign exchange rate exposure for local or domestic firms, the managers of these firms are unwilling to engage in hedging activities that may mitigate exchange rate exposure. A change in prices, the cost of final goods, the cost of raw material, labor costs or the costs of input or output and other substitute goods due to fluctuating exchange rates may have an adverse effect on the competitive position of a local or domestic firm with no international and foreign activities. The outcomes of this study will determine whether the domestic firms are exposure to the fluctuation of foreign exchange rates.

Keywords: exchange rate exposure, foreign exchange risk, determinants of exchange rate exposure

1. Introduction

The purpose of this study is to examine the foreign exchange rate exposure of domestic corporations in the United Arab Emirates (UAE) and the implications of that exposure for the market value of those corporations. The starting points for this study is the questions left unanswered by the most recent literature in this field of finance, especially that of Aggarwal and Harper (2010). These authors attempt to fill an important gap in the literature by examining the nature and causes of foreign exchange rate exposure of domestic firms. These firms are not generally considered to bear foreign exchange risk and, to date, they had not been studied in the literature. This study contributes to the literature by augmenting the Aggarwal and Harper (2010) model and extending its application to the UAE. Specifically, although Aggarwal and Harper (2010), like Williamson (2001), consider 'competition' as a determinant of foreign exchange rate exposure, their approach to measuring this variable uses a methodology that has been questioned in economic literature. By augmenting the Aggarwal and Harper (2010) model by explicitly incorporating an alternative measurement methodology for 'competition' into a model of foreign exchange exposure and by applying the model to a new context (UAE) where domestic corporations have not traditionally considered their FX exposure and where there are limited foreign exchange hedging activities. This study aims to contribute to our understanding of the determinants of foreign exchange rate exposure of domestic corporations. The study takes one additional step by examining the implications of foreign exchange exposure for the market value of domestic corporations. This, of course, is of paramount interest to investors and the corporate financial managers charged with the task of creating market value.

2. Background

Modern finance and economics have been concerned with the effects of changes in exchange rates on returns and cash flows of corporations (Aggarwal & Harper 2010). After the collapse of the Bretton Woods System in the mid-1970s, most corporations throughout the world viewed exchange rates as significant risk factor (Bartram

2008). This is especially the case in those industries that have been subject to substantial globalisation (Bartram et al. 2010). The changes in exchange rates have an impact on domestic and international corporations that can be defined as the 'exposure' of the corporation to fluctuating foreign exchange rates. The exposure to foreign exchange rate fluctuations usually manifests itself as an impact on: (i) 'the value of net monetary assets with fixed nominal payoffs' and (ii) the value of real assets held by the firm' (Jorion 1990, p. 333).

3. How Corporations Are Exposed to Foreign Exchange Fluctuations

Corporations are exposed to the risk of changing exchange rates through many channels. For example, if a firm relies on international or cross-border sales, the firm exposes itself to the risk of foreign exchange rate fluctuations. The change in exchange rates will have an impact on the value of international sales revenue. However, exposure to exchange rates can be decreased or managed. For example, if the firm sources raw materials from abroad or any cross-border location, it can ensure that its imports and exports are both in the same currency.

Generally, however, such a type of firm may have assets and liabilities at various cross-border locations. This can play a vital role in increasing the firm's exposure to changing exchange rates. Furthermore, it should be noted that it is not necessarily only those firms involved in exporting or importing activities or are classified as multinational corporations that have exposure to changing exchange rates. Local companies, firms and corporations that do not have any international revenue or are not involved in cross-border sales may also be impacted by changing exchange rates, possibly indirectly through their competition with other importing companies (Jong et al. 2006).

4. Implications of Foreign Exchange Rate Exposure

Researchers continue their efforts to understand the determinants and level of exposure to changing exchange rates for corporations because of the implications for business activity of FX risk and the difficulty in predicting fluctuations in foreign exchange markets (Salifu et al. 2007). Empirical research indicates that volatile exchange rates affect the revenue and profits of both multinational and local corporations (Muller & Verschoor 2006). Because of the prevalence of outsourcing activities to foreign countries, corporations incur costs in foreign currency (e.g., wages, taxes and material) and it is important for corporate financial managers to be aware of the extent of this exposure (Abor 2005). Furthermore, corporations not involved in foreign exchange trades or outsourcing activities are also exposed to the fluctuating exchange rates through competition with multinational organisations, foreign competitors, and macroeconomic conditions. Therefore, many local and multinational organisations find their income statements and business performance affected by fluctuating exchange rates, in spite of their having only indirect financial exposure (Parsley & Popper 2006).

A change in prices, the cost of final goods, the cost of raw material, labor costs or the costs of input or output and other substitute goods due to fluctuating exchange rates may have an adverse effect on the competitive position of a local or domestic firm with no international and foreign activities. Theory and empirical work in financial economics suggests that the exposure of a firm to changing exchange rates depends on the type of product and the nature of the competitive environment in which the firm operates (Bradley & Moles 2001). The general concept of exposure is the level of impact on the net worth of a firm due to fluctuating exchange rates (El-Masry 2006).

5. Case Study: United Arab Emirates

During 1962, when the United Arab Emirates (UAE) discovered oil within its region, the economy of the UAE increased significantly. The inflow of funds from oil sales provided money to establish and develop economic activities. In addition, fundamental structural reforms, together with liberal and market-oriented policies, have fostered the rapid expansion of the non-oil economy with a well-integrated trading system that has also encouraged the participation of the private sector. The non-oil export structure of the UAE has been improved to engage in the production of more diversified products such as transport equipment and light machinery (mainly from the free zone exports (Note 1)). This development was due primarily to a dependence based on domestic industry such as cement, fertilizers, petrochemicals and financial industries. The basket of trade collected by the UN shows that the UAE has performed well in products such as consumer electronics, basic manufacturing and IT. In addition, employment in the non-oil sector has increased to about 8.7 % (Mohamad Elhage 2005).

The World Economic Forum issued its Global Competitiveness Report for the year 2010-2011 in which the UAE was the only Arab country that was included in the elite club of countries that have shown an increment in endorsing new and improved methods for developing their economies. It is the second time that the UAE has been included in the "Innovation-driven economies'' category, alongside global power houses such as Germany,

Sweden, Japan, Australia, Canada, Switzerland, the USA, the UK and Singapore. The UAE was ranked 25th in this report for having been active in enhancing its economy through innovative ideas (Sala-i-Martin et al. 2010).

The justification for choosing the UAE for this study is that the UAE has an open economy with a high per capita income and a sizeable annual trade surplus. The successful economic efforts of the UAE diversification have reduced the portion of GDP based on oil and gas output to 25%. A boost has been given to the private sector by providing greater economic provisions by the government—which has also increased its budget allocation for the creation of more jobs and infrastructure development (CIA 2011). Foreign trade constitutes an important factor in economic activity in the UAE and confirms the UAE is an open economy. For instance, the proportion of exports and imports to GDP in UAE exceeds unity for every year during the 1990s compared to the US at less than 0.25 in the same period (Darrat & Al-Yousif 2003). In addition, the main aim of this study is to investigate how changes in foreign exchange rates affect the competitiveness of domestic firms in developing countries. In this case, this study focuses on a developing country that has a high rank of competitiveness globally. Moreover, in the Global Competitiveness Report, the UAE has received a high ranking for competitiveness and has been included in the elite club of countries exhibiting an increment in endorsing new and improved methods for developing their economies.

6. Study Motivation

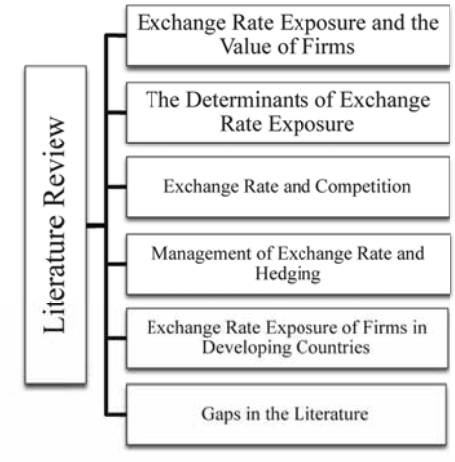
This study is motivated by ongoing concerns about the impact of foreign exchange rate exposure on the value of returns of domestic firms in the UAE. More specifically, this research is motivated by concerns about the increased foreign exchange risk faced by firms after the global financial crisis and the lack of research into the foreign exchange exposure of domestic firms operating in developing countries such as the UAE. Kolasa, Rubaszek and Taglioni (2010) have indicated that most countries have experienced adverse effects of world trade contraction, even firms in countries that have avoided the worst of the financial crisis. According to Melvin and Taylor (2009), exchange rates have experienced a record level of unpredictability. Corporate non-financial managers of domestic UAE firms who ignore the risks associated with foreign exchange when sales and purchases are made solely in their local market may expose their business and their shareholders to substantial risks.

7. Scope of the Study

The main objective of this study is to focus on the determinants of the exchange rate exposure of non-financial domestic UAE firms and the effect of that exposure on the value of domestic firms, considering the effect of competition as a determinant of exchange exposure. This study will focus on the main market of the UAE. The sample for this study will be 111 domestic firms listed on the main market of UAE between 2005 and 2011 for monthly data (84 months). In addition, this study will focus only on firms with sales and purchases in the local market (i.e., domestic corporations).

8. Literature Review

This literature review is organised as follows. First, those studies that have examined the effect of exchange rate exposure on the value of firms are reviewed. Second, the empirical work that has investigated the determinants of exchange rate exposure is appraised. Third, the theoretical and empirical work that has considered ‘competition’ as a determinant of exchange rate exposure is reviewed. Fourth, the empirical studies that have examined the approaches that corporate financial managers take to manage foreign exchange rate risks are evaluated. The literature review generates several important conclusions:



Conceptual diagram of literature review

a. Exchange rate exposure (or FX risk), if not appropriately managed, may have significant adverse effects on the business performance and market value of corporations.

b. Several determinants of exchange rate exposure have been identified.

c. Although 'competition' has been identified as a determinant of exchange rate exposure, the methodology that has been applied to measuring competition in the existing investigations into the exchange rate exposure of domestic corporations (most notably Aggarwal and Harper 2010) suffers from shortcomings.

d. Although corporate financial managers have several (or more) options or tools that can be used to manage exchange rate exposure, corporate financial managers of domestically-focused corporations tend to overlook the importance of exchange rate exposure.

e. To date, there have been limited studies on the exchange rate exposure of domestic corporations in the UAE. This study promises to increase our understanding of the exchange rate exposure of these corporations and, in so doing, contribute further to our understanding of the determinants of exchange rate exposure of domestic corporations.

8.1 Exchange Rate Exposure and the Value of Firms

This part of the literature review focuses on those studies that have examined the impact of FX rate exposure on firm value. He and Ng (1998) investigated the influence of fluctuations in the exchange rate on the value of multinational Japanese corporations. In all, 171 multinational Japanese organisations were examined, of which 25% experienced significant positive exposure effects from January 1979 to December 1993. Choi and Prasad (1995) explored and estimated a model of exchange rate risk exposure and the individual firm's value. Stock return data of 409 US multinational firms from 1978 to 1989 was the basis of this model. Choi and Prasad found that nominal and real exchange rates affect a firm's value. Gao (2000) conducted another similar study in which the prime focus was on multinationals in the manufacturing industry that have operations in foreign countries. An effect by profitability from exchange rate news appears in the stock market based on Gao's experimental results, in which 80 multinationals from the United States were taken from the 3-digit SIC of manufacturing industries. Fraser and Pantzalis (2004) examined the correlation between stock prices and changes in foreign exchange rates for 310 multinational US corporations. Exposure was found to be negatively correlated with the market value of corporations.

According to De Jong et al (2006), some studies have failed to find a strong association between the firms' returns on the stock markets (and, therefore, market value) and fluctuations in the exchange rates. Jorion (1990), Bodnar and Gordon (1993) and Bartov and Bodnar (1994, 1995) found very little evidence concerning the relationship between stock prices and the value of the US dollar. Among these, Jorion (1990) was interested more in the relationship between the firm's stock returns and exchange rate changes. He assessed 287 multinational non-oil-based companies to see whether stock returns changed with the trade-weighted exchange rate over the period from January 1971 to December 1987. His results suggest that only about 5% of the sample firms showed a significant relationship between stock returns and exchange rate fluctuations.

8.2 The Determinants of Exchange Rate Exposure

Shapiro (1975) devised a two-country model with a focus on profitability. First, he focuses on the characteristics and then examined the bi-national maximising profit strategy of oligopolistic firms, under the influence of the reduction of values and inflation. The principal conclusions in his paper are that one of the main factors influencing companies' exchange rate risk is its sales distribution in foreign and domestic markets. The domestic competition that the multinational firm undergoes amid the influences of imported and local production is another vital factor for exchange risk. Shapiro's (1975) model also implies that in the case of depreciation of the local currency, a value increase in the domestic firm will occur, along with a decrease in the foreign value with which it competes.

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Following Shapiro's early study, many investigations were undertaken into the determinants of exchange rate exposure. For example, Pantzalis, Simkins and Laux (2001) investigated the effects of operational hedges on US multinational companies and their exchange rate exposure. They found strong evidence that the firm's ability to build operational hedges is measured by determinants (e.g., breadth and depth of MNC network) that affect the firm's exchange rate risk exposure. Dominguez and Tesar (2006) argue that firm features like size of the firm and its affiliation with an industry are correlated with exposure. He and Ng (1998) found that companies that are less exposed to movements in exchange rates are those with short-term liquidity, high financial leverage, and well-defined hedging activities.

Dominguez and Tesar (2006) studied the connection between the exchange rate and the firm value. The exchange rate exposure of firms publicly listed was observed in 8 countries in both industrialised and emerging markets. The results indicated the link between exposure and other variables such as the size of the firm, its position in the multinational market, foreign trade and transaction, international assets, and ability to compete according to the industrial standard as indicated by an example of their regression where exposure was observed more in small firms compared to large and medium firms. Moreover, exposure was also observed in firms with international activity dependent on multinational status, international assets, and foreign sales holdings.

He and Ng (1998) examined the determinants of exposure and found that the estimated exposure is directly affected by the organisation's export ratio level. They also found that this exposure is linked to other factors that are the proxies for the organisation's hedging incentives. Therefore, they were able to explore the effects on the foreign exchange rate by observing variables such as stock returns, ratio of debt and ratio of dividend payout. These variables also include equity value, ratio of organisation's export and the organisation's size. By using this approach, He and Ng were able to explain the possibility of an organisation's variables that are proxies for an organisation's hedging activity by its exposure to foreign exchange. Gradually these types of studies identified those factors that determine the exposure of companies to foreign exchange risk. Research conducted by Doidge, Griffin and Williamson (2002) produced similar findings to He and Ng (1998). These authors established that large firms are more sensitive to currency movements than small firms.

Similar variables were utilised by Géczy, Minton and Schrand (1997) and Aabo, Høg and Kuhn (2010) to identify the risks involved in foreign currency exposure from variables such as foreign activities, foreign debt or an increased concentration of foreign competitors in their industries. The firms' size, R&D expenditures, export and import ratio, amount of profit and firm's debt were also identified in this exposure. Firms with a higher R&D expenditure are more likely to hedge because of the increased probability of competition and financial distress. Opler and Titman (1994) found that customers would be more reluctant to engage with firms spending more on R&D owing to their perception that a high R&D expenditure means that the firms are specialised in certain products.

Aggarwal and Harper (2010) conducted an important study in the literature that is consistent with this study; these researchers measured and determined exchange rate exposure for a sample of domestic firms. They used the average of the suitable financial factors for the previous years of each firm to evaluate the financial and operational strength and the possibility of reducing exposure. They explained that firms with increased levels of

debt and financial risks and leverage are more likely to face additional risks and should indicate a positive connection to the exposure of foreign exchange. Firms with higher gross margins enjoy more in elasticity in the pricing of their products and services.

Another important determinant that is consistent with this study is competition. For example, Deshapiro (1975), Dominguez and Tesar (2006), Marston (2001), Luehrman (1990) and Williamson (2001) argue that the amount of domestic and foreign competition export sales, and the substitutability in using domestic or foreign inputs are all determinants of exposure.

8.3 Exchange Rate and Competition

To date, an important determinant of exchange rate exposure has been overlooked. This determinant is 'competition'. Movements in exchange rates can have an impact on a company's values through different channels whether or not they have foreign operations. In addition, movements in exchange rates can also affect domestic companies that do not operate in the international market but face international competition in their local market or are indirectly exposed. For example, they may be importing raw materials from suppliers who use foreign material used by domestic companies (Dominguez & Tesar 2006). Marston (2001) emphasised that a domestic firm (i.e., one that neither imports nor exports) can also experience changes in value when changes in the exchange rate occur. This domestic firm may compete with overseas firms in the local market or may have input purchases that are highly dependent on the exchange rates.

Marston (2001) argues that the exchange rate exposure of an organisation is a function of the net revenues and demand elasticity of the products by the firm and the firm's competitors in the foreign market, as well as the domestic market and location of production. In addition, it can be concluded that a firm facing elevated standards of competition will also have elevated demand elasticity. According to Géczy, Minton and Schrand (1997), variations in the firm's short-term cash flow depends on changes in exchange rates. These changes can be affected by foreign competition which, in turn, may affect the market prices and the demand for domestic output.

Bradley and Moles (2001) attempted to establish the degree to which exchange rate exposure can be linked with industry association. They assume that companies within a particular industrial grouping share a similar competitive position and, in particular, are largely involved in importing, exporting, or competing domestically with foreign-based competitors to the same extent. Utilities, services, consumer goods, general industries and mineral extraction are the five basic categories in which the companies in the survey have been classified. The findings have identified substantial deviation in sensitivities throughout the different industries in question. Thus, the magnitude of deviation highlights the need and importance of evaluation of firms while considering their markets and industries type, rather than aggregating all firms.

Williamson (2001) explored the effects of exposure to changes in the real exchange rate with regard to the industry value of automotive firms. The role played by industry competition and structure in the relationship between the value of firms and the exchange rate exposure were taken into consideration. The automotive industry was used because it is an industry in which high levels of foreign competition are present and in which firms face high elasticity of demand. The companies compete with each other not only on the local level, but also on the international level; therefore, competition between companies, along with the financial health of the company, impacts on the risk a company faces in each country.

8.4 Management of Exchange Rate and Hedging

Exchange rate exposure has become an important issue for domestic and foreign firms. Companies need to develop strategies of risk management using operational hedges and financial derivatives (Allayannis et al. 2001). Risk management is critical and has been an important focus in many recent surveys. The prominence of risk management can be observed through the importance assigned to it by financial researchers and practitioners. Knowledge of risk management helps in providing managers with a formula to design hedging strategies (Froot et al. 1993). In addition, the existing research acknowledges the importance of hedging in determining exposure to exchange rates. Bartov and Bodnar (1994) argue that a systematic error is likely to be made by investors when characterising the relation between the firm's value and exchange rate changes. Personnel may not be fully aware of the firm's procedures in hedging foreign currency exposures.

Bodnar, William, and Gordon (1993) conjecture that hedging activities could have led to the minute success in finding considerable exchange rate exposure for industries situated in the United States, Japan and Canada. The tests are based on the assumption that hedging is an incomplete factor that cannot be observed due to the availability of incomplete data on hedging by industries.

According to the observations made by Allayannis and Ofek (1997), exchange rate exposures are found to have less effect on the hedging activities of large organisations. In the case of small businesses (mostly importers), a positive effect of foreign exchange exposure is found. Nevertheless, hedging is more common in large organisations than small organisations as evident in the studies.

A study by Elliott et al (2003) used US multinational companies as a sample and studied their foreign debt denomination in relation to the foreign currency exposure and its derivative use. The data revealed that the foreign currency risk exposure and the foreign denominated debt level have a significant positive relationship. Therefore, debt can be used as a hedge. However, a negative relationship exists between the foreign-denominated debt and the foreign currency derivative. Consequently, this is also an indication of using foreign denominated debt as a hedge, which alternates to the reducing currency risk in terms of usage by the foreign currency derivative.

Hedging is also studied to discern the ideal strategy for hedging. Wang and Low (2003) provide one such strategy in which the best hedging strategy is given in terms of the relationship of other factors to the hedge (e.g., future of foreign currency denominated stock index, equity interdependence, futures, markets of foreign exchange). These factors play a vital role in designing the best strategies for hedging. Contemporary investors also use future contracts to expand hedging, regardless of their type, as is portrayed in the Singapore Exchange given in the traded MSCI (Note 2) Taiwan index futures.

The scope of the exchange rate hedging literature is very broad. It encompasses within itself many facets that involve hedging and protection measures to be applied by firms for maintaining their existence in their market. One strategy that does not rely on hedging instruments is 'pass through.' Companies adopt different methods to 'pass through' changes in exchange rates into foreign prices; as a result of their 'exposure' to exchange rates their profits have to be adjusted accordingly. As prices lead to a change in profitability, a company's pass through and exposure should be related. Bodnar, Dumas and Marston (2002) demonstrate that pass through can have an effect on the exchange rate exposure because companies with inelastic demand can pass the changes in price on to the end user. The question of exchange rates affecting the price level is again a popular one among research methods according to Barhoumi (2006). This application is called exchange rate pass through because it informs how much of the exchange rate impact is passed through changes in the price. Donnenfeld and Zilcha (1991) found that using the technique of invoicing in the consumer's currency results in higher profits, bigger output and lower prices as compared to billing in the exporter's currency.

8.5 Exchange Rate Exposure of Firms in Developing Countries

A number of studies have investigated the foreign exchange exposure of firms operating in domestic companies. Kiymaz (2003) found that Turkish companies are greatly exposed to currency risk. The level of exposure is particularly intensified for textile, machinery, chemical and financial institutions. In addition, companies with greater levels of export and import participation are at an increased risk compared to companies with limited participation. In a more general study, Thirunavukkarasu (2006) attempted to understand the exposure risk of Emerging Market Multinationals (EMNCs) compared to that of the developed market multinationals (DMNCs). It was found that almost 60% of multinational companies in the sample were acutely exposed to exchange rate movements and that the EMNCs are more severely affected than DMNC by exchange rate movements. A number of other studies examine the economic impact of exchange rate fluctuations. However, few of them focus on the exposure of firms, especially domestic firms, and the UAE has not figured prominently in the existing studies.

8.6 Gaps in the Literature

After reviewing the literature, the following gaps have been identified:

1. This study contributes to a growing literature in international economics that provide compelling evidence that it is important to consider the effects of foreign exchange rate through competition on the value of domestic firms. Until now the empirical work that examine the effect of exchange rates on the value of firms has not considered the effect of foreign exchange rate on the value of domestic firms through their competition in developing countries.

2. The existing investigations into the exchange rate exposure of domestic corporations use measurements of 'competition' that have been questioned in the literature.

3. The existing literature does not contain an investigation into the exchange rate exposure of domestic corporations in the UAE.

4. Aggarwal and Harper (2010) recommend further study of the nature and effects of foreign exchange exposure on domestic corporations. Moreover, Williamson (2001) undertook further study into exchange rate exposure and the competitive aspects of industry structures. This study aims to contribute positively on these points and take some steps toward filling the gaps that exist in the literature.

9. Exchange Rates, Purchasing Power Parity and Competition

With the move to flexible exchange rates in the early 1970s, is generally assumed that the exchange rate would quickly adjust to change in relative price levels (Lan 2001). The theory of purchasing power parity (PPP) is one of the fundamental principles in international finance. The PPP theory of the exchange rate looks at the relationship between a country's foreign exchange rate and its price level, as well as the relationship between changes in those variables (Allen & Gandiya 2004).

The purchasing power parity (PPP) is the exchange rate between two currencies that would equate the two relevant national price levels if expressed in a common currency at that rate; the purchasing power of a unit of one currency would be the same in both economies. This concept of PPP is often termed absolute PPP. Relative PPP is said to hold when the rate of depreciation of one currency relative to another matches the difference in aggregate price inflation between the two countries concerned (Lan 2001). If the nominal exchange rate is defined simply as the price of one currency in terms of another, then the real exchange rate is the nominal exchange rate adjusted for relative national price level differences. When PPP holds, the real exchange rate is a constant, so that movements in the real exchange rate represent deviations from PPP. Hence, a discussion of the real exchange rate is tantamount to a discussion of PPP (Sarno & Taylor 2002).

The relative PPP theory focuses on the change over time in the relative prices of trade baskets of similar goods and services in two countries. At any given time, the exchange rate between the two currencies is related to the rate of change in the price of the similar market baskets. According to relative PPP theory, as prices change in one country relative to those prices in another country for a traded basket of similar goods and services, the exchange rate will tend to change proportionately but in the opposite direction.

The rationale for this theory is that if one country experiences rising prices while its international trading partners do not, its exports will become less competitive. Similarly, imports will become more attractive because of their relatively lower prices. The exchange rate will change as citizens purchase currency of the country with falling prices and sell the currency of the country with rising prices (Gallagher & Andrew 2000).

The volatility occurs for both nominal and real exchange rates. Real exchange rate changes translate into deviations from PPP which, for a domestic firm with local competitors, should have a direct effect on firm value. A local competitor is a firm that faces substantial foreign and domestic competition. In the simple case of an exporter with costs denominated in its home currency and sales in a local market with local competition, the firm's cash flows will be affected by changes in foreign currency. The sensitivity of a firm's cash flow in its home currency to changes in exchange rates is primarily a function of the elasticity of demand for a firm's product. Therefore, the first of those revenue exposures is the exposure of the corporation to change in its revenues resulting from a change in demand. The assumption is that a firm facing high levels of foreign and local competition will also face high demand elasticity. Therefore, a useful test for the existence of exchange rate would employ a sample of firms that have both high levels of local sales and face foreign and local competition (Williamson 2001).

To evaluate the effect of an exchange rate shock on the value of a firm, the firm should identify those shocks that are permanent and unanticipated. Firms selling and purchasing domestically may be exposed to changes in exchange rates via competition or economic exposure. As Lessard and Lightstone (1986) have observed, firms do not need foreign activity to have currency exposure; they need only more foreign competition in their home markets. The relative exposure to the change in the competitors' home currency is estimated by the rate in the home country of the competitors. If the firm is a simple exporter and denominates costs in local currency as well as selling in a local market with foreign and domestic competitors, the value of the firm in this case will be affected by a change in the exchange rate.

In spite of the absence of foreign assets or liabilities in the sample in this study, a nominal change in exchange rates if offset by a change in the price level in two countries should affect the real value of the firm. This offsetting effect of the price level with the exchange rate change would be consistent with the existence of purchasing power parity. Therefore, the exchange rate change that should determine the effect of a rate change on firm value is the real exchange rate change. The real exchange rate change implies deviation from PPP condition. These deviations happen as a result of the competition between the firm and a result of the strength of demand and supply (e.g., wage, inflation and cost of final goods).

These deviations create either a disadvantage or advantage for firms because if a corporation prices in a currency different from its competitors operating in the same markets or because its scale of operations differs from that of the competition in particular markets, this supposition is true even though it prices in the same currency as its market competitors. In this context, the important factor is the customers' perception of the price in particular markets. Two competitors may operate out of the same country; however, if they price in different currencies, currency volatility will alter their price competitiveness.

The cash flow of the firm in local currency relative to changes in the exchange rate is mainly a function of the elasticity of the demand for a company's product which, in turn, depends on the degree of competition in an industry. Therefore, the assumption is that if local and foreign competition exists, higher demand elasticity exists as well. To demonstrate the existence of exchange rate exposure, one would use sample firms that have a high level of local sales with a high level of foreign and domestic competition (Williamson 2001). Theoretically, we would expect a positive relationship between foreign exchange exposure and competition.

The literature and theoretical financial economics provides the basis for a formal model that can be used to address the following research question:

What are the determinants of the exchange rate exposure of domestic corporations in the UAE and what are the implications of this exposure for the market value of those corporations?

We can expect to find a significant relationship between each of our determinants of foreign exchange exposure (including competition) and the foreign exchange exposure of domestic UAE firms. This expectation can be confirmed (or rejected) by undertaking a formal analysis in which the degree of variation in the foreign exchange exposure of domestic UAE firms is explained by variation in each of our determinants (including competition). This formal analysis is described in the following section.

10. Methodology

10.1 Sample of Non-financial Companies in the UAE

The type of companies must be defined to identify the companies as subjects for this research. Domestic firms in this study may be defined as only those firms with sales and purchases on the local market. Some firms may also come under the genre of domestic companies that purchase their goods from a wholesaler or a supplier from foreign countries and, therefore, may have indirect exposure to foreign exchange rates.

The sample of this study is selected from the Emirates Securities Market and OSIRIS - publicly listed companies worldwide. The total firms in this research registered in the market are 133 according to the UAE market for securities and Osiris program. This study covers all domestic non-financial firms in the market. Therefore, the sample of companies used in this research excludes banks, financial firms or insurance firms.

Only firms which provided complete data for the 7 year period were included in the research. This method led to the selection of 49 non-financial firms of UAE domestic firms. Data for the period from January 2005 to December 2011 was used on a monthly and quarterly basis. Therefore, the total number of companies yielding insufficient information is 31.

Table 1. Sample selection of firm

Emirates Securities Market firms	Number of firms include	Total number of firms
Total number of extracted firms from the market		133
Financial companies	-25	108
Insurance companies	-28	80
Total number of companies that yielded information	-31	49
Total number of firms qualified for final inclusion		49

Note: This table shows how the data is collected from Osiris program and the securities and commodities of UAE. Financial firms (banks and insurances) are excluded from the sample. From the remaining firms, only those with full data from January 2005 onward are included. The total number of firms that qualified for final inclusion is associated with the six-year study period (2005-2 011).

10.2 Data Analysis

This study uses Eviews program to analyse data collection. In addition, the method used to analyse the data and generate results may be summarised as follows:

a. A two-factor market model will be used to determine the exchange rate exposure for each firm in the sample. This is depicted in Equation (1) below.

b. The values for the residual exchange exposure in Equation (1) become the dependent variable for the multivariate regressions undertaken in the subsequent steps of the analysis.

c. Drawing on the literature to identify determinants of exchange exposure (independent variables in Equation (2)), the analysis proceeds to estimate a multivariate regression Equation (2) for a sample of domestic UAE firms.

d. The results of the regression analysis will provide an indication of the nature of foreign exchange exposure of domestic UAE firms.

This study will employ a regression model inferred from Jorion (1991). The analysis starts with a two-factor model: (1) the return on the market index is the first factor; and (2) the second factor is the exchange rate changes. To test the relationship between foreign exchange rate exposure for firms and the average of the appropriate financial variables for the period of study for each firm, this study employs the following regression model for ten economic factors postulated inferred from Aggarwal and Harper (2010), and the component of the exchange rate as the eleventh factor with some modification in this model. To measure foreign exchage exposure, this study draws on the two factor model, based on Jorion (1991), the exchange rate, and a market index as an independent variable.

$$R_{i,t} = a + \beta_i R_{m,t} + \gamma_i XR_{j,t} + \varepsilon_i \quad (1)$$

From the equation (1) where: α is the constant term; $R_{i,t}$ is the return of firm i, over time period t; $R_{m,t}$ is the return on the market index; $XR_{j,t}$ is the exchange rate change of currency or currency index that represent six currencies used in this study *j* over time period t; and γ measures the firm's residual foreign exchange exposure to the foreign exchange exposure of the market. This study investigated the impact of foreign exchange rates on a monthly basis. Due to the exposure of foreign exchange rate the impact comes from the competitive situation and is primarily indirect. The average monthly foreign exchange rate (Europe euro, Japanese yen, UK pound, Australian dollar, and Indian rupee currencies, as well as equally weighted exchange rate) will be used to determine its impact on the return for the full sample of firms. The measures of change in exchange rate coefficients will provide the relationship to the index through the effect of the exchange rate on stock return.

$$R_{i,t} = a + \beta_i R_{m,t} + \gamma_i GBP_{j,t} + \varepsilon_i \quad (2)$$

$$R_{i,t} = a + \beta_i R_{m,t} + \gamma_i EUR_{j,t} + \varepsilon_i \quad (3)$$

$$R_{i,t} = a + \beta_i R_{m,t} + \gamma_i JPY_{j,t} + \varepsilon \quad (4)$$

$$R_{i,t} = a + \beta_i R_{m,t} + \gamma_i AUD_{j,t} + \varepsilon_i \quad (5)$$

$$R_{i,t} = a + \beta_i R_{m,t} + \gamma_i IND_{j,t} + \varepsilon \quad (6)$$

$$R_{i,t} = a + \beta_i R_{m,t} + \gamma_i EQW_{j,t} + \varepsilon_i \quad (7)$$

The motivation in choosing this model is that the exchange rate risk in this model is the residual risk after the control of the market's own exchange rate exposure. In addition, this model is the most preferred approach by researchers to measure the exposure of foreign exchange (Bodnar & Wong 2003). Ordinary least squares are used for the equations (2 -7) to obtain the exposure of exchange rate coefficients for the study sample.

To test the relationship between foreign exchange rate exposure for firms and the financial and operational variables (the determinants of foreign exchange rate) that influence a firm's ability to reduce exposure, this study employs the following regression model drawn from Aggarwal and Harper (2010) with some modifications. This study added return on equity (ROE), price cost margins (PCM) and gross margin.

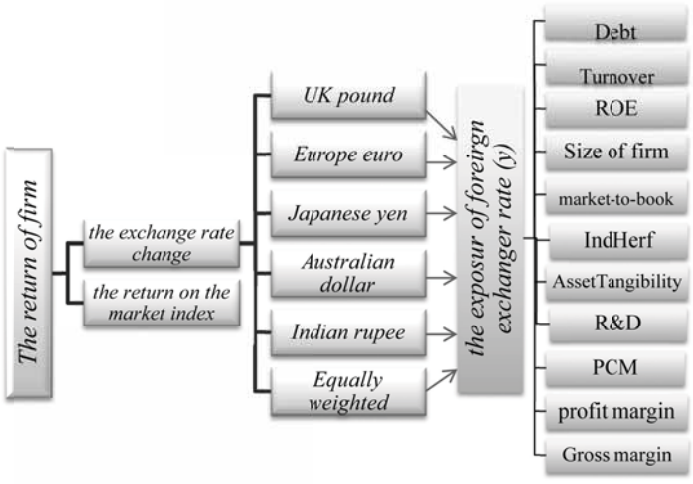

Figure 1. Conceptual model of Factors Affecting The return of firms

$$\left|\hat{\gamma}_i\right| = \alpha + \beta_1 \text{Debt} + \beta_2 \text{Turnover} + \beta_3 \text{ROE} + \beta_4 \text{Size} + \beta_5 \text{MkBk} + \beta_6 \text{IndHerf} + \beta_7 \text{AssetTangibility} + \beta_8 \text{R\&D} + \beta_9 \text{PCM} + \beta_{10} \text{profit margin} + \beta_{11} \text{Gross margin} \sum_{j=2}^{n} b_i \text{SIC}_j + \varepsilon \quad (8)$$

where Debt = the average debt ratio, **Turnover** = the average asset turnover, the **Turnover** represents the amount of sales generated for each currency's worth of assets. **Size** = the averaged log equity market value of the firm. This study has avoided the average gross profit margin, which has insignificant exposure and is not related to industry competitive structures in the study of Aggarwal and Harper (2010), and replaced it with (ROE). **ROE**= Return on Equity. The amount of net income is returned as a percentage of shareholder equity. This metric can be used to compare a company with its competitors and is also useful for comparing the profitability of a company to that of other firms in the same industry. **MkBk** = the average market-to-book ratio, a ratio used to find the value of a company by comparing the book value of a firm to its market value, and **AssetTangibility** = the average long-term assets to total assets ratio, and the long-term assets represent the value of a company's property, equipment, and other capital assets, such as stocks, bonds or other assets that an investor plans to hold for a long period of time. **IndHerf** = the average industry Herfindahl index, a factor that usually measures market concentration. It is calculated by squaring the market share of each firm competing in a market, which captures information about the number of firms in the industry and the distribution of their market shares. In addition, research and development (R&D) is a segment of any corporation (R&D/Sales). Determining the degree of **R&D** is important to determine the degree of competition. R&D is defined as discovery of new products or development of new products. Moreover, the R&D investments reduce the exposure of any firm to the foreign exchange rates. Therefore, R&D expenses enable a firm to avoid experiencing exchange rate variations. In addition, the insulation of a firm from both foreign and local competition depends on the firm's desire to invest in unique services and products.

Price cost margins **(PCM)** is an important indicator of the competitiveness of the market and the market power in any country because it determines the difference in the price and the marginal cost of the goods that are traded in the market. **Profit margin**, is the ratio of profitability calculated as net income divided by revenue, or net profits divided by sales. It measures how much out of every dollar of sales a company actually keeps in earnings. Profit margin is very useful when comparing companies in similar industries. A higher profit margin indicates a more profitable company that has better control over its costs compared to its competitors. **Gross margin** is a company's total sales revenue minus its cost of goods sold, divided by the total sales revenue, expressed as a percentage. The gross margin represents the percent of total sales revenue that the company retains after incurring the direct costs associated with producing the goods and services sold by a company. The higher the percentage, the more the company retains of each dollar of sales to service its other costs and obligations. The final factor is a dummy variable **(SICj),** which is usually evaluated by the financial analysts for almost all companies prevailing in the economic market. Nevertheless, the most critical aspect of exchange rates is that

firms operating in industries like petrochemicals and other manufacturing and production firms will experience considerable fluctuations and respective exchange service firms will be swayed much less by the global implications of the international economy.

Market share: Market share is the firm's sales divided by total industry sales,

$$s_i = \frac{y_i}{\sum_i y_i} \tag{9}$$

Where $y^i = p_i q_i$, is firm revenues.

Herfindahl: It is calculated on the sum of the squared market shares, which captures information about the number of firms in the industry and the distribution of their market shares.

$$H = \sum_i s_i^2 \tag{10}$$

Price cost margins (PCM) is an important indicator of the competitiveness of the market and the market power in any country because it determines the difference in the price and the marginal cost of the goods that are traded in the market.

Price-cost margin: The weighted (by market share) price-cost margin, or the gross profit margin, is

$$PCM = \sum_i s_i \frac{y_i - TVC_i}{y_i} \tag{11}$$

Where i indexes firms and $TVC^i = c_i q_i$ is total variable costs to the firm, which includes labour and intermediate costs.

Equation (8) is estimated for a sample of all firms. The goal of these cross-sectional regressions, using the full sample of domestic firms or the firms with statistically significant estimated exposures, is to determine what causes variations in foreign exchange exposure among firms. The estimated parameter (ε) indicates that some firms have positive exposure, whereas others exhibit negative exposure. To explain the determinants of the absolute size of the exposures, the regression model is estimated using the absolute value of (ε).

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Notes

Note 1. A free trade zone (FTZ) or export processing zone (EPZ) is an area of a country where some normal trade barriers such as tariffs and quotas are eliminated and bureaucratic requirements are lowered in hope of attracting new business and foreign investments. In addition, it is a region where a group of countries has agreed to reduce or eliminate trade barriers.

Note 2. MSCI (Morgan Stanley Capital International) is a leading provider of investment decision support tools to investors globally, including asset managers, banks, hedge funds and pension funds.

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Exchange Rates and Portfolio Rebalancing: Evidence from Emerging Economies

Sorin Rizeanu[1] & Hao Zhang[1]

[1] Peter B. Gustavson School of Business, University of Victoria, Victoria, BC, V8W 2Y2, Canada

Correspondence: Hao Zhang, Peter B. Gustavson School of Business, University of Victoria, Victoria, BC, V8W 2Y2, Canada. Tel: 1-250-853-3871. E-mail: hzhang@uvic.ca

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Abstract

This paper tests the portfolio rebalancing model of Hau and Rey (2006) based on a sample of 23 emerging economies for the period of 1994-2010. We find that the exchange rate returns in emerging economies are significantly and positively correlated with excess emerging stock market returns vis-à-vis the United States, indicating that portfolio rebalancing does not characterize the exchange rate movements for emerging economies. Our findings are strongly supported at daily and monthly frequencies, and are robust to cross-market correlations, different stock market capitalizations, alternative exchange rate systems, capital controls and financial crises.

Keywords: exchange rates, equity returns, portfolio rebalancing, emerging markets

1. Introduction

Recent exchange rate theories have advanced beyond the scope of traditional macroeconomic theory. In their seminal work, Hau and Rey (2006) suggest a dynamic relationship between exchange rates and stock market returns under incomplete foreign exchange risk trading. Focusing on short- and medium-run fluctuations, the authors show that exchange rates are significantly impacted by portfolio rebalancing following equity market innovations. In their model, investors hold equity risk and currency risk as a bundle. If a portfolio of domestic and international equity investments is optimally allocated, then a positive shock to foreign stock markets increases the risk of the portfolio. Investors sell part of their foreign portfolio holdings to reduce the exposure to currency risk, triggering order flows in the foreign exchange markets and driving down the exchange rate for the foreign currency. Therefore, portfolio rebalancing induces foreign currency depreciation following positive shocks in foreign equity markets, causing a negative correlation between exchange rates and stock market returns. This framework, based on the micro-foundation of foreign exchange markets, suggests that stronger equity markets should be associated with weaker currencies.

This paper extends Hau and Rey's (2006) analysis for a sample of 23 emerging market currencies across Asia, Latin America, Europe and Africa over the period 1994–2010. Our undertaking is motivated by notable dissimilarities between emerging and developed countries' currencies. First, emerging currencies constitute a substantial part of the currency trade, but hedging instruments in many of the emerging countries are limited and foreign purchases of stocks are often unhedged (Remsperger, 2007; Saxena & Villar, 2008). Therefore, portfolio rebalancing should be an essential tool for managing currency risk in emerging market investments. Second, emerging economies often depart from the declared currency regime and may prevent the free movement of exchange rates (Calvo & Reinhart, 2002; Edwards, 2007). Many emerging economies also impose capital controls to reduce pressure on their exchange rates (Edwards, 2007; Edwards & Rigonbon, 2009; Baba & Kokenyne, 2011; Magud *et al.*, 2011). Therefore, the correlation structure between exchange rates and stock market returns predicted by Hau and Rey (2006) may be distorted in emerging economies. Third, emerging market currencies are more exposed to financial contagion and crises, resulting from inflation, currency attacks, systemic or financial distresses, and sovereign debt defaults (Reinhart, 2010), raising the question of how these shocks impacts the correlation between exchange rates and equity market returns. Fourth, emerging economies are on a more accelerated tempo of capital market development and integration into the world economy, thus being an excellent laboratory to study whether these factors affect the correlation structure suggested by Hau and Rey (2006).

This study contributes to the understanding of the correlation structure between exchange rates and equity market returns, a central issue for international diversification and risk management (Campbell *et al*., 2010). We find that portfolio rebalancing does not characterize the exchange rate dynamics of emerging economies, as indicated by the positive and significant correlation between exchange rate returns and excess emerging stock market returns vis-à-vis the United States, at daily and monthly frequencies. Our results take into account cross-market correlations and are robust to emerging economies with different stock market capitalizations, alternative exchange rate systems, capital controls and financial crises.

This research is organized as follows: Section 2 reviews the literature on the correlation between exchange rates and stock market returns for emerging economies. Section 3 describes the methodology and data. Section 4 reports the results and Section 5 concludes the paper.

2. Literature Review

In the last decade, the share of emerging market currencies in global foreign exchange market turnover has increased to about 20% (Bank for International Settlements, 2010). Large investors, such as pension funds in the United States and other developed economies have made emerging markets the main beneficiaries of their international diversification (Note 1).

In contrast to developed countries, many emerging market currencies are subject to foreign exchange convertibility restrictions and capital controls imposed by local authorities. Emerging market currencies are often thinly traded and associated with high inflation and volatility. However, the offer for derivative products for risk management in emerging market currencies is limited. For example, traditional forward contracts are not available for many Latin American and Asian currencies, such as Brazil, Chile, China, Columbia, India, Indonesia, Korea, Malaysia, Peru and Taiwan. These currencies trade in non-deliverable forward markets, where 60–80% of the estimated trading volume relates to speculation (Lipscomb, 2005). Given the growing importance of capital flows to emerging economies and lack of alternative hedging instruments, portfolio rebalancing should be an essential tool for managing currency risk in emerging market investments. Hau and Rey (2006) find that portfolio rebalancing characterizes the exchange rate dynamics for 17 developed countries. Chaban (2009) finds that the portfolio rebalancing model does not hold for commodity currencies of Australia, Canada and New Zealand, suggesting that commodities prices, offsetting the fluctuations in exchange rates, may play a similar role to the terms of trade in risk sharing between commodity exporting and importing countries. Several issues arise when testing Hau and Rey (2006) model for emerging market currencies.

2.1 Currency Regimes and Capital Controls

Although portfolio rebalancing by international investors induces selling in the foreign exchange markets, substantial capital inflows generate upward pressure on emerging currencies. According to International Monetary Fund (IMF), the net capital flows, including portfolio flows and direct investments, account for about 3% of gross domestic product (GDP) for emerging economies, compared to about 2% of GDP for developed economies during 2002-2010 (IMF, 2011a, Figure 4.2). For the same period, the net portfolio equity flows to emerging economies account for about 1% of GDP, compared to about 0.5% of GDP for developed economies (IMF, 2011a, Figure 4.4). Substantial net equity inflows offset the exchange rate movements induced by portfolio rebalancing and may create positive correlations between exchange rates and stock market returns.

Capital controls and central bank interventions in the foreign exchange markets in 2000s aim to alleviate the upward pressure on emerging currencies by curbing speculative inflows (Edwards, 2007; Edwards & Rigobon, 2009; Ostry *et al*., 2010; IMF, 2011b). The effect of such actions on exchange rates remains an open question. While early studies suggest that capital controls and central bank interventions have short-term effects on exchange rates (Magud *et al*., 2011), recent research indicates that these actions are ineffective in changing the trend for emerging currencies (Binici *et al*., 2009; Rincon & Toro, 2010; Baba & Kokenyne, 2011; Concha & Galindo, 2011; Magud *et al*., 2011) (Note 2). Therefore, in contrast to developed economies, the correlation structure between exchange rates and excess emerging stock market returns is affected by several factors including the magnitude of net equity inflows to emerging economies, the impact of capital controls and central bank interventions on the foreign exchange markets, and the significance of portfolio rebalancing by international investors. A negative correlation indicates that portfolio rebalancing characterizes the exchange rate dynamics for emerging market currencies. A positive correlation suggests that other factors, such as substantial capital inflows, influence the exchange rates for emerging economies.

2.2 Financial Crises and Contagion

Emerging economies and their currencies are more prone to boom and bust cycles (e.g., 1994 Mexican Tequila crisis, 1997 Asian flu and 1998 Russian default). As pointed out by Longin and Solnik (2001), Ang and Bekaert (2002), and Forbes and Rigobon (2002), the correlation structures for the boom and bust periods may differ due to higher volatilities during bear markets. Specifically, when foreign capital pushes into emerging markets during a boom period, portfolio rebalancing based on currency risk may be important for international investors, inducing negative correlations between exchange rates and emerging stock markets returns. During crisis periods, investors pull out or freeze their foreign investments amid dramatic downturns in the currency or stock markets, inducing positive correlations between exchange rates and stock markets returns.

The correlation structure for emerging market currencies can also be affected by contagion, that is, crises in the foreign exchange or equity markets in one country can spread to other countries. Investors suffering losses in one country may sell assets in other countries, triggering forced equity portfolio rebalancing (Forbes, 2004, Kaminsky *et al*., 2004). Contagion effects are pronounced across countries within a region (Calvo & Reinhart, 1996; Froot et al., 2001, Bekaert *et al*., 2005b) and are related to such fundamental economic variables as interest rates, exchange rates, and equity market volatilities (Bae *et al*., 2003). Therefore, we expect cross-market correlations in our sample due to regional interdependence.

2.3 Financial Market Developments and Integration

Hau and Rey (2006) conjecture that the negative correlation structure should be more evident during periods of increasing equity market integration and for countries with higher degrees of capital market development. Since the mid-1990s, many emerging market countries have relaxed or removed restrictions on capital flows and opened their capital markets to international investors. The financial economics literature suggests that correlations between emerging and developed markets have increased in the last decades, and financial liberalization and integration reduce the cost of capital, spur growth, and offer significant diversification benefits to international investors (Bekaert & Harvey, 1995, 1997, 2000; Henry, 2000; Bekaert *et al*., 2005a; Carrieri *et al*., 2007). In the process of integrating into world financial markets, international investors in emerging markets gain better access to liquidity, information flow, and risk management tools. We expect that, for our sample of emerging markets, the correlation between exchange rates and stock markets returns should be increasingly significant over time following the path of financial integration, and the correlations should be more significant for countries with greater capital market development, as measured by the ratio of stock market capitalization to GDP.

2.4 Equity Flows and Exchange Rates

A number of studies on cross-border capital flows focus on contemporaneous correlations between equity flows and equity returns in developed and emerging markets (Tesar & Werner, 1994, 1995; Brennan & Cao, 1997). The evidence indicates that international investors engage in positive feedback trading in foreign equity markets, that is, buying subsequent to positive returns and selling subsequent to negative returns (Bohn & Tesar, 1996; Edelen & Warner, 2001; Froot *et al*.**,** 2001; Kim & Wei, 2002; Griffin *et al*., 2004, 2007; Richards, 2005; Froot & Ramadorai, 2008). Therefore, positive feedback trading may induce positive correlations between equity market returns and exchange rates.

Previous studies on equity flows and exchange rates in emerging markets focus on the period around currency crises. Bailey *et al*. (2000) document a significant relation between the depreciation of Mexican peso and the price decline of Latin American mutual funds and American Depositary Receipts during 1994 Mexican peso crisis. Choe *et al*. **(**1999) find strong evidence of positive feedback trading by foreign investors in Korean equity markets before the 1997 Asian currency crisis, and show that herding disappeared during the crisis. Swanson and Lin (2003) find positive feedback trading for seven emerging Asian countries around the Asian currency crisis. These findings suggest that financial crises may be an important factor when assessing the correlation between exchange rates and equity market returns for emerging economies.

Fewer studies, however, have examined the dynamics between equity flows and exchanges rates over longer periods. Brooks *et al.* (2004) find that higher portfolio flows to US stocks are associated with appreciation of the US dollar against the euro and Japanese yen. Siourounis (2004) reports that the net equity flows to the United States from Japan, Germany, Switzerland and the United Kingdom are associated with US dollar appreciation. Hau and Rey (2006) predict that higher equity flows are associated with stronger currencies and provide significant supporting evidence based on US equity flows to 17 developed economies. Our tests, covering a

16-year period, contribute to the literature on the relationship between US equity flows and exchange rates for emerging economies.

3. Methodology and Data

3.1 Methodology

We test the correlation between the exchange rate returns and the equity return differentials for emerging and US stock markets by focusing on Hau and Rey (2006) model:

$$-FXR_{i,t} = \alpha_i + \beta_i \ MSCI\_Excess_{i,t} + \varepsilon_{i,t} \quad (1)$$

where, $FXR_{i,t}$ is the exchange rate return calculated as the log difference of the spot exchange rates, which are in foreign currency units per US dollar. Following Hau and Rey (2006), we multiply $FXR_{i,t}$ by -1 when calculating the correlations and performing regression analyses. $MSCI\_Excess_{i,t}$ is the difference between the emerging market and US market MSCI returns, measured in the respective local currencies, i refers to the emerging economies in our sample, α_i is the intercept, β_i is the estimated coefficient, and $\varepsilon_{i,t}$ is the error term. A negative β_i indicates that a stronger emerging stock market is associated with depreciation of the emerging currency, as predicted by Hau and Rey (2006). A positive β_i indicates that a stronger emerging stock market is associated with appreciation of the emerging currency. It is well known that stock market returns and changes in exchange rates are stationary variables and OLS regressions can be applied to Equation 1. We perform this regression for each country in our sample and compute Newey-West (1987) standard errors to account for heteroskedasticity and autocorrelation. We correct for the correlations of the error terms across countries using seemingly unrelated regression (SUR) system to ensure that cross-market correlations do not affect our results.

3.2 Data

Our sample includes 21 countries in the MSCI Emerging Markets Index: Brazil, Chile, China, Colombia, the Czech Republic, Egypt, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Morocco, Peru, the Philippines, Poland, Russia, South Africa, Taiwan, Thailand, and Turkey. To this initial sample, we add Hong Kong and Singapore. These newly industrialized countries play an important role in the regional economy (Frankel & Poonawala, 2010). The final sample consists of 23 countries from a variety of geographical locations (Asia, Latin America, emerging Europe and Africa) and at different stages of financial market development. Our sample covers a variety of exchange rate systems, including independent floating (Brazil, Chile, Mexico, the Philippines, Poland, South Africa, South Korea and Turkey), managed floating (Columbia, the Czech Republic, Hungary, India, Indonesia, Malaysia, Peru, Russia, Singapore, Taiwan and Thailand) and pegged system (China, Egypt, Hong Kong and Morocco) (Note 3).

Spot exchange rates and the MSCI series are obtained from Datastream for the period January 1994 to November 2010. The spot exchange rates are WM/Reuters closing middle rates quoted against the US dollar. The MSCI series are in US dollars for the United States and in local currencies for the 23 countries studied.

Crisis data are obtained from Reinhart (2010). The crises index is the sum of seven dummy variables that take the value of one if in a given year the country confronts a currency crisis, inflation crisis, stock market crash, domestic sovereign debt, external sovereign debt crisis, or banking crisis, and zero otherwise. Table 1 reports the average of the yearly crisis index over the period 1994–2010.

Capital flow data (TIC) are obtained from the Board of Governors Federal Reserve System and are available on a monthly basis. Using these data, we calculate the net increase in foreign stock ownership by US residents, defined as net US purchases of foreign equities minus net foreign purchases of US equities. Following Hau and Rey (2006), we normalize net foreign stock ownership as the proportion of the average absolute level of increase in net foreign ownership by US residents over the previous 12 months.

Table 1 provides a summary of the data. The average daily foreign exchange returns vary between -0.0010 and 0.0010, with the lowest in the Czech Republic and Singapore and the highest in Turkey. The MSCI daily excess emerging stock markets returns, relative to the United States, vary between -0.0030 and 0.0024, with the lowest average values in China and the highest values in Brazil. Stock market capitalization to GDP, obtained from the World Bank, varies from 0.0090 for South Korea to 3.1530 for Hong Kong. The average yearly crisis index, varying between 1.76 and 0.18, has the highest value for Turkey and the lowest value for Taiwan.

Table 1. Summary statistics

Country	Dates	Currency regime	*FXR* Mean	*FXR* SD	*MSCI Excess* Mean	*MSCI Excess* SD	MCap/ GDP	Crisis
Brazil	Jul-94	Independent	0.0001	0.0099	0.0024	0.0234	0.328	1.18
Chile	Dec-93	Independent	0.0000	0.0058	0.0003	0.0127	0.947	0.35
China	Dec-93	Peg	0.0000	0.0062	-0.0003	0.0223	0.270	0.88
Colombia	Dec-93	Managed	0.0002	0.0062	0.0005	0.0167	0.160	1.12
Czech	Dec-94	Managed	-0.0001	0.0075	0.0001	0.0175	0.213	n/a
Egypt	Dec-94	Peg	0.0001	0.0036	0.0004	0.0202	0.256	0.24
Hong Kong	Dec-93	Currency Board	0.0000	0.0003	0.0001	0.0183	3.153	n/a
Hungary	Dec-93	Target Zone	0.0001	0.0078	0.0004	0.0203	0.182	0.88
India	Dec-93	Managed	0.0001	0.0033	0.0002	0.0190	0.342	0.71
Indonesia	Dec-93	Managed	0.0003	0.0156	0.0001	0.0219	0.239	1.59
Malaysia	Dec-93	Managed	0.0000	0.0080	0.0000	0.0185	1.822	0.65
Mexico	Dec-93	Independent	0.0003	0.0098	0.0005	0.0130	0.279	1.18
Morocco	Dec-94	Peg	0.0000	0.0049	0.0001	0.0146	0.279	0.24
Peru	Dec-93	Managed	0.0001	0.0030	0.0005	0.0180	0.218	0.65
Philippines	Dec-93	Independent	0.0001	0.0060	0.0001	0.0190	0.556	0.88
Poland	Jan-95	Independent	0.0000	0.0078	0.0004	0.0219	0.117	0.88
Russia	Mar-96	Managed	0.0005	0.0186	0.0003	0.0312	0.215	1.76
Singapore	Dec-93	Managed	-0.0001	0.0036	-0.0001	0.0157	1.562	0.47
South Africa	Dec-93	Independent	0.0002	0.0096	0.0002	0.0152	1.528	0.53
Korea	Dec-93	Independent	0.0001	0.0094	0.0000	0.0217	0.009	0.76
Taiwan	Dec-93	Managed	0.0000	0.0028	-0.0001	0.0201	1.015	0.18
Thailand	Dec-93	Managed	0.0000	0.0060	-0.0001	0.0213	0.556	0.82
Turkey	Dec-93	Independent	0.0010	0.0140	0.0012	0.0282	0.260	1.76

Notes: Dates indicate the starting date for the data in our sample. Currency regime is the exchange rate system, based on Bekaert and Hodrick (2009). Independent refers to independent floating. Managed refers to managed floating. *FXR* is the daily exchange rate return calculated as the log difference of the spot exchange rates, which are in foreign currency units per U.S. dollar. *MSCI_Excess* is the excess emerging stock market return calculated as the difference between the emerging market and US market MSCI returns. MCap/GDP is the ratio of the country's stock market capitalization to GDP. Crisis is the average index of the country's crisis index, based on Reinhart (2010). Crisis data for the Czech Republic and Hong Kong are unavailable.

4. Empirical Findings

4.1 Correlations between Exchange Rates and Excess Equity Market Returns in Emerging Economies

Table 2 presents the daily and monthly correlations of exchange rate returns and excess emerging stock market returns. Of the 23 countries analyzed, the daily correlation is positive for 20 countries, with 16 countries significant at 1% level and Czech Republic and Morocco significant at 5% and 10% levels, respectively. Chile, China and Egypt have negative daily correlations, which is significant for Egypt at 10% level. For monthly data, we find that 15 countries show positive correlations, and 11 countries have positive and significant correlations. Notably, none of the countries in our sample has a significantly negative correlation as predicted by Hau and Rey (2006). These findings are supported at regional levels with significant and positive daily correlations for eight countries in Asia, four countries in Latin America and seven countries in emerging Europe and Africa. Based on the results for the total sample, we find strong statistical evidence that the portfolio rebalancing model does not hold for emerging economies.

Table 2. Correlations of Exchange Rate Returns and Excess Emerging Stock Market Returns

	All Sample		1994–2002		2003–2010	
Country	Daily	Monthly	Daily	Monthly	Daily	Monthly
Higher market capitalization						
Brazil	0.1040***	-0.0076	0.0193	-0.0880	0.2248***	0.1011
Chile	-0.0233	-0.0795	-0.0136	0.1133	-0.0966***	-0.1980
Hong Kong	0.0101	0.0469	-0.0152	0.2060**	0.0381	0.0480
India	0.1473***	0.2481***	0.0235	0.1797*	0.2418***	0.2327**
Malaysia	0.1060***	0.1479**	0.1159***	0.1885*	0.0532**	-0.3291***
Mexico	0.0605***	0.1550**	0.0531**	0.2209**	0.0586**	-0.1234
Philippines	0.1158***	0.2008***	0.1089***	0.2559***	0.1426***	-0.1340
Singapore	0.1016***	0.1802***	0.1305***	0.2804***	0.0418*	-0.1230
South Africa	0.0137	-0.0829	-0.0079	0.1508	-0.0514**	-0.2451**
Taiwan	0.1864***	0.1914***	0.1885***	0.2150**	0.1790***	0.0879
Thailand	0.1448***	0.0295	0.1678***	-0.037	0.0942***	0.2110**
Lower market capitalization						
China	-0.0181	0.1355*	-0.0277	0.1467	0.0858***	0.1594
Colombia	0.0505***	-0.0024	0.0119	-0.0558	0.0713***	-0.0748
Czech	0.0360**	-0.0040	0.0183	0.0734	-0.0270	-0.2139*
Egypt	-0.0265*	-0.1195	0.0336	-0.1139	-0.0490**	-0.1754
Hungary	0.1181***	0.0617	0.0043	-0.0496	0.1562***	0.0691
Indonesia	0.1859***	-0.0144	0.1885***	-0.0818	0.3087***	0.2783**
Morocco	0.0294*	-0.1173	0.1243***	0.1470	-0.0868***	-0.3175
Peru	0.0473***	0.1797***	0.0273	0.2311**	0.0750***	0.1674
Poland	0.1179***	0.1315*	0.0668***	0.2068**	0.1543***	0.0473
Russia	0.1696***	0.4676***	0.1775***	0.5004***	0.2274***	0.2692**
South Korea	0.2466***	0.1062	0.2312***	0.1998**	0.2234***	-0.1739
Turkey	0.1237***	0.1581**	0.0538***	0.1510	0.4141***	0.3525***

Notes: This table reports the Pearson correlations of exchange rate returns on excess emerging stock market returns relative to the U.S. stock market returns. The subsample 2003-2010 excludes the data for 2008. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

4.2 Financial Market Development and Integration

To investigate whether the correlations change over time, we divide the sample into two sub-periods, 1994-2002 and 2003-2010. The period 1994–2002 marks the beginning of market openness for emerging economies. This period experiences a large number of financial crises, leading to credit freezes, stock market reforms and capital controls (Bekaert & Harvey, 2003). The period 2003–2010, from which we exclude 2008, is characterized by financial market openness and integration with the financial systems around the world functioning smoothly, except for 2008. Moreover, technological progress leads the integration, allowing better access to emerging stock markets and currency trading. Table 2 reports the results. At the daily level, 12 countries show significant correlations for 1994-2002, while 21 countries exhibit significant correlations for 2003-2010. We note that nine countries, including Brazil, Chile, China, Colombia, Egypt, Hungary, India, Peru and South Africa, have insignificant daily correlations during 1994-2002 and highly significant correlations during 2003-2010 when the degree of financial market integration is higher. The monthly correlations reveal fewer significant changes for the two sub-periods, with 11 countries showing significant correlations during 1994-2002 and eight countries showing significant correlations during 2003-2010. Analyzing separately the countries with higher (lower) market capitalizations indicates that the number of countries with significant correlations is similar for the two subsamples. Across geographical regions, ten countries have shown insignificant daily correlations for 1994-2002 and significant correlations for 2003-2010, including two countries in Asia (China and India), four countries in Latin America (Brazil, Chile, Colombia and Peru), and four countries in emerging Europe and Africa (the Czech Republic, Egypt, Hungary and South Africa). Overall, the results are consistent with Hau and Rey (2006) indicating that financial market development and integration affect the correlation between exchange rates and equity market returns.

4.3 Currency Regimes, Capital Controls and Financial Crises

Table 3 reports the country regressions of exchange rate returns on excess emerging stock market returns, tabulated by alternative exchange rate systems. The results show that, for countries with a pegged exchange rate system, including China, Egypt, Hong Kong and Morocco, the estimated coefficients are insignificant supporting the prediction of Hau and Rey (2006) that the portfolio rebalancing model may not hold for pegged exchange rate systems. For countries with declared independent floating and managed floating systems, the estimated coefficients are positive and significant for 16 of the 18 countries based on daily data, and positive and significant for eight countries (13 countries positive) based on monthly data. These results do not support the portfolio rebalancing model of Hau and Rey (2006). None of the countries in our sample exhibits a significantly negative coefficient. Among the countries with a declared independent floating system, Chile is the only country with a negative coefficient.

Several countries in our sample impose controls on foreign capital inflows and outflows during various periods of this study, including Brazil, Chile, China, Colombia, the Czech Republic, India, Indonesia, Korea, Malaysia, Peru and Thailand (Note 4). Controls on capital outflows in Malaysia, Thailand and South Africa have been gradually relaxed in our sample period. Across geographical regions, many Asian countries impose strict rules for capital controls while Latin American countries introduce capital controls periodically during our sample period. Table 3 indicates that the estimated coefficients for countries with capital controls are predominantly positive and significant based on daily data, except for Chile and China. Based on monthly data, the estimated coefficients are generally insignificant for countries with capital controls. Overall, these results are consistent with the literature that controlling capital flows are less successful in easing the upward pressure on exchange rates (Baba & Kokenyne, 2011, Magud *et al*., 2011), indicating that capital controls have a limited impact on the correlation between the exchange rate returns and excess emerging stock market returns regardless of geographical locations.

To test whether financial crises affect the correlation between exchange rate returns and excess emerging stock market returns, we obtain a subsample of daily observations from which we eliminate all the years when a country confronted with a crisis. Crisis data for the Czech Republic and Hong Kong are unavailable. The last two columns of Table 3 report the results. We find that 19 of the 21 countries analyzed show positive relationship between exchange rate returns and excess emerging stock market returns, and 17 countries with significantly positive regression coefficients. The results are similar across regions of Asia, Latin America, emerging Europe and Africa.

Overall, Tables 3 confirms the evidence reported in Table 2 that the portfolio rebalancing model does not hold for our sample of emerging economies. Our results are robust to alternative exchange rate systems, capital controls, and financial crises.

Table 3. Regressions of Exchange Rate Returns on Excess Emerging Stock Market Returns

Independent Floating						
	Daily	(t-stat) N	Monthly	(t-stat) N	Non-Crisis	(t-stat) N
Brazil	0.0582**	(2.35) 4265	-0.0059	(-0.05) 196	0.1634***	(8.74) 1785
Chile	-0.0108	(-0.93) 4394	-0.0424	(-0.91) 202	-0.0358***	(-3.57) 3088
Mexico	0.0457*	(1.71) 4394	0.1145	(1.53) 202	0.0262*	(1.67) 2046
Philippines	0.0356***	(3.54) 4394	0.0710***	(2.65) 202	0.0256***	(4.96) 2047
Poland	0.0472***	(5.48) 4132	0.0625*	(1.73) 189	0.0893***	(5.04) 1785
South Africa	0.0085	(0.54) 4394	-0.0685	(-0.92) 202	0.0085	(0.54) 4394
South Korea	0.1038***	(7.02) 4394	0.0588	(1.00) 202	0.0731***	(7.24) 2045
Turkey	0.0615***	(3.66) 4394	0.0729**	(2.18) 202	0.1596***	(10.68) 1524
Managed Floating						
	Daily	(t-stat) N	Monthly	(t-stat) N	Non-Crisis	(t-stat) N
Colombia	0.0185**	(2.49) 4394	-0.0009	(-0.03) 202	0.0241**	(2.45) 1785
Czech	0.0154	(1.40) 4134	-0.0021	(-0.05) 190	n/a	n/a
Hungary	0.0462***	(5.09) 4134	0.0288	(0.72) 190	0.0217**	(2.34) 1565
India	0.0251***	(6.78) 4394	0.0570***	(3.33) 202	0.0363***	(5.63) 2307
Indonesia	0.1251***	(4.83) 4394	-0.0118	(-0.09) 202	0.0900***	(8.07) 1525
Malaysia	0.0435***	(3.67) 4394	0.0675	(1.49) 202	0.0083	(1.48) 2308
Peru	0.0081**	(2.20) 4394	0.0310**	(2.03) 202	0.0059*	(1.72) 2046
Russia	0.1004***	(2.59) 3826	0.1911*	(1.78) 175	0.0218***	(5.96) 1785
Singapore	0.0218***	(4.25) 4394	0.0584**	(2.29) 202	0.0119**	(2.29) 2566
Taiwan	0.0268***	(7.69) 4394	0.0441**	(2.31) 202	0.0268***	(7.69) 4394
Thailand	0.0395***	(3.53) 4394	0.0094	(0.22) 202	0.0222***	(5.30) 2308
Pegged system						
	Daily	(t-stat) N	Monthly	(t-stat) N	Non-Crisis	(t-stat) N
China	-0.0049	(0.86) 4394	0.0435	(1.03) 202	0.0017***	(2.82) 1262
Egypt	-0.0047	(-0.79) 4134	-0.0220	(-0.63) 190	-0.0047	(-0.79) 4134
Hong Kong	0.0001	(0.47) 4394	0.0009	(0.90) 202	n/a	n/a
Morocco	0.0098	(1.43) 4134	-0.0403	(-1.45) 190	0.0098	(1.43) 4134

Notes: This table reports the regression coefficients for exchange rate returns on excess emerging stock market returns relative to US stock market returns. The data are for daily and monthly frequency. The subsample Non-Crisis contains daily observations excluding all the years when a country confronted with a crisis, based on Reinhart (2010). Crisis data for the Czech Republic and Hong Kong are unavailable. The exchange rate system is based on Bekaert and Hodrick (2009). The t-statistics are in parentheses. N is the number of observations. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

4.4 Cross-market Correlations

To test whether cross-market correlations affect our results, we re-estimate Equation 1 using the SUR system. The data starts from March 1996, the starting date for Russia in our sample. The number of observations is 3090 at daily frequency for each country in the regression system. Our SUR system consists of 32 countries including 23 emerging economies and nine developed economies of Australia, Canada, Denmark, the euro zone, Japan, Norway, Sweden, Switzerland, and the United Kingdom (Note 5). The explanatory variable is the excess foreign stock market return, calculated for each country, as the difference between the foreign market and US market MSCI returns. The SUR estimators gain efficiency by jointly estimating 32 equations in the system and correcting for the correlations of the error terms across 32 countries. Table 5 reports the results. The estimated coefficients for the Euro zone, Japan, Switzerland and UK are negative and significant at 1% level, confirming that the portfolio rebalancing model holds for developed economies (Hau & Rey, 2006). The estimated coefficients for Australia and Canada are positive and significant at 1% level, confirming that the portfolio rebalancing model does not hold for commodity currencies (Chaban, 2009). The estimated coefficients are positive and significant for 18 of the 23 emerging economies, with 15 countries significant at 1% level and two countries significant at 5% and 10% levels, respectively. Chile and Egypt show negative coefficients with 10% level of significance. Across geographical regions, the estimated coefficients are positive for nine emerging economies in Asia, four in Latin America and five in emerging Europe. Overall, Table 4 confirms that the portfolio rebalancing model does not hold for our sample of emerging economies.

Table 4. SUR of Exchange Rate Returns on Excess Foreign Stock Market Returns

Developed Countries	Coefficient	SE	z	P >|z|	χ^2	Adj.R^2
Australia	0.1075***	0.009861	10.91	0	119.01***	0.0688
Canada	0.0247***	0.006480	3.82	0	14.58***	0.0199
Denmark	0.0027***	0.000917	3.01	0.003	9.06***	0.0005
Euro	-0.0103***	0.000796	-13.00	0	168.97***	0.0007
Japan	-0.0328***	0.007113	-4.61	0	21.27***	0.0143
Norway	0.0525***	0.004406	11.93	0	142.33***	0.0455
Sweden	0.0574***	0.003721	15.45	0	238.55***	0.0346
Switzerland	-0.0778***	0.004021	-19.36	0	374.86***	0.0374
UK	-0.0187***	0.005970	-3.15	0.002	9.91***	-0.0077
EM—Asia	Coefficient	SE	z	P >|z|	χ^2	Adj.R^2
China	0.0003	0.000540	0.59	0.556	0.35	0.0005
Hong Kong	-0.0001	0.000286	-0.13	0.895	0.02	-0.0001
India	0.0282***	0.002417	11.7	0	136.93***	0.0373
Indonesia	0.0816***	0.006372	12.82	0	164.28***	0.0507
Malaysia	0.0175***	0.004470	3.92	0	15.34***	-0.0004
Philippines	0.0383***	0.003607	10.63	0	112.94***	0.0182
Singapore	0.0043**	0.002228	1.97	0.049	3.88**	0.0024
South Korea	0.0702***	0.004758	14.77	0	218.21***	0.0566
Taiwan	0.0226***	0.001958	11.57	0	133.79***	0.0345
Thailand	0.0160***	0.003132	5.14	0	26.39***	0.0118
EM—Latin America	Coefficient	SE	z	P >|z|	χ^2	Adj.R^2
Brazil	0.0162	0.011149	1.46	0.145	2.13	0.0049
Chile	-0.0133*	0.007718	-1.73	0.084	2.99*	0.0012
Colombia	0.0279***	0.006154	4.54	0	20.6***	0.0032
Mexico	0.0125**	0.007350	1.71	0.087	2.93*	0.0037
Peru	0.0018	0.002784	0.68	0.498	0.46	0.0011
EM—EMEA	Coefficient	SE	z	P >|z|	χ^2	Adj.R^2
Czech	-0.0057	0.003563	-1.61	0.107	2.59	-0.0012
Egypt	-0.0064*	0.003348	-1.94	0.053	3.75*	0.001
Hungary	0.0189***	0.004071	4.66	0	21.74***	0.0106
Morocco	0.0031*	0.001778	1.77	0.077	3.13*	0.0002
Poland	0.0199***	0.004860	4.11	0	16.90***	0.0087
Russia	0.0221***	0.003089	7.18	0	51.59***	0.0298
South Africa	-0.0430***	0.009512	-4.53	0	20.48***	-0.0025
Turkey	0.0573***	0.008279	6.92	0	47.91***	0.0253

Notes: This table reports the results for the seemingly unrelated regression (SUR) systems of daily exchange rate returns on daily excess foreign stock market returns relative to US stock market returns. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

4.5 Equity Flows and Exchange Rates

Table 5 reports the correlations of monthly exchange rate returns and net increase in foreign stock ownership by US residents (or net foreign equity inflows). The net foreign equity inflows are calculated as net US purchases of foreign equities minus net purchases of US equities by foreigners, normalized as a proportion of the average absolute level of increase in net foreign stock ownership by US residents over the previous 12 months. For the overall sample, eight countries have negative correlations and 15 countries have positive correlations, suggesting that higher equity flows are associated with stronger currencies. The sub-period results indicate that 13 countries have positive correlations for 1994-2002 and 18 countries have positive correlations for 2003-2010. Overall, the evidence supports the prediction of Hau and Rey (2006) that equity flows are positively correlated with exchange rates and is consistent with the literature on capital flows to emerging economies.

Table 5. Correlations of Exchange Rate Returns and Net Foreign Equity Inflows

Country	All Sample	1994–2002	2003–2010
Brazil	0.0683	0.0436	0.1240
Chile	0.0356	-0.0963	0.1050
China	-0.0143	-0.0061	-0.1362
Colombia	0.0096	-0.0283	0.0791
Czech	-0.1062	-0.1942	0.0668
Egypt	0.0025	-0.0054	0.0056
Hong Kong	0.0931	0.0275	0.1396
Hungary	0.0156	0.0228	0.0443
India	0.0924	0.0895	0.2048
Indonesia	-0.0099	-0.0254	0.0853
Malaysia	0.0703	0.0657	0.1098
Mexico	-0.0605	-0.0193	-0.1277
Morocco	-0.0584	-0.0600	-0.0708
Peru	-0.0551	0.0012	-0.2881
Philippines	0.0489	0.0369	0.0777
Poland	0.0066	0.0141	0.0034
Russia	-0.0032	0.0181	-0.0470
Singapore	-0.0367	-0.1464	0.1474
South Africa	0.1082	0.0545	0.2078
South Korea	0.0579	0.0356	0.1798
Taiwan	0.0558	0.0507	0.0702
Thailand	0.1014	0.1030	0.0978
Turkey	0.0180	-0.0288	0.1187

Notes: This table reports the Pearson correlations of monthly exchange rate returns and net US purchases of foreign equities minus net purchases of US equities by foreigners, normalized as a proportion of the average absolute level of increase in net foreign stock ownership by US residents over the previous 12 months.

5. Conclusion

This paper tests the portfolio rebalancing model of Hau and Rey (2006) for a sample of 23 emerging economies at different stages of capital market development and from diverse geographical regions. We find significant and positive correlations between the exchange rate returns and excess emerging stock market returns relative to the United States, indicating that positive shocks in emerging equity markets are associated with appreciation of the emerging market currencies. This result suggests that the portfolio-rebalancing perspective of foreign exchange markets does not hold for our sample of emerging economies. Our findings take into account cross-market correlations and are robust to emerging economies with different stock market capitalizations, alternative exchange rate systems, capital controls and financial crises. We also find that, consistent with previous research, higher equity flows are associated with stronger currencies for our sample of emerging economies.

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Notes

Note 1. For instance, in the period 2006–2007, the California Public Employees' Retirement System had about 90% of the increased exposure to foreign securities in emerging market currencies.

Note 2. See Edwards (2007) & Magud *et al*. (2011) for extensive reviews of capital controls and exchange rates in emerging economies.

Note 3. See Bekaert & Hodrick (2009) for exchange rate systems in our sample of emerging economies. We include Hungary in the sample of managed floating currencies as the Hungarian forint maintains a target zone to the euro but remains floating against the US dollar for our sample period.

Note 4. See, e.g., Magud *et al.* (2011) and IMF (2011b) for surveys on various measures of capital controls imposed in these countries.

Note 5. The euro zone is treated as one country.

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How Did the Financial Crisis Affect the Forecasting Performance of Time Series Exchange Rate Models? Evidence from Euro Rates

Dimitris G. Kirikos[1,2]

[1] Technological Educational Institute of Crete, Greece

[2] Hellenic Open University, Greece

Correspondence: Dimitris G. Kirikos, Department of Accounting, School of Management and Economics, TEI Crete, P.O. Box 1939, 71004 Heraklion, Crete, Greece. Tel: 30-281-037-9661. E-mail: kirikosd@staff.teicrete.gr

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Abstract

This paper uses monthly data on euro exchange rates vis-à-vis major currencies, covering the period 1999-2012, to compare the forecasting ability of alternative stochastic exchange rate representations. In particular, we test the out-of-sample forecasting performance of a random walk, a non-linear Markov switching regimes process, and a vector autoregressive representation reflecting the dynamics of linear structural exchange rate models. These statistical models are evaluated in terms of the root mean square error of one-month to twelve-month out-of-sample forecasts. The empirical evidence points to the random walk puzzle, that is, the superiority of the naïve model in forecasting exchange rates before the crisis of 2008. However, this outcome is consistently reversed following the 2008 financial turmoil and the naïve model seems to regain some of its forecasting power only after 2011. These results suggest that different stochastic representations are appropriate for the exchange rate depending on the presence of financial calmness or turbulence.

Keywords: Forecasting, random walk, linear models, switching regimes

JEL classification: F31, F37

1. Introduction

The superiority of a naïve random walk model in out-of-sample exchange rate prediction, relative to structural approaches based on fundamentals, has long been documented (Meese and Rogoff, 1983). Recent evidence has also reproduced the random walk property of exchange rates (see Chortareas *et al*., 2011), and the whole research project has converged to a rather widespread belief holding that exchange rate random walk forecasts are extremely difficult to beat.

However, Engel and Hamilton (1990) presented evidence that refuted the result of Meese and Rogoff (1983) on the superiority of the random walk over other atheoretical time series representations. In particular, Engel and Hamilton (1990) reported that a Markov switching regimes model appears to beat in-sample and out-of-sample exchange rate forecasts of a random walk. Also, Kirikos (2000), based on an extended data set, verified the in-sample superiority of a random walk but he also reported evidence on the out-of-sample superiority of the Markov switching regimes process as the forecast window converged to the end of the full sample. More recently, Nikolsko-Rzhevskyy and Prodan (2012) found that the model of Engel and Hamilton (1990) outperforms the random walk in both short-run and long-run forecasting accuracy for US dollar exchange rates over the post-1973 floating period.

In this paper, we reconsider the forecasting ability of a random walk against that of a Markov stochastic segmented trends process and of a vector autoregression (VAR), using a data set on euro rates. Specifically, the forecasting performance of the three models is evaluated on the basis of the root mean square error (RMSE) of forecasts estimated on monthly data on the currencies of the USA, the UK, Japan, Norway, Sweden, Switzerland, Australia, and Canada relative to the euro (€) over the period 1999 - 2012. The empirical evidence points to the random walk puzzle, that is, the superiority of the naïve model in forecasting exchange rates before the crisis of 2008. However, it turns out that structural approaches and representations that allow for policy shifts provide a better setting for predicting euro rates after the outbreak of the financial crisis.

The methodological approach is outlined in section 2 and the empirical results are reported in Section 3. The

final section contains a discussion and conclusions.

2. Methodological Approach (Note 1)

Assume that e_t (t = 1, 2, …, T) denotes the logarithm of the exchange rate and s_t the first difference of e_t ($s_t = e_t - e_{t-1}$). If e_t follows a random walk with a drift, the k-period-ahead forecast of e_{t+k}, based on information at time t, is:

$$\hat{e}_{t+k|t} = e_t + k \cdot \bar{s} \quad (1)$$

where $\bar{s} = \frac{1}{n-1}\sum_{t=1}^{n-1} s_t$, and n is any sub-sample ($n \leq T$) used for out-of-sample forecasting.

Alternatively, the drift parameter may be allowed to vary as follows:

$$s_t = \mu_{h_t} + u_t, \qquad u_t \sim N(0, \sigma^2_{h_t}) \quad (2)$$

Where h_t is an unobserved state variable taking the values {1, 2}, and u is an error term. State 1 can be thought of as the exchange rate depreciation state while state 2 can be regarded as the revaluation state. Obviously, equation (2) allows for different means and variances across states and the variable h_t will be assumed to follow a Markov chain with stationary transition probability matrix:

$$P = \begin{bmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{bmatrix} \quad (3)$$

where $p_{ij} = Pr(h_t = j | h_{t-1} = i)$, i, j = 1, 2. Under these circumstances, the forecast of s_{t+k}, on the basis of information available at time t, is (Hamilton, 1993; Kirikos, 1996):

$$\hat{s}_{t+k|t} = E(s_{t+k} \mid S_t) = \alpha_t' \cdot P^k \cdot \mu_h \quad (4)$$

where S_t is the history of s up to time t, $\alpha_t' = [Pr(h_t=1|S_t)\ Pr(h_t=2|S_t)]$ is the vector of state probabilities at date t (Hamilton, 1990, 1993), and $\mu_h' = [\mu_1\ \mu_2]$ is the vector of state means. The probabilities α_t' are based on a nonlinear filter and, therefore, forecasts given by (4) are nonlinear.

Estimates of the parameters (μ_1, μ_2, σ_1^2, σ_2^2, p_{11}, p_{22}) are based on the maximization of the sample likelihood function through the EM algorithm (see Hamilton, 1990).

Using (4), we obtain forecasts of the logarithm of the exchange rate by the following equation:

$$\hat{e}_{t+k|t} = e_t + \hat{s}_{t+1|t} + \hat{s}_{t+2|t} + \ldots + \hat{s}_{t+k|t} \quad (5)$$

Next, we look at a class of linear forecasts along the lines of structural asset market models of the exchange rate. In particular, we consider vector autoregressive (VAR) representations for exchange rates and observed fundamentals as proposed by Engel and West (2004, 2005), that is, VARs in the exchange rate and the variables $y_t - y_t^*$, $m_t - m_t^*$, $p_t - p_t^*$, $r_t - r_t^*$, where y_t is the logarithm of domestic GDP, m_t is the logarithm of the domestic money supply, p_t is the logarithm of the domestic price level, r_t is the domestic interest rate and starred variables are the foreign counterparts. More specifically, it is assumed that the vector series $\boldsymbol{x_t} = [s_t\ \Delta(y-y^*)_t\ \Delta(m-m^*)_t\ \Delta(r-r^*)_t\ \Delta(p-p^*)_t]'$ has the following VAR representation:

$$\begin{bmatrix} s_t \\ \Delta(y-y^*)_t \\ \Delta(m-m^*)_t \\ \Delta(r-r^*)_t \\ \Delta(p-p^*)_t \end{bmatrix} = \begin{bmatrix} \pi_1(L) & \pi_2(L) & \pi_3(L) & \pi_4(L) & \pi_5(L) \\ \rho_1(L) & \rho_2(L) & \rho_3(L) & \rho_4(L) & \rho_5(L) \\ \varphi_1(L) & \varphi_2(L) & \varphi_3(L) & \varphi_4(L) & \varphi_5(L) \\ \psi_1(L) & \psi_2(L) & \psi_3(L) & \psi_4(L) & \psi_5(L) \\ \omega_1(L) & \omega_2(L) & \omega_3(L) & \omega_4(L) & \omega_5(L) \end{bmatrix} \cdot \begin{bmatrix} s_{t-1} \\ \Delta(y-y^*)_{t-1} \\ \Delta(m-m^*)_{t-1} \\ \Delta(r-r^*)_{t-1} \\ \Delta(p-p^*)_{t-1} \end{bmatrix} + \begin{bmatrix} u_{1t} \\ u_{2t} \\ u_{3t} \\ u_{4t} \\ u_{5t} \end{bmatrix} \quad (6)$$

where $\pi_i(L)$, $\rho_i(L)$, $\varphi_i(L)$, $\psi_i(L)$, and $\omega_i(L)$ (i = 1,2,3,4,5) are polynomials in the lag or backshift operator L, all of

order *j*. The VAR process (6) can be equivalently written in the companion form:

$$\begin{bmatrix} s_t \\ \cdot \\ s_{t-j+1} \\ \Delta(y-y^*)_t \\ \cdot \\ \Delta(y-y^*)_{t-j+1} \\ \Delta(m-m^*)_t \\ \cdot \\ \Delta(m-m^*)_{t-j+1} \\ \Delta(r-r^*)_t \\ \cdot \\ \Delta(r-r^*)_{t-j+1} \\ \Delta(p-p^*)_t \\ \cdot \\ \Delta(p-p^*)_{t-j+1} \end{bmatrix} = \begin{bmatrix} \pi_{11} & \cdot & \pi_{1j} & \pi_{21} & \cdot & \pi_{2j} & \pi_{31} & \cdot & \pi_{3j} & \pi_{41} & \cdot & \pi_{4j} & \pi_{51} & \cdot & \pi_{5j} \\ 1 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 \\ \rho_{11} & \cdot & \rho_{1j} & \rho_{21} & \cdot & \rho_{2j} & \rho_{31} & \cdot & \rho_{3j} & \rho_{41} & \cdot & \rho_{4j} & \rho_{51} & \cdot & \rho_{5j} \\ 0 & \cdot & 0 & 1 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 \\ \varphi_{11} & \cdot & \varphi_{1j} & \varphi_{21} & \cdot & \varphi_{2j} & \varphi_{31} & \cdot & \varphi_{3j} & \varphi_{41} & \cdot & \varphi_{4j} & \varphi_{51} & \cdot & \varphi_{5j} \\ 0 & \cdot & 0 & 0 & \cdot & 0 & 1 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 \\ \psi_{11} & \cdot & \psi_{1j} & \psi_{21} & \cdot & \psi_{2j} & \psi_{31} & \cdot & \psi_{3j} & \psi_{41} & \cdot & \psi_{4j} & \psi_{51} & \cdot & \psi_{5j} \\ 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 & 1 & \cdot & 0 & 0 & \cdot & 0 \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 \\ \omega_{11} & \cdot & \omega_{1j} & \omega_{21} & \cdot & \omega_{2j} & \omega_{31} & \cdot & \omega_{3j} & \omega_{41} & \cdot & \omega_{4j} & \omega_{51} & \cdot & \omega_{5j} \\ 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 & 1 & \cdot & 0 \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 & 0 & \cdot & 0 \end{bmatrix} \cdot \begin{bmatrix} s_{t-1} \\ \cdot \\ s_{t-j} \\ \Delta(y-y^*)_{t-1} \\ \cdot \\ \Delta(y-y^*)_{t-j} \\ \Delta(m-m^*)_{t-1} \\ \cdot \\ \Delta(m-m^*)_{t-j} \\ \Delta(r-r^*)_{t-1} \\ \cdot \\ \Delta(r-r^*)_{t-j} \\ \Delta(p-p^*)_{t-1} \\ \cdot \\ \Delta(p-p^*)_{t-j} \end{bmatrix} + \begin{bmatrix} u_{1t} \\ \cdot \\ 0 \\ u_{2t} \\ \cdot \\ 0 \\ u_{3t} \\ \cdot \\ 0 \\ u_{4t} \\ \cdot \\ 0 \\ u_{5t} \\ \cdot \\ 0 \end{bmatrix} \tag{7}$$

$$\text{or } \boldsymbol{z}_t = \mathbf{A}\boldsymbol{z}_{t-1} + \boldsymbol{\nu}_t \tag{8}$$

where $\boldsymbol{z}_t$, $\boldsymbol{\nu}_t$, and the matrix of coefficients **A** are defined implicitly in (7) and (8). The first-order companion form (8) is very convenient for taking conditional expectations since $E(\boldsymbol{z}_{t+k}|\ \mathbf{I}_t) = \mathbf{A}^k\boldsymbol{z}_t$, $k > 0$, where $\mathbf{I}_t$ is the information set which contains the history through time *t* of the information variables included in the vector $\boldsymbol{z}_t$.

For all models, out-of-sample forecasts are taken by rolling estimation. More precisely, we select a sub-sample of size *n* and obtain an initial prediction for the forecast horizon *k*. The next *k*-period-ahead forecast is computed by including in the sub-sample the next available observation, so that the sub-sample size becomes *n+1*, and this iteration continues until the maximum possible sub-sample size *T-k*, *T* being the full sample size.

The root mean square error (RMSE) of forecasts is computed by:

$$RMSE = \left[\frac{1}{T-n-k+1} \sum_{i=0}^{T-n-k} (\hat{e}_{n+i+k|n+i} - e_{n+i+k})^2 \right]^{1/2} \tag{9}$$

Where *n* is the initial sub-sample size and *k* is the forecast horizon.

3. Emprirical Results

The empirical investigation is based on monthly data on the currencies of the USA (USD), the UK (GBP), Japan (JPY), Norway (NOK), Sweden (SEK), Switzerland (CHF), Australia (AUD), and Canada (CAD) *vis-á-vis* the euro (€) covering the period from January 1999 to August 2012 (164 observations). Data and sources are described in the appendix and all estimations are carried out by code written in GAUSS.

Variables included in the VAR representation are difference stationary and, thus, the first differences of the series are taken into account for the estimation of the linear model. VAR estimates were obtained for lag lengths between 3 and 6 but the results do not change considerably and, therefore, forecast errors are reported for a VAR with 3 lags only. However, VAR forecasts are not reported for the currencies of Switzerland and Australia due to lack of monthly data on the industrial production which is used to proxy output.

The RMSEs of out-of-sample forecasts at horizons of 1 to 12 months are presented in the following graphs for three different post-sample periods, namely 2006:9 – 2012:8, 2008:9 – 2012:8, and 2011:9 – 2012:8. Each row of the graphs is related to a specific euro exchange rate, while each column refers to a given post-sample period in

the order outlined previously. The only exception is the Euro/CAD rate for which the second post-sample period is 2009:9 – 2012:12. The notation is RW(dr) for the random walk with a drift, (Note 2) 'Markov' for the Markov switching regimes model, and VAR(3) for the vector autoregressive model with 3 lags.

The graphs in the first column show that the random walk by far outperforms both the Markov and the VAR models in terms of RMSEs of forecasts for all currencies and forecast horizons, when the post-sample period is 2006:9 – 2012:8. However, the middle column of graphs reveals a rather systematic reversal of this outcome for all currencies when the forecast window is limited to the period after the outburst of the financial crisis in September 2008. Indeed, RMSEs of naïve model forecasts deteriorate for all currencies and most forecast horizons, when the post-sample period is 2008:9 – 2012:8. (Note 3) Especially for the Euro/CAD rate (last row of graphs) this reversal sets in rather later and, for this reason, the second post-sample period is 2009:9 – 2012:8 in this case only.

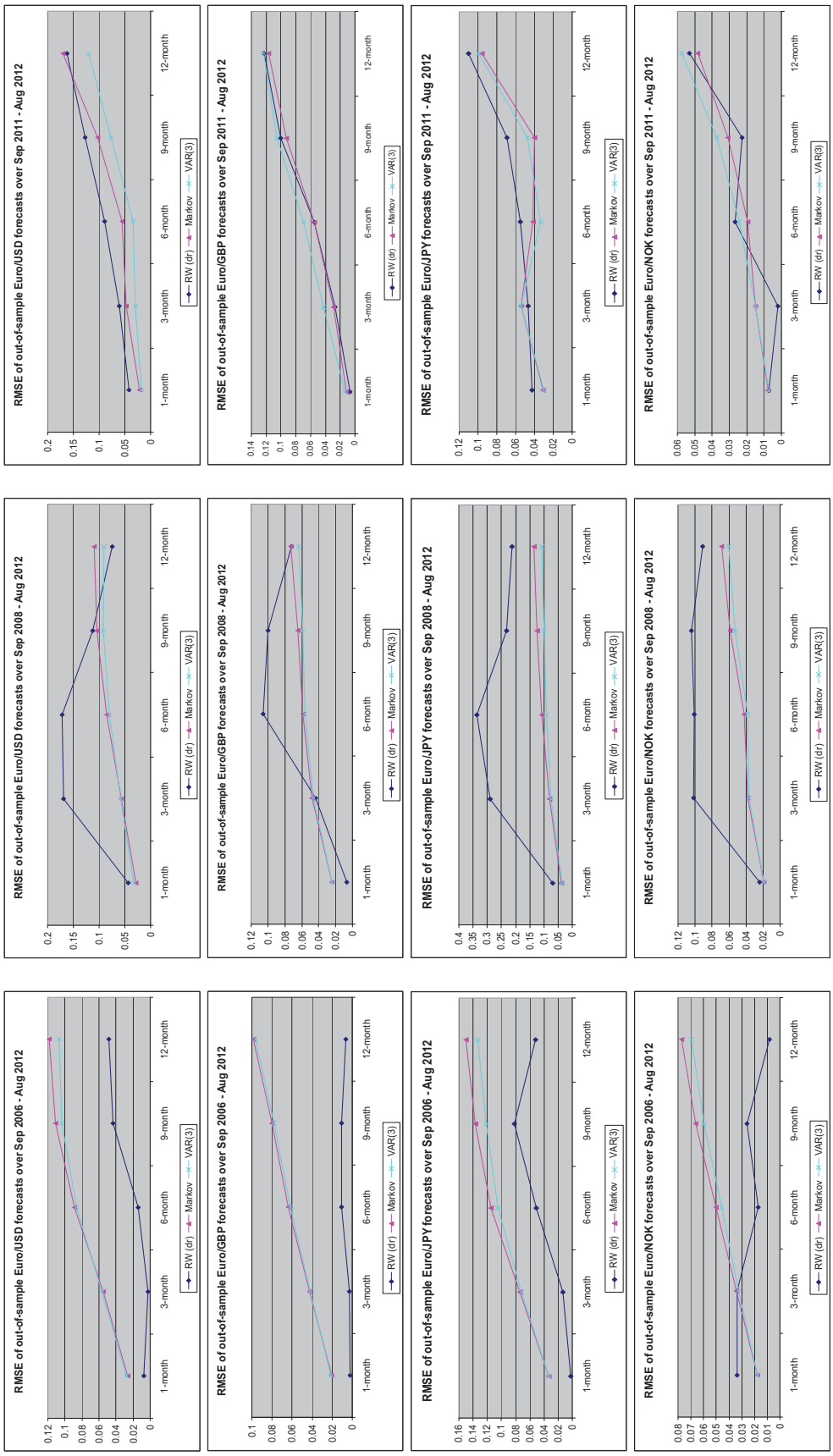
When the forecast window is further limited to the period after September 2011, the naïve model seems to regain some of its predictive power as RW(dr) RMSEs improve considerably relative to those of the Markov and the VAR(3) models. This can be easily inferred from the graphs in the third column, for all currencies and forecast horizons. Nevertheless, the pre-crisis superiority of the random walk is not re-established as Markov and VAR forecasts seem to be equally good to, and in many cases (USD, JPY, CHF) better than naïve forecasts.

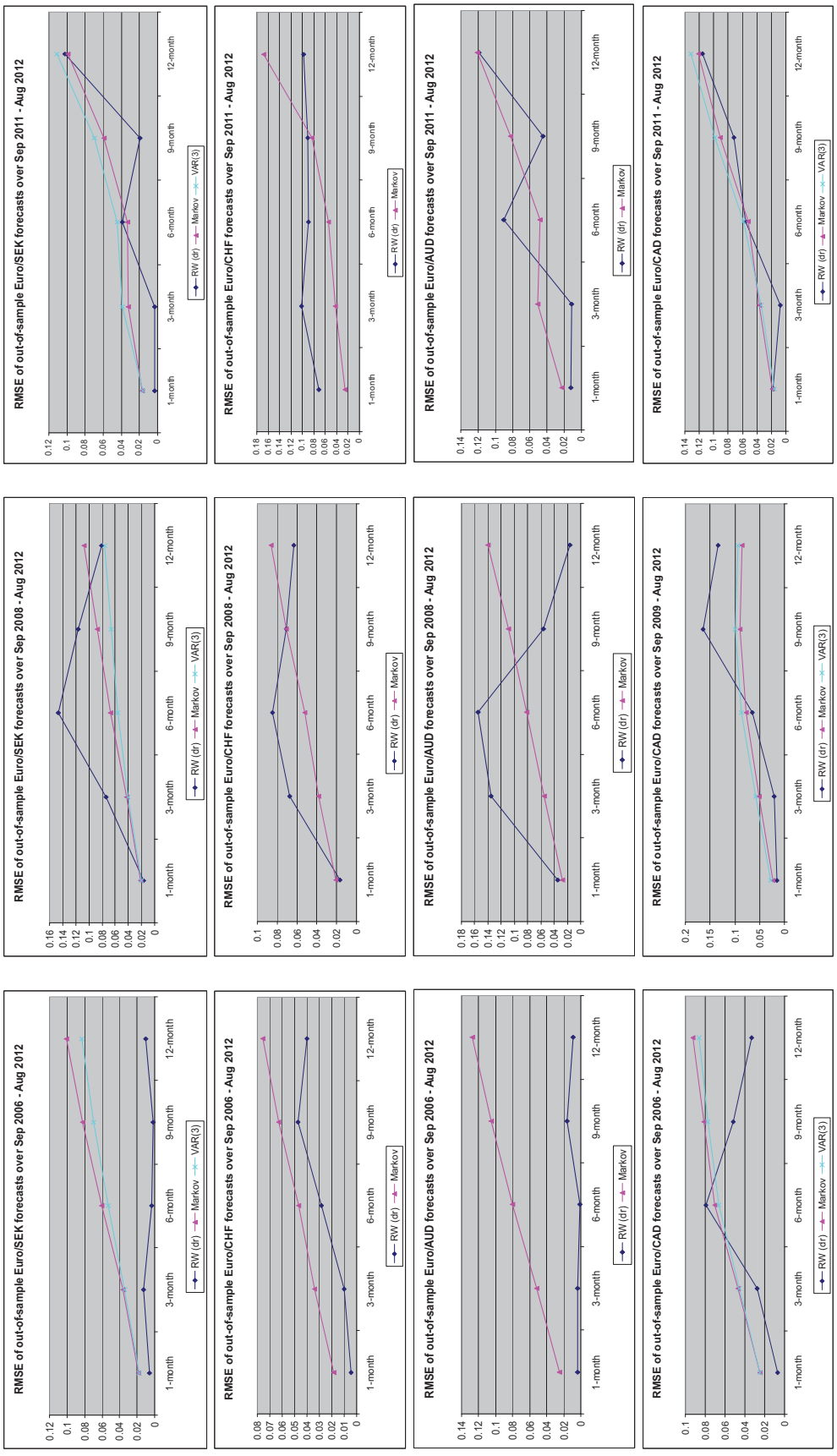
4. Conclusions

Based on a monthly data set for euro rates over the period 1999-2012, we obtained evidence that, before the 2008 financial crisis, the out-of-sample forecasting performance of a random walk with a drift is superior to that of a Markov switching regimes model and of a VAR representation. However, this outcome is consistently reversed following the 2008 financial turmoil.

These findings strongly suggest that in periods of financial calmness there is no better use of the information included in past values of the exchange rate than a simple observation of the values themselves. This result is most likely due to the absence of exceptional monetary or fiscal actions that could produce noticeable effects on exchange rates. However, in periods of financial turmoil this naïve approach does not work since there are active monetary and fiscal interventions which are not accounted for when a simple reproduction of past behavior is projected into the future. Indeed, after September 2008 the forecasting superiority of the random walk is drastically reversed for all euro rates considered, and models that allow for policy shifts or include targeted fundamentals do a much better job in predicting the exchange rate. Since this was a period of exceptionally active fiscal consolidation in many euro area countries, due to the debt crisis, and of very active monetary interventions in most major economies we can rather safely infer that the naïve random walk model does not capture exchange rate behavior under such conditions. Instead, both the Markov switching regimes model and the linear VAR model appear to be better representations for the stochastic behavior of the exchange rate in periods of turbulence which are characterized by very active policy actions. Also, it is worth noting that the non-linear Markov model and the linear VAR representation exhibit similar forecasting competence, suggesting that policy changes can be traced either by searching the data for structural shifts or by resorting to information variables that incorporate such changes. (Note 4) In any case, it seems that policy response explanations associated with non-linearities in euro rates (e.g. Kirikos, 2002, 2004) may be empirically relevant.

Finally, the reported evidence indicates that as we move away from the crisis outbreak and the financial turmoil recedes, the naïve model regains some of its predictive power. This behavior should be further gauged as time goes by and new observations become available, and in conjunction with the evolution of the ongoing crisis. Such additional information will provide a more solid basis as to whether or not different stochastic representations are appropriate for the exchange rate hinging on the presence of financial calmness or turbulence, as suggested by the evidence presented here. Probably, this is a non-trivial issue because, insofar as this emerging exchange rate behavior is replicated in the future, it opens up new directions both for theoretical exchange rate modeling and for more efficient statistical treatments.


RMSE of out-of-sample Euro/USD forecasts over Sep 2011 - Aug 2012
RMSE of out-of-sample Euro/GBP forecasts over Sep 2011 - Aug 2012
RMSE of out-of-sample Euro/JPY forecasts over Sep 2011 - Aug 2012
RMSE of out-of-sample Euro/NOK forecasts over Sep 2011 - Aug 2012
RMSE of out-of-sample Euro/USD forecasts over Sep 2008 - Aug 2012
RMSE of out-of-sample Euro/GBP forecasts over Sep 2008 - Aug 2012
RMSE of out-of-sample Euro/JPY forecasts over Sep 2008 - Aug 2012
RMSE of out-of-sample Euro/NOK forecasts over Sep 2008 - Aug 2012
RMSE of out-of-sample Euro/USD forecasts over Sep 2006 - Aug 2012
RMSE of out-of-sample Euro/GBP forecasts over Sep 2006 - Aug 2012
RMSE of out-of-sample Euro/JPY forecasts over Sep 2006 - Aug 2012
RMSE of out-of-sample Euro/NOK forecasts over Sep 2006 - Aug 2012
1-month
3-month
6-month
9-month
12-month
RW (dr)
Markov
VAR(3)


RMSE of out-of-sample Euro/SEK forecasts over Sep 2006 - Aug 2012
RMSE of out-of-sample Euro/CHF forecasts over Sep 2006 - Aug 2012
RMSE of out-of-sample Euro/AUD forecasts over Sep 2006 - Aug 2012
RMSE of out-of-sample Euro/CAD forecasts over Sep 2006 - Aug 2012
RMSE of out-of-sample Euro/SEK forecasts over Sep 2008 - Aug 2012
RMSE of out-of-sample Euro/CHF forecasts over Sep 2008 - Aug 2012
RMSE of out-of-sample Euro/AUD forecasts over Sep 2008 - Aug 2012
RMSE of out-of-sample Euro/CAD forecasts over Sep 2009 - Aug 2012
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RMSE of out-of-sample Euro/CAD forecasts over Sep 2011 - Aug 2012
1-month
3-month
6-month
9-month
12-month
RW (dr)
Markov
VAR(3)

Figure 1.

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Notes

Note 1. This section draws partly on section II of Kirikos (2000).

Note 2. Results were also obtained for a driftless random walk but they are not reported as they are consistently worse than those of the RW(dr) for almost all currencies and forecast horizons.

Note 3. Our results for the pre-crisis period reproduce the findings of Chortareas *et al.* (2011) based on daily data of euro rates, but refute the evidence reported in the same study for the post-crisis period.

Note 4. This corroborates Nikolsko-Rzhevskyy and Prodan's (2012) result that the forecasting success of structural models is partly due to the constant term and, therefore, modeling the drift and ignoring fundamentals may be just as promising.

Appendix: Data description and sources

The data set covers the period from January 1999 to August 2012 (164 monthly observations). The eurozone is considered to be the home country and the performance of the models is assessed for the currencies of the USA, the UK, Japan, Norway, Sweden, Switzerland, Australia, and Canada against the euro.

The spot exchange rate series were taken from the European Central Bank (ECB) site. Interest rates are short-term rates obtained from the OECD database, except for the Japanese rate which was taken from the Bank of Japan site as the series *Average Interest Rates on Certificates of Deposit / 90 Days - 119 Days*.

Data on the consumer price index and the GDP, which was proxied by the industrial production index, were obtained from the OECD database. However, monthly data on the industrial production index of Switzerland and Australia are not available and, therefore, the VAR representation was not estimated for the currencies of these countries.

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An Empirical Study of China's Second Board

Jun Chen[1] & Ting Yang[1]

[1] Department of Finance, Auckland University of Technology, Auckland, New Zealand

Correspondence: Ting Yang, Department of Finance, Auckland University of Technology, Private Bag 92006, Auckland 1142, New Zealand. Tel: 64-9-921-9999 ext. 5397. E-mail: ting.yang@aut.ac.nz

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Abstract

In this paper we conduct a comprehensive study on China's second board, ChiNext. We compare ChiNext against other major second boards in the world to assess its performance in attracting new listings and facilitating capital raising. We find that it has fared very well in these aspects. We examine the firm characteristics, pre-IPO operating performance, and governance practices and ownership structures for 355 ChiNext firms. We find that these are young and small firms that are profitable and experiencing high growth. They generally adopt good governance practices. Their ownership remains to be highly concentrated after their IPOs. We explore the determinants of IPO underpricing and find that IPOs of larger and more profitable firms are less underpriced, while those of firms with high volatility are more underpriced. IPOs conducted in a hot IPO market are less underpriced. In addition, investors may perceive the length of the time interval between the IPO issue date and the listing date on ChiNext as a signal of firm quality: the longer it takes a firm to list its IPO shares on ChiNext, the more its shares are underpriced. Our paper contributes to the IPO literature, provides insight into Chinese private enterprises, and sheds light on factors affecting the success of a second board.

Keywords: China, governance, IPOs, second board, underpricing

1. Introduction

Capital markets in many countries are structured as having multiple tiers: a main board where large and mature firms are listed, and a second board where small and young firms are able to obtain financing. There exists a strand of literature examining second boards. Some of such studies examine the second boards across many countries. For example, Vismara, Paleari, and Ritter (2012) examine the reasons for the creation of second boards in France, Germany, Italy, and the UK and for their successes or failures, and compare the initial public offerings (IPOs) on the main boards with those on the second boards. Lee, Rui, and Wang (2004) study whether there are return and volatility spillovers from NASDAQ to 5 Asian second boards in Hong Kong, Japan, Korea, Singapore, and Taiwan. Mizuno and Tabner (2008) compare the features of second boards in Hong Kong, Japan, Singapore, and the UK. Other studies tend to focus on a single second board. For the second board in the UK, the Alternative Investment Market (AIM), Espenlaub, Khurshed, and Mohamed (2012) examine the survival rate of IPOs on AIM. Gerakos, Lang, and Maffett (2011) study the post-listing returns, liquidity, information asymmetry, and survival rates for firms listed on AIM. Hill and Short (2009) analyze the risk disclosure by firms conducting IPOs on AIM. Wu and Hsu (2012) study the underpricing of AIM IPOs. For the second board in Hong Kong, the Growth Enterprise Market (GEM), Chan, Moshirian, Ng, and Wu (2007) and Vong and Zhao (2008) examine the long-term return performance and the initial underpricing, respectively, for IPOs on GEM. For Malaysia, How, Jelic, Saadouni, and Verhoeven (2007) document the IPO share allocation, the underpricing, and the long-rum performance for IPOs on its second board. For France, Vandemaele (2003) analyzes the factors that determine the choice between 2 IPO issue procedures: an auction-like procedure and a fixed price introduction procedure for IPOs on its second board. However, for China's second board, ChiNext, to the best of our knowledge, there are only 2 studies. Jingu (2009) introduces the historical background, the institutional settings, and the rules governing the listings on ChiNext. This paper is mainly descriptive. Using a sample of 100 IPOs from October 2009 to August 2010, Guo and Fung (2011) compare ChiNext with China's main board, and examine the importance of 5 variables as determinants of IPO underpricing. However, Guo and Fund (2011) are constrained by their small sample from the short sample period of less than 1 year. In this paper, we rely on a larger sample from a longer sample period and conduct a comprehensive study of ChiNext. In particular, we ask the following questions: How does ChiNext compare with second boards in other economies? How did the firms

perform during their pre-IPO years? What governance practices and ownership structures do these firms adopt after their IPOs? What are their IPO issuance characteristics? What are the factors determining their IPO underpricing? The motivation of our paper is to find answers to these important questions.

By providing answers to these questions, we endeavour to contribute to the literature on 3 dimensions. First, our paper is related to the IPO literature. It is a stylized fact that IPOs are on average underpriced. A large number of studies examine why IPOs are underpriced. Many explanations are proposed and tested (Ritter & Welch, 2002; Brau & Fawcett, 2006). However, there are very few studies that examine whether firms' corporate governance practices affect their IPO underpricing (Wu & Hsu, 2012). Our paper is the first to study this issue for IPOs on China's second board. Jensen and Meckling (1976) point out that the price at which an investor will pay for a firm's stocks will reflect the agency problems in the firm. Therefore, it is important to examine whether corporate governance mechanisms, which are used to control the agency problems, affect IPO underpricing. Second, our paper is relevant to the literature on private enterprises. On the one hand, most of the firms listed on China's main board are state-owned. Studying such firms does not allow us to understand China's private enterprises. On the other hand, the role played by private enterprises in China's overall economy has become too important not to properly understand. Most of our sample firms listed on ChiNext are not state-owned enterprises (SOEs). Studying such firms therefore allows us to offer some insights to China's private enterprises. Third, our paper is also linked with the literature that examines the competition among stock exchanges to attract listings (Zingales, 2007). We compare the listing and capital raising activities on ChiNext with such activities on other major second boards to shed some light on this issue.

Our paper is structured as follows. Section 2 describes our sample and compares ChiNext with other major second boards. Section 3 documents firm characteristics, governance practices and ownership structure, and IPO issuance characteristics. Section 4 examines the determinants of IPO underpricing. Section 5 offers concluding remarks.

2. ChiNext Compared with Other Major Second Boards

ChiNext was officially launched in October 2009. The first IPO that was listed on ChiNext was conducted in September 2009. We include all the firms that conducted IPOs during September 2009 till September 2012 in our sample. There are altogether 355 firms.

In this section, we examine how ChiNext fares in terms of attracting new listings and raising capital when compared against other major second boards in the world. We use NASDAQ in the US, AIM in the UK, and GEM in Hong Kong as the benchmarks. The reason is because NASDAQ is the first true second board, AIM is considered by many as one of the most successful second boards, and GEM was set up to mainly attract mainland Chinese firms.

Table 1. ChiNext in context

	ChiNext	GEM (HK)	AIM (UK)	NASDAQ (US)
Beginning	Oct 2009	November 1999	June 1995	February 1971
Number of IPOs in 2009	42	4	21	22
Number of IPOs in 2010	116	7	102	78
Number of IPOs in 2011	125	13	90	66
Number of IPOs in 2012	72	10	56	50
Total number	355	31	269	216
Amount raised in 2009	3,381.094	41.478	699.352	6,074.377
Amount raised in 2010	13,634.721	83.509	1,908.294	8,034.023
Amount raised in 2011	11,229.687	171.756	940.958	9,845.448
Amount raised in 2012	4,990.155	127.327	702.939	20,418.712
Total amount raised	33,235.657	424.070	4,251.543	44,372.560

Beginning refers to the month when an exchange was established. To be comparable, 2009 starts from September 2009 (inclusive), and 2012 ends in September 2012 (inclusive). Amount raised is in millions of US dollars. Data are collected from the websites of the stock exchanges and IPO prospectuses. The numbers for AIM are based on the firms newly admitted into AIM.

Table 1 presents the statistics. First, ChiNext hosts more IPOs or new listings over our sample period than all the other 3 second boards. In addition, each year, ChiNext has more IPOs than the other 3. On average, about 10 IPOs are conducted on ChiNext every month during the sample period. Second, the amount of money raised on

ChiNext ranks the second largest over the sample period, totalling around 33 billion US dollars. It is almost 8 times as large as that on AIM. In addition, in 3 of the 4 years, ChiNext raises the largest amount of money. On average, approximately 94 million US dollars was raised in a ChiNext IPO. This is particularly impressive given the fact that ChiNext has the shortest history among the 4 second boards.

Results in Table 1 indicate that ChiNext has fared very well when compared against world's major second boards. What contributes to its success? AIM has been successfully attracting many new listings. It sets very low eligibility criteria for firms applying for a listing. For example, there is no requirement of minimum market capitalization, trading record, or minimum number of shareholders. AIM adopts a principle-based regulatory approach, which gives listing firms flexibility in interpreting the principles and discretion in implementing them (Espenlaub et al., 2012). Therefore, some attribute the success of AIM to its lack of regulation. However, the evidence in Table 1 suggests that setting low requirement may not be the only way to successfully attract new listings. ChiNext imposes more listing requirements and adopts stricter regulations than AIM does, but Table 1 shows that ChiNext performs better than AIM both in terms of the number of new listings and the amount of money raised. In terms of listing requirement, in order to list on ChiNext, a firm must have a total equity capital of no less than 30 million yuan, and have no fewer than 200 shareholders, and the number of shares issued in an IPO must be more than 25% of shares outstanding if the firm's total share capital is no more than 400 million yuan. In terms of regulation governing listing firms, ChiNext adopts strict regulations. Some of them are even stricter than those adopted by China's main board (Jingu, 2009).

We believe that the reasons why ChiNext has been successful are twofold. First, there are a large number of potential candidates for listing. As China's economy grows, non-SOEs are becoming more and more important. Young and small private enterprises need to raise external capital to grow as they pass earlier stages of their life cycle. However, typically only large SOEs are able to list on the main board. The young and small private enterprises will have to mainly rely on ChiNext to obtain their financing. Second, there is strong demand for more investment instruments. China has a very high household savings rate (Ma & Yi, 2010). Chinese investors need financial instruments of various risk and return profiles to diversify their portfolios.

3. Firm Characteristics, Governance and Ownership Structure, and Issuance Characteristics

In this section, we first document the firm characteristics of ChiNext firms and their operating performance during the years before their IPOs, we then analyze their corporate governance practices and ownership structure, and we finally examine their IPO issuance characteristics.

3.1 Firm Characteristics

Table 2 presents firm characteristics and per-IPO operating performance for ChiNext firms. Data on firm age, volatility, and operating performance measures are collected from IPO prospectuses, Datastream, and Osiris, respectively.

Table 2. Firm characteristics

	Age	Firm size	Profitability	Growth	Leverage	Debt maturity	Volatility
Mean	9.689	362.973	0.168	0.504	0.438	0.888	3.411
Median	9.425	290.075	0.153	0.370	0.438	0.928	3.326
Standard Deviation	3.915	291.658	0.077	0.544	0.147	0.128	1.118
Minimum	0.405	68.516	0.040	-0.048	0.084	0.347	0.734
Maximum	24.093	2,875.240	0.512	5.030	0.774	1.000	6.368

This table shows the firm characteristics for all the firms that conducted an IPO and listed shares on ChiNext during September 2009 till September 2012. Age is the firm age measured as the number of years between the date of incorporation and the listing date. Firm size is the total assets at the end of the last financial year before an IPO in millions of Chinese yuan. Profitability is the return on assets calculated as net income/total assets, Growth is the sales growth rate, Leverage is calculated as total liabilities/total assets, and Debt maturity is the measured as current liabilities/total liabilities. Profitability, Leverage, and Debt maturity are calculated as the average over the 3 years before an IPO, while Growth is calculated as the average over the 2 years before an IPO. Volatility refers to the standard deviation of daily returns over the 20 trading days after an IPO and is in percentage.

Table 2 indicates that an average ChiNext firm is about 10 years old and has total assets of around 363 million yuan at the time of IPO. These firms on ChiNext are younger and smaller than those on China's main board.

Consistent with these characteristics, ChiNext firms exhibit high risk with an average standard deviation of daily returns of more than 3%. To measure the pre-IPO operating performance, we calculate their profitability, growth, and leverage over the 3 years prior to their IPOs. Table 2 shows that ChiNext firms are profitable and experience substantial growth during their pre-IPO years. The average return on assets, our profitability measure, is about 17%. Average sales growth rate is as high as 50%. These numbers indicate that ChiNext attracts its intended targets: the profitable firms that grow fast. In terms of financial leverage, the average leverage ratio, measured as total liabilities over total assets, is about 0.44. Approximately 89% of total liabilities are short-term. This suggests that ChiNext firms do not rely heavily on debt, and when they raise debt capital, they tend to rely on short-term debt. This is consistent with existing evidence on the capital structure characteristics of young and small firms (Hillier, Grinblatt, & Titman, 2012).

3.2 Governance Practices and Ownership Structure

To the best of our knowledge, no study has comprehensively examined the governance practices and ownership structure for ChiNext firms. To fill this gap, we manually collect data from their IPO prospectuses. For governance, we examine board size, board independence, the existence of a female director, and the existence of CEO duality. For ownership, we analyze the ownership of senior management and of top 10 largest shareholders, and the number of block shareholders. All these measures are based on the data at the time of the IPOs and have taken into account the shares issued in the IPOs.

Table 3. Governance and ownership characteristics

	Board size	Board independence	Female director	CEO duality	Managerial ownership	Top 10 ownership	Block holder
Mean	8.408	0.374	0.600	0.532	28.683	72.404	3.200
Median	9.000	0.333	1.000	1.000	26.360	74.210	3.000
Standard Deviation	1.463	0.062	0.491	0.500	20.560	8.433	1.314
Minimum	4.000	0.300	0.000	0.000	0.000	7.950	1.000
Maximum	14.000	0.750	1.000	1.000	86.000	90.900	7.000

This table shows the governance and ownership characteristics for our sample firms. Board size is the number of directors sitting on the board. Board independence is the fraction of independent directors. Female director is a dummy variable that equals 1 if there is a female director and 0 otherwise. CEO duality is a dummy that equals 1 if the CEO is also the chairman of the board and 0 otherwise. Managerial ownership is the percentage ownership of the senior management including the CEO, the vice-CEO, the CFO, and the secretary of the board. Top 10 ownership is the percentage of shares owned by the 10 largest shareholders of a firm. Block holder refers to the number of shareholders who own at least 5% of the shares outstanding. All the governance and ownership variables are measured at the date when an IPO prospectus was released and have been adjusted for the number of shares offered in the IPO.

Table 3 indicates that ChiNext firms on average have 8 directors, about 37% of whom are independent directors. Around 60% of the firms have at least one female director sitting on the board. In about 53% of the firms, the CEO also serves as the chairman of the board. These statistics suggests that ChiNext firms adopt good corporate governance practices. In terms of ownership structure, immediately after IPOs, senior management, defined as the CEO, the vice-CEO(s), the CFO, and the secretary of the board, own about 29% of the shares. These firms tend to be closely-held even after the IPOs: the average ownership by the 10 largest shareholders is about 72%. In addition, there are only about 3 block holders, who are defined as a shareholder owning at least 5% of the shares. These figures indicate that ChiNext tend to have very concentrated ownership even after their IPOs. On the one hand, high management ownership and concentrated ownership may motivate the managers to maximize firm value. On the other hand, concentrated ownership may increase the risk that minority shareholders' interests may be encroached on.

3.3 IPO Issuance Characteristics

Table 4. Issuance characteristics

Panel A: overall statistics							
		Underpricing	Adjusted underpricing	Proceeds	Relative proceeds	Issue price	Lapse
Mean		34.227	33.765	606.306	2.003	29.758	11.862
Median		25.235	23.839	483.436	1.660	25.000	10.000
Standard Deviation		37.592	35.964	405.175	1.304	15.792	5.415
Minimum		-37.148	-30.184	148.878	0.397	8.180	6.000
Maximum		209.735	206.508	2,436.853	11.532	110.000	50.000
Panel B: statistics by year							
	Number of IPOs	Underpricing	Adjusted underpricing	Proceeds	Relative proceeds	Issue price	Lapse
2009	42	84.015	80.523	549.669	2.483	27.176	19.048
2010	116	37.280	36.361	778.472	2.609	37.761	12.440
2011	125	22.181	22.582	566.066	1.715	27.483	10.000
2012	72	21.182	21.720	431.829	1.248	22.319	9.972
Panel C: statistics by region							
	Number of IPOs	Underpricing	Adjusted underpricing	Proceeds	Relative proceeds	Issue price	Lapse
EastorSouth	223	29.436	29.139	602.800	1.962	29.115	11.202
Others	132	42.321	41.580	612.230	2.074	30.844	12.977

This table shows the IPO issuance characteristics for our sample firms. Underpricing is calculated as the difference between the closing price on the first trading day and the issue price divided by the issue price and is in percentage. Adjusted underpricing equals underpricing minus the contemporaneous return on the Shenzhen SME composite index and is in percentage. Proceeds is the net proceeds raised in an IPO in millions of Chinese yuan. Relative proceeds is proceeds scaled by total assets at the last financial year end before an IPO. Issue price is the price at which the shares are offered in Chinese yuan. Lapse refers to the number of days between the issue date and the listing date. Panel A shows the statistics for the overall sample. Panel B presents the averages for all the above variables for each year. Panel C reports the averages for the variables for 2 regions. EastorSouth is a dummy that equals 1 if a firm is located in East or South China and 0 otherwise.

To document the IPO issuance characteristics, we collect data from IPO prospectuses and Datastream. Panel A of Table 4 shows that the average issue price for ChiNext IPOs is about 30 yuan per share. We measure IPO issue size by IPO net proceeds and relative proceeds (net proceeds scaled by total assets at the end of the last financial year end preceding IPOs). On average, each IPO raises about 606 million yuan for a ChiNext firm, which is about twice as large as its total assets. We calculate two underpricing measures. Underpricing is calculated as the closing pricing on the first trading day minus the IPO issue price and then divided by the issue price. Because IPO shares may start trading some time after the offer price has been set, the first-day closing price may be affected by market movements in between the offer date and the listing date. Therefore, we also calculate an adjusted underpricing, which is calculated as the (unadjusted) underpricing minus the market index return over the same time period. Panel A shows that ChiNext IPOs are on average underpriced by a substantial amount of 34%, whether adjusted or not. To put this figure in perspective, the average underpricing for IPOs in the US over the same time period is about 11% (Note 1). We also document the length of the time interval between the IPO offer date and the listing date on ChiNext (lapse). The average length is about 12 days.

The overall statistics presented in Panel A of Table 4 muffles the variations across time and geographical location. Therefore, we break down the overall results by year in Panel B and by geographical area in Panel C. Panel B indicates that there is a clear declining trend in underpricing. The first year of ChiNext shows a staggering underpricing of 84%, but in the second year it decreases substantially to 37%, which is less than half of that in the first year. The large underpricing shown in 2009 may be due to a high speculative demand at the initial stage of ChiNext. Over time, absolute issue size does not show a declining trend, but the relative issue size declines. When we break down the IPOs by geographical area in Panel C, we find that there are more IPOs conducted by firms located in East or South China than those by firms located in other areas of China. In addition, the IPOs by firms in East or South China are significantly less underpriced. Their average underpricing is about 29%, while the average underpricing is 42% for IPOs from other parts of China. All the other IPO characteristics examined (issue size, issue price, and lapse) are very similar between these two groups. The significant difference in underpricing may be related to investors' perception. East and South China are more

developed than other parts of China. Investors may consider firms from East or South China as firms of higher quality.

4. Determinants of IPO Underpricing

Table 4 indicates that the underpricing for IPOs on ChiNext exhibits substantial variation across firms. The standard deviation of underpricing is about 38%, and it ranges from a negative 37% to 210%. In this section, we try to explore the determinants of underpricing for ChiNext IPOs.

To this end we run the following cross-sectional regression:

$$\begin{aligned} Underpricing_i &= \alpha + \beta_1 age_i + \beta_2 firm\,size_i + \beta_{3,i} profitability_i + \beta_4 growth_i + \beta_5 leverage_i \\ &+ \beta_6 eastorsouth_i + \beta_7 proceeds_i + \beta_8 nipo_i + \beta_9 lapse_i + \beta_{10} volatility_i + \beta_{11} board\,size_i \\ &+ \beta_{12} board\,independence_i + \beta_{13} female\,director_i + \beta_{14} CEO\,duality_i + \beta_{15} managerial\,ownership_i \\ &+ \beta_{16} top10\,ownership_i + \beta_{17} block\,holder_i + \varepsilon_i \end{aligned} \quad (1)$$

where firm size is the natural logarithm of the total assets at the last fiscal year end prior to an IPO. Nipo is the number of IPOs in China during the quarter preceding an IPO. All the other variables are as defined in Tables 2, 3, and 4.

The rationale for including the above explanatory variables is as follows. Beatty and Ritter (1986) and Rock (1986) suggest that underpricing is the compensation to investors in IPOs for taking the risk resulting from the information asymmetry between issuing firms and investors or between more informed and less informed investors. Firm age and firm size are included because older firms have a longer track record available for investors to analyze, and larger firms are more likely to be covered by analysts. The level of information asymmetry between the issuing firm and outside investors is lower. Therefore investors may require lower underpricing, which is essentially the first day return, as compensation for investing in IPO shares of older or larger firms. We expect a negative relation between underpricing and firm age and size. Profitability, growth, and leverage are included because they are the fundamentals that investment banks and analysts use as inputs in their valuation model to set the fair IPO share price. Empirical evidence in Teoh, Welch, and Wong (1998) supports the argument that strong positive earnings prior to IPOs signal strong performance in the future. In addition, a survey by Brau and Fawcett (2006) finds that the most important positive signal at IPO is past historical earnings. Therefore, investors may require lower compensation for investing in IPO shares of issuing firms that are more profitable and with higher growth rate. Hence we expect a negative relation between underpricing and profitability and growth. When leverage increases, the bankruptcy risk increases accordingly. Therefore, we expect a positive relation between underpricing and leverage as investors require more compensation for the increase in bankruptcy risk. To capture the difference in underpricing between IPOs by firms from different geographical areas, we include the dummy variable Eastorsouth, which equals 1 if an IPO is conducted by a firm located in East or South China and 0 otherwise. Panel C of Table 4 indicates that IPOs from East or South China are less underpriced. Therefore, we expect the coefficient estimate for this dummy variable to have a negative sign. IPO proceeds is included as a measure of IPO issue size. If the demand curve for IPO shares is downward sloping, issuing firms and investment banks may need to underprice IPO shares more in order to sell all the IPO shares. We therefore expect a positive relation between underpricing and proceeds. We include nipo, the number of IPOs in China during the most recent quarter, to capture firms' market timing behaviour. Baker and Wurgler (2000) find that firms time the market when they raise equity. IPO studies document that hot IPO market and cold IPO market occur in waves. Moreover, Ritter and Welch (2002) find that firms go public in response to favourable market conditions. Issuing firms and investment banks may take advantage of a hot IPO market to price the IPO shares more aggressively. Therefore, we expect a negative relation between underpricing and nipo. Lapse is the length of the time interval between the IPO issue date and the listing date. If it takes less time for an issuing firm to get its IPO shares listed on ChiNext, we argue that this may be considered as an indirect certification of the quality of the issuing firm given by ChiNext. Therefore, if investors perceive longer interval between IPO issue date and exchange listing date as weaker certification from ChiNext, we expect a positive relation between underpricing and lapse. Volatility is included in the regression to capture the investment risk of IPO shares. Brau and Fawcett (2006) find that CFOs of issuing firms feel that underpricing compensates investors for taking risk. Therefore, we expect a positive relation between underpricing and volatility: IPO shares issued by firms of higher investment risk are more underpriced.

We then include all the governance and ownership variables. If investors aim to hold IPO shares as a long-term investment, they will value better governance and ownership structure and require less compensation for investing in firms of better governance and ownership structure. Therefore, we expect a negative relation between underpricing and better governance or ownership attributes. We include 4 board characteristics, the first of which is board size. Jensen (1993) argues that smaller boards may be more efficient and more difficult for the CEO to control. One the other hand, relying on 131 samples drawn from 20,620 companies, Dalton, Daily, Johnson, and Ellstrand (1999) conduct a meta-analysis and find a positive and systematic relationship between board size and a firm's financial performance. They identify various advantages associated with larger boards. For example, larger boards may possess more expertise and valuable experiences and therefore are better able to offer high-quality advice to the management. Larger boards may enable a firm to better extract critical resources. Questioning the notion that one board size fits all firms, Coles, Daniel, and Naveen (2008) report that the Tobin's Q for firms that have greater advising requirements (complex firms) increases with their board size, though the opposite is true for simple firms. Since our sample firms are in the important transition from a privately held to a publicly traded firm, their demand for expert advice should be high and a larger board is more desirable. Consequently, we expect a negative relationship between underpricing and board size. The second board characteristic that we examine is board independence. More independent boards are associated with better monitoring of mangers. For instance, Weisbach (1988) documents that boards dominated by outsiders are more likely to remove CEOs following poor firm performance than boards dominated by insiders. Dahya and McConnell (2007) report that UK firms that add outside directors to comply with the Cadbury Report recommendation of having at least 3 outside directors obtain a significant improvement in their operating performance. Hence, we expect a negative relationship between underpricing and board independence. The third board aspect that we study is the gender diversity, i.e., whether there is a female director on the board. Using a sample of Fortune 1000 firms, Carter, Simkins, and Simpson (2003) find a significant positive relationship between firm value and the presence of women on boards. Adams and Ferreira (2009) also report that gender-diverse boards are more effective monitors. However, after controlling for unobservable firm heterogeneity and reverse causality, they find that the relationship between firm performance and gender diversity in boards is complex. While gender diversity improves performance for firms with weak governance, it decreases performance for firms with strong governance. On average, the relationship between firm performance and gender diversity in boards is negative. Therefore, we expect that underpricing is positively associated with the dummy variable indicating the presence of women directors. The fourth board feature that we include is CEO duality, a dummy that equals 1 if the CEO also serves as the chairman of the board and 0 otherwise. While Goyal and Park (2002) find that CEO duality significantly reduces the sensitivity of CEO turnover to firm performance, Brickley, Coles, and Jarrell (1997) argue that CEO duality has not only costs but also benefits and find that the costs of separating CEO and chairman of the board titles are larger than the benefits for most large firms. According to Donaldson and Davis (1991), CEO duality is considered as a bad practice in the agency theory because it allows a CEO to dominate the board and may render the board ineffective, but it may be considered as a good practice in the stewardship theory as CEO duality allows the CEO to formulate and implement plans more effectively. Donaldson and Davis (1991) find evidence in support of stewardship theory, but not agency theory. We therefore expect that underpricing is negatively associated with CEO duality. In addition to the 4 board characteristics, we include 3 ownership structure variables. The first is managerial ownership. Morck, Shleifer, and Vishny (1988) point out that the relationship between firm value and managerial ownership depends on 2 opposing forces: higher ownership aligns the interests of managers with those of other shareholders (the convergence of interests effect) but allows managers to entrench themselves (the entrenchment effect). Therefore, theory offers little guidance on what the relationship should be. We hence believe that the relationship between underpricing and managerial ownership is an empirical issue. The second aspect of ownership structure that we examine is ownership concentration. Examining a sample of 706 Czech firms that went through the Czech Republic's mass privatization program, Claessens and Djankov (1999) find that firm profitability and labour productivity are positively associated with ownership concentration. We therefore expect a negative relationship between underpricing and ownership concentration. The last ownership structure variable that we include is the number of block holders. Barclay and Holderness (1989) and Barclay, Holderness, and Pontiff (1993) document that block holders use their voting power to extract private benefits that do not accrue to other shareholders for both traditional corporations and closed-end funds, respectively. Consequently, we expect that underpricing is positively associated with the number of block holders in a firm.

Table 5. Determinants of IPO underpricing

	Adjusted underpricing (1)	Adjusted underpricing (2)	Underpricing (3)	Underpricing (4)
Constant	249.147***	263.822***	256.129***	273.321***
	(0.000)	(0.000)	(0.000)	(0.000)
Age	-0.225	-0.306	-0.163	-0.254
	(0.554)	(0.424)	(0.686)	(0.529)
Firm size	-17.525***	-18.215***	-17.962***	-18.541***
	(0.000)	(0.000)	(0.000)	(0.000)
Profitability	-0.821***	-0.784***	-0.839***	-0.797***
	(0.001)	(0.002)	(0.001)	(0.003)
Growth	-0.583	-1.227	0.462	-0.232
	(0.841)	(0.697)	(0.877)	(0.943)
Leverage	3.858	0.068	2.629	-1.234
	(0.748)	(0.996)	(0.836)	(0.928)
Eastorsouth	-2.707	-2.730	-2.624	-2.695
	(0.376)	(0.409)	(0.417)	(0.437)
Proceeds	0.009*	0.008	0.007	0.007
	(0.095)	(0.104)	(0.146)	(0.184)
Nipos	-0.251**	-0.240**	-0.231**	-0.217**
	(0.013)	(0.017)	(0.031)	(0.038)
Lapse	0.842**	0.755**	1.183***	1.097***
	(0.025)	(0.040)	(0.003)	(0.005)
Volatility	14.376***	13.941***	14.358***	13.869***
	(0.000)	(0.000)	(0.000)	(0.000)
Board size	-1.106	-0.608	-1.340	-0.782
	(0.339)	(0.594)	(0.267)	(0.516)
Board independence	-18.063	-14.645	-19.367	-15.555
	(0.398)	(0.513)	(0.387)	(0.510)
Female director	1.194	0.566	1.098	0.365
	(0.664)	(0.835)	(0.706)	(0.899)
CEO duality	-1.821	-2.331	-1.951	-2.427
	(0.604)	(0.517)	(0.598)	(0.522)
Managerial ownership	-0.025	-0.022	-0.041	-0.037
	(0.776)	(0.809)	(0.660)	(0.698)
Top 10 ownership	-0.119	-0.109	-0.155	-0.154
	(0.536)	(0.587)	(0.433)	(0.457)
Block holder	0.052	0.198	-0.044	0.142
	(0.961)	(0.853)	(0.968)	(0.899)
With industry dummies	No	Yes	No	Yes
Adjusted R^2	0.455	0.463	0.446	0.456
Number of observations	355	355	355	355

This table shows the cross-sectional regression results. Firm size is the natural logarithm of the total assets at the last financial year end before an IPO. Nipos is the number of IPOs conducted in China during the quarter before an IPO. All the other variables are as described in Tables 2, 3, and 4. All variables except for the dummy variables are winsorized at the 1st and the 99th percentiles. Two and three asterisks indicate statistical significance at the level of 5% and 1%, respectively. P-values based on White's heteroskedasticity-consistent standard errors are provided in the parentheses.

Our cross-sectional regression results are presented in Table 5. We use both underpricing adjusted for contemporaneous market movement (in Regressions 1 and 2) and unadjusted underpricing (in Regressions 3 and 4) as dependent variables. In Regressions 2 and 4 we also include industry dummies to control for industry effects. Results are robust across all the regressions. First, we observe that all the independent variables altogether explain about 46% of the variation in underpricing. Second, the coefficient estimates for all the non-governance and ownership variables show the expected signs. Among them, the relationship between underpricing and firm size, profitability, nipo, lapse, and volatility are all statistically significant at least at the

level of 5%. The IPOs of larger ChiNext firms are less underpriced, which is consistent with the argument in Beatty and Ritter (1986) and Rock (1986) that underpricing is used to compensate investors for the risk resulting from asymmetric information. More profitable ChiNext firms' IPOs are less underpriced, suggesting that investors do rely on historical earnings to value ChiNext IPOs. IPOs conducted following a larger number of IPOs during the most recent quarter are less underpriced, which indicates that ChiNext firms exhibit the market timing behaviour to take advantage of favourable market conditions. The longer it takes an issuing firm to list its IPO shares on ChiNext, the more their IPO shares are underpriced. This suggests that investors may consider the length of the time interval between the issue date and the listing date as a certification of firm quality indirectly given by ChiNext. IPOs with higher volatility are more underpriced, which supports the notion that investors require higher compensation to invest in IPO shares of higher investment risks. In addition to being statistically significant, all the above relations are also economically significant. For example, a 1% increase in return on assets is associated with a decrease in underpricing of about 0.8%. A 1% hike in daily volatility is associated with approximately 14% increase in underpricing. Third, none of the governance and ownership variables are statistically significant, though their coefficient estimates show the expected signs. Wu and Hsu (2012) also report the lack of significant relation between governance and underpricing for IPOs on the AIM in the UK. One possible reason may be because the non-governance and ownership variables, which are significant, are highly correlated with the governance and ownership variables. However, we examine the correlations and they are not high enough to cause this. What, then, may explain the finding that governance and ownership structure do not affect underpricing for ChiNext IPOs? We conjecture the following explanations. One is that investors that participate in IPOs are short-term investors who care more about short-term returns and less about the long-term performance of issuing firms. Therefore, governance practices and ownership structure do not matter to them. A second possible explanation is that given the strict rules and regulations governing firms listed on ChiNext, some of which are even stricter than those for firms on the main board, investors are not concerned about the possibility that a ChiNext firm adopts weak governance practices.

5. Conclusions

In this paper, we conduct a comprehensive study of China's second board, ChiNext. We assess the performance of ChiNext and find that it has been very successful in attracting new listings and facilitating capital raising, when compared with the major second boards around the world. We document the firm characteristics, governance practices and ownership structure, and IPO issuance features for ChiNext firms. We find that these are young, small, and non-state-owned firms that are profitable and demonstrate high growth. In general, these firms adopt good governance practices in terms of board structure. Their ownership remains to be highly concentrated even after their IPOs. We document that ChiNext IPOs are on average substantially underpriced. We find that the IPOs of larger or more profitable firms are less underpriced while IPO shares with high return volatility are underpriced more. Moreover, firms that conduct IPOs on ChiNext seem to time the market: IPOs during a hot IPO market are less underpriced. Furthermore, investors perhaps consider the length of the time interval between the IPO offer date and the listing date as a signal of firm quality: the longer it takes a firm to list its IPO shares, the more these shares are underpriced. However, we do not find a significant relationship between underpricing and governance and ownership structure for ChiNext IPOs, which may be because investors participating in ChiNext IPOs have a short investment horizon or perhaps because investors trust that the strict rules governing firms listed on ChiNext can sufficiently protect investors.

Our paper contributes to the IPO literature by being the first paper to conduct a comprehensive examination of the characteristics of IPOs on China's second board and a variety of variables, including corporate governance and ownership structure, as determinants of IPO underpricing. Since most of the ChiNext firms are not owned by the state, our paper is also a study of a sample of successful Chinese private enterprises and therefore contributes to the literature on private enterprises. In addition, by comparing the performance of ChiNext with other major second boards, this study sheds light on what makes a second board successful in the competition for new listings.

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Notes

Note 1. The average underpricing for IPOs in the US over the same time period (September 2009 till September 2012) are based on data available on the website of Jay Ritter. http://bear.warrington.hfl.edu/ritter/IPOALL_2011.xls

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Simultaneous Effects of Supply and Demand Elasticity with Market Types on Tax Incidence (Graphical Analysis of Perfect Competition, Monopoly and Oligopoly Markets)

Engin Oner

Correspondence: Engin Oner, Head of the Public Finance Department, Faculty of Economics and Administrative Sciences, Yuzuncu Yil University, Zeve Campus, 65080, Van, Turkey. E-mail: enginoner@yyu.edu.tr

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Abstract

The type and character of tax (level of tax rate, narrow or far-reaching scope of tax, being indirect or direct), difference of the market in which activities are being carried out (perfect competition market, monopolist competition, oligopoly, monopoly, etc.), cost conditions (fixed cost conditions, increasing cost conditions, decreasing cost conditions), supply and demand elasticity, conjuncture periods (crisis, welfare, war and interim periods) all affect the extent of incidence. In particular, degrees of elasticity greatly affect the incidence possibility in all market types. Similarly, depending on the elasticity when the demand elasticity is rigid and supply elasticity is high, the incidence becomes easy, but in the opposite situation however, tax incidence through price mechanism becomes harder.

Keywords: tax incidence, perfect competition market, oligopoly, monopoly, supply and demand elasticity

JEL: H22, D41, D42, D43, D19

1. Introduction

Tax incidence is an event that clarifies which of the legal taxpayer (according to law the person who is charged with paying the tax) or actual taxpayer must finally bear the monetary burden of taxation. In other words, the tax-paying person's (legal taxpayer) transferring of the tax in question to others (to actual taxpayers, tax carriers) through some mechanisms (price mechanism, etc.) is called incidence.

As a result of the reactions of taxpayers against the taxes, at the transfer degree, the burden of tax is on different people (Fisher, 1996: 302; Due & Friedlaender, 1981: 225). .

Tax incidence emerges as a study about who bears the economic burden of the tax (Fullerton & Metcalf, 2002: 1789).

An incidence case comprises four consecutive stages. These are as follows:

- Tax is paid by the legal taxpayer to the relevant tax office (payment),

- The paid tax has negative pressure on the legal taxpayer (emphasis – psychological pressure)

- The uncomfortable taxpayer has the ability to transfer of the burden of the tax he paid to someone else generally through the price mechanism and depending on supply and demand factors (transfer – switching)

- The bearing of the tax by the last person to whom the shifting was made (settling of tax).

While the statutory taxpayer can bear the whole of the tax, he can shift all of it forward or backward, he can find the possibility to simultaneously and partially shift forward or partially shift backward and he can bear some of the tax burden (Edizdogan, 2007: 200).

When the incidence types are taken into account;

- Depending on the economic situation, the characteristics of the product and the supply-demand elasticity, incidence can be in a forward or backward direction. If tax is passed onto the consumers through the increasing of the prices, then it is the case of forward incidence. In such a case there might be no change in the production prices. On the other hand, if tax is transferred to production factors with no change in consumer prices or if there is a decrease in producer prices, it is the case of backward incidence (Fullerton & Metcalf, 2002: 1791).

- In other words, if the statutory taxpayer transfers the tax he paid by increasing the price of the product sold in the market to his customers by totally or partially benefiting from the price mechanism, then this is called forward shifting; in the cases where demand elasticity does not allow the sales price to increase, he can attempt to transfer the tax burden to the ones before him by decreasing the prices of goods (raw materials) he bought or labor costs, and this is called backward shifting.

- Once the statutory taxpayer has transferred the tax he paid to someone else, if this transfer resides with that person, this is called first degree incidence, if that person is also able to shift the tax shifted to himself to some other people, then it is called multiple degree incidence,

- If the shifting of the tax is realized in accordance with the purposes of the law maker, for example when tax laws are prepared, if the legislative organ allows for provisions stipulating that tax to be paid should be borne by the statutory taxpayer or it can be transferred to someone else (Heper, 1987: 148; Heper, 2000: 178), this is called statutory incidence. Benefiting from the price mechanism, a taxpayer's transferring of his tax burden to some other people is called actual incidence. Value Added Tax and Banking and Insurance Transaction Tax are examples of taxes where statutory incidence is realized in our country.

- While limited incidence states that incidence will be in a certain direction and rolled out over certain people or economic factors, limitless incidence means that the tax burden will be spread across the society and eventually the tax burden will be insensible.

- When the structure and effects of the incidence are taken into account, the incidence type that only deals with who pays the tax is called formal incidence, while the incidence where the taxpayer's reaction against the tax, its results and its effects are explored is called effective incidence (Akdogan, 2005: 250; Orhaner, 1992: 160).

- Absolute incidence is the effect of an increase in a certain tax on income distribution while differential incidence, when the public spending is assumed to be constant and a tax is replaced with another tax, shows the change in the income distribution (Akdogan, 2005: 250; Orhaner, 1992: 160),

- In the cases where the entrepreneur adds the tax he paid on the intermediate good he had purchased onto price of the good and calculates the profit on the new price and hence he makes profit because of tax, as well as the cases where tax is added to the price in the later stages and is put to taxation again, layered incidence (double incidence – tax pyramidation) emerges.

- Particularly due to the tax imposed on income generating securities and real estate capital factors, a decrease in the value of a taxed good by an amount corresponding to the profit rate of real estate investments prevalent at that date in the market constitutes amortization of the tax (in the case of purchase, it is in favor of the new owner in the form of amortization of the tax amount); an increase in the value of the real estate and the owner indirectly gaining additional capital value when the tax on real estate is lifted is called capitalization of the tax. While some authors exclude amortization and capitalization from incidence, they have been mentioned as types of incidence by some others, as well (Turk, 1992: 216-217; Uluatam, 1991: 239; Erginay, 1990: 118; Orhaner, 1992: 163; Nadaroglu, 1985: 326-331).

2. Factors Affecting Incidence

The type and character of tax (level of tax rate, narrow or far-reaching scope of tax, being indirect or direct), difference of the market in which activities are being carried out (perfect competition market, monopolist competition, oligopoly, monopoly, etc.), cost conditions (fixed cost conditions, increasing cost conditions, decreasing cost conditions), supply and demand elasticity, conjuncture periods (crisis, welfare, war and interim periods) all affect the extent of incidence.

Therefore, the factors determining the incidence are comprised of such micro economic factors as the elasticity of supply and demand, the structure of the market, the type and character of the tax, as well as macro economic factors like the conjuncture situation that the economy is in (Sengok, 1993: 42).

Institutional, informational, and behavioral factors may influence tax incidence. Furthermore, there is no accounting in the theoretical literature for the potential influence of the type of market institution on tax incidence. Markets need institutions to function, and these institutions specify how buyers and sellers interact to determine prices and quantities. Different market institutions are known to have different price formation and quantity determination properties; there is no reason to believe *a priori* that these different properties will not affect the incidence and excess burden of a tax (Cox, Rider & Sen, 2012: 2).

The final incidence of a tax often cannot be directly observed nor even estimated with absolute objectivity. The subjective selection of economic and behavioral assumptions exerts a heavy influence on the calculated incidence,

and myriad assumptions are possible (Combs, 2007: 43).

Due to changes in the equilibrium prices and behaviors of the shifters, economic incidence happens to become different from statutory incidence (Fullerton and Metcalf, 2002: 1789).

As a result of the incidence of taxes and depending on elasticity in investment and consumption spending of people and groups, two effects take place. The first one of them is the income effect and it can be defined as a decrease in disposable income due to tax. The second one is called the substitution effect. The substitution effect is that as a result of a relative increase in the price of tax imposed goods, consumption is cut or goods with less tax burden are demanded (Durmus, 2003: 234).

To understand the distributional effects of a tax, it is necessary to know who ultimately bears the burden of the tax. The theory of tax incidence concerns itself with answering this very question, and there may be no more important one in public finance. According to the standard theory, the incidence of a tax in long-run competitive equilibrium has nothing to do with the statutory assignment of the liability to pay tax. Rather, it depends on the relative elasticities of supply and demand; the more inelastic of the two ultimately bears the greater burden of the tax (Cox, Rider & Sen, 2012: 1).

When the elasticity is taken into consideration, incidence will be easy if the demand elasticity is rigid and supply elasticity is high and elasticity will be hard in the opposite situation. Further elaboration follows:

- Incidence is inversely proportional with demand elasticity and directly proportional with supply elasticity. When the demand elasticity decreases, forward tax incidence gets easier and when the demand elasticity increases, backward incidence becomes easier. On the other hand, when the supply elasticity increases, forward incidence gets easier and when the supply elasticity decreases, backward incidence becomes easier. (Edizdogan & Celikkkaya, 2010: 185; Erginay, 1990: 121; Dalton, 1961: 38),

- If the demand elasticity is equal to zero, the increase taking place in the indirect taxes will be totally reflected in the market price and because there is not much that the consumers can do against price changes, they will feel forced to buy the good (Odabasi, 2007: 42).

- If the price elasticity of the demand is high, the change in the price will be zero and the increase in the indirect tax will not be reflected in the price in any way. In fact, if the market demand is sensitive against the price changes, sellers will have difficulty in forward shifting the indirect tax and the tax burden will remain totally on their shoulders (Odabasi, 2007: 43).

- If the supply price elasticity is zero, an increase in the indirect tax will not be reflected in the market price in any way and the change in the price will be zero. In cases where the market supply is rigid, whatever the demand elasticity may be, it is the sellers who have to pay the total of the indirect tax. If the supply price elasticity is $+\infty$, an increase in the indirect tax will be completely reflected in the market price and the change in the tax and change in the price will be the same. This situation means complete forward shifting of the tax (Odabasi, 2007: 44).

3. Incidence with Respect to Market Types and Elasticity

By taking both the market types and elasticity simultaneously into account, let us see how the incidence occurs on the consumption taxes collected according to quantity and value.

When both the supply and demand in a perfect competition market are assumed to be less elastic (Figure 1);

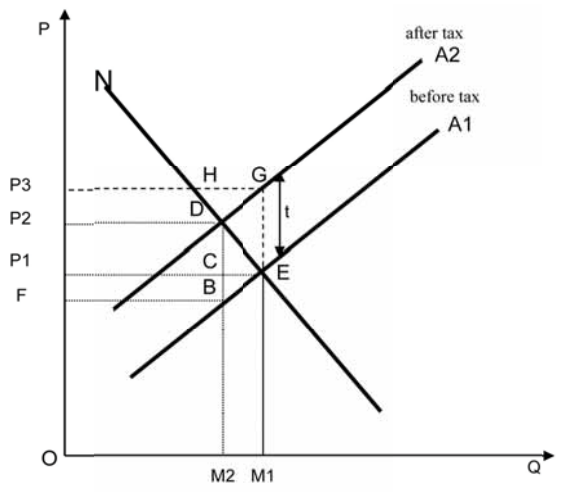

Figure 1. Incidence in the situation where supply and demand are less elastic in a perfect competition market

Point (P1) shows the equilibrium price before a specific tax has been introduced or increased. After the tax at the rate of (t) has been imposed, by increasing the sales price by the tax amount meaning at (t) level, the seller tries to shift the tax burden forward. Therefore, the supply curve shifts upward by (t) amount. The equilibrium point between the new supply curve (A2) and demand curve (N) is (P2) and the sales price corresponding to this is (M2). In such a case, (P_1CDP2) portion of ($FBDP_2$) tax revenue is shifted to the buyer, as well. The portion that remains with the seller is (P1CBF) (Turhan, 1997: 378).

In a situation where the demand is completely elastic, let us see the direction of the incidence with the help of Figure 2:

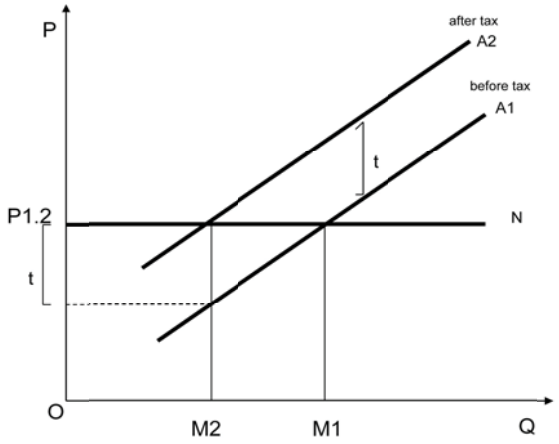

Figure 2. Incidence in a perfect competition market where the demand is elastic

As seen in Figure 2, the (A1) curve shifts in an upward direction by a tax amount which is at (t) level and turns into (A2) curve. Although the new equilibrium price does not change (P1=P2), the amount of demanded goods reduces from (M1) to (M2). Hence, the seller himself has been bearing all of the tax he should pay to the tax office (t.M2), in other words incidence does not occur (Turhan, 1977: 378).

In a situation where the demand is completely rigid (Figure 3), just the opposite situation to the above explanations emerges.

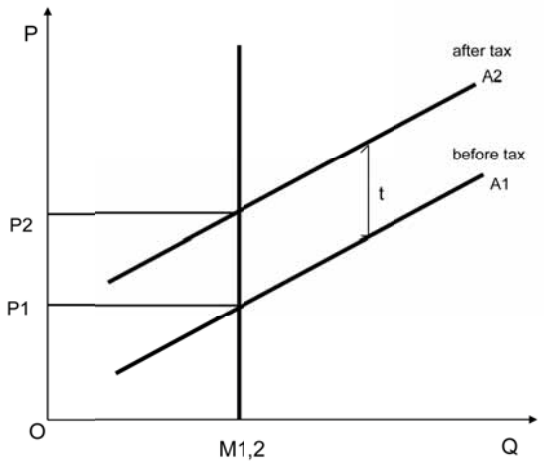

Figure 3. Incidence in a perfect competition market where demand is completely inelastic

As seen in Figure 3, the tax increase is completely shifted to the buyer. The equilibrium price increases by tax rate (t) per piece from (P1) to (P_2). These types of situations can be encountered in the taxation of essential consumption goods (for example: bread, salt, etc.) where demand elasticity is completely rigid (Turhan, 1977: 379).

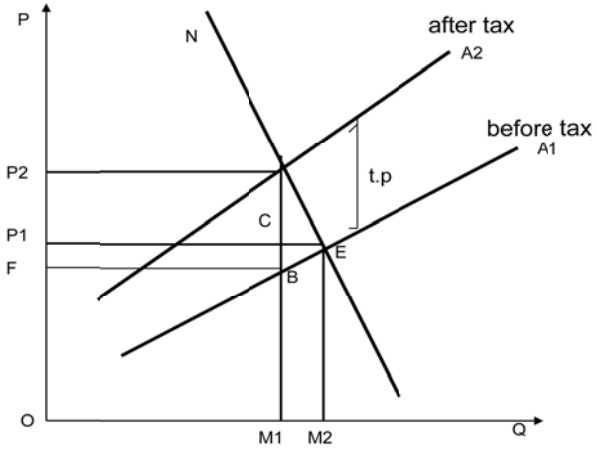

Figure 4. Incidence in the taxes collected according to value

With the help of Figure 4 above it is possible to show that in a market where perfect competition is prevalent, the incidence of a tax collected according to value (ad valorem taxation) would not cause very different problems from a tax collected according to quantity (specific taxation).

From the point of view of their effects on firms and the market, ad valorem sales taxes lead to similar results as specific indirect taxes, both in the short and the long term. The characteristic that distinguishes ad valorem sales taxes from specific sales taxes is that tax is stated as a fraction of taxable value. This situation not only shifts the market supply curve but it also leads to a change in the slope of the market supply curve. In a clearer statement, an increase in ad valorem sales taxes causes both the shifting of the market supply curve to the north-west and decreases the slope of market supply function or increases the slope of market inverse supply function. This means that as a result of an increase in ad valorem sales taxes, supply price elasticity gets more rigid (Bulmus, 1994: 303).

The most salient characteristic that distinguishes Figure 4 from Figure 1 is that the after tax supply curve is more perpendicular compared to the initial supply curve. The reason for this is that the application of the tax rate is not only on quantity but also on the proceeds (price). Because the tax rate amount per piece (t.p) increases in

absolute terms as the price of the good increases, the supply curve after tax must be in a more perpendicular shape compared to the supply curve before the tax. Therefore, the distance between the two supply curves (A1 and A2) is determined by the value that comes up as a result of the multiplication of the tax rate by the price (t.p) (Turhan, 1997: 380).

In the long term income has been changing, and in principle, it is realized in the form of income increases. In such a case, income elasticity of a good, for example of a luxurious good, becomes high which means that if the good in question is demanded more as the income increases, then the demand curve shifts outward and it makes the possibility of forward incidence relatively easier. Contrarily, with "ordinary" goods (because of negative income elasticity) the course of actions is in the reverse direction (Turhan, 1997: 380).

It is imperative not to think that the conclusions reached for the case of perfect competition are important only for this form of the market. In particular, the fact that elasticity degrees affect incidence possibility to a great extent is also valid for other market forms. For instance, the rule of "the more the demand gets elastic, i.e., the flatter the demand curve is, the harder it will be to shift the tax through the price mechanism" is also valid for a market form where a monopoly exists.

This is because in a monopoly market and in fixed costs conditions the price increase will be less than the total amount of tax, part of the tax will be endured by monopoly profit and profit will decrease to the extent of the hardship of incidence (Edizdogan & Celikkaya, 2010: 187; A. M. Sharp & B.F. Sliger, 1970: 225).

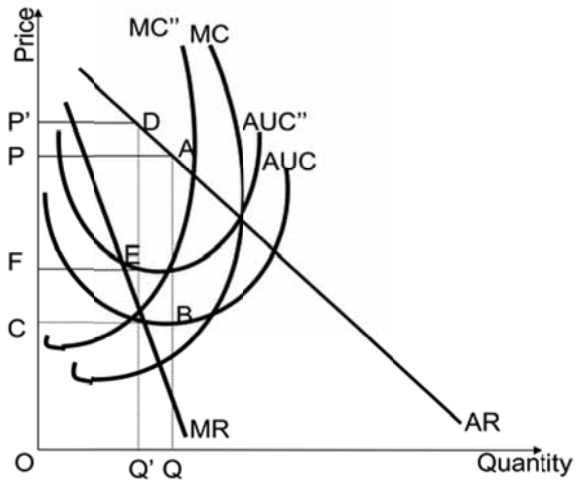

Figure 5. Incidence in a monopoly market

In a monopoly, as it is seen in Figure 5, the equilibrium production level is 0Q and the equilibrium price is QP. At this point the marginal cost is equal to the marginal income and the profit of the monopoly has reached its peak (PABC).

After imposing a special sales tax per piece, the MC and AUC curves shift upward left and they form MC' and AUC' curves. The new equilibrium point is 0P1 and the new price is QP'. It is the (PIDEF) rectangle that determines the monopoly profit after tax. Because it is smaller than (PABC) rectangle, the monopoly profit after tax remains at a lower level than the monopoly profit before tax. This means that tax has partly settled on the monopolist and it has partly shifted forward (Nemli, 1979:147).

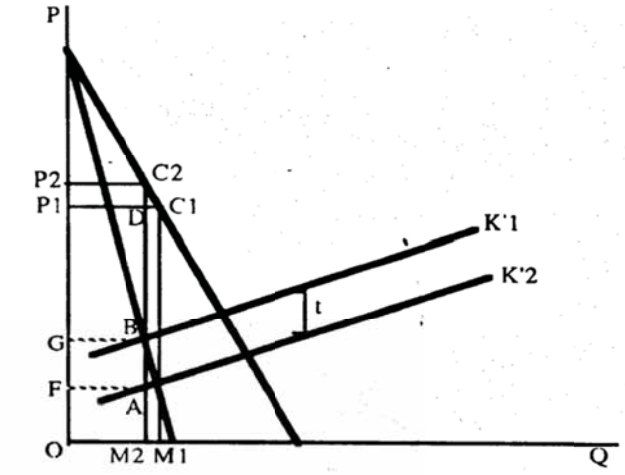

Figure 6. Incidence in a monopoly market when the demand is less elastic

In Figure 6 where demand elasticity is low, imposing or increasing by (t) amount of specific tax causes the marginal cost curve to shift to the left (K'2) and therefore leads to an increase equal to the tax amount in the marginal expenses per piece. The increase in question causes a relatively smaller decrease in the sales amount (from M_1 to M2') and a stronger increase in the prices (from P1 to P2). As a result of this, incidence occurs on a relatively large scale. Because [(P2-^{P}1).M_2], which means (P1 DC2P2) portion of the new tax in the amount [M_2.t (or FABG)] is being shifted, the remaining portion (FABG - P1DC2P2) is however, borne by the seller (the monopolistic firm) (Turhan, 1997: 382).

In monopoly markets tax incidence in the short and long term is dependent on the monopoly power of the firms. Particularly when there is a tax that affects the costs in monopoly markets, the tax can be shifted by increasing the monopoly price (Heper, 2000: 181).

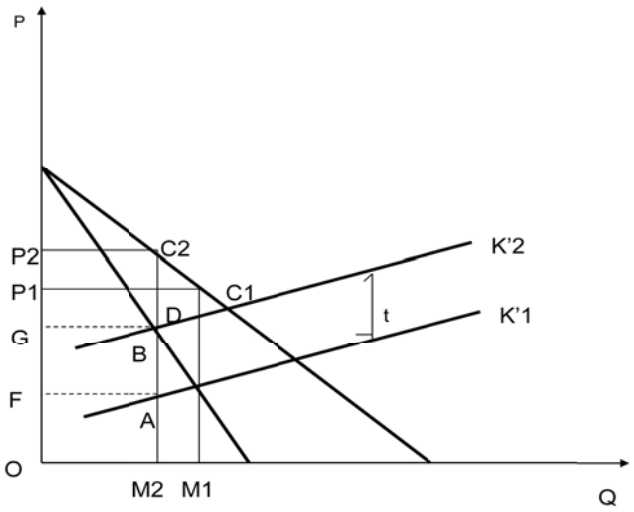

Figure 7. Incidence in a monopoly market where demand is elastic

The situation where demand is elastic is in completely the reverse direction (Figure 7). The increase taking place in the marginal costs due to tax causes a greater decrease in the sales amounts and a lesser increase in prices. As a natural result of this, incidence occurs in a smaller volume (P1 DC_2P_2) (Turhan, 1997: 382).

Because perfect competition and monopoly are two extreme market forms, it is hard to encounter them in real life. Therefore, let us analyze the incidence of a specific tax in an oligopoly market which is more common. As is

known, the number of firms in this form of market is small. The oligopolist must always take the reactions of his competitors into account in his price policy. This is because a price increase policy of a firm will not be followed by the others and it causes the threat of that firm losing its customers and hence, a great decrease in its circulation. A policy working in the reverse direction, which means a price decrease however, does not give the desired result because it is adopted exactly by competitor firms. Therefore, a preference for price stability emerges as a general tendency in the oligopoly market type (Turhan, 1997: 384).

The small number of firms and comparison probability in an oligopoly market makes it difficult to forecast the amount and direction of the tax incidence (Edizdogan and Celikkaya, 2010: 187). The fact is that a few large firms must establish close relations and parallelism in production – price matters, hence prevalent uncertainty in policies are the main characteristics of an oligopoly market. When special consumption tax per unit is imposed, a decrease occurs in this degree of uncertainty because each enterprise knows clearly that costs increase due to tax in other enterprises, too.

If the demand for the good produced in the industry is not elastic and enterprises have been producing various goods together, each firm can likely add all of the tax to the sales price.

If, before the tax firms have not increased their profits to the maximum level, the efforts for tax incidence draw them closer to this position. However, in order not to draw a reaction from the public and be subject to state intervention, some enterprises refrain from adjusting the production amount and the price in a way to maximize profit. Therefore, depending on the situation, tax can partially or completely shift forward.

In the short term due to such reasons as the fact that the cost per unit increases when the sales decrease or that the demand conditions do not allow for price increases, firms can find it necessary to meet the tax from excess profit (Due & Friedlaender, 1981: 390).

As a result of tax application in an oligopoly market because each firm guesses that their competitors will increase the prices, as well, prices will increase by the tax amount. If before tax prices have not formed at the optimal profit level, the excuse of tax profits can be rearranged. In the situation where the demand is not elastic, if the firms guess that their competitors will follow them, the probability of shifting the tax to the consumers is high. (Edizdogan, 1981: 46).

In the situation shown in Figure 8, if a specific tax is collected, the marginal cost curve – as in the case earlier- shifts to the left. In such a case, what is important from the perspective of incidence likelihood is whether or not the marginal cost curve shifting to the left (K'2) crosses the marginal revenue curve (E') in the dotted (perpendicular) section area or above it.

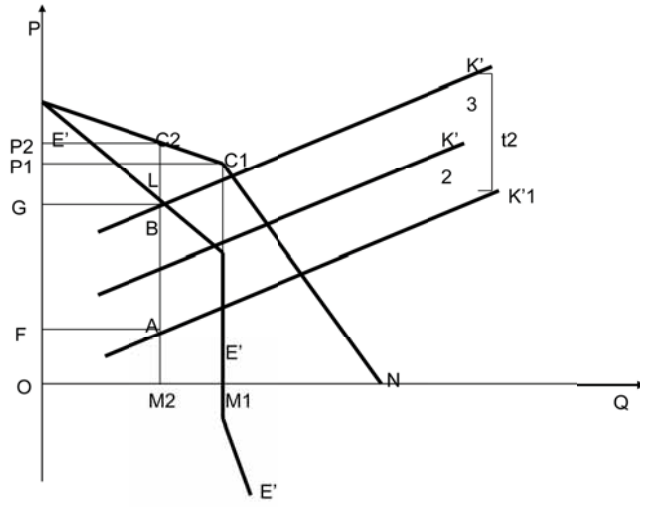

Figure 8. Incidence in an oligopoly market

Because in the first case, meaning in the case when the marginal cost curve (K'2) crosses the marginal revenue curve (E') within the perpendicular price area and the production level does not change, the seller must bear all of

the tax in the (M1.t1) amount and therefore, incidence does not occur. On the other hand, if the tax amount reaches (t2) level, the marginal cost curve shifts from (K'1) to (K'3) and crosses the marginal cost curve (Ei) at point (B). As a result of this, the (P2) price which is higher than (P1) is established. In this way, while the portion of the tax at (p_1 DC2P2) height is shifted to the buyer, the difference between (FABG) which is the total of the tax amount and the shifted (P1 DC2P2) is borne by the seller (the oligopolist firm). If the demand had been more rigid at the top of point (C_1), in other words the demand curve had been more perpendicular, then the buyer would have borne relatively more tax while the seller would have borne less tax. Because in general the demand curve concerning the entire market is more vertical compared to the demand curve of each oligopolist firm, the likelihood of incidence is greater (Turhan, 1997: 385).

4. Assessment and Conclusion

Incidence differs with respect to taxes. Although indirect taxes can be more easily shifted than direct taxes, the incidence possibility in itself of the taxes in the character of direct tax can be different.

Incidence analysis attempts to identify who bears the ultimate burden of a given tax. The analysis can be conducted on two levels: first, measurement of the initial direct "impact" of the tax in terms of the share borne by consumers and/or different business sectors; and second, measurement of the ultimate "incidence," frequently represented by translating the initial impacts in terms of their effects on different household income groups (Combs, 2007: 43).

Taxes collected from merchants, manufacturers, farmers and self-employed earners can be shifted less compared to expenditure taxes. Here adding the tax on top of prices is less easy; calculations regarding the incorporation of the tax into the prices are more complex. Despite this, the incidence of tax is possible.

Taxes collected from wages and salaries and revenues as well as the taxes that are not collected from the sale of a good or service are the taxes that can be shifted the least. This is because here there is no customer or buyer to whom the tax can be shifted. Doubtlessly, in theory it cannot be claimed that tax cannot be shifted; if a group of wage-earners have been united within labor unions by going on strike or exerting pressure on employers through their unions, although rarely, they can incorporate the taxes they paid on their wages into the wage increases they obtain and shift them to the employer (Turk, 1992: 218).

Because excise taxes are added to the cost of good or service supplied for sale, they can be easily transferred to buyers. In our country, Banking and Insurance Transactions Tax and Value Added Tax are the taxes that can be easily shifted to consumers. The tax that has been paid by the statutory taxpayer is partially or completely transferred to consumer within the price mechanism. The extent of incidence however, changes with respect to the factors we mentioned earlier affecting the incidence (Orhaner, 1992: 162).

Sales and consumption taxes are stated as inversely increasing rated when they are assumed to be borne by consumers and they are stated as increasing rated when the factor revenues are assumed to be borne by buyers.

In Inheritance and Succession tax there is virtually no possibility of tax incidence. The tax is borne by heirs and the ones in whose favor assets are donated.

In property tax incidence possibility is limited. In general, taxes collected on real estate do not shift and they are borne by the owner. However, if the building or land has been rented out and the economic situation allows for increasing the rents, then incidence can be observed. This means that the tax collected from real estate capital gain can be transferred to tenants when the economic situation allows (Shah & Whalley, 1991: 539).

In corporate tax, while the possibility of shifting the tax in the medium and short term is low, in the long term and depending on the situation of the firm, the possibility of incidence of tax can increase as much as economic situation allows (Turhan, 1997: 361-394; Akdogan, 2005:257; Nadaroglu, 1985:297; Uluatam, 1991: 202; Kizilyalli, 1969: 97-104; Akkaya, 1993: 147).

From the perspective of incidence of various taxes, the closer the tax is to the supply and demand mechanism, the easier it can be shifted. Taxes collected over expenditures are the taxes that can be shifted the most, as these taxes are the taxes which are the most dependent on the supply and demand mechanism. Expenditure taxes are calculated on cost of the goods sold. It is very easy to add these taxes onto the prices of the goods sold. Here the question encountered is, in the buy-sell chain who among the buyers – the producer, wholesaler, semi-wholesaler, retailer or consumer- will eventually pay the tax. Because forward shifting of the tax is a general tendency, the tax is shifted towards the consumer.

As a conclusion, it can be said that elasticity degrees greatly affect incidence possibility in all market types. Depending on the elasticity, when the demand elasticity is rigid and the supply elasticity is high, incidence is easy, in the opposite situation however, incidence of tax through the price mechanism becomes harder.

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Retesting the Monetary Approach to Foreign Exchange Rates: The Case of the US Dollar

Samih Antoine Azar

Correspondence: Samih Antoine Azar, Associate Professor, Faculty of Business Administration & Economics, Haigazian University, Mexique Street, Kantari, Beirut, Lebanon. Tel: 96-11-349-230. E-mail: samih.azar@haigazian.edu.lb

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Abstract

This paper estimates successfully a version of the monetary approach to foreign exchange rates applied to the US dollar for the post-1973 floating exchange rate period. Although this approach has lately fallen in disrepute, the statistical evidence is strongly in support of the model. The results conform to expectations. All coefficients have the correct sign and are highly significant statistically. The null hypothesis that the coefficient on the money stock variable is equal to +1 fails to be rejected in all four estimated regressions. This reflects money neutrality. The null hypothesis that the coefficient on the scale variable is equal to -1 fails to be rejected in all these four regressions. This means that there are neither economies nor diseconomies of scale for aggregate income. The joint null hypothesis that both of the above two constraints hold fails to be rejected at marginal significance levels much higher than 10% for the first two regressions and fails to be rejected at a marginal significance level higher than 2% for the last two regressions. Finally, the adjustment to the long run falls upon the real interest rate and probably upon the scale variable. There is evidence that the foreign exchange rate, the money supply, and the nominal interest rate are all weakly exogenous. One implication of this study is that businesses, economists, individual investors, central bankers and policy-makers should have a more benign look upon fluctuations in foreign exchange rates, and should become convinced that these fluctuations are determined by fundamental forces.

Keywords: US dollar foreign exchange rate, money demand, cointegration, likelihood ratio tests, money neutrality, economies of scale, vector error-correction model

JEL codes: F31, E41, F41, C58, C32.

1. Introduction

There is no doubt that floating foreign exchange rates are volatile. Since 1973 the mean of the log returns, i.e. the mean of the first-difference of the natural logarithms, of the trade-weighted foreign exchange rate of the US dollar recorded an annualized standard deviation of 5.99%. Log returns are approximately equal to percentage changes particularly when the frequency of the data is high. Obviously, bilateral foreign exchange rates of the US dollar have a higher volatility than the trade-weighted one because there is no averaging. In Azar (2012a) bilateral annualized volatilities of the US dollar are estimated to be 7.13% for the Canadian dollar, 10.12% for the sterling pound, and 11.49% for the Japanese yen.

An annualized volatility of 5.99% is higher than the annual inflation rate volatility which is 4.2% (Ross et al., 2010), but compares well with interest rate volatilities. For example, Ross et al. (2010) document an annual volatility of 5.7% for intermediate-term government bonds. However, foreign exchange rates are relative asset prices and their volatility should be compared to other asset price volatilities. A commodity like oil has an annualized volatility of 33.08% (Azar, 2012a). A portfolio of large-company stocks has an annual volatility of 20.6%, while the annual stock volatility of some individual firms, like that of Amazon, can reach up to 78.05% (Ross et al., 2010). Therefore, the volatility of foreign exchange rates is significantly less than that of asset prices. This does not preclude the fact that foreign exchange rates are highly variable in an absolute sense.

Since the volatility of foreign exchange rates is well established, the question that arises is whether this volatility can be explained, macro-economically, by fundamentals. In this regard short run volatility is likely to be too noisy, but long run volatility may be more amenable to modeling. This is the purpose of this paper: to test whether the US dollar is anchored in the long run to fundamentals. If a proper model exists then the appropriate

long run relation can be found by applying cointegration techniques (Engle and Granger, 1987; Johansen, 1991, 1995). Cointegration, if it fails to be rejected, implies that the variables in the multiple regression equation move together in the long run, or, in other terms, they are anchored to each other. Of course, as will become evident below, some special data characteristics need to obtain and certain sign and coefficient restrictions need to be imposed and tested. Otherwise the model will not conform to theory.

The theoretical model adopted in this paper is what is known as the monetary approach to foreign exchange rates. This model was popular in the late seventies (Bilson, 1978; Dornbusch, 1980; Hodrick, 1978) but went into disrepute later. The turning point was Meese and Rogoff (1983), who found that a random walk model of the foreign exchange rate outperforms in forecasting ability the predictions of all other theoretical and macroeconomic models. Nonetheless, some more recent and supportive empirical analyses of the monetary model showed up in the 2000s (Groen, 2000; Rapach and Wohar, 2002). Lizardo and Mollick (2010) use the same monetary model to test for the effect of real oil prices and their evidence on the model is mixed. Some coefficients, that turn out to be statistically significant, have the wrong signs. In addition, many coefficients are not statistically significant.

If the monetary model is validated by statistical analysis this is an important step in the direction of explaining the determinants of foreign exchange rates. In such a case the implications are substantial. First, economists should regain confidence in the model, and should be assured that foreign exchange rate fluctuations are justified by the fundamentals included in the model. At the very least, volatility of foreign exchange rates may fail to be regarded as excessive, especially in the long run. There are also policy implications. Policy makers and central bankers should have another and more benign look upon foreign exchange rate changes and should come to believe that the latter do not move "out of hand." Firms and businesses should become persuaded that in the long run they can forecast the level and volatility of foreign exchange rates, and that they need not put too much attention on short run unpredictability. Individual investors should be more tranquil about the returns on their foreign investments and these returns should turn out to be better in line with their expectations.

The monetary approach to foreign exchange rates, as the name indicates, relies on a stable money demand relation. If m is the natural log of the money stock, y is the log of aggregate output, p is the log of the price level, i is the nominal interest rate, and α, β, and γ are regression coefficients then the money demand relation can be stated as follows, with ε as a regression residual:

$$m - p = \alpha + \beta y + \gamma i + \varepsilon \qquad \text{with} \quad \beta > 0 \quad \text{and} \quad \gamma < 0 \tag{1}$$

In equation (1) β should be close to +1. However, this depends on the proxy utilized for the variable y. Rearranging equation (1) and ignoring the interest rate effect then one has:

$$p = -\alpha + \lambda m - \beta y + \varepsilon \qquad \text{with} \quad \lambda = 1 \tag{2}$$

Equation (2) has been estimated by cointegration methods for commodity indexes as the price variable using monthly data (Azar, 2012b) or quarterly data (Browne and Cronin, 2007, 2010), for individual monthly commodity prices as the price level (Azar, 2012a, 2012c), and for individual monthly commodity futures as the price level (Azar, 2012d). The relevance of this literature to this paper is threefold. One, the existence of a long run relation is supported. Two, the price level is replaced by prices set in auction markets that are characterized by high flexibility and high volatility that come close to the flexibility and volatility of foreign exchange rates. Three, the coefficient on the money supply (λ) turns out to be invariably statistically insignificantly different from +1 whatever the way the price level is defined.

The rest of the paper is organized as follows. The theoretical model is presented in section 2. The data source, the empirical results and their interpretation form the major part of section 3. The last section summarizes and concludes.

2. The Theory

The first theoretical construct is the Fisher equation (Fisher, 1930). The nominal rate of return has two components: the real rate of return and expected inflation. If r_t is the real rate at time t, sometimes called the *ex ante* real rate, if i_t is the nominal rate, and if $E_t(\pi_{t+1})$ is expected inflation, with E_t being the expectation operator, then the following relation is true:

$$r_t = \frac{(1+i_t)}{(1+E_t(\pi_{t+1}))} - 1 = \frac{i_t - E_t(\pi_{t+1})}{(1+E_t(\pi_{t+1}))} \approx i_t - E_t(\pi_{t+1}) \tag{3}$$

In equation (3) the reason why the nominal and real rates are indexed with t and the inflation rate is indexed with $t+1$ is due to the fact that rates of returns are usually known in advance, especially if they are rates of interest. The approximation in equation (3) holds well since the data in this paper is monthly. In such a case:

$$1+E_t(\pi_{t+1})\approx 1 \tag{4}$$

The second construct is the definition of the real foreign exchange rate. If S_t is the nominal foreign exchange rate at time t, measured as the number of units of the domestic currency per one unit of the foreign currency, if P_t is the domestic price level, and if P_t^* is the foreign price level, then the following is true:

$$\text{Real exchange rate} = X_t = \frac{S_t P_t^*}{P_t} \tag{5}$$

In equation (5) a depreciation of the nominal or of the real foreign exchange rate is an increase in value. Taking natural logs (ln) in equation (5) then:

$$ln(X_t) = ln\left(\frac{S_t P_t^*}{P_t}\right) = ln\left(S_t P_t^*\right) - ln(P_t) \tag{6}$$

Equation (6) states that the log of the real foreign exchange rate is composed of two elements: the domestic loss in purchasing power of the US dollar $(ln(P_t))$, and the foreign loss in purchasing power of the US dollar $\left(ln\left(S_t P_t^*\right)\right)$. Since in this paper the trade-weighted exchange rate of the US dollar is used, this corresponds to the average foreign purchasing power of the US dollar, i.e. it stands for $\left(ln\left(S_t P_t^*\right)\right)$ and not for $(ln(S_t))$. Define, for simplicity, the log of the trade-weighted exchange rate of the US dollar $\left(ln\left(S_t P_t^*\right)\right)$ as $(ln(Z_t))$. The actual data on this trade-weighted rate is provided as the number of units of foreign currency per one unit of the US dollar. In order to be consistent with the definition of (Z_t) in this paper the inverse of the published series must be taken, or, in the log formulation, the log of the inverse of the published series, which equals minus the log of the published series, is to be computed.

The third construct is that the log of the real exchange rate is explained by the difference in real interest rates, i.e. the difference between the domestic real interest rate (r) and the foreign real interest rate $\left(r^*\right)$. If the relation is linear then:

$$ln(X_t) = ln\left(\frac{S_t P_t^*}{P_t}\right) = ln(Z_t) - ln(P_t) = \delta + \phi\left(r_t - r_t^*\right) + \varepsilon_t \qquad \text{with} \quad \phi < 0 \tag{7}$$

Equation (7) is consistent with the Mundell-Fleming IS/LM open macroeconomic model with capital mobility (Fleming, 1962; Mundell, 1968) whereby a higher differential in real interest rates, between the domestic and foreign country, appreciates the real exchange rate. It is also partly consistent with the NATREX (Natural Real Exchange Rate) approach to real exchange rates (Rey, 2009; Stein et al., 1997). Below another specification of the model will be derived that is more compatible with Stein et al. (1997) and Rey (2009).

Two problems surface with equation (7). One, the real interest rates require knowledge about expected differential inflation rates. An approximation is used by taking the *ex post* real interest rate, instead of the ex ante interest rate in equation (3). The *ex post* real interest rate is defined as:

$$i_t - \pi_{t+1} \tag{8}$$

There is no doubt that the approximation in equation (8) creates a problem of measurement error in the real interest rate variable. However, as long as the measurement error is stationary then the problem is relatively minor.

The second problem is in trying to measure or in defining a proxy for the real foreign interest rate. Since this real foreign rate must include real rates of all countries with which the US trades, and since some of these countries have higher real rates while others have lower real rates, it is expected that, on average, the weighted real foreign rate of interest is little variable, if at all, and can be ignored. One should recall that, in regression analysis, a fundamental requirement for statistical precision is that each regressor be variable enough.

The fourth construct is the money demand relation that includes the nominal interest rate. If this money demand is solved for the log of the price level $ln(P_t)$, that was defined as p in equations (1) and (2), then one has:

$$ln(Z_t) - ln(P_t) = \delta + \phi\left(r_t - r_t^*\right) \Rightarrow ln(Z_t) \approx \delta + \phi r_t + \lambda m_t + \beta y_t + \gamma i_t + \varepsilon_t \tag{9}$$

In equation (9) γ is the semi-elasticity of money demand of the nominal interest rate. The following sign restrictions must hold:

$$\phi < 0, \quad \lambda > 0, \quad \beta < 0, \quad \gamma > 0 \tag{10}$$

In addition, the following size restrictions should bind:

$$\lambda = 1, \quad \beta = -1 \tag{11}$$

The second size restriction in (11), i.e. $\beta = -1$, depends on the proxy selected for the scale variable y. Another specification of the same model is a log-log relation with the nominal interest rate:

$$ln(Z_t) \approx \delta + \phi r_t + \lambda m_t + \beta y_t + \theta(ln(i_t)) + \varepsilon_t \tag{12}$$

In this case θ is the elasticity of money demand of the nominal interest rate, and should also be positive in sign. The same sign restrictions (equations (10)) and size restrictions (equations (11)) apply for equation (12) as they do for equation (9). Equations (9) and (12) compare better with the NATREX model that includes a domestic productivity variable that Stein et al. (1997) and Rey (2009) proxy by the domestic growth in income. The variables m and i are not present in the NATREX model which includes however foreign growth and domestic government expenditures, both of which are not directly part of equations (9) and (12). If government expenditures are related to aggregate output then these expenditures appear indirectly in these equations through the output variable. However, there is a complication: are these expenditures positively or negatively related to output? In Stein et al. (1997) and Rey (2009) the effect of government expenditures on the NATREX, the natural real exchange rate, is opposite to that of domestic growth. Higher government spending reduces saving, while domestic growth increases saving. The Keynesian IS/LM analysis would predict that the two variables should have the same effect because higher government expenditures generate a higher output, at least in the short run. In the long run however, if there is enough capital mobility, fiscal policy is ineffective and neutral when foreign exchange rates are flexible and floating.

A salient feature of the NATREX model and of the monetary model, as exemplified by equations (9) and (12), is that an increase in domestic aggregate output appreciates the foreign exchange rate. The traditional balance of payments view of the foreign exchange rate predicts the opposite effect (MacDonald, 1988): higher domestic output is reflected by higher imports, a deterioration of the trade balance, and a depreciation of the foreign exchange rate.

3. The Empirical Results

The source of all data is from the website of the Federal Reserve Bank of Saint Louis. The data consists of the trade-weighted foreign exchange rate of the US dollar, the seasonally adjusted MZM money stock, the MZM money stock that is not seasonally adjusted, the industrial production index, the 10-year Treasury rate, the Moody's aaa corporate bond yield, and the Consumer Price Index (all items). The choice of the MZM money stock, instead of M2, derives from the fact that the former is more popular according to the same web site. The use of the industrial production index as a scale variable, or as a proxy for aggregate output, follows the tradition initiated by Fama (1981). All the data is monthly and span the period from January 1973 to July 2012. This corresponds to the floating period of the foreign exchange rate of the US dollar. The total number of observations per variable is 475, except for the real rate which has 474 observations.

In order to undertake cointegration analysis, the variables must be tested for stationarity. The condition is that all variables need to be non-stationary with the same degree of integration. The first step is to specify the maximum lag length of the unit root test because the latter is sensitive to this lag length. If N is the sample size, then the maximum number of lags is equal to the integer number of the factor $N^{0.25}$ (Diebold and Nerlove, 1990; Mills, 1999; Mills and Markellos, 2008; Schwert, 1987). Since the sample size is composed of 475 observations this rule provides a result of $475^{0.25} = 4.67$, which is rounded to 5. The results of the Elliott-Rothenberg-Stock point optimal unit root test (Elliott et al., 1996), with the presence of a trend, are presented in Table 1.

The log of the trade-weighted foreign exchange rate of the US dollar, the logs of the two US money supply series, the log of the US industrial production index, and the log of the 10-year Treasury rate are all non-stationary in levels but stationary in first-differences. Therefore all are integrated of order one. The 10-year Treasury rate is also integrated of the same order. However the *ex post* real US rate is stationary in levels and in first-differences. However, if the KPSS test (Kwiatkowski et al., 1992), with a constant but without a trend, is applied on the *ex post* real US rate, this variable turns out to be integrated of order one. Hence in what follows all variables are considered integrated of order one and cointegration tests can proceed without any problem.

Table 1. Elliott-Rothenberg-Stock point-optimal unit root tests with a constant and a linear trend. The maximum lag is set to 5. The null hypothesis is a unit root

Variable	Test statistic on the level	Test statistic on the first-difference
Log of US the trade-weighted foreign exchange rate	8.454339	1.036214
Log of the US MZM money stock (seasonally adjusted)	8.979281	0.554572
Log of the US MZM money stock (not seasonally adjusted)	5.988808	1.817775
Log of the US industrial production index	7.377106	1.946514
The US 10-year Treasury rate	26.41814	0.283635
Log of the US 10-year Treasury rate	22.43756	0.306432
Ex post US real interest rate	2.195923	3.505309

Notes: the critical values for the test are 3.96 (1%), 5.62 (5%), and 6.89 (10%). The *ex post* US real interest rate is the Moody's aaa corporate bond yield minus actual inflation. US inflation is measured by the log change of the US Consumer Price Index (all items).

Testing for cointegration is to be preceded by determining the specification and the optimal number of lags. The default specification is adopted, meaning that a constant, but no trend, is included. The optimal lag length is selected by minimizing the Akaike Information Criterion (Akaike, 1974). This criterion opts for three lags in all four cointegration regressions. These four regressions consist of equations (9) and (12) with either the seasonally adjusted money stock or the money stock that is not seasonally adjusted.

Table 2. Johansen cointegration tests. The lag length is 3 for all regressions and these include a constant but not a trend

Equation (9) in the text using the seasonally adjusted money stock

Hypothesized number of cointegration equations	Eigen value	Trace statistic	5% critical value	Probability	Maximum Eigen value	5% critical value	Probability
None	0.165698	133.6561	69.81889	0.0000	85.14506	33.87687	0.0000
At most 1	0.052083	48.51101	47.85613	0.0433	25.13959	27.58434	0.0996
At most 2	0.025601	23.37142	29.79707	0.2283	12.18900	21.13162	0.5291
At most 3	0.019554	11.18242	15.49471	0.2005	9.281615	14.26460	0.2635
At most 4	0.004036	1.900809	3.841466	0.1680	1.900809	3.841466	0.1680

Equation (9) in the text using the not seasonally adjusted money stock

Hypothesized number of cointegration equations	Eigen value	Trace statistic	5% critical value	Probability	Maximum Eigen value	5% critical value	Probability
None	0.167781	136.3031	69.81889	0.0000	86.32012	33.87687	0.0000
At most 1	0.055126	49.98297	47.85613	0.0311	26.65081	27.58434	0.0655
At most 2	0.025922	23.33217	29.79707	0.2301	12.34395	21.13162	0.5141
At most 3	0.019032	10.98822	15.49471	0.2122	9.031291	14.26460	0.2836
At most 4	0.004155	1.956926	3.841466	0.1618	1.956926	3.841466	0.1618

Equation (12) in the text using the seasonally adjusted money stock

Hypothesized number of cointegration equations	Eigen value	Trace statistic	5% critical value	Probability	Maximum Eigen value	5% critical value	Probability
None	0.166402	130.7068	69.81889	0.0000	85.54182	33.87687	0.0000
At most 1	0.042224	45.16493	47.85613	0.0876	20.27648	27.58434	0.3223
At most 2	0.030657	24.88844	29.79707	0.1655	14.63405	21.13162	0.3154
At most 3	0.017093	10.25439	15.49471	0.2617	8.102952	14.26460	0.3683
At most 4	0.004567	2.151440	3.841466	0.1424	2.151440	3.841466	0.1424

Equation (12) in the text using the not seasonally adjusted money stock

Hypothesized number of cointegration equations	Eigen value	Trace statistic	5% critical value	Probability	Maximum Eigen value	5% critical value	Probability
None	0.167711	132.2578	69.81889	0.0000	86.28075	33.87687	0.0000
At most 1	0.042766	45.97707	47.85613	0.0743	20.54270	27.58434	0.3048
At most 2	0.031730	25.43437	29.79707	0.1465	15.15497	21.13162	0.2782
At most 3	0.016859	10.27940	15.49471	0.2598	7.991191	14.26460	0.3796
At most 4	0.004857	2.288210	3.841466	0.1304	2.288210	3.841466	0.1304

Table 2 presents the Johansen cointegration tests (Johansen, 1991, 1995). Since there are five variables then four cointegration equations at most can exist for each regression. In all four regressions the hypothesis that there is one cointegration equation is strongly supported. The Johansen maximum Eigen value test statistic always rejects the presence of two or more cointegration equations per regression at conventional marginal significance levels. However, the trace test statistic finds some evidence for two cointegration equations in the two estimations of equation (9), with the two definitions of the money stock. In this case, although the two marginal significance levels are lower than 5% they are still higher than 3%. As for the estimation of equation (12), and for the two definitions of the money stock, one cointegration equation is supported by both the trace test statistic and the maximum Eigen value test statistic. Decision is taken to conclude that there is only one cointegration equation in all four regressions.

Table 3 reports the estimated coefficient slopes for all variables in all four cointegration regressions. All sign restrictions are met and are according to expectations. A higher money stock depreciates the US dollar. A higher scale variable appreciates the US dollar. The effect of the nominal interest rate is positive, i.e. a higher nominal rate depreciates the US dollar, while the effect of the real interest rate is negative, i.e. a higher real rate appreciates the US dollar.

Table 3. Long run coefficients and likelihood ratio (LR) hypothesis tests

	Equation (9) with the seasonally adjusted money stock	Equation (9) with the not seasonally adjusted money stock	Equation (12) with the seasonally adjusted money stock	Equation (12) with the not seasonally adjusted money stock
constant	-5.837647	-5.791516	-6.109887	-6.098457
Coefficient on the money supply	0.681901	0.702784	0.849848	0.866911
(t-statistic)	(5.46958)	(5.56423)	(6.87041)	(6.90178)
[standard error]	[0.12467]	[0.12630]	[0.12370]	[0.12561]
Coefficient on the industrial production index	-1.015794	-1.065342	-1.421345	-1.458158
(t-statistic)	(-2.90644)	(-3.00868)	(-4.52181)	(-6.90178)
[standard error]	[0.34950]	[0.35409]	[0.31433]	[0.31891]
Coefficient on the nominal interest rate	111.2116	112.7742	0.683780	0.693806
(t-statistic)	(5.33479)	(5.31116)	(5.71150)	(5.67022)
[standard error]	[20.8465]	[21.2334]	[0.11972]	[0.12236]
Coefficient on the real interest rate	-136.7328	-140.0479	-125.9374	-128.7815
(t-statistic)	(-10.2753)	(-10.3933)	(-10.4394)	(-10.5038)
[standard error]	[13.3070]	[13.4748]	[12.0637]	[12.2604]
LR test: 1st slope = +1				
Actual χ^2 (1)	1.374844	1.180209	0.376228	0.292296
P-value	0.240981	0.277314	0.539629	0.588753
LR test: 2nd slope = -1				
Actual χ^2 (1)	0.001547	0.025756	1.322256	1.521075
P-value	0.968625	0.872498	0.250187	0.217457
LR test: joint test on the above two slopes				
Actual χ^2 (2)	3.195833	3.195214	7.659972	7.715088
P-value	0.202318	0.202380	0.021710	0.021120

Three coefficient hypothesis restrictions are tested by likelihood ratio tests that are χ^2 distributed under the null. The first hypothesis is that the slope coefficient on the money stock is +1. In all four regressions this hypothesis fails to be rejected at marginal significance levels much higher than 10%. This implies money neutrality. Money neutrality means that the specification of the model is appropriate, because such neutrality is a basic requirement in many theoretical models. The second hypothesis is that the slope on the scale variable is -1. In all four regressions this hypothesis fails to be rejected at marginal significance levels much higher than 10%. This implies the absence of economies and diseconomies of scale. The third hypothesis is whether the two slope coefficients are jointly +1 and -1. For the two estimates of equation (9) this joint hypothesis fails to be rejected at

marginal significance levels much higher than 10%. However for the two estimates of equation (12) the actual marginal significance levels of the joint hypothesis are 2.171% and 2.112%, less than a 5% marginal significance level, but higher than a 2% marginal significance level. This differential result in significance may be due to the fact that the specification of equation (9) is better than that of equation (12) or else that the industrial production index is a bad proxy for the scale variable.

The semi-elasticity of money demand of the nominal interest rate is -111.2116 and -112.7742 (Table 3). These estimates are monthly because the interest rate variable is divided by 1200 in the estimation procedure. For comparability purposes the semi-elasticity must be divided by 1200 and is measured as -0.09268 and -0.09398. These two estimates are close to -0.10, which is the value suggested by Stock and Watson (1993) for the 20th century, and close to the estimates in Ball (2001), but higher, in absolute values, than the estimates in Friedman and Schwartz (1982). The average of the 10-year Treasury rate over the sample period is 7.062%, implying two estimates of the interest rate elasticity of money demand: -0.6545, and -0.6637. These estimates are close to the estimates of equation (12), and which are -0.6838 and -0.6938 (Table 3), and close to the estimates for the United Kingdom which range between -0.499 and -0.905 (Matthews et al., 2004).

The semi-elasticity of the real interest rate in the foreign exchange rate cointegration regression has four estimates (Table 3). The coefficient values in Table 3 must also be divided by 1200 for comparability purposes, and doing so, the semi-elasticities become respectively for the four cointegration regressions in Table 3: -0.1139, -0.1167, -0.1049, and -0.1073. These estimates are so close to each other that it is difficult to favor one specification over another. The average real rate is 3.8918% per annum, implying four real rate elasticities, which are also close to each other: -0.4433, -0.4542, -0.4083, and -0.4176.

Table 4. Coefficients on the error-correction lagged residuals

	Error-correction model of each of the following cointegration regression			
Dependent variable: First-difference of the log of each of the below variable with exceptions (see the table Notes).	Equation (9) with the seasonally adjusted money stock	Equation (9) with the not seasonally adjusted money stock	Equation (12) with the seasonally adjusted money stock	Equation (12) with the not seasonally adjusted money stock
The foreign exchange rate	-0.005707	-0.005449	-0.007609	-0.007281
(t-statistic)	(-1.72893)	(-1.69688)	(-1.99912)	(-1.96452)
[standard error]	[0.00330]	[0.00321]	[0.00381]	[0.00371]
The money supply	0.000566	0.002895	0.001633	0.004383
(t-statistic)	(0.54306)	(1.76375)	(1.30786)	(2.28058)
[standard error]	[0.00104]	[0.00164]	[0.00125]	[0.00192]
The industrial production index	0.003770	0.003650	0.003906	0.003840
(t-statistic)	(2.83129)	(2.80684)	(2.52291)	(2.54028)
[standard error]	[0.00133]	[0.00130]	[0.00155]	[0.00151]
The nominal interest rate	-9.13E-05	-9.14E-05	-0.014051	-0.014711
(t-statistic)	(-1.83906)	(-1.90164)	(-1.30151)	(-1.40573)
[standard error]	[5.0E-05]	[4.8E-05]	[0.01080]	[0.01046]
The real interest rate	-0.004013	-0.003893	-0.004670	-0.004506
(t-statistic)	(-8.02174)	(-7.96329)	(-8.11342)	(-8.00325)
[standard error]	[0.00050]	[0.00049]	[0.00058]	[0.00056]

Notes: For the nominal interest rate error-correction model, the dependent variable is the first-difference of the rate for the two specifications of equation (9), and is the first-difference of the logs of the rate for the two specifications of equation (12). The first-difference of the real interest rate is the dependent variable in the error-correction model of the real interest rate.

Weak exogeneity is now tested following Engle et al. (1983) and Rapach and Wohar (2002). A variable is weakly exogenous if the coefficient on the lagged error-correction residual in the Vector Error-Correction Model (VECM) is statistically insignificant (Table 4). The foreign exchange rate is weakly exogenous only in the first specification of the model, i.e. equation (9), in which the nominal interest rate enters linearly and is not logged. The money supply is weakly exogenous in 3 out of 4 cases. The scale variable, the industrial production index, is not weakly exogenous, although the error-correction coefficient has the wrong sign. The nominal interest rate is

weakly exogenous in all 4 cases. The real interest rate is not weakly exogenous, and the error-correction coefficient has the correct sign and is highly significant statistically. It seems that the real interest rate and probably the scale variable bear the brunt of the adjustment to the long run, i.e. their adjustment restores long run equilibrium. These results are in sharp contrast to Rapach and Wohar (2002) who find that the scale variable is weakly exogenous and that the money stock is the variable that achieves the adjustment towards the long run.

In order to represent the dynamic impact of a shock in the log of the money stock on the log of the trade-weighted exchange rate of the US dollar a Vector Autoregressive Model (VAR) comprising all the above 5 variables is estimated. The number of lags is four, selected according to the Akaike Information Criterion. The response of the log of the US dollar to the shock in the log of the seasonally adjusted US money stock is portrayed in Figure 1. This figure shows that initially the response of the US dollar is negative, i.e. the US dollar appreciates for about 6 months, after which it begins depreciating gradually until the final effect is almost constant and positive, significantly above the zero line. This long run impact reflects the neutrality of the money stock. The short run overshooting, or appreciation of the US dollar, the gradual depreciation, and the long run return to equilibrium, are consistent with the Dornbusch overshooting hypothesis (Dornbusch, 1976). This has received empirical support lately, as shown by the evidence in Bjørnland (2009), where overshooting occurs within 1-2 quarters, a period which is consistent with the finding of a 6-month overshooting in this paper.

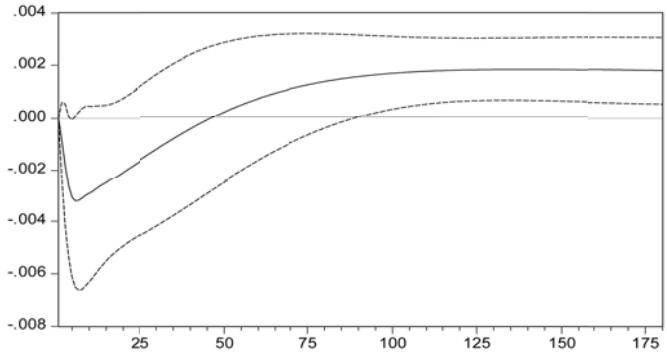

Figure 1. Response of the log of the US dollar to a one standard deviation Cholesky innovation in the log of the US money stock

Figure 2 portrays the dynamic impact of an innovation in the US money stock on the nominal interest rate. Again overshooting is the main characteristic in this figure. The nominal rate shoots up initially for about 5 months. Then it gradually falls, reaching a new long run equilibrium which is significantly below the zero line. The nominal rate is permanently lower than at the start. The behavior of the nominal rate in Figure 2 is consistent with the behavior of the foreign exchange rate in Figure 1 and the two follow from the same theoretical principle.

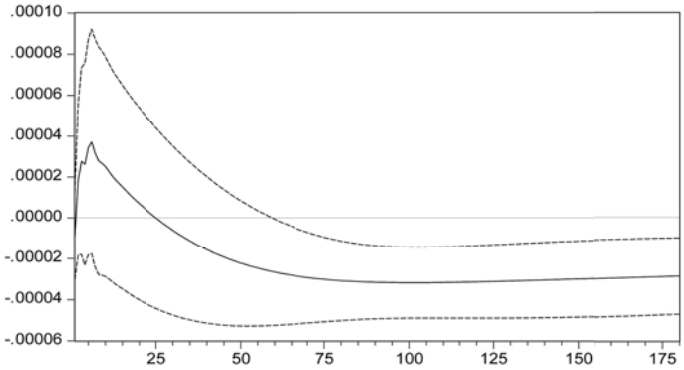

Figure 2. Response of the US 10-year Treasury rate to a one standard deviation Cholesky innovation in the log of the US money stock

4. Conclusion

This paper has estimated successfully a version of the monetary approach to foreign exchange rates applied to the US dollar for the post-1973 floating exchange rate period. The variables that explain the loss in the international purchasing power of the US dollar are: the US money stock, a US scale variable, a US nominal interest rate and a US real yield. Since all variables are integrated of order 1, the econometric procedure adopted is cointegration, which enables carrying out tests for a long run relation.

There is strong support for only one cointegration equation in all four estimated regressions. All coefficients have the correct sign and are highly significant statistically. The null hypothesis that the coefficient on the money stock variable is equal to +1 fails to be rejected in all four regressions. This supports money neutrality, which is a crucial constituent of many macro models. The null hypothesis that the coefficient on the scale variable is equal to -1 fails to be rejected in all four regressions. This excludes economies and diseconomies of scale. The joint null hypothesis that both of the above two constraints hold fails to be rejected at marginal significance levels much higher than 10% for the two regressions based on equation (9). However, for the two regressions based on equation (12) this joint null hypothesis fails to be rejected at a marginal significance level higher than 2%. It seems that a linear specification of the nominal interest rate variable as in equation (9) is better supported than a log specification as in equation (12), or else that the proxy for the scale variable is a bad proxy. Finally, the adjustment to the long run falls upon the real interest rate and probably also upon the scale variable. There is evidence that the foreign exchange rate, the money supply, and the nominal interest rate are all weakly exogenous.

The evidence on the estimated model, on money neutrality, and on the absence of economies and diseconomies to scale should urge economists to regain confidence in this monetary model, and should assure them that foreign exchange rate fluctuations may be justified by the fundamentals included in that model. At the very least, long run volatility of foreign exchange rates may fail to be regarded as excessive. And a more benign look upon these long run fluctuations in foreign exchange rates is warranted, especially by policy makers. If, in the long run, the level and volatility of foreign exchange rates are predictable individual investors should be more tranquil about their returns on foreign investments and these returns should turn out to be better in line with their expectations.

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The Ability of Explaining and Predicting of Economic Value Added (EVA) versus Net Income (NI), Residual Income (RI) & Free Cash Flow (FCF) in Tehran Stock Exchange (TSE)

Akbar Parvaei[1] & Soran Farhadi[1]

[1] Faculty of Management, University of Tehran, Tehran, Iran

Correspondence: Akbar Parvaei, Faculty of Management, University of Tehran, Tehran, Iran. Tel: 98-935-645-6089. E-mail: parvaei.a@gmail.com

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Abstract

Current research examines the main performance measures (Net income (NI), residual income (RI), economic value added (EVA) & free cash flow (FCF)) of firm and management to find out whether EVA works better than other performance measures in terms of evaluating the firm's performance. Then we examine the predictability of Economic Value Added for future performance. For doing this, we employ both relevant information content and incremental information content of measures. Our results generally show that EVA is the best measure for evaluating the performance of firm and management among other measures. Furthermore, we find that EVA has low predictability for performance and FCF has slightly superior predictability compared to other measures.

Keywords: net income, residual income, economic value added, free cash flow, relevant information content, incremental information content

1. Introduction

Choosing the best performance measure for evaluating the firm and management has always been considered as a crucial issue. As a result of time constraints and specialization of activities, the role of management and its importance has emerged in corporations formed centuries ago. In spite of all advantages, major challenges have arisen following the emergence of managers that indicate the aspect of agency theory, known as separation of interests between managers and ownerships. Business owners hire the managers to administer the firm's activities and as result this leads to agency relationships. It is evident that the goals of managers and business owners are hardly ever compatible because managers look for extensive economic benefits (such as compensation, prestige, etc.), while the owners are interested in maximizing their investments return and price of stocks. Jensen (1986) proposes that managers tend to squander the free cash flow in the firms, whenever the objectives of shareholders and managers differ. Due to this interest asymmetry between owners and managers, researchers have looked for the best performance measure to evaluating the ability of managers to conclude their tasks. Therefore, the current paper is going to present the most optimal performance measure of firm and management. Nowadays, many performance measures are presented that the three most important ones are net income, cash flows and economic income.

Net income (NI) has been considered as a performance measure since many years. This scenario continued until extensive researches finally showed that accounting income is unsatisfactory concept for performance and profitability measurement. The reason for this claim is that accounting income does not consider the opportunity cost of the capital employed (Dearden 1972 and Anthony 1973). They believed that residual income (RI) is a better measure for evaluation of firms and managers compared to the accounting income.

As another performance measure, Economic value added (EVA) is one of the newest techniques used for evaluating performance. The first evidence about economic value added and market value added was documented by Stewart (1991). Stewart surveyed 613 American firms and found that EVA approximately explains 97% of market value added changes. Moreover, he justified that EVA is more optimal performance measure than other measures.

The main point inferred from EVA is that firms generate positive EVA whenever the investment return rate overcomes Cost of Capital rate. In the other research, Stewart (1993) investigated accounting and economic

measures to find out which one works more effectively. Results of his research showed that EVA has superiority to explain the stock return versus other accounting measures such as return on equity (ROE), earnings per share (EPS) and cash changes. Consequently these results are led to use of EVA instead of other measures in many firms. EVA as management control system uses for calculating performance of firms (Desai et al., 2006) and it also helps the management to improve the performance of firm by paying attention to capital costs and investment returns.

Free cash flow (FCF) as another performance measure indicates cash flows that firms retain after capital maintenance and developing assets. Mulford and comiskey (2005) believe that "the term 'free' refers to an absence of a superior claim; it is cash flow that is available for use with no strings attached. Spending it will not affect the firm's ability to generate more."

From decision making point of view, cash flow plays significant role for evaluating firm's position compared to income statement which is one of the noisiest statements that may mislead investors. For example, the firm can show high net income in its financial statements, while it is unable to pay back its liabilities. Fabozzi and Peterson (2003) believe that "From a shareholder's perspective, free cash flow may be an appropriate measure because this represents the cash flow that is reinvested in the company.

As a result, the current paper is going to examine the main performance measures (Net income (NI), residual income (RI), economic value added (EVA) & free cash flow (FCF)) of firm and management. First, we will examine whether EVA works better than other performance measures in terms of evaluating the firm's performance. Then we will determine which measure has more predictability power in order to find out whether EVA has the highest predictability power among other variables. For this pupose, we employ measures' relevant information content as well as incremental information content. Our results generally show that EVA is the best measure for evaluating the performance of firm and management among others. Furthermore, we find that EVA has low performance predictability power and FCF has slightly superior predictability power in comparison with other measures. The details will be presented in the next parts.

2. Literature Review

Specifying a rational performance measure for firms has turned out as a crucial issue for researchers. In time, the gradual growth of this incentive was accompanied by the emergence of new measures of firm and management evaluation. In different decades, researches centered around different measures and in 1990s they were mostly centered on EVA as one the most recent measures. After Stewart (1991) claimed; EVA is the best performance measure, many researches have been done to verify its accuracy. Lehn and Makhija (1996) examined the American firms to evaluate the relationship between performance measures such as EVA, market value added (MVA), return to equity (ROE), return to assets (ROA) and return to sales (ROS), and the stock return. Results showed that all the mentioned performance measures have positive relationship with the stock return. Furthermore, they argued that there is significant association between stock return and EVA among other measures. Similarly, there are many researches that evaluated the relationship between EVA and the stock return and their results showed the superiority of EVA, e.g. (Uyemura et al. 1996, Hall 1998, Holiana et al. 2011 and Haddad 2012).

Some researchers examined different measures. For example, Worthington and West (2004) investigated the accounting measures (earnings before extraordinary items (ERN) and net cash flows from operations (NCF)) and economic measures (residual income (RI) and economic value added (EVA)) to find out which variable has the largest relative information content. Their research was on 110 Australian companies over the period 1992–1998 and they showed that EVA has the largest relative information content among others.

Some papers also evaluated the relationship between performance measures and market value added (MVA). For example, Fingan (1991) demonstrated that there is significant association between MVA and EVA comparing to other performance measures such as earning per share, cash flows, capital growth and return on equity.

In EVA literature, some researchers studied about adoption of EVA and firm's risk. Prakash et al. (2003) examined the impact of adoption of EVA on the risk characteristics of the firms. They employed the event study approach and their sample included 48 firms that adopted EVA between 1987 and 1996. Their results showed that in the post adoption period, for majority of the firms systematic risk decreases, but unsystematic risk and total risk increase. Their justification was that firms that adopt EVA, simultaneously reach higher stock return and this leads to high levels of risk for them. As other research about adoption of EVA by firms, Hamilton et al. (2009) investigated that whether firms that adopt EVA comparing to non-adopters are faced with higher performance. They reported that EVA adopters show less negative performance than non-adopters. They also found that adopter performance improves in a positive direction, while non-adopters experience a performance decline too. They claimed that EVA creates some benefit for adopters.

Some papers also examined predictability of EVA and other measures. Machuga et al. (2002) studied information content of EVA, net income, cash flows and stock return for predicting earning per share (EPS). They reported that EVA has the greatest ability for predicting EPS among others. Movassagh et al. (2011) reached similar conclusions.

The evidence of paradox about EVA and the stock return was documented by Fu et al. (2011). They formed 10 portfolios and ranked from the highest positive EVA firms to most negative EVA firms. They reported that returns of negative EVA firms are higher than for positive EVA firms. They argued that this situation arise because of investor's confidence in future expectations for these firms.

In contrast, in EVA literature there are some papers that documented that EVA has no superiority among other measures and rejected the Stewart's claims. Tsuji (2006) examined to find out which valuation measures including EVA, cash flow, operating income and profit after tax can indicate market value of the firms effectively. His sample size included 562 Japanese listed firms and the sample period was the 21 years from 1982 through to 2002. The results of his research exhibited that firm's market values have stronger linkages with cash flow and other earnings measures than EVA. O'Byrne (1996) investigated the relationship between EVA, earnings measures and free cash flow (FCF), and the stock return. He reported that earnings measures unlike EVA have significant association with the stock return. Similarly there are many papers that documented the superiority of net income among other measures, e.g. (Biddle et al. 1997, Chen and Dodd 2001, Kramer and peters 2002, Fernandez 2003 and Shubita 2010).

Some papers also concluded that return to assets (ROA) has the superiority among others. For example, Chen and Dodd (1996) examined the relationship between EVA, EPS, ROA and ROE, and the stock return. They reported that ROA unlike the other measures has significant association with the stock return. ArabSalehi and Mahmoodi (2011) reached similar conclusions.

Some researchers investigated EVA from valuation aspect. For example Shrieves and Wachowicz (2001) examined EVA, free cash flow (FCF) and net present value (NPV) to show that which measure has greater power from valuation aspect. They documented that all the measures have same power for valuating.

As result, there is no agreement among the researches about the best performance measures but from quantitative point of view, Sharma and Kumar (2010) argue that there are less numbers of studies that do not show the superiority of EVA among other measures in developed country.

3. Sample and Variables

3.1 Sample Selection

The sample used for this research includes 80 Iranian firms that listed in Tehran stock exchange (TSE) over the years 2005 to 2009. For better evaluation, firms with equal time periods had been selected. In addition, firms without transactions in periods of more than two months have been excluded. Furthermore, banks and financial companies were omitted.

3.2 Variables

3.2.1 Dependent Variable

Dependent variable in this research is annual stock return. The variable is directly acquired from Tehran stock exchange (TSE).

3.2.2 Independent Variables

Economic value added (EVA) is calculated in this way:

$$EVA = Adj\ NOPAT - (Capital\ Employed \times WACC) \quad (1)$$

NOPAT = Net operating profit after taxes

WACC = weighted average cost of capital

$$Adj\ NOPAT = Operating\ Profit \times (1 - Tax\ Rate) + Provisions \quad (2)$$

Provisions = Advertising Expense + R&D Expense + Bad debt

$$WACC = w_e k_e + w_d k_d (1\text{-}Tax) \quad (3)$$

w_d , w_e = debt' weight and common stock' weight, respectively

k_d , k_e = Cost of debt and cost of equity, respectively

Cost of debt is obtained from annual government's reports. Capital assets pricing model (CAPM) is employed to calculate the cost of equity. We calculate Beta individually for each firm and put them in CAPM model to find out the cost of equity. This approach was used by Teker et al. (2011) and Fiordelisi (2007).

$$K_e = K_{rf} + \beta\ (K_m - K_{rf}) \quad (4)$$

K_{RF} = Treasury Bills Rate of Return of Central Bank of Iran

K_M = Market Index Rate of Return of Tehran Stock Exchange

β = market risk for the stock of each firm

$$\beta_c = \ (Cov\ (R_m, R_c\ ))/(var\ (R_c\ )) \quad (5)$$

R_m = periodic return of index

R_c = periodic stock return of firm c

Free cash flow (FCF) is calculated in this way:

$$FCFF = EBIT\ (1\text{-}T) + Depreciation - Capital\ expenditures - Increase\ in\ NWC \quad (6)$$

FCFF = free cash flow for the firm

EBIT = earnings before interest and taxes

NWC = net working capital

Residual income (RI) is calculated in this way:

$$RI = NOPAT_t - (Capital\ Employed_{t-1} \times WACC_t) \quad (7)$$

Net income (NI) is directly obtained from financial statement of the firms for different periods.

Table 1 presents descriptive statistics of dependent and independent variables. As shown, maximum and minimum amounts of mean respectively belong to RI (1.28) and ΔEVA (0.31). We employ Jarque-bera test for checking the normality of variables. The results of the test show that all variables follow the normal distribution. We also use Variance Inflation Factors method (VIFs) to measuring the level of collinearity in models. The result of VIFs test reveals that VIF of variables are less than 10 which indicates that collinearity is not significant in our research.

Table 1. Descriptive statistics

	R_t	EVA	NI	RI	FCF	R_{t+1}	ΔEVA	ΔNI	ΔRI	ΔFCF
Mean	0.28	0.00	0.05	1.29	0.09	0.30	-0.32	-0.11	-0.03	-0.03
Median	0.19	0.25	0.16	1.15	0.11	0.20	-0.06	0.00	0.08	0.02
Maximum	5.02	1.26	1.29	5.84	3.77	5.02	1.60	1.23	1.84	3.28
Minimum	-0.64	-5.58	-6.08	0.08	-10.48	-0.64	-6.45	-1.02	-9.69	-2.25
Std. Dev.	0.55	0.91	0.51	0.61	7.92	0.54	0.85	0.77	1.26	3.58

4. Hypothesis

This research includes 8 hypotheses that classify in 4 categories.

Hypothesis 1: A. EVA has the largest relative information content with the current stock return among other measures.

B. EVA has the largest incremental information content with the current stock return among other measures.

Hypothesis 2: A. EVA changes (ΔEVA) have the largest relative information content with the current stock return among changes of other measures.

B. EVA changes (ΔEVA) have the largest incremental information content with the current stock return among changes of other measures.

Hypothesis 3: A. EVA has the largest relative information content with the future stock return among other measures.

B. EVA has the largest incremental information content with the future stock return among other measures.

Hypothesis 4: A. EVA changes (ΔEVA) have the largest relative information content with the future stock return among changes of other measures.

B. EVA changes (ΔEVA) have the largest incremental information content with the future stock return among changes of other measures.

5. Methodology

In this paper, we employ pooled regression method for testing the hypothesis. Baltagi (2008) argued that pooling data has some advantages such as giving a richer source of variation which allows for more efficient estimation of the parameters. With additional informative data, one can get more reliable estimates and test more sophisticated behavioral models with less restrictive assumptions. Also, another advantage is their ability to control for individual heterogeneity. There are different methods of pooling panel data including the fixed effects and the random effects model. Fixed effects are used when we want to consider all regression coefficients restrict to be the same across all cross sections and random effects are used when we think that the unobserved effect is uncorrelated with the explanatory variables. We use F–test and Hausman-test to identify which method should be considered for models of this research. According to the results, fixed effects pooled model is more appropriate for our models.

For determining which measure has the greatest relative information content, we employ one variable regression for each measure. Then, we observe adjusted R^2 of all regression models. Whichever that has greater adjusted R^2, has greater relative information content too. Many researchers employed this approach in their papers, e.g. (Biddle et al. 1997 and Holiana et al. 2011).

Our approach for investigating the incremental information content is that we first pair variables together in a multiple regressions, and then we deduct adjusted R^2 of multiple regressions from adjusted R^2 of related one variable regressions, the difference indicates the incremental information content. Worthington and West (2004) apply this approach in their research.

6. Empirical Results

Hypothesis 1: Results of the investigating hypothesis 1 are presented in table 2. As shown, this table consists of 3 parts. Part A shows the data of regression models and part B exhibits the results of relative information content and finally results of incremental information content are presented in part C. part A shows data such as Estimated Coefficient, t–statistics, Standard Errors, F–statistic and adjusted R^2 related to each models. Every four proceeding models contain one variable regression for each independent variable (EVA, NI, RI and FCF) and the next 6 models include the multiple regressions for paired variables. In every one variable regression, all independent variables have a positive relationship with the current stock return and EVA has the greatest Estimated Coefficient among others. Minimum Standard Errors for all one variable regressions belong to FCF. In pairwise regressions there is also positive relationship between independent variable and the stock return and again EVA has the greatest Estimated Coefficient among others.

As mentioned, part B in table 2 shows the degree of relative information content for each independent variable. The greatest relative information content belongs to EVA (0.27), NI (0.14), RI (0.11) and FCF (0.09), respectively.

Therefore, Hypothesis 1(A) is accepted. In other words, EVA has the largest relative information content with the current stock return among others. Other variables have relatively equal relative information content. This result supports the claims made by Stewart that EVA is a better measure for explaining the stock returns among other accounting based performance measures. Lehn and Makhija (1996) and Haddad (2012) reached similar conclusions.

Part C in table 2 exhibits the results of incremental information content. As mentioned before, for calculating the incremental information content, first we obtain the adjusted R^2 from pairwise regression models and then deduct them from related adjusted R^2 of every one variable regression. For example, for obtaining (EVA-NI), we deduct the adjusted R^2 of (EVA, NI) from adjusted R^2 of (NI), that is, 29% -13% = 16%.

As shown in table 2, EVA has the greatest incremental information content among other measures. It means that Hypothesis 1(B) is accepted too. The incremental information content of NI and RI are almost the same. Furthermore, FCF doesn't have any incremental information content. Worthington and West (2004) and ArabSalehi and Mahmoodi (2011) reached similar conclusions.

Table 2. This table contains data about regression models

(A) Model Data

	EVA				NI				RI				FCF					
	Coefficient	Estimated	t–stat	Error	Standard	Coefficient	Estimated	t–stat	Error	Standard	Coefficient	Estimated	t–stat	Error	Standard	Coefficient	Estimated	t–stat	Error	Standard	F	Adj. R^2
1	0.37		7.71		0.05																2/7	0/26
2						0.29		3.08		0.10											1/7	0/13
3											0.19		2.21		0.09						1/5	0/11
4																0.001		1.18		0.0014	1/4	0/09
5	0.36		7.27		0.05	0.25		2.84		0.09											2/9	0/29
6						0.27		2.95		0.09	0.15		1.73		0.09						1/7	0/14
7											0.19		2.19		0.09	0.002		1.32		0.0010	1/5	0/11
8	0.40		7.23		0.05						0.28		3.49		0.08						3/0	0/30
9						0.29		3.08		0.10						0.001		1.47		0.0010	1/7	0/13
10	0.37		7.71		0.05											0.001		0.86		0.0018	2/6	0/26

(B) Relative Information Content

EVA (0.27)	>	**NI** (0.14)	>	**RI** (0.11)	>	**FCF** (0.09)
P Value of two	0.000		0.0001		0.003	
variable		0.000		0.0004		
regressions			0.000			

(C) Incremental Information Content

EVA-NI	EVA-RI	EVA-FCF	NI-EVA	NI-RI	NI-FCF	RI-EVA	RI-NI	RI-FCF	FCF-EVA	FCF-NI	FCF-RI
0.16	0.19	0.17	0.03	0.03	0.04	0.04	0.01	0.02	0.00	0.00	0.00

significant at the 5 percent level

Notes: There are 10 regression models that four first of them are one variable regressions and the rest of them are two variable regressions. The dependent variable is current stock return and the independent variables are economic value added (EVA), net income (NI), residual income (RI) and free cash flow (FCF).

Hypothesis 2: Results of the investigating hypothesis 2 are exhibited in table 3. Part A shows Estimated Coefficient, t–statistics and Standard Errors related to each models. Four first models include one variable regressions for each independent variable (ΔEVA, ΔNI, ΔRI and ΔFCF) and the next 6 models contain the multiple regressions for paired independent variables. In right side of table 3, F–statistic and adjusted R2 of models are shown. In every one variable regression, all independent variables have a positive relationship with the current stock return and EVA changes have the greatest Estimated Coefficient among others. Minimum Standard Errors for all one variable regression belong to ΔFCF, ΔRI, ΔNI and ΔEVA, respectively. In pairwise regressions, there is positive and significant relationship between ΔEVA and the stock return.

Part B in table 3 shows the results of relative information content for each independent variable. The greatest relative information content is related to ΔEVA (0.22), ΔNI (0.101), ΔFCF (0.1) and ΔRI (0.09), respectively. As a result, our claim that ΔEVA has the largest relative information content with the current stock return among other measures, are accepted. Other variables have relatively equal relative information content. Similarly, O'Byrne (1996) examined the relationship between changes of EVA, earnings measures and free cash flow (FCF), and the stock return and he revealed that changes of EVA have significant association with the stock return.

Part C in table 3 shows the results of incremental information content. As shown in table 3, the incremental information content of ΔNI, ΔRI and ΔFCF are close to zero, while ΔEVA has great incremental information

content. It shows that Hypothesis 2 (B) is accepted. This result accommodate with result of Worthington and West (2004) research. They showed that EVA changes have the greatest incremental information content among other measures such as earnings before extraordinary items, net cash flows from operations and residual income.

Table 3. This table contains data about regression models

(A) Model Data

	ΔEVA				ΔNI				ΔRI				ΔFCF					
	Coefficient	Estimated	t–stat	Error	Standard	Coefficient	Estimated	t–stat	Error	Standard	Coefficient	Estimated	t–stat	Error	Standard	Coefficient	Estimated	t–stat	Error	Standard	F	Adj. R^2
1	0.26		5.01		0.05																2.33	0.22
2						0.07		2.37		0.03											1.53	0.101
3											0.02		1.54		0.01						1.49	0.09
4																0.003		1.62		0.0022	1.53	0.1
5	0.29		6.23		0.04	-0.05		-1.13		0.05											2.34	0.22
6						0.13		2.02		0.06	-0.04		-0.97		0.04						1.53	0.10
7											0.02		1.36		0.01	0.003		1.59		0.0021	1.52	0.10
8	0.32		7.47		0.04						-0.06		-2.57		0.02						2.42	0.23
9						0.06		2.24		0.03						0.003		1.57		0.0021	1.56	0.10
10	0.26		4.92		0.05											0.003		1.41		0.0022	2.36	0.22

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(B) Relative Information Content

ΔEVA (0.22)	>	**ΔNI** (0.101)	>	**ΔFCF** (0.10)	>	**ΔRI** (0.09)
P Value of two	0.000		0.003		0.005	
variable regressions		0.000		0.005		
			0.000			

(C) Incremental Information Content

ΔEVA-ΔNI	ΔEVA-ΔRI	ΔEVA-ΔFCF	ΔNI-ΔEVA	ΔNI-ΔRI	ΔNI-ΔFCF	ΔRI-ΔEVA	ΔRI-ΔNI	ΔRI-ΔFCF	ΔFCF-ΔEVA	ΔFCF-ΔNI	ΔFCF-ΔRI
0.12	0.140	0.120	0.000	0.010	0.000	0.010	-0.001	-0.001	0/00	-0.001	0.009

significant at the 5 percent level

There are 10 regression models that four first models of them are one variable regressions and the rest of them are two variable regressions. The dependent variable is current stock return and the independent variables are changes in economic value added (ΔEVA), changes in net income (ΔNI), changes in residual income (ΔRI) and changes in free cash flow (ΔFCF).

Hypothesis 3: Results of the investigating hypothesis 3 are presented in table 4. Part A shows data such as Estimated Coefficient, t–statistics, Standard Errors, F–statistic and adjusted R^2 related to each models. Every four proceeding models contain one variable regression for each independent variable (EVA, NI, RI and FCF) and the Next 6 models include the multiple regressions for paired variables. In every one variable regression, all independent variables have a negative relationship with the future stock return except EVA. Minimum Standard Errors for all one variable regressions belong to FCF again. In pairwise regressions there is also positive relationship between EVA and the stock return in all situations.

Part B in table 4 exhibit the degree of relative information content for each independent variable. The greatest relative information content belongs to FCF (0.08), RI (0.06), EVA (0.059) and NI (0.058), respectively. As shown, FCF slightly surpasses other measures in relative information content with the future stock return. As result, our claim that EVA has the largest relative information content with future the stock return, are rejected. In contrast, in a study that is close to our research, Machuga et al. (2002) documented that EVA has the greatest ability for

predicting EPS among other measures such as net income and cash flows. Our results show that none of the variables have high ability of predicting the stock return.

Part C in table 4 reveals the results of incremental information content. As shown in table 4, all variables have relatively the same degree of incremental information content. Only FCF slightly takes advantage of greater incremental information content. It means that Hypothesis 3(B) is rejected too.in other words, EVA has not the largest incremental information content with the future stock return among other measures.

Table 4. This table contains data about regression models

(A) Model Data

	EVA					NI					RI					FCF						
	Coefficient	Estimated	t–stat	Error	Standard	Coefficient	Estimated	t–stat	Error	Standard	Coefficient	Estimated	t–stat	Error	Standard	Coefficient	Estimated	t–stat	Error	Standard	F	Adj. R^2
1		0.02	0.64	0.04																	1.3	0.0594
2						-0.008	-0.02	0.04													1.29	0.0584
3											-0.13	-1.44	0.093								1.35	0.0687
4																-0.009	-3.31	0.002			1/4	0.0801
5		0.02	0.65	0.04		-0.004	-0.1	0.040													1.28	0.0564
6						0.023	0.04	0.527			-0.139	-1.45	0.095								1.33	0.0660
7											-0.126	-1.35	0.093			-0.008	-3.66	0.002			1.44	0.0861
8		0.01	0.34	0.04							-0.132	-1.36	0.097								1.33	0.0660
9						0.527	0.07	0.040								-0.009	0.002	-3.311			1.39	0.0772
10		0.02	0.66	0.04												-0.009	-3.36	0.002			1.40	0.0783

(B) Relative Information Content

FCF (0.08)	>	**RI** (0.06)	>	**EVA** (0.059)	>	**NI** (0.058)			
P Value of two variable regressions	0.013178	0.021128	0.041643	0.041694	0.022518	0.067470			

(C) Incremental Information Content

EVA-NI	EVA-RI	EVA-FCF	NI-EVA	NI-RI	NI-FCF	RI-EVA	RI-NI	RI-FCF	FCF-EVA	FCF-NI	FCF-RI
-0.001	-0.002	-0.001	-0.003	-0.002	-0.002	0.007	0.007	0.006	0.018	0.018	0.017

significant at the 5 percent level

There are 10 regression models that four first models of them are one variable regressions and the rest of them are two variable regressions. The dependent variable is stock return of year (t+1) and the independent variables are economic value added (EVA), net income (NI), residual income (RI) and free cash flow (FCF).

Table 5. This table contains data about regression models

(A) Model Data

	ΔEVA				ΔNI				ΔRI				ΔFCF					
	Coefficient	Estimated	t–stat	Error	Standard	Coefficient	Estimated	t–stat	Error	Standard	Coefficient	Estimated	t–stat	Error	Standard	Coefficient	Estimated	t–stat	Error	Standard	F	Adj. R^2
1		0.03	1.02	0.0347																	1.31	0.0607
2							0.01	0.50	0.021												1.30	0.0586
3												0.01	0.77	0.015							1.30	0.0591
4																	-0.005	-8.75	0.0006		1.44	0.0855
5		0.04	0.91	0.0425			-0.006	0.02	-0.24												1.29	0.0578
6							-0.01	-0.3	0.05			0.02	0.55	0.037							1.28	0.0563
7												0.018	1.2	0.015			-0.006	-10.0	0.00060		1.43	0.0845
8		0.03	0.79	0.0424								0.002	0.12	0.018							1.29	0.0577
9							0.02	0.97	0.021								-0.005	-9.3	0.00064		1.43	0.0835
10		0.04	1.14	0.0349													-0.006	-9.2	0.00064		1.44	0.0856

(B) Relative Information Content

ΔFCF (0.08)	>	**ΔEVA** (0.06)	>	**ΔRI** (0.059)	>	**ΔNI** (0.058)			
P Value of two variable regressions	0.013662	0.014597	0.063329	0.015465	0.063182	0.067882			

(C) Incremental Information Content

ΔEVA-ΔNI	ΔEVA-ΔRI	ΔEVA-ΔFCF	ΔNI-ΔEVA	ΔNI-ΔRI	ΔNI-ΔFCF	ΔRI-ΔEVA	ΔRI-ΔNI	ΔRI-ΔFCF	ΔFCF-ΔEVA	ΔFCF-ΔNI	ΔFCF-ΔRI
-0.0	-0.001	0.000	-0.002	-0.002	-0.002	-0.00	-0.002	-0.001	0.024	0.0249	0.025

significant at the 5 percent level

There are 10 regression models that four first models of them are one variable regressions and the rest of them are two variable regressions. The dependent variable is stock return of year (t+1) and the independent variables are changes in economic value added (ΔEVA), changes in net income (ΔNI), changes in residual income (ΔRI) and changes in free cash flow (ΔFCF).

Hypothesis 4: Results of the investigating hypothesis 4 are exhibited in table 5. Part A shows Estimated Coefficient, t–statistics and Standard Errors related to each models. Four first models include one variable regressions for each independent variable (ΔEVA, ΔNI, ΔRI and ΔFCF) and the next 6 models include the multiple regressions for paired independent variables. In right side of table 3, F–statistic and adjusted R2 of models are shown. In every one variable regression, all independent variables have a positive relationship with the future stock return except ΔFCF. The greatest Estimated Coefficient is belonged to ΔEVA, but generally all the variables have low amounts of Estimated Coefficient. Minimum Standard Errors for all one variable regressions are belonged to ΔFCF. In pairwise regressions, there are positive relationship between ΔEVA and ΔRI, and the future stock return in all situations.

Part B in table 5 exhibits the results of relative information content for each independent variable. The greatest relative information content is related to ΔFCF (0.08), ΔEVA (0.06), ΔRI (0.059) and ΔRI (0.058), respectively. All variables have relatively the same degree of relative information content. Only ΔFCF slightly takes advantage of greater relative information content. As result, our claim that ΔEVA have the largest relative information content with the future stock return, are rejected.

Part C in table 5 shows the results of incremental information content. According to table 3, the incremental information content of all variables is close to zero, but ΔFCF has the greatest degree of incremental information content among others. This result shows that Hypothesis 4 (B) is rejected.it means that ΔEVA does not have the largest incremental information content with the future stock return among others.

6. Conclusions

There are many researches that examined the relationship between EVA and the stock return that show the superiority of EVA for evaluating the firm's performance among other measures, e.g. (Uyemura et al. 1996, Lehn and Makhija (1996)). Some papers also reported that EVA has a high power of predictability among others, e.g. (Machuga et al. (2002) and Movassagh et al. (2011)). Current research examines the main performance measures (Net income (NI), residual income (RI), economic value added (EVA) & free cash flow (FCF)) of firm and management to find out whether EVA has a high power of explaining among other measure or not. For this pupose, we apply measures' relevant information content as well as incremental information content. Pooled regression method is employed for testing the hypothesis. Moreover, our investigation is based on main variables (EVA, NI, RI and FCF) and their changes (ΔEVA, ΔNI, ΔRI and ΔFCF). Our results support the claims made by Stewart (1993) that EVA is a better measure to explain the stock returns among other accounting based performance measures. Furthermore, by comparing different performance measures this research concludes that ΔEVA has both the largest relative information content and the largest incremental information content with the current stock return. Worthington and West (2004) reached similar conclusions.

This research also examine the predictability of EVA among other measures and results of this investigation reveal that neither EVA nor ΔEVA have the largest relative information content or the largest incremental information content with the future stock return. Only FCF and ΔFCF slightly take advantage of them.

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2007-2009 Bear Market and Corporate Takeovers

Ozge Uygur[1], Gulser Meric[1] & Ilhan Meric[2]

[1] Department of Accounting and Finance, Rowan University, U.S.A.

[2] Department of Finance and Economics, Rider University, U.S.A.

Correspondence: Gulser Meric, Professor of Finance, Department of Finance and Accounting, Rohrer College of Business, Rowan University, Glassboro, NJ 08028, U.S.A. E-mail: Meric@rowan.edu.

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Abstract

Mergers and acquisitions (M&A) are among the most popular research topics in finance. The synergistic benefits of and the market reaction to mergers have been studied extensively. However, the impact of financial/economic crises on M&A activities has not been studied sufficiently. In this empirical study, we make a contribution on this subject by studying the financial characteristics of acquisition targets in the U.S. before, during, and after the October 9, 2007-March 9, 2009 bear market. The MANOVA (multivariate analysis of variance) test statistics indicate that the overall financial characteristics of the acquired firms were not significantly different from the financial characteristics of the non-acquired control group firms during the bear market and immediately before and after the bear market. However, we find that the acquiring firms preferred targets with significantly higher total assets turnover ratios before the bear market, with significantly higher inventory turnover ratios during the bear market, and with significantly lower capital expenditure ratios after the bear market.

Keywords: 2007-2009 bear market, acquisition target, financial characteristics, MANOVA (multivariate analysis of variance)

JEL Classification: G30, G34

1. Introduction

Mergers and acquisitions (M&A) have been studied extensively in finance. Poor post-merger performance and bad market reaction to mergers are generally explained by reasons such as hubris (Roll, 1986), managerial entrenchment (Jensen 1986; Morck et al., 1988; Shleifer and Vishny, 1989), empire building (Rhoades, 1983; Black, 1989) and bad judgment (Morck et al., 1990). The focus of most M&A studies has been generally limited to specific countries (see, e.g., Rose, 1987; Trifts and Scanlon, 1987). The M&A literature has traditionally focused more on the acquirers than on the targets. Meric et al. (1991) and Aghigbe et al (2004) have studied the financial characteristics of and the gains to bank acquisition targets.

Value creation in mergers has received considerable attention. Value creation and destruction in mergers have been evaluated extensively in the context of diversification (Lang and Stulz, 1994; Berger and Ofek, 1995; Servaes, 1996). Datta et al (1992) study the factors that affect value creation in mergers and acquisitions. Becher (2004) and Beitel et al. (2004) have studied value creation in bank mergers. An extensive literature review of M&A studies can be found in Schweiger and Goulet (2000), Cartwright and Schoenberg (2006), and DeYoung et al. (2009).

The effect of economic/financial crisis periods on M&A activities has not been studied sufficiently in the extant literature. In this paper, we make a contribution on this subject by studying the financial characteristics of U.S. companies that have been takeover targets during the 2007-2009 bear market. This was the worst bear market in U.S. history since the Great Depression. U.S. stocks lost 55 percent of their market value from October 9, 2007 to March 9, 2009 and many U.S. companies became attractive acquisition targets to both domestic and foreign buyers during this period. For comparison, we also study the January 1, 2005-October 8, 2007 period immediately before and the March 10, 2009-December 31, 2011 period immediately after the bear market.

2. Methodology

Comparing the financial characteristics of different groups of firms with financial ratios has long been a popular research methodology in finance. Altman (1968), Edmister (1972), and Dambolena and Khoury (1980) predict bankruptcy by comparing the financial ratios of bankrupt and healthy firms. Stevens (1973), Belkaoui (1978),

Rege (1984), Meric et al. (1991), and Uygur et al. (2012) use financial ratios to identify the financial characteristics of companies which become the target of corporate takeovers. Hutchinson et al. (1988) use financial ratios to identify the financial characteristics of companies, which achieve stock market quotation in the UK. Meric et al. (2000) compare the financial characteristics of Japanese *kieretsu*-affiliated and independent firms with financial ratios.

Several studies use financial ratios to compare the financial characteristics of firms in different countries. Kester (1986) and Wald (1999) compare the capital and ownership structures of firms in different countries. Meric and Meric (1989, 1994) compare the financial characteristics of U.S. and Japanese manufacturing firms. Meric at al. (2003) compare the financial characteristics of U.S. and Canadian manufacturing firms. Meric et al. (2002) compare the financial characteristics of U.S., E.U., and Japanese manufacturing firms.

MDA (Multiple Discriminant Analysis) and MANOVA (Multivariate Analysis of Variance) are the two multivariate statistical methods most commonly used in previous studies to compare the financial characteristics of different groups of firms (see, e.g., Stevens, 1973; Meric et al., 1991). In this paper, we use the MANOVA method (see: Johnson and Wichern, 2007) to compare the financial characteristics of U.S. firms that have been takeover targets with the financial characteristics of a control group of comparable size firms.

ANOVA (analysis of variance) is a special case of MANOVA that focuses on a single variable (see: Wilks, 1932; Bartlett, 1936). It is a statistical inference method to test for significant differences between means of two or more groups. The *F* statistic is given by

$$F = \frac{SSB}{SSW} \tag{1}$$

Where SSB is data variation between the means of different groups and SSW is data variation within each group.

MANOVA (multivariate analysis of variance) is a generalized form of ANOVA to multi-variant cases. In contrast to the univariate ANOVA, the total variation in MANOVA is not only contributed by the variation within and between groups, it may also be contributed by the interactions among different variables.

The multivariate test statistic Wilks' Lambda is given by

$$\Lambda_{Wilks} = \frac{|\boldsymbol{A}_{SSW}|}{|\boldsymbol{A}_{SSW}+\boldsymbol{A}_{SSB}|} \tag{2}$$

where $|\boldsymbol{A}|$ is the determinant of matrix $\boldsymbol{A}$. Wilks' Lambda can also be transferred into an F statistic in hypothesis testing (see: Bartlett, 1938).

3. Data

Our data collection process consists of three steps. First, we identify the U.S. firms that were acquisition targets during the 2005–2011 period. Secondly, we group these target firms into three categories based on their merger announcement dates. Merger announcements between January 1, 2005 and October 8, 2007 are considered as "Before Crisis" mergers, those between October 9, 2007 and March 9, 2009 are consider as "During Crisis" mergers, and those between March 10, 2009 and December 31, 2011 are considered as "After Crisis" mergers. Lastly, we collect the data from the financial statements of the target U.S. companies.

The mergers and acquisitions data are collected from the Capital IQ database. We first identified the U.S. public firms that were acquisition targets during the 2005–2011 period. We then collected the annual data from the year-end financial statements of the firms from the Compustat database for the fiscal year one year prior to the year of the merger. In order to mitigate the excessive influence of the outliers, we winsorized our sample at the 1% and 99% levels.

As the final step of our data collection, we created a matched-sample control group for the target firms. We matched every target company with a same-size non-acquired public company from the same industry. After determining the matched sample of control group firms, we collected their annual financial statements data from the Compustat database.

Overall, our sample consists of 321 target firms and 321 control group firms. The break-down of the sample based on the merger announcement date is displayed in Table 1. The summary statistics of the targets firms and the control group firms are presented in Table 2. The financial ratios used in the comparisons as measures of the financial characteristics of the firms are presented in Table 3.

Table 1. Sample Information and Number of Observations

	Before Crisis	During Crisis	After Crisis	Full Sample
Target Companies	83	51	86	220
Control Group Companies	45	25	31	101
All Companies	128	76	117	321

Table 2. Summary Statistics for the Target and Control Group Companies

	Target Companies			Control Group Companies		
Variables	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
Total Assets	1,652.11	360.31	4,552.23	5,355.90	1,151.85	18,162.13
Current Assets	621.04	179.74	1,847.09	1,494.22	371.09	4,811.61
Net Fixed Assets	1,031.07	134.23	3,034.85	3,861.68	555.55	13,477.80
Sales	1,425.75	355.33	3,578.92	4,305.08	553.52	14,111.47
Net Income	88.42	11.42	436.08	278.88	24.94	862.16
Stock Price per Share	19.46	13.14	18.79	24.25	18.87	23.90

Table 3. Financial Ratios Used in the Study as Measures of Firm Financial Characteristics

Financial Ratio Name	Financial Ratio Definition
Liquidity	
Current Ratio (CUR)	Current Assets / Current Liabilities
Quick Ratio (QUR)	(Current Assets - Inventories) / Current Liabilities
Liquid Assets Ratio (LAR)	(Cash + Marketable Securities) / Total Assets
Asset Management (Turnover) Ratios	
Accounts Receivable Turnover (ART)	Sales / Accounts Receivable
Inventory Turnover (INT)	Sales / Inventory
Fixed Assets Turnover (FAT)	Sales / Net Fixed Assets
Total Assets Turnover (TAT)	Sales / Total Assets
Financial Leverage	
Total Debt Ratio (TDR)	Total Debt / Total Assets
Profitability	
Net Profit Margin (NPM)	Net Income / Sales
Operating Profit Margin (OPM)	Operating Income / Sales
Return on Assets (ROA)	Net Income / Total Assets
Earning Power Ratio (EPR)	Operating Income / Total Assets
Return on Equity (ROE)	Net Income / Common Equity
Growth	
Capital Expenditures Ratios (CER)	Capital Expenditures / Total Assets
Market Value	
Market-to-Book Ratio (MBK)	Market Value Per Share / Book Value Per Share

4. Empirical Findings

4.1 Pre-Crisis Period

The MANOVA test statistics for the pre-crisis period are presented in Table 4. The multivariate F statistic is used to test the null hypothesis that the mean ratio/variable vector for the target firms is not significantly different from the mean ratio/variable vector for the control group. The multivariate F statistic in the table indicates that the null hypothesis should be accepted (i.e., the overall financial characteristics of the two groups of firms are not significantly different).

The univariate F statistics show that the financial characteristics of the two groups of firms are significantly different only in terms of total assets turnover at the ten-percent level. The test result indicates that the acquiring firms preferred targets with significantly higher total assets turnover ratios during the pre-crisis period.

4.2 Crisis Period

The MANOVA test statistics for the crisis period are presented in Table 5. The multivariate test statistic in the table indicates that the overall financial characteristics of the two groups of firms are not significantly different in the crisis period. However, the univariate test statistics show that the two groups of firms are significantly different in terms of the inventory turnover ratio at the ten-percent level. It appears that the acquiring firms preferred targets with higher inventory turnover rates (i.e., targets with a lower level of inventories relative to sales) during this period.

Table 4. MANOVA Statistics for the Pre-Crisis Period: Target Firms vs. Control Group Firms

Financial Ratios	Means and Standard Deviations†		Univariate Statistics	
	Acquisition Targets	Control Group	F Value	P Value
Liquidity				
Current Ratio	2.89	3.28	1.19	0.28
	(2.37)	(3.28)		
Quick Ratio	2.23	2.41	0.44	0.51
	(2.17)	(2.25)		
Liquid Assets Ratio	0.20	0.21	0.12	0.73
	(0.19)	(0.20)		
Asset Management (Turnover) Ratios				
Accounts Rec. Turnover	12.88	12.06	0.08	0.78
	(22.62)	(25.20)		
Inventory Turnover	26.19	22.48	0.39	0.53
	(50.45)	(44.00)		
Fixed Assets Turnover	11.53	9.69	0.80	0.37
	(18.36)	(14.44)		
Total Assets Turnover	1.11	0.98	3.39*	0.07
	(0.62)	(0.51)		
Financial Leverage				
Total Debt Ratio	42.1%	41.8%	0.02	0.90
	(19.9%)	(20.7%)		
Profitability				
Net Profit Margin	0.2%	-5.1%	0.85	0.36
	(39.7%)	(52.1%)		
Operating Profit Margin	2.7%	-0.2%	0.24	0.63
	(38.7%)	(54.2%)		
Return on Assets	3.5%	3.7%	1.34	0.25
	(11.2%)	(11.0%)		
Earning Power Ratio	6.2%	5.4%	0.24	0.63
	(12.8%)	(13.7%)		
Return on Equity	5.3%	2.9%	0.50	0.48
	(28.3%)	(25.4%)		
Growth				
Cap. Expenditure Ratio	5.0%	5.0%	0.01	0.94
	(5.0%)	(5.1%)		
Market Value				
Market-to-Book Ratio	2.77	2.95	0.30	0.58
	(2.21)	(2.85)		
Multivariate Statistics:			0.76	0.72

† The figures in parentheses are the standard deviations.

***, **, * indicate that the difference is significant at the 1-percent, 5-percent, and 10-percent levels, respectively.

Table 5. MANOVA Statistics for the Crisis Period: Target Firms vs. Control Group Firms

Financial Ratios	Means and Standard Deviations†		Univariate Statistics	
	Acquisition Targets	Control Group	F Value	P Value
Liquidity				
Current Ratio	2.95	3.00	0.02	0.90
	(2.47)	(2.23)		
Quick Ratio	2.33	2.31	0.00	0.97
	(2.28)	(2.06)		
Liquid Assets Ratio	0.20	0.19	0.02	0.90
	(0.21)	(0.19)		
Asset Management (Turnover) Ratios				
Accounts Rec. Turnover	9.03	10.33	0.42	0.52
	(9.12)	(14.93)		
Inventory Turnover	28.71	15.40	3.36*	0.07
	(59.80)	(20.93)		
Fixed Assets Turnover	10.90	8.22	1.41	0.24
	(14.26)	(13.62)		
Total Assets Turnover	1.01	0.93	0.91	0.34
	(0.61)	(0.46)		
Financial Leverage				
Total Debt Ratio	43.6%	44.0%	0.01	0.92
	(23.3%)	(21.6%)		
Profitability				
Net Profit Margin	-1.9%	-3.8%	1.02	0.31
	(46.2%)	(30.7%)		
Operating Profit Margin	-0.5%	-3.8%	1.11	0.29
	(54.3%)	(30.7%)		
Return on Assets	2.2%	-0.9%	1.25	0.27
	(13.5%)	(19.9%)		
Earning Power Ratio	4.5%	1.8%	0.99	0.32
	(14.5%)	(19.0%)		
Return on Equity	4.8%	-4.8%	2.24	0.14
	(29.2%)	(48.0%)		
Growth				
Cap. Expenditure Ratio	4.3%	4.9%	0.70	0.41
	(3.7%)	(5.3%)		
Market Value				
Market-to-Book Ratio	3.11	3.37	0.27	0.61
	(2.68)	(3.47)		
Multivariate Statistics:			0.75	0.73

† The figures in parentheses are the standard deviations.

***, **, * indicate that the difference is significant at the 1-percent, 5-percent, and 10-percent levels, respectively.

4.3 Post-Crisis Period

The MANOVA test statistics for the post-crisis period are presented in Table 6. The multivariate F statistic in the table indicates that, as in the previous two periods, the overall financial characteristics of the two groups of firms are not significantly different. However, the univariate F statistic shows that the capital expenditure ratio is significantly lower for the target firms than for the control group firms at the ten-percent level. It implies that the acquiring firms preferred targets with lower capital expenditure ratios during this period. These firms presumably had lower market valuations compared with growth firms with greater capital expenditure ratios making them less expensive targets.

Table 6. MANOVA Statistics for the Post-Crisis Period: Target Firms vs. Control Group Firms

Financial Ratios	Means and Standard Deviations†		Univariate Statistics	
	Acquisition Targets	Control Group	F Value	P Value
Liquidity				
Current Ratio	2.81	3.14	1.27	0.26
	(1.89)	(2.57)		
Quick Ratio	2.21	2.38	0.52	0.47
	(1.64)	(2.02)		
Liquid Assets Ratio	0.22	0.22	0.03	0.86
	(0.20)	(0.21)		
Asset Management (Turnover) Ratios				
Accounts Rec. Turnover	8.60	9.17	0.19	0.66
	(9.58)	(10.39)		
Inventory Turnover	26.42	24.39	0.07	0.79
	(62.54)	(50.71)		
Fixed Assets Turnover	10.81	11.14	0.02	0.88
	(16.26)	(17.55)		
Total Assets Turnover	0.93	0.86	0.98	0.32
	(0.53)	(0.46)		
Financial Leverage				
Total Debt Ratio	45.1%	43.7%	0.25	0.62
	(19.8%)	(23.0%)		
Profitability				
Net Profit Margin	-8.2%	-7.4%	0.01	0.92
	(54.5%)	(59.2%)		
Operating Profit Margin	-1.1%	-1.5%	0.00	0.96
	(49.9%)	(58.4%)		
Return on Assets	-2.9%	-2.4%	0.05	0.83
	(14.3%)	(18.3%)		
Earning Power Ratio	2.2%	2.0%	0.01	0.92
	(10.9%)	(15.9%)		
Return on Equity	-6.8%	-12.5%	0.35	0.56
	(33.7%)	(99.2%)		
Growth				
Cap. Expenditure Ratio	3.8%	4.8%	3.24*	0.07
	(3.6%)	(5.0%)		
Market Value				
Market-to-Book Ratio	2.17	2.24	0.07	0.80
	(1.75)	(2.45)		
Multivariate Statistics:			0.75	0.73

† The figures in parentheses are the standard deviations.

***, **, * indicate that the difference is significant at the 1-percent, 5-percent, and 10-percent levels, respectively.

5. Summary and Conclusions

Mergers and acquisitions (M&A) are among the most popular research topics in finance. However, M&A activities during economic/financial crisis periods have been understudied. In this paper, we make a contribution on this subject by studying the financial characteristics of acquisition targets before, during, and after the October 9, 2007-March 9, 2009 bear market.

We find that acquiring firms preferred targets with higher total assets turnover ratios before the bear market, with higher inventory turnover ratios during the bear market, and with lower capital expenditure ratios after the bear market.

In the pre-crisis period, the total assets turnover ratio is significantly higher in the acquired target firms than in the non-acquired control group firms. It appears that acquiring firms saw greater profit and growth potential in targets that are able to achieve high total assets turnover rates during this relatively normal period before the bear market.

During the crisis period, the inventory turnover ratio is significantly lower in the acquired target firms than in the non-acquired control group firms. The acquiring firms appear to have avoided targets with a low inventory

turnover and excessive inventories during this period. The expectation on the part of the acquiring firms must have been that it would be extremely difficult to liquidate the inventories of the target in a bear market and recessionary economy.

In the post-crisis period, the capital expenditure ratio is significantly lower in the acquired target firms than in the non-acquired control group firms. A strong bull market followed the bear market for several months during the March-July, 2009 period. The market values of growth firms with high capital expenditure ratios increased sharply during this period. Our finding implies that the acquiring firms preferred targets with lower capital expenditure ratios (and with relatively lower market valuations) in the post-bear market period.

Our findings in this study can provide valuable insights to managers of potential acquiring and target firms with respect to what characteristics are considered to be important in acquisition targets during normal, crisis, and post-crisis periods. The information provided in this study may enable the managers of both acquiring and target firms to adopt the right strategies to earn the maximum benefit from mergers and acquisitions.

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Economic Growth and Environmental Sustainability: Empirical Evidence from East and South-East Asia

Md. Samsul ALAM[1] & Md. Nurul KABIR[2]

[1] Graduate School of Asia Pacific Studies, Ritsumeikan Asia Pacific University, Japan

[2] Department of Accounting Finance and Economics, Griffith University, Australia

Correspondence: Md. Nurul kabir, Department of Accounting and Finance, Griffith Business School, Australia. Tel: 61-470-635-893. E-mail: mdnurul.kabir@griffithuni.edu.au

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Abstract

This study investigates the relationship between economic growth and environmental sustainability in the East and South-East Asian countries focused on the environmental Kuznets curve hypothesis, using data from environmental performance index (EPI) in 2010. Both pollution and eco-efficiency measures, two components of environmental sustainability, are considered as dependent variables while GDP per capita is used as an independent variable. Besides independent variable, the study also considers population density and civil and political liberty index (CIVLIB) as control variables and East and South-East Asia as a dummy variable. By using ordinary least square (OLS) method, this study reveals that while the increase of the GDP per capita appears to have positive impact on the pollution measures, it is found mix (both positive and negative) results on eco-efficiency measures. These findings prove the hypothesis of environmental Kuznets curve partially but not entirely. We conclude the paper by suggesting that the policy makers should give priority to the eco-efficiency measures along with pollution measures in order to ensure environmental sustainability in the process of economic development.

Keywords: economic growth, environmental sustainability, kuznets curve

JEL Classification: O1, O2, O5

1. Introduction

The relationship between economic growth and environmental sustainability has been receiving an intensified attention from the researchers since the early 1970s as the world policy makers have started to realize the importance of environmental sustainability with the increasing economic growth. Economic growth refers to the persistence increase in economic activity to produce and consume goods and services over a certain period of time in order to improve the quality of life. Although these increasing production and consumption activities are desirable for their positive social and economic impacts, at the same time it is also important to maintain the environmental sustainability as it is now proven that the economic growth and environmental quality are intricately interrelated to each other over time (Orubu and Omotor, 2010). However, it is not that straightforward to regard this inter-connection as either positive or negative, as the existing literature is divided in their opinions by supporting either of the two directions and thus, the issue still remains controversial.

Traditional economic theory suggests a trade-off between economic growth and the quality of the environment. For example, Stagl (1999) and Smulders (2000) argue that the relationship between economic growth and environmental sustainability during 1970-1990 was largely influenced by the material balance paradigm which recommends that the economic growth has a detrimental impact on the environmental sustainability. However, since the early 1990s, an important path-breaking understanding with regard to the relationship between economic growth and environmental sustainability has been derived to challenge the understanding of the traditional economic theory. To illustrate it more, Borghesi and Vercilli (2003), Grossman and Krueger (1993), Hill and Magnani (2002), Pearce and Warford (1993), Selden and Song (1994) and World Bank (1992) are some of the pioneer studies that provide the evidences in favor of the relationship between economic growth and environmental improvement by arguing that both are compatible to each other and economic growth is a perquisite for the environmental sustainability. They find that there is an inverted U-relationship exists between

the GDP per capita increase and some indicators of environmental quality. Consequently, they coined the term 'Environmental Kuznets Curve' (EKC) for this phenomenon.

The argument to support the EKC is plausibly intuitive. Every economy on its early stage of economic development gives high interest on increasing industrial production which causes rapid pollution. Moreover, the policy makers also emphasize more on the generation of income rather than on the maintenance of environment. However, during the later stage of the development process when income reaches to a sufficiently high level, people become more conscious regarding the clean environment than the income and accordingly, policy makers, government, and regulatory institutions pay more attention to the environment which eventually helps pollution level to decline. Therefore, the EKC curve reveals that the economic growth can be compatible to environmental sustainability.

Substantial literature has been attempted so far to derive at the EKC relationship either by adopting theoretical approaches or empirical evidences. For example, Arrow et al. (1992), Andreoni and Levinson (2000), Grossman and Kruger (1995), John and Pecchenino (1994), Selden and Song (1995), Stokey (1998) and Suri and Chapman (1998), Stern (2003) are few of the most cited studies that contribute greatly to the theoretical development of EKC. In addition to the theoretical aspects, Bhattarai and Hamming (2001), Binder and Neumayer (2005), Cole et al. (1997), Carson et al., (1997), Lists and Gallet (1999), Lee (2005), Liu et el.,(2007), Shafiq and Bandopadhyay (1992), and Song et al., (2008) are the pioneer studies that prove the concept of EKC empirically with regard to both developing and developed countries.

However, it is important to mention that all of the above-mentioned studies focus on the relationship between economic growth and pollution while pollution represents only part of the environmental problem. To be specific, these studies particularly concentrate on air pollution and water pollution. Nevertheless, environment includes other factors as well such as biodiversity, ecosystem, natural resource and energy efficiency, etc., which are also important for maintaining environment sustainability as a whole. The relationship between economic growth and all of the important environmental factors still remains substantially unexplored, as no study prior to this has attempted to tackle this issue. In this regard, focusing on the EKC hypothesis, this study is, therefore, undertaken to explore the relationship between the economic growth and environment as whole by using cross-country data for some selected East and the South-East Asian countries (Note 1). The data regarding environment related variables have been gathered from the 2010 Environmental Performance Index (EPI).

While this paper adopts the same methodology similar to Lee et al., (2005), however this paper is substantially different from their work as this study particularly focuses on East and South-east Asian countries and updated data have been considered for this analysis. Therefore, findings of this paper contribute to the literature in its original form.

Apart from the introduction, the rest of the paper is structured as follows. Section 2 gives the general overview of the EPI and its framework. The general picture of the relationship between the GDP per capita and different indicators of environmental sustainability by using scatter plots is presented in section 3. Section 4 provides the econometric analysis and empirical findings while section 5 concludes the paper.

2. The Environmental Performance Index (EPI) and Its Framework

The EPI is a composite index that produces a wide range of socio-economic, environmental, political and institutional indicators which have tremendous influence on environmental sustainability at the national level. To illustrate it more, the index covers comprehensive information about the core pollution and institutional policies and capabilities to change future pollution and resource use trajectories (Emerson et al., 2010). The index has been published by Yale Center for Environmental Law & Policy at Yale University in collaboration with Columbia University's Center for International Earth Science Information Network in every two or three year interval since 2005.

The 2010 EPI has been prepared based on the pilot environmental sustainability index in the year 2000 to 2008 and includes all important opinions and feedbacks from more than 70 governments and hundreds of policymakers who are working on environmental issues. The 2010 EPI presents an arbitrary weight of the 25 indicator scores out of ten core policy categories. The ten core policy categories are as follows: environmental burden of disease, water resources for human health, air quality for human health, air quality for ecosystem, water Resources for ecosystems, biodiversity and habitat, forestry, agriculture, carbon-di-oxide and climate Change. All 25 indicators and their weighted scores are presented in the Table1.

Table 1. EPI Component, Indicators and Indicator Weighted Score

Index	Objectives	Policy Categories	Indicators	Score
EPI	Environmental Health/Pollution	Environmental burden of disease	Environmental burden of disease	25%
		Air pollution (effects on human)	Indoor air pollution	6.3%
			Outdoor air pollution	6.3%
		Water pollution (effects on human)	Access to Water	6.3%
			Access to Sanitation	6.3%
	Ecosystem	Air Pollution (effects on ecosystem)	Sulfur dioxide emissions per populated land area	2.1%
			Nitrogen oxides emissions per populated land area	0.7%
			Non-methane volatile organic compound emissions per populated land area	0.7%
			Ecosystem ozone	0.7%
		Water (effects on ecosystem)	Water quality index	2.1%
			Water stress index	1%
			Water scarcity index	1%
		Biodiversity & Habitat	Biome protection	2.1%
			Marine protection	1%
			Critical habitat protection	1%
		Forestry	Growing stock change	2.1%
			Forest cover change	2.1%
		Agriculture	Agricultural water intensity	0.8%
			Agricultural subsidies	1.3%
			Pesticide regulation	2.1%
		Climate Change	Greenhouse gas emissions per capita (including land use emissions)	12.5%
			CO2 emissions per electricity generation	6.3%
			Industrial greenhouse gas emissions intensity	6.3%

Source: Yale Center for Environmental Law & Policy (2010)

The EPI 2010 ranks 163 countries where Iceland secures the first rank with the highest score of 93.5 while Sierra Leone has the lowest score with 32.1. The top five scorers are Iceland, Switzerland, Costa Rica, Sweden, and Norway; while the lowest five are Sierra Leone, Central African Republic, Mauritania, Angola, and Togo. Among the East and South-East Asian countries, Japan and Cambodia secure the highest score of 72.5 and the lowest score of 41.7, respectively.

Out of these 25 indicators of EPI, this study consider three pollution measures and seven eco-efficiency measure which are directly related with environmental sustainability to examine the relationship between economic growth and environmental sustainability. Three pollution measures are environmental burden of disease (DALY), air quality (Air_H), water quality (Water_H) and 7 indicators for eco-efficiency: water pollution effects on ecosystem (Water_E), emission air pollution effects on ecosystem (Air_E), forestry (FOREST), biodiversity (BIODIV), agriculture (AGRI), carbon-di-oxide (C02KWH_W), and green house gas emission (GHH_CAP) which are major components of environmental sustainability

The remaining 15 indicators are related to social issue, uncontrollable natural disaster, political and governance system and technology and therefore this study excluded these indicators. Hence, the indicators considered in this study are major components of environmental sustainability and the examination of the relationship between economic growth and these two categories of indicators will meet the objective of this study.

3. The General Picture of Economic Growth and Environmental Sustainability

In this section, we show the simple scatter plots of original data on the basis of regression output of the selected

indicators on GDP per capita with regard to the chosen East and South-East Asia's countries. Firstly, the study shows the scatter plots of EPI on per capita GDP in the figure 1(See Appendix). The figure suggests that high per capita GDP holding countries are doing better in environmental performance than the poor per capita GDP holders. However, the low r-squared (33%) indicates that many developed countries are still far behind to maintain the expected environmental performance. For instance, although the GDP per capita of South Korea has been progressing rapidly for the last couple of decades, the environmental performance has not been improving along with its GDP growth.

The regression results of environmental pollution or health such as environmental burden of disease (DALY), air quality (Air_H), water quality (Water_H) on GDP per capita are shown in the figure 2-4. All of the three figures demonstrate a positive relationship between the environmental health or pollution and economic growth. These findings suggest that higher econmic growth countries seem to have better environmental health and vice versa.

Figures 5- 11 illustrate the regression outcomes of eco-system related measures of environmental sustainability on GDP per capita. Out of the seven indicators of eco-system, only 2 indicators such as water pollution effects on ecosystem (Water_E) and forestry (FOREST) have a positive relationship with GDP per capita. However, 2 indicators namely air pollution effects on ecosystem (Air_E) and green house gas emission (GHH_CAP) have found to indicate a strong negative relationship with economic growth by maintaining R-squared of 0.204 and 0.538 respectively. The biodiversity (BIODIV), agriculture (AGRI) and carbon-di-oxide (C02kWH_W)**,** the remaining 3 eco-efficiency indicators, seem to have no relationship with GDP per capita increase or decrease.

The general picture of economic growth and environmental sustainability seems very optimistic as high GDP per capita holding countries tend to have better performance in maintaining environmental health and eco-efficiency of environmental sustainability. However, high income countries should give more attention to control air pollution effects on ecosystem and green house gas emission as the results of these indicators are very alarming.

4. Model of the Income-Environmental Sustainability Relationship

4.1 Model and Data

In order to achieve the objective of this paper, the following econometric specifications have been developed.

$$Environmental\ sustainability = \beta_0 + \beta_1 Economic\ Growth + \varepsilon_t \quad (1)$$

In order to measure the environmental sustainability, which is a dependent variable in this equation, this study considers the EPI score for each country in the year of 2010. The independent variable economic growth is measured by GDP per capita of the year 2010 for each country. GDP per capita is measured as the number of the average population of that country divides the final value of all goods and services produced in a country. GDP per capita is one of the useful indicators to measure the standard of living for a particular country. An increase in GDP would help to make the environment more sustainable, thus expect a positive relationship between GDP per capita and environmental sustainability. Our first hypothesis to be tested in this study is as follows:

H_1: There is a positive relationship between GDP per capita and environmental sustainability

Based on this, new equation takes the following form:

$$EPI = \beta_0 + \beta_1\ GDPpc + \varepsilon_t \quad (2)$$

In addition to GDP per capita, this study includes two other control variables, which are land area per capita (PCLAN) and civil and political liberties (CIVLIB). The reason for including PCLAN in the model is that the highly populated country tends to have the high risk for the environmental degradation. Increase in population would lead to deforestation as well as reduce the agricultural land, which have adverse effects on environment. Besides this, population density has also effect on ecological change. Population density is measured by land area per capita for all the countries. Thus this study expects a negative relationship between EPI and population density. Based on this, our second hypothesis is as follows:

H_2: There is a negative relationship between population density (PCLAN) and environmental sustainability

One of the most important factors that contribute in creating a sustainable environment is civil and political liberty. A country which facilitates the political debate, freedom of voice, fair coordination among the parties, active NGOs would positively contribute to create a sustainable environment, since these activities force the government to think about the enforcement of environmental laws and legislation actively. Civil and political liberties index captures the level of enforcement of legislation and democratic activities for each sample country of this study. A higher score indicates the low level of political liberty. For example, in the year 2012, United States score 1 and treated as full free where the North Korea has score of 7 and considered as a least free country in the world. A number of researchers raise the issue of legislation and freedom of speech, which have an

influence on the environmental sustainability such as Helliwell (1994), Perrotti (1996) and Barret and Graddy (2000). According to them, countries with a high degree of civil and political liberty tend to take stern action against any pollution/decay to progress the quality of the environment. Based on the above arguments, we develop our third hypothesis as follows:

H_3: There is a negative relationship between civil and political liberties index and environmental sustainability

Finally, this study distinguishes between the East and South-East Asian countries and the countries in the other regions by introducing dummy variables such as 1 is considered for East and South-East Asian countries and 0, if otherwise. The purpose of introducing dummy variables is to explore how the East and South-East Asia's countries perform in contrast with the other regions.

Based on the foregoing discussion, the final model of the equation takes the following form

$$EPI = \beta_0 + \beta_1 GDPpc + \beta_2 PCLAN + \beta_3 CIVLIB + \beta_4 East\ and\ South\text{-}East\ Asia + \varepsilon_t \quad (3)$$

Where:

EPI = Environmental Performance Index

GDPpc = GDP per capita under purchasing power parity

PCLAN = Population Density is the density of people.

CIVLIB = civil and political liberty index

East and South-East Asia = dummy variable of the East South-East Asia region**.**

As stated in section two, this research is also interested to examine the relationship between pollution measures and economic growth as well as eco-efficiency measures and economic growth. Consequently, each variable that represent both pollution measure and eco-efficiency have been used as dependent variable in equation (3). All the data for both dependent and independent variable have been collected from environmental performance index report of 2010 and 2008

4.2 Empirical Results

This study uses ordinary least square (OLS) method for estimating the results. Before conducting the regression, we have conducted multicollenearity test in order to ensure that the selected variables are not highly correlated with each other. Variance Inflation Factor (VIF) test is used to check multicollineraity among the variables. Under the VIF test, it is suggested that if any variables contains more than 10 VIF value, then the variable is considered to have multicollinearity problem. The VIF test with all the independent variables of our model shows that there is no multicolleniarity problem.

Table 2. Variance Inflation Factor (VIF) test

Variable	VIF	1/VIF
GDPpc	2.35	0.425961
PCLAN	1.99	0.503721
East ASIA	1.42	0.705948
CIVLAB	1.16	0.862364

After conducting the VIF test, this study first runs the regression on equation (3) where dependent variable is EPI (See Table 3). Moreover, regression results of selected variables of EPI on GDP per capita (GDPpc), population density (PCLAN) and civil and poverty index (CIVLIB) are presented in Table 4, 5 and 6 respectively.

Table 3. Regression of EPI on GDP per capita, population density, CIVLIB and East and South-East Asia

Variables	Coefficients	t-Statistic	P>[t]
GDP per capita	0.0003282	1.97	0.045
Population density	-0.000943	-2.73	0.000
CIVLIB	-1.747509	-1.43	0.187
East and South-East Asia	5.68731	0.95	0.366
Constant	56.86888	6.02	0.000
Prob > F	0.0183		
R squared	0.5040		
Adj R- squared	0.2835		

According to the results based on Table 3, the GDP per capita has a positive relationship with the overall index of environmental performance at 5% significance level. This finding suggests that the higher the GDP per capita, the better the environmental performance. This finding also supports the theoretical argument of 'Environmental Kuznets Curve'. Moreover, regression result of environmental pollution and eco efficiency variables on GDP per capita is presented at Table 4. According to the Table 4, environmental pollution variables such as environmental burden of disease (DALY), effect of Air on human (Air_H) and effect of Water on human (Water_h) have a positive relationship with GDP per capita. A positive relation between these variables and GDP per capita indicate that if GDP per capita increases, environmental pollution will get lower and an improvement in reducing both air pollution and water pollution. At the same time, an increase in GDP also increases eco efficiency variable that includes Water effect on air, forestation and agricultural production among the sample country. However, the rest of the four variables of eco efficiency measure such as biodiversity, green-house gas emission, CO2 emission and air effect on environment have negative relationship with GDP per capita which indicate the an increase in GDP Per capita is lowering the score of these variables. Therefore government should take appropriate measurements on these aspects along with GDP growth.

Table 4. Regression of selected measures of EPI on GDP per capita

Variables	Coefficients	t-Statistic	P>[t]
DALY	0.0010215	4.00	0.003
Air_H	0.0008547	2.19	0.056
Water_H	0.0009369	2.23	0.053
Air_E	-0.0000362	-0.13	0.896
Water_E	0.0001671	0.74	0.480
BIODIV	-0.0001368	-2.01	0.106
FOREST	0.0000837	0.35	0.738
GHH_CAP	-0.0016448	-4.68	0.001
C02KWH_w	-00000625	-0.52	0.616
AGRI	0.0001733	0.51	0.624

When the second control variable, population density is regressed against EPI, it shows a negative relationship as predicted by theory (See Table 5). The higher the population density the lower the environmental performances score. The same relationship exists for all the three variables of pollution measurements (See Table 5). Furthermore, increase in population of a particular country lowers the biodiversity and increases deforestation, which has vital impact on environment. Interestingly, from the result it shows increase in population density has positive effect on agriculture, which means more people are employed in agricultural cultivation.

Table 5. Regression of selected measures of EPI on population density

Variables	Coefficients	t-Statistic	P>[t]
DALY	-0.0008236	-0.40	0.700
Air_H	-0.0008377	-0.27	0.797
Water_H	-0.0017694	-0.52	0.616
Air_E	0.00176494	2.18	0.057
Water_E	0.0036166	1.97	0.081
BIODIV	-0.0031778	-0.67	0.570
FOREST	-0.0018743	-1.97	0.097
GHH_CAP	0.0064298	2.25	0.051
C02KWH_w	-0.0000978	-0.03	0.976
AGRI	0.0009218	0.33	0.747

Finally, CIVLIB is negatively related with environmental performance index (See Table 3), suggesting that the higher the CIVLIB score the lower the environmental performance score. Again, if we decompose the EPI score according the environmental pollution and eco-efficiency variables, it shows that, all three pollution variables as well as all the variables of eco-efficiency except agriculture and air effects on environment have the negative relationship with CIVLIB (See Table 6). This finding gives a serious indication that; all sample countries should emphasize on the active enforcement of environmental laws and legislation as well as citizen should raise their democratic voice for a sustainable environment. Therefore it is necessary to have democratic practice in a country which will ensure both the government and citizen can work together to increase sustainable development.

Table 6. Regression of selected measures of EPI on CIVLIB

Variables	Coefficients	t-Statistic	P>[t]
DALY	-1.420441	-0.82	0.435
Air_H	-5.795269	-2.19	0.056
Water_H	-2.74395	-0.96	0.362
Air_E	2.642911	1.44	0.183
Water_E	-1.839511	-1.19	0.264
BIODIV	-1.513267	-0.38	0.713
FOREST	-3.02672	-1.83	0.10
GHH_CAP	-2.875849	-1.20	0.260
C02KWH_w	-0.66775	-0.11	0.912
AGRI	0.1231156	0.05	0.959

5. Concluding Remarks

This study is undertaken to investigate the relationship between economic growth and environmental performance empirically in the context of East and South-East Asian countries. By employing both general analysis and empirical model, it is found that the increase of the GDP per capita appears to have positive impact on the pollution measures. However, the situation is partially true in case of eco-efficiency measures as 3 out of 7 eco-efficiency measures such as water effects on ecosystem, forestry and agriculture are positively affected by the increasing of GDP per capita. Hence, these findings prove the theoretical aspect of the Environmental Kuznets Curve to some extent but not in full extent. The important argument regarding the positive relationship between economic growth and environmental sustainability could be the blessings of economic freedom. It is obvious that when the people become richer, the consciousness and education regarding environment are generally increased. Moreover, the rich people can afford the environment friendly goods and technology more than that of the poor people.

The findings of this study suggest an important dictation to the policy makers of the developing countries in the sense that the policies should not be developed only on the basis of pollution controls; rather it is also necessary to consider the eco-efficiency aspects of environmental sustainability with a view to accelerating the process of economic development.

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Notes

Note 1. The countries which are considered in this study are Japan, South Korea, North Korea, Mongolia, Singapore, Malaysia, China, Thailand, Brunei, Laos, Myanmar, Cambodia, Vietnam, Philippine and Indonesia.

Appendix A

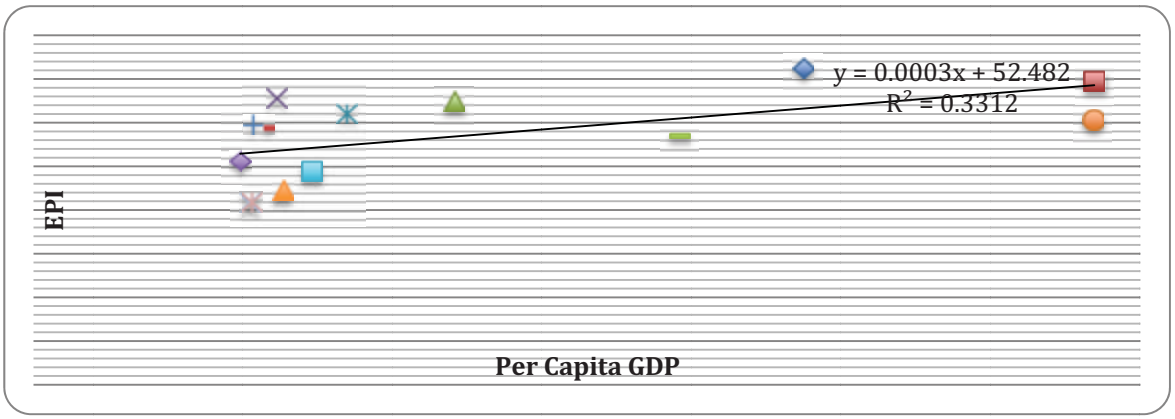

Figure 1. Regression of the EPI on per capita GDP (R- squared =0.331)

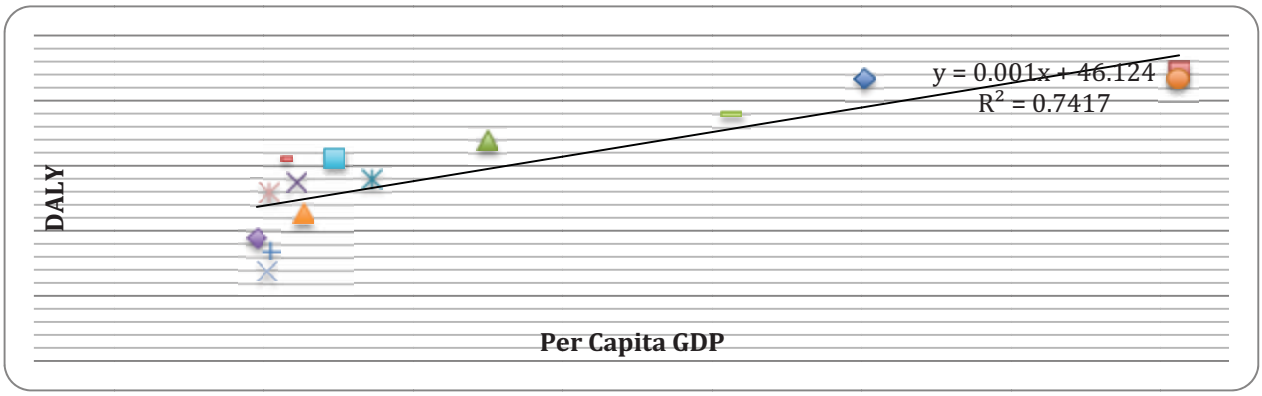

Figure 2. Regression of the environmental burden of disease (DALY) on per capita GDP (R- squared =0.741)

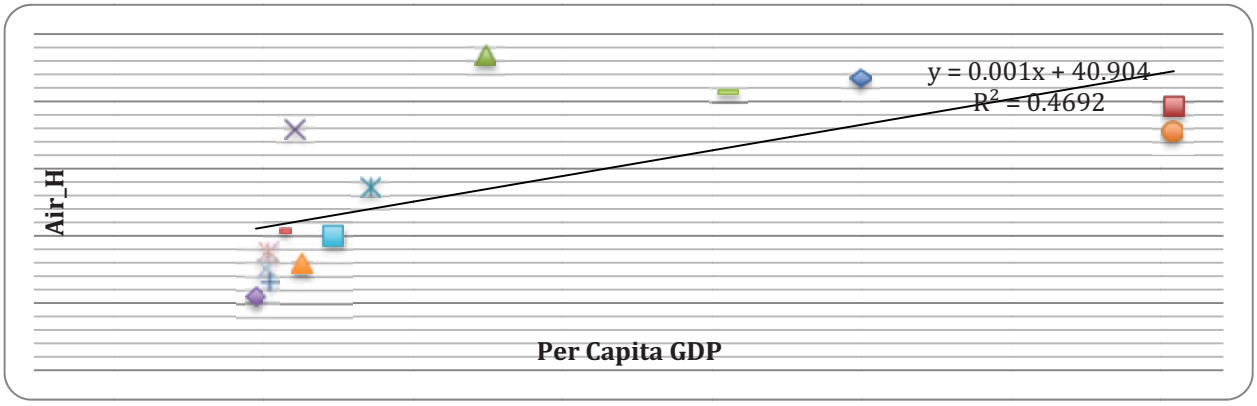

Figure 3. Regression of the air quality (Air_H) on per capita GDP (R- squared =0.463)

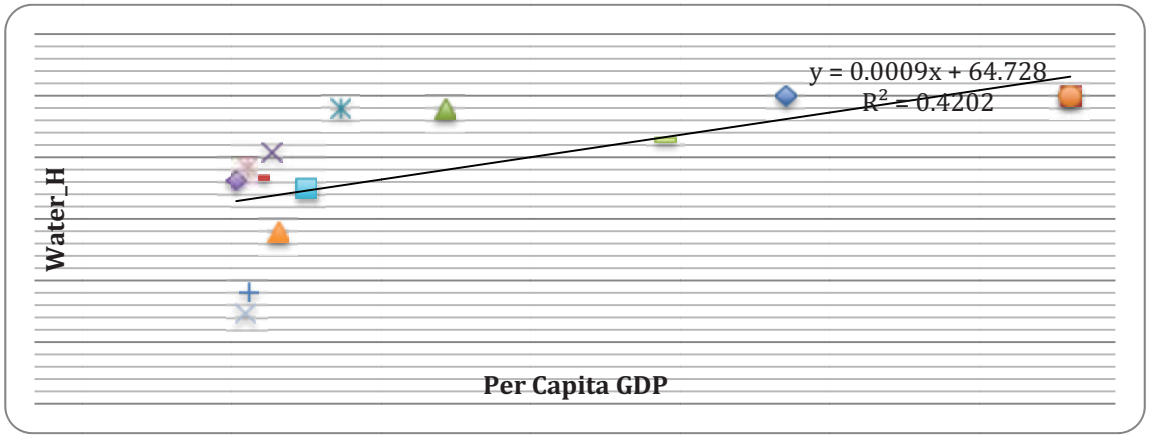

Figure 4. Regression of the water quality (Water_H) on per capita GDP (R- squared =0.420)

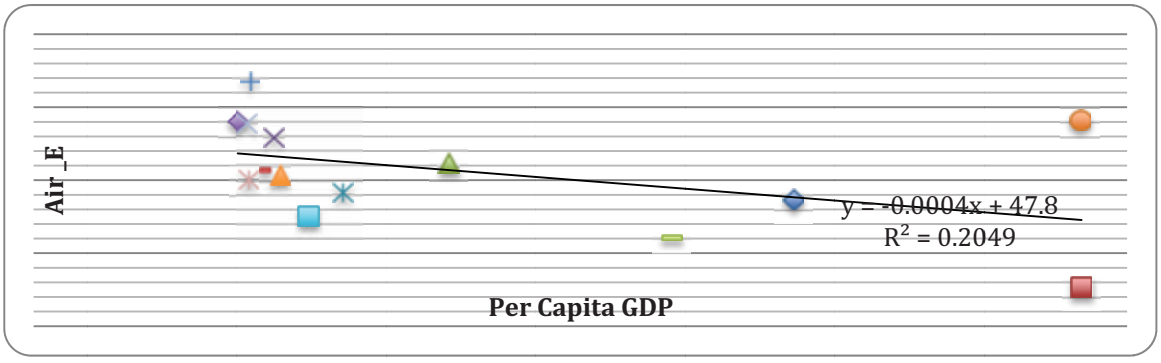

Figure 5. Regression of the Air pollution effects on ecosystem (Air_E) on per capita GDP (R- squared =0.204)

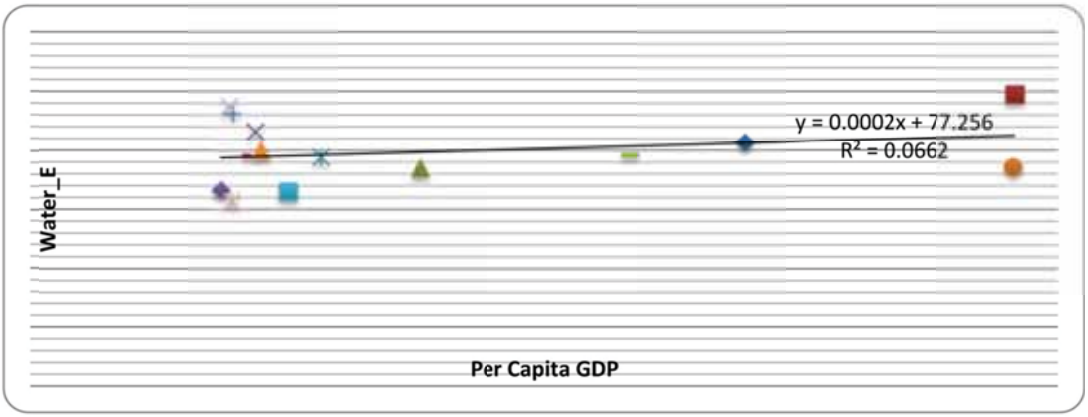

Figure 6. Regression of the water pollution effects on ecosystem (Water_E) on per capita GDP (R- squared =0.066)

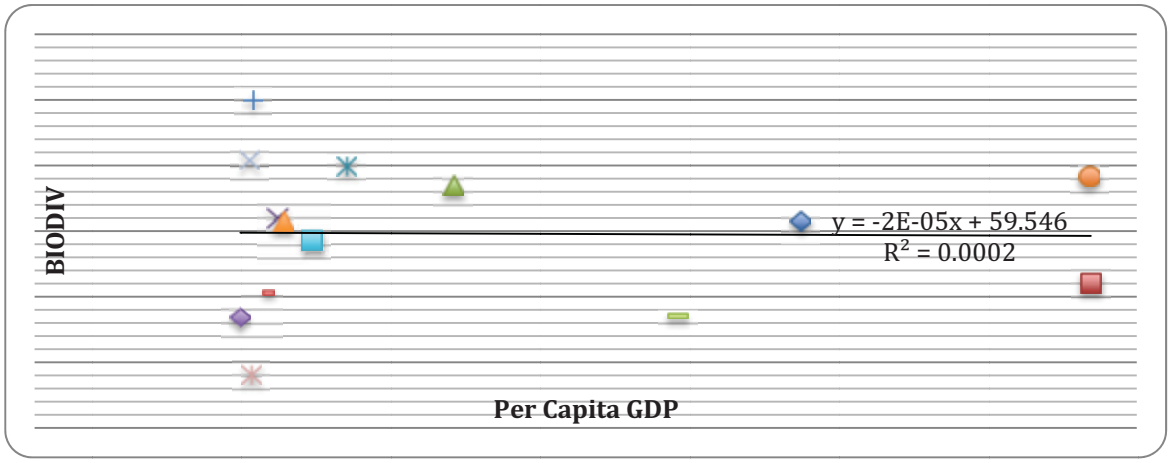

Figure 7. Regression of the biodiversity (BIODIV) on per capita GDP (R- squared =0.000)

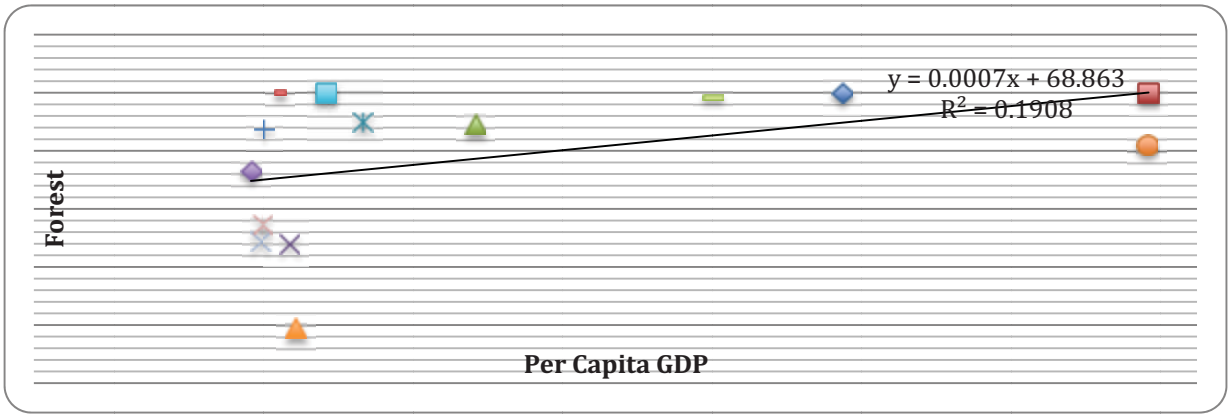

Figure 8. Regression of the forestry (Forest) on per capita GDP (R- squared =0.192)

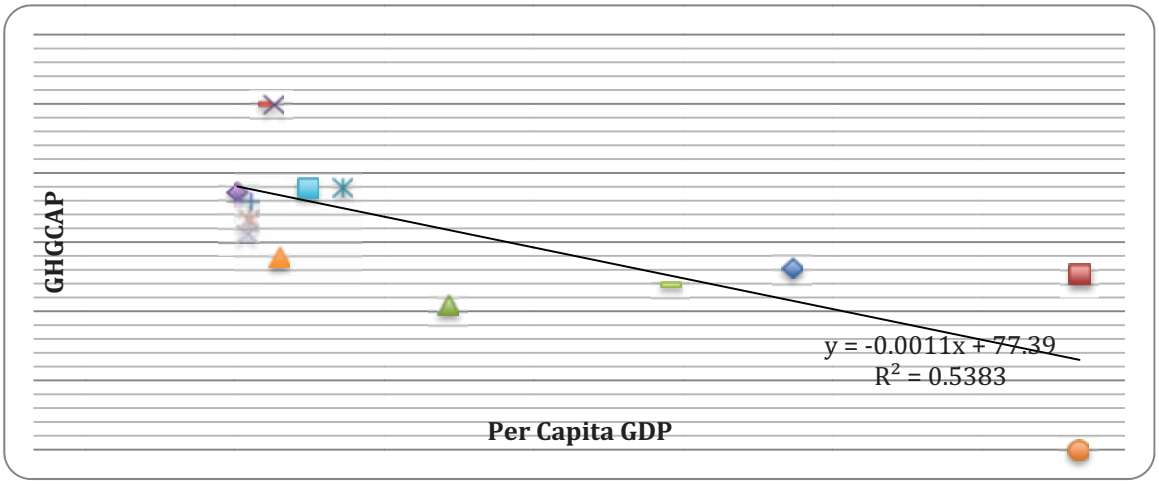

Figure 9. Regression of green house gas emission (GHG-CAP) on per capita GDP (R- squared =0.538)

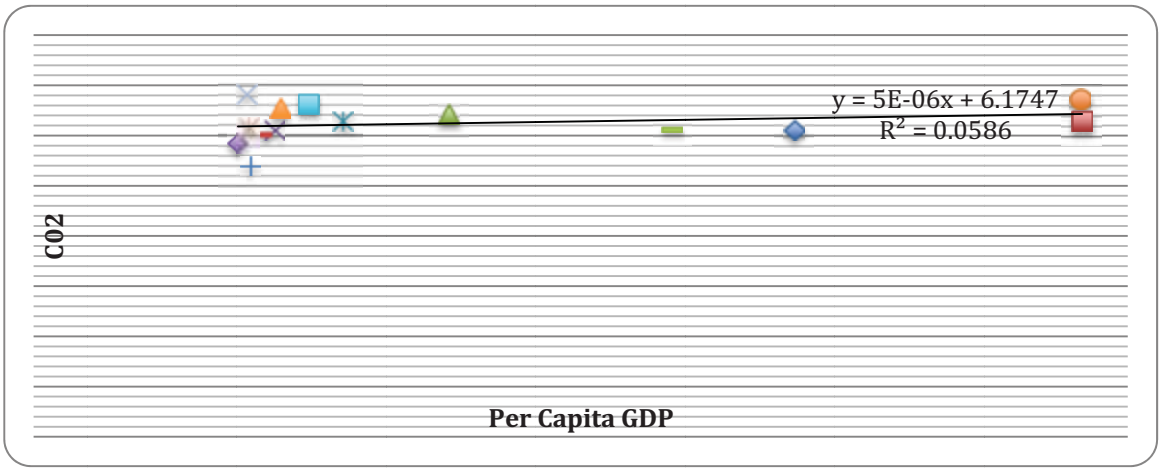

Figure 10. Regression of carbon-di-oxide (C02kWH_W) emission on per capita GDP (R- squared =0.058)

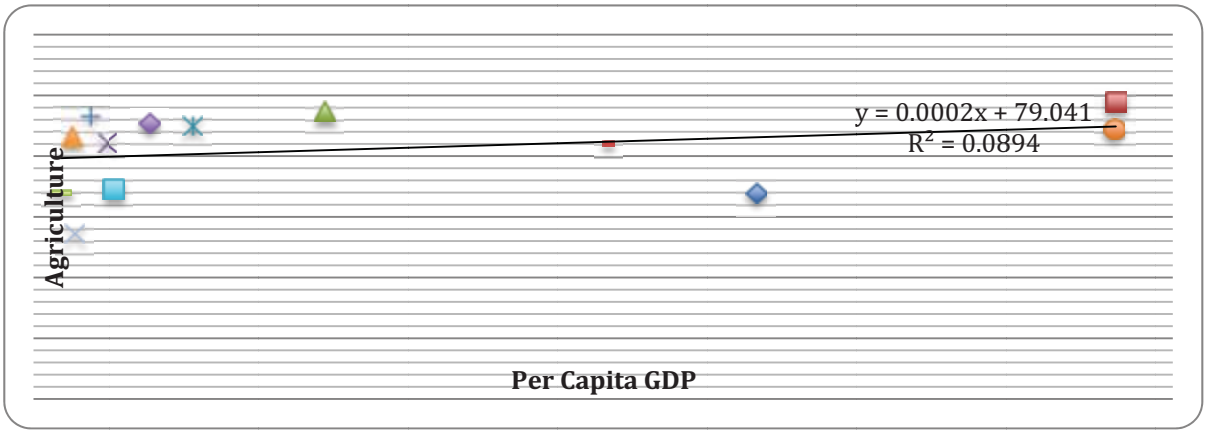

Figure 11. Regression of Agriculture (AGRI) on per capita GDP (R- squared =0.089)

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Economic Policy Uncertainty in the United States and Europe: A Cointegration Test

Vichet Sum

Correspondence: Vichet Sum, School of Business and Technology, University of Maryland – Eastern Shore, Princess Anne, MD, 21853, USA. Tel: 1- 410-651-6531. E-mail: vsum@umes.edu

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Abstract

Economic uncertainty is closely followed and analysed by businesses, policy makers and academic scholars because the world economies have now become very closely interconnected more than ever. This study is to examine a relationship between economic policy uncertainty between the United States and Europe. The results reveal a long-run equilibrium relationship (cointegration) in economic policy uncertainty between the United States and Europe. The findings provide evidence of the interconnectedness of economic conditions between the United State and Europe in line with the international transmission and spill-over literature.

Keywords: economic policy uncertainty, cointegration

JEL Classifications: E60

1. Introduction

The world economies have now become very closely interconnected more than ever; this phenomenon is, no doubt, a direct result of globalization. A shockwave related to any specific economic, social and political activities in one country can carry itself across the globe instantly due to technology advancement and rapid media coverage. According to the international transmission and spill-over literature (Awad & Goodwin, 1998; Becker, Finnerty, & Friedman, 1995; Forbes & Chinn, 2004; Chinn & Frankel, 2004; Ehrmann & Fratzscher, 2009; Kim, 2001), a major structural economic or financial shock in one country can have a direct or indirect effect on the economies and financial markets of other countries and the world economies alike; this effect can be especially strong when this country is one of the leading economies in the world. Among many changes taking place in an advanced economy, changes related to economic policy are most likely followed and analysed by businesses, policy makers and academic scholars.

Why do changes in economic policies matter a lot? The answer to this question is that economic uncertainty perceived by consumers and investors can have a negative impact on economic recovery and growth. Consumers and investors hesitate to spend and invest as they sense higher uncertainty in the economy. According to Bernanke (1983), a high level of economic uncertainty incentivizes firms to delay potential investment projects and freeze hiring accordingly. The economy is likely to contract when firms postpone investment and employment decisions. Baker, Bloom, and Davis (2012) report that when uncertainty about future taxes, spending levels, regulations, health-care reform, and interest rates is high, consumers and businesses delay spending on investment and consumption. Rodrik (1991) shows that policy uncertainty is associated with firms' investment delay. Julio and Yook (2012) also empirically document a negative relationship between political uncertainty and investment activities. Moreover, economic uncertainty is associated with higher cost of finance (Gilchrist et al., 2010; Fernandez-Villaverde et al., 2012). Higher financing cost leads to lower investment and economic slowdown as a result.

The effect of economic uncertainty is also observed in the financial market. Financial market dislikes uncertainty. Bansal and Yaron (2004) document that increased economic uncertainty is associated with lower asset prices. Bansal, Khatchatrian and Yaron (2005) find that drop in asset valuations is linked to higher economic uncertainty. Ozoguz (2009) reports a negative relationship between equity prices and investors' perceived uncertainty. Dzielinski (2011) reports that in the week following a rise in economic uncertainty, aggregate stock returns fall. Paster and Veronesi (2011) propose that drop in stock prices should be significant when a higher uncertainty about the government policy is observed in the economy.

Since economic uncertainty is likely most followed and analysed by businesses, policy makers and academic scholars and because the world economy has now become very closely interconnected more than ever, this study is to examine a relationship between economic policy uncertainty between the United States and Europe. This study is necessary because no prior study in the current literature examines this phenomenon before. This paper seeks to contribute to further the understanding of the interconnectedness in economic policy and uncertainty between the United States and Europe.

2. Method and Data

The index of monthly economic policy uncertainty in the United States and Europe spanning from 1993-2011 is constructed by Baker, Bloom, and Davis (2012). Equation (1) and (2) are employed to conduct a unit root test for economic policy uncertainty variables in Europe and the United States, respectively; this is the Augmented Dickey-Fuller test for unit root.

$$\Delta EPU_{EU_t} = \lambda_0 + \lambda_1 EPU_{EU_{t-1}} + \lambda_2 T + \sum_{i=1}^{p} \Psi_i \, \Delta EPU_{EU_{t-i}} + \varepsilon_t \quad (1)$$

$$\Delta EPU_{US_t} = \lambda_0 + \lambda_1 EPU_{US_{t-1}} + \lambda_2 T + \sum_{i=1}^{p} \Psi_i \, \Delta EPU_{US_{t-i}} + \varepsilon_t \quad (2)$$

Where:

ΔEPU_{US_t}= Change in Economic policy uncertainty in the United States in time *t*

ΔEPU_{EU_t}= Change in Economic policy uncertainty in Europe in time *t*

$EPU_{EU_{t-1}}$= Economic policy uncertainty in the Europe in time *t-1*

$EPU_{US_{t-1}}$= Economic policy uncertainty in the United States in *t-1*

$\Delta EPU_{US_{t-i}}$= Change in Economic policy uncertainty in the United States in time *t-i*

$\Delta EPU_{EU_{t-i}}$= Change in Economic policy uncertainty in Europe in time *t-i*

T = trend term

Equation (3) and (4) are carried out to test for a long-run equilibrium relationship (cointegration) in economic policy uncertainty between the United States and Europe. First equation (3) is run in order to obtain residuals; another Augmented Dickey-Fuller test for unit root in the residuals is tested using equation (4).

$$EPU_{EU_t} = \beta_0 + \beta_1 EPU_{US_t} + u_t \quad (3)$$

$$\Delta u_t = \gamma_0 + \gamma_1 u_{t-1} + \gamma_2 T + \sum_{i=1}^{p} \Theta_i \, \Delta u_{t-i} + \varepsilon_t \quad (4)$$

Where:

Δu_t = The change in the error term (residual) in time *t* obtained from equation 3

u_{t-1} = The error term (residual) in time *t-1* obtained from equation 3

Δu_{t-i} = The change in the error term (residual) in time *t-i* obtained from equation 3

T = trend term

3. Results

First, in order to determine the appropriate length of lags to be included in the model, Schwarz's Bayesian information criterion (SBIC), the Akaike's information criterion (AIC), and the Hannan and Quinn information criterion (HQIC) tests are conducted; the results suggest 5 lags. As shown in Table 1 and 2, the economic policy uncertainty index in the United States is non-stationary, and so is the economic policy uncertainty index of Europe. Therefore, a cointegration test is appropriate to test for a long-run equilibrium relationship between the two variables. As shown in Table 4, the ADF test for unit root in the residuals obtained from equation (3) using equation (4) shows that the residuals are stationary with Z(t) = -3.171 significant at a 5% level. As a result, there is a long-run equilibrium relationship (cointegration) in economic policy uncertainty between the United States and Europe.

Table 1. ADF test of economic policy uncertainty in europe (equation 1)

Augmented Dickey-Fuller test for unit root				Number of observations = 222
		Interpolated Dickey-Fuller		
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-2.254	-3.469	-2.882	-2.572

MacKinnon approximate p-value for Z(t) = 0.1872

Table 2. ADF test of economic policy uncertainty in the united states (equation 2)

Augmented Dickey-Fuller test for unit root				Number of observations = 222
		Interpolated Dickey-Fuller		
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-1.227	-3.469	-2.882	-2.572

MacKinnon approximate p-value for Z(t) = 0.6620

Table 3. Regression results of equation 3

Economic policy uncertainty index of Europe in time t is regressed on economic policy uncertainty index of the United States in time t.

EPU_{EU_t}	**Coefficient**	**Std. Err.**	***t***	**Sig.**
Constant	5.65	6.1447	0.83	0.408
EPU_{US_t}	0.9583	0.0549	17.43	0.000
R-Square	0.5734			
Adj. R-Square	0.5715			
F(1, 214)	303.79			0.000

Number of Observation = 228

Table 4. ADF test of residuals obtained from running equation (3) using equation (4)

Augmented Dickey-Fuller test for unit root				Number of observations = 222
		Interpolated Dickey-Fuller		
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.171	-3.469	-2.882	-2.572

MacKinnon approximate p-value for Z(t) = 0.0218

4. Conclusion

A major structural policy change in one country can have a direct or indirect effect on the economics of other countries and the world economy alike; this effect can be especially strong when this country is one of the leading economics in the world. Among many changes taking place in an advanced economy, changes related to economic policy are closely followed and analysed by businesses, policy makers and academic scholars. This study is to examine a relationship between economic policy uncertainty between the United States and Europe. The results reveal a long-run equilibrium relationship (cointegration) in economic policy uncertainty between the United States and Europe. The provide evidence of the interconnectedness of economic conditions between the United State and Europe in line with the international transmission and spill-over literature.

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The Analysis of Inflation Rate Dynamic in Central and South-Eastern Europe's States in the Context of The EU Accession

Ovidiu Stoica[1] & Monica Damian[2]

[1] Department of Finance, Money and Public Administration, "Alexandru Ioan Cuza" University of Iasi, Romania

[2] Department of Finance, Money and Banking, "Alexandru Ioan Cuza" University of Iasi, Romania

Correspondence: Ovidiu Stoica, Department of Finance, Money and Public Administration, "Alexandru Ioan Cuza" University of Iasi, Romania.

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Abstract

In the year 2004 ten states from Central and South-Eastern Europe joined the European Union. The majority of them have registered a significant consumer price increase in the year 2004. The goal of this paper is to examine the fundamental factors that have influenced inflation rate after EU accession and to analyse the causes of the inflation differential in EU member states which acceded in 2004. The impact of EU accession was different in analysed countries, the increasing of inflation rate in accession year being determined by the adoption of the Common Agricultural Policy, the harmonization of the structure and rates of indirect taxes, the introduction of the Common Customs Policy, the free movement of goods, the free movement of capital and the expected inflation.

From the analyses we have done, we have remarked that the main cause of inflation differential has been the oil price on the international market, because of the different degree of dependence on oil import of these countries, but also on the different weight of electricity, gases and other fuels in the consumer basket.

Keywords: European Union accession, inflation rate, inflation differential, causes, Central and South-Eastern Europe

1. Introduction

Following the rapid change of the political systems and the restructuration process of the economies, the countries from Central and Eastern Europe have begun the political and economic integration with the European Union. These countries have expressed their wish to accede to the European Union and realign their economies towards the West. Some of them have managed to attract important sums of foreign direct investments, most of which coming from the member states of the European Union. The European Union has supported this process through the conclusion of the European Agreements, which gave the institutional framework for the future integration, in terms of trade and other economic relations.

The European Council in Copenhagen in June the 22nd and 23rd 1993 agreed that the associated countries from Central and Eastern Europe who wish and satisfy the required political and economic conditions will become members of the European Union.

At the reunion of the European Council in Copenhagen in December 2002, the EU enlargement was decided with ten states, such as: Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia. The decision to expand the European Union is an important step towards modelling of the future political, institutional and economical structures of Europe.

From a macroeconomic point of view, the enlargement of the European Union is a "profitable investment", because it has positive effects both on the economies of the new member states, and the European Union as a whole, especially, in the registration of high economic growth rates.

Inflation is extremely important, according to the political agenda of the EU, as can be seen from the main conclusions reached at the Helsinki seminar (1999): Accession countries therefore need to continue to implement monetary policies geared towards achieving and maintaining price stability, and to support this process with prudent fiscal policies and adequate structural reforms" (European Central Bank, 2000).

The paper is organised as follows: Section 2 discusses the evolution of inflation rate in transition to a market economy period, Section 3 estimates the impact of EU accession upon inflation rate in Central and South-Eastern Europe's states; Section 4 analyses the causes of inflation differential in Central and South-Eastern Europe's states; Section 5 presents concluding remark.

2. The Implications of the Transition to a Market Economy upon the Inflation

The majority of countries in transition from Central and Eastern Europe have struggled with a strong inflationary process, manifesting itself in the first years of transition as corrective inflation, following that persistent imbalance between supply and demand to change it into a structural inflation (Table 1).

The consumer price evolution in the transition economies from Central and Eastern Europe can be divided in four stages (ICEG European Center, 2002). In the first phase (until 1992) almost all of the countries have registered a corrective inflation associated with the liberalization of prices and of trade and the significant depreciation of the exchange rate.

Table 1. The average inflation rate in Central and Eastern European countries (%, 1989-1999)

Country	*1989*	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*
Czech Republic	1.4	9.7	52.0	11.1	20.8	9.9	9.6	8.9	8.4	10.6	2.1
Estonia	6.1	23.1	210.5	1076.0	89.8	47.7	29.0	23.1	11.2	8.1	3.3
Hungary	17.0	28.9	35.0	23.0	22.5	18.8	28.2	23.6	18.3	14.3	10.0
Latvia	4.7	10.5	172.2	951.2	109.2	35.9	35.9	25.0	17.6	8.4	4.7
Lithuania	2.1	8.4	224.7	1020.5	410.4	72.1	39.6	24.6	8.9	5.1	0.8
Poland	251.1	585.8	70.3	43.0	35.3	32.2	27.8	19.9	14.9	11.8	7.3
Slovakia	2.3	10.8	61.2	10.0	23.2	13.4	9.9	5.8	6.1	6.7	10.6
Slovenia	1285.3	551.6	115.0	207.3	32.9	21.0	13.5	9.9	8.4	8.0	6.2

Source: European Bank for Reconstruction and Development, http://www.ebrd.com/pages/research/economics/data/macro.shtml#macro

But this liberalization was not complete, the weight of goods in the consumer basket whose prices are administered being included between 13% and 24% in the countries from Central and Eastern Europe. Of the prices administered, the liberalization of energy prices for households represents one of the most important tasks which had to be finished until the accession. Reininger (2000) analyses the evolution of the energy price in four acceding countries from Central and Eastern Europe: the Czech Republic, Poland, Hungary and Slovakia in the 1992-1999 period. His results shows us that the energy prices in the candidate countries have reached the level of those in the European Union for industrial consumers, while the prices charged for households were low even in the 1998-1999 period. The author concludes that major adjustments are necessary in order to reach the level of the EU economies. The adjustment of energy prices has had a significant impact upon the consumer price index in the acceding countries, because they hold approximately 15% in the consumer basket (Backé, Fidrmuc, Reininger & Schardax, 2002).

The second period (1992/1993-1998) was marked by the decrease of the inflation rate at moderate levels. In the next stage, between the years 1998-2000, the inflationary process was strongly influenced by the crises in Asia and Russia, through the negative shock of demand (the decrease of external demand) and the positive shock of supply (the decrease of oil prices) which have tempered the inflation rate. In this period, the inflation rate has registered values with one or two numbers. The last price evolution stage which characterized these economies (from the beginning of the year 2001) was marked by a disinflationary process.

The registration of different inflation rates in the 1992-1998 period is due to the existence of macroeconomic imbalances in some economies and of the type of monetary and exchange policies adopted by each country. These countries have adopted, on different transition stages, different monetary policies, depending on the specific characteristics of each country. Despite all of these, we can observe a shift from monetary policy strategies based on the exchange rate, used, generally, at the beginning of the transition, to strategies based more on the inflation targeting, in a more advanced transition stage.

Another cause which has slowed down the disinflationary process was the high fiscal deficit due to the low level of income collection for the state budget and the unchanged maintenance of expenditure. The cover of the fiscal deficit through seigniorage has constituted the main inflationary source in some transition economies.

The inflation rate divergence during the ongoing transition is explained by the economic analysts through differences between the level of economic development and the capacity to uphold the reforms necessary to become a market economy.

European Bank for Reconstruction and Development calculates nine reform indices: Large scale privatisation, Small scale privatisation, Enterprise restructuring, Price liberalisation, Trade & Forex system, Competition Policy, Banking reform & interest rate liberalisation, Securities markets & non-bank financial institutions, Overall infrastructure reform. An index score equal to 1 indicates no reform relative of a "standard" planned economy, while the maximum score 4.3 corresponds to a well-functioning market economy (Staehr, 2003).

In the Baltic States, in 1991, inflation rate has registered values with 3 digits (172.2%-224.7%), while in 1992 inflation rate has accelerated to approximately 1000%. Regarding reform indices, in 1991 in Estonia majority of indices has registered the value of 1, while in Latvia and Lithuania only Price liberalisation indicated a index score equal to 2.67, rest of indices being equal to 1. In 1992 majority of indices scores has increased and in 1993 index of Price liberalisation was 4.33 in Estonia, Latvia and 4 in Lithuania. In this year inflation rate has decreased significant, following a disinflationary trend in the next years.

Hungary has registered in 1989 the index score of Price liberalisation of 2.67, Trade & Forex system of 2, while the inflation rate was 17%. The highest value of inflation rate was in 1991 (35%); in this year, index score of Price liberalisation has indicated 4.33, Trade & Forex system has indicated 4.

In Poland the reform has begun early, in 1989 Small scale privatisation and Price liberalisation has indicated a index score equal to 2, respective 2.33. In 1990 only one of the indices (Securities markets & non-bank financial institutions) has indicated a score equal to 1, justifying the high inflation rate (585.8%) in this year. Disinflationary trend is correlated with the reform index score, these indices being above 2.67 in 1996. Small scale privatisation and Trade & Forex system have registered maxim value – 4.33.

If in 1990 all the index equal to 1 in Slovakia, in 1991 the majority of the indices has increased with one, two or three; index score of Price liberalisation was 4. In this year inflation rate has increased by 50.4%, in 1992 the inflation rate returning to value in 1990.

In 1989 inflation rate in Slovenia was 1285.3%, while the index score was above 2 for Small scale privatisation and Price liberalisation. In 1990 index of Securities markets & non-bank financial institutions has increased to 2 and index of Price liberalisation has increased from 2.67 to 3.67, imprinted the increase of consumer prices by 551.6%. In 1993 the inflation rate has registered a significant decrease (from 207.3% to 32.9%), due the high values of reform indices.

We remark the positive correlation between reform indices score and inflation rate in the first years of transition. Disinflationary process has begun when reform indices has registered high values, which means that structural reforms have had a significant impact upon the evolution of inflation rate in the transition period.

Therefore, the acceleration of inflation rate in 1991 in all countries is justified by beginning of reforms necessary to become a market economy.

In contrast with the transition countries we have the member states of the European Union, whose inflation rates maintained themselves at relatively low levels, which suggests the differences between a mature market economy and a forming one.

3. The Inflationary Effects of Accession to the European Union

The years prior the European Union accession were marked by a significant disinflationary process in most of the accession countries, seeing as price stability is one of the requirements to join the EU. The registered progress by the accession countries starting with 2001 were due to the favourable shocks in supplying (the decrease of oil prices) and the deceleration of foods prices, in some countries, but also due to the policies used to combat inflation. This signifies the importance of price stability as statutory objective of the central banks in each accession country. Even if the inflation tempered, it is a major preoccupation for the monetary authorities, the evolution of inflation being an indicator in the convergence evaluation with the euro area.

The statistic data (Table 2) show that the negative aspect of EU accession refers to the accentuated increase of inflation rate in accession year (2004), the highest inflation rate registering in Latvia (from 2.9% to 6.2%), Poland (from 0.8% to 3.5%), the Czech Republic (from 0.2% to 2.8%), Lithuania (from -1.1% to 1.2%) and Hungary (from 4.7% to 6.8%). The alignment of some prices to the consumer goods and services and of some taxes, imposed in the context of accession to the level of the old EU countries created objective inflationary pressures in the new member states.

Table 2. The average inflation rate in Central and Eastern European countries (%, 2000-2004)

Country/Year	*2000*	*2001*	*2002*	*2003*	*2004*
Czech Republic	4,0	4,7	1,8	0,2	2,8
Estonia	4,0	5,8	3,6	1,3	3,0
Hungary	9,8	9,2	5,3	4,7	6,8
Latvia	2,6	2,5	1,9	2,9	6,2
Lithuania	1,0	1,5	0,3	-1,1	1,2
Poland	10,1	5,5	1,9	0,8	3,5
Slovakia	12,0	7,3	3,0	8,5	7,5
Slovenia	8,9	8,4	7,5	5,6	3,6

Source: European Bank for Reconstruction and Development, http://www.ebrd.com/pages/research/economics/data/macro.shtml#macro

The increasing of consumer prices in accession year has been determined by the adoption of the EU acquis and of some policies and mechanisms specific to the European Union. In this sense, the following six factors have been analysed:

1). Implementing the *Common Agricultural Policy (CAP)* represents one of the factors that affects consumer prices after accession. The changes of agricultural prices have influenced the food prices, whose weight in the consumer basket was approximately 16-20%, the impact being stronger in Lithuania and Latvia where these had approximately 26% in the consumer basket. We must notice that prices of the agricultural products in the analysed countries were lower than the EU level. Prediction show that in the Czech Republic, Hungary, Poland, Slovakia, Slovenia the levels of compared agricultural prices were between half and three quarters of the EU average (Backé et al., 2002).

2). The necessity of excises alignment on the level of the those from the EU has determined a significant rising of excisable goods and services, exerting influences upon prices of Alcoholic beverages, tobacco; prices of Housing, water, electricity, gas and other fuels and prices of Transport. The contribution of these components of the HICP to annual inflation rate was different in EU countries from Central and South-Eastern Europe, differences that are explained on account of prices increase of these goods and services and of the weight in the consumer basket.

3). Another factor which has exercised influences upon consumer prices was *Common Customs Policy*, but its impact has been positive. The elimination of the customs duties applied to import of goods from the EU has offset the negative impact of the two factors mentioned above. The size of the positive effect varies from country to country, depending on the share of EU imports in total imports, in 2004 this being between 63.3% (Lithuania) to 81.3% (Slovenia).

4). *The free movement of goods* among the EU countries has determined the increase of competition, with an effect upon the price and quality of goods.

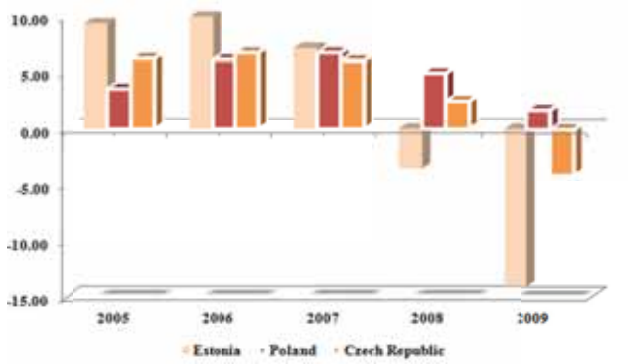

Figure 1. Real GDP in the Czech Republic, Estonia, Poland (2005-2009)

Source: Eurostat, http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/themes

5). *Free movement of capital*, another chapter in the EU acquis, promotes an efficient allocation of economies on

a global level and a better diversity of financial risks. On this way, the capital account liberalization can lead to economic growth and social welfare (Altar, Albu, Dumitru & Necula, apud Fisher, 1998).The rapid *economic growth* generated by the inflow of the EU funds created inflationary pressures upon internal demand. This process is reflected by the increasing of the inflation rate in Poland starting with 2007 (Office of the Committee for European Integration Department of Analyses and Strategies, 2008). The statistics data show that the analysed countries have registered significant increases of the real GDP after EU accession, until 2007, being an inflationary factor (Figure 1).

6). According to the Eurobarometer 62 from May 2005, European citizens perceive a negative role of the European Union in the development of the inflation rate, which means that the *expected inflation* has negatively influenced the inflation rate in 2004. Less than 35% from the citizens of the analysed countries consider that the European Union has a positive role upon inflation, the most pessimistic being the Czech (13%) and the Polish (11%).

The inflationary effects of the accession process in the Central and South-Eastern Europe countries have been on a short-run, but the catching process, in order to adopting the euro, has been on a long-run, leading to inflation differential between EU member states.

4. The Causes of Inflation Differential in EU Member States from Central and South–Eastern Europe

The inflation rate from the European Union countries does not converge to a common level. Numerous research have analysed the convergence of the inflation rate in the European Union and the causes of differential among them. The inflation differentials between EU countries are generated by five factors.

1). Maier (2004) analyses the inflationary consequences of price convergence of tradable goods in the accessing countries in 2004 and the future member states of European Union (Romania, Bulgaria, Turkey). Taking into consideration the prices differential of the tradable goods (they have 40% in consumer basket), the *convergence of these prices* is a source of *inflation differential.* When the price differential are hidden, there are the inflation differential. As a result of the convergence process of the price of tradable goods, the inflation in the new member states could be on average by 1.5 – 3.5% higher than in the euro area.

The price level convergence towards a common level is a prime source of inflation differential, because the price level in the member states varies from one country to another. The countries where the price level is lower by 20% than the euro area average are exposed to a rate of inflation higher by 1% over the euro area (Horváth & Koprnická, 2008).

2). The real convergence, necessary for adopting the single currency, has a major impact upon the inflationary process, because the reduction of disparities in terms of GDP/capita is accompanied by price increase of services. The inflation differential between countries can be explained based on the *Balassa-Samuelson effect*, due to the lower development level in the accession countries vis-à-vis the euro area. Depending on the services weight in the consumer basket, the increase of their prices will have a higher or lower impact upon overall inflation. In the year 2009 the weight of services in the consumer basket in the analysed countries was between 25.33% (Lithuania) and 39.33% (Malta). De Grauwe and Skudelny (2000) have estimated on the long-run the effects of the differential of productivity between the tradable sector and non-tradable sector upon inflation rate in EU member states, highlighting that the impact of a productivity shock upon inflation rate can be substantial, meaning an increase of 8% in the inflation differential.

3). Another cause of inflation differential is given by the *exchange rate.* The impact of the exchange rate is reflected, firstly, on the import prices, then fuels the prices of tradable goods on the internal market and finally, the overall inflation. The biggest influence is exerted by currency fluctuations against the euro, given that the imports from the European Union have a significant share in the international trade of the member countries. The share of imports from European Union in the total of imports is approximately 60-80% in the analysed countries. But the *fluctuations of the exchange rate depend on the type of exchange rate arrangement,* therefore the inflation rate is not influenced by exchange rate variations in case of the Currency Board (Lithuania) or is influenced very little in case of other conventional fixed peg arrangements (Latvia). In case of floating (the Czech Republic, Poland), the variations of the Czech koruna and of the Polish zloty have a significant influence upon the inflation rate.

Honohan and Lane (2003), investigating the causes of divergent inflation rates among EMU member countries in the 1999-2001 period, highlight that, despite the common currency, the exchange rate fluctuations have had a substantial impact on changes in inflation rate and inflation differentials in EMU. This is explained by the different degree of exposure of member states to trade outside the euro area. The divergent inflation rates have

coincided with convergence of price levels.

4). The rising of the *oil price* on the international market exerts pressure upon consumer prices, being another cause of inflation differential. The effect of oil price upon the inflation rate depends on the degree of dependence on oil import of that country. The influence of the oil price upon the inflation differentials can be explained through the weight of Housing, water, electricity, gas and other fuels and of Transport in the consumer basket, this varying in the year 2005 between 6.45% (Cyprus) and 20.60% (Slovakia), respectively 10.31 (Lithuania) and 17.78% (Cyprus).

5). Another factor that plays an important role in explaining of the inflation differential is different weight of goods and services in the consumer basket (Figure 2). Food and non – alcoholic beverages have a higher weight in the consumer basket in Latvia and Lithuania (approximately 27%) in comparison with the other countries (approximately 18-20%).

For example, the increase of food prices on the international market has a different impact upon inflation in the EU Member States, due to different weight of these goods in the consumer basket, leading, thus, to inflation differential.

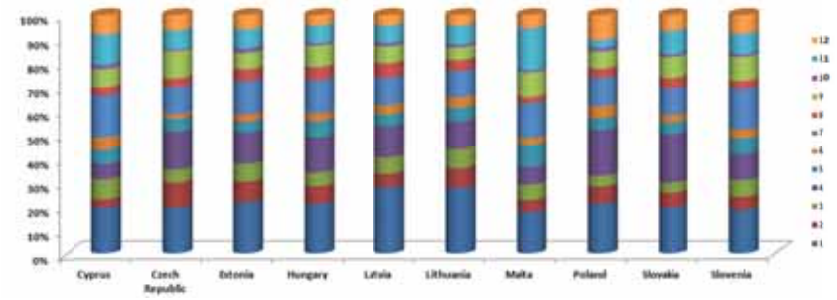

Figure 2. Weights of HICP components in EU Member States (2005)

Note: 1 – Food, non-alcoholic beverages, 2 – Alcoholic beverages, tobacco, 3 – Clothing and footwear, 4 – Housing, water, electricity, gas and other fuels; 5 – Furnishings, household equipment and routine house maintenance, 6 – Health, 7 – Transport, 8 - Communication, 9 – Recreation and culture, 10 - Education, 11 – Restaurants and hotels, 12 – Miscellaneous goods and services.

Source: European Central Bank, http://sdw.ecb.europa.eu/browse.do?node=2120778.

In the Czech Republic the alcoholic beverages and tobacco have a significant weight in the consumer basket (10.5%), three times higher than in Cyprus, which means that harmonization of the legislation regarding excises has had a major impact upon the inflationary rate from the Czech Republic.

To show the divergence of the inflation rate, *we have calculated the standard deviation for the 2004-2010* period in analysed countries. Figure 3 shows us the high inflation differentials in the year 2008, the main explanation for this being related to the oil price oscillations on the international market, which went up to the level of 85.9 euro/barrel in June. In the following months it has changed its evolution, in December the price of oil being 32.1 euro/barrel, signifying a drop by approximately 63% by the maximum level from June 2008, as a result of improving the supply conditions. In the year 2009, this had an ascending trend caused by deepening economic crisis and decreasing demand.

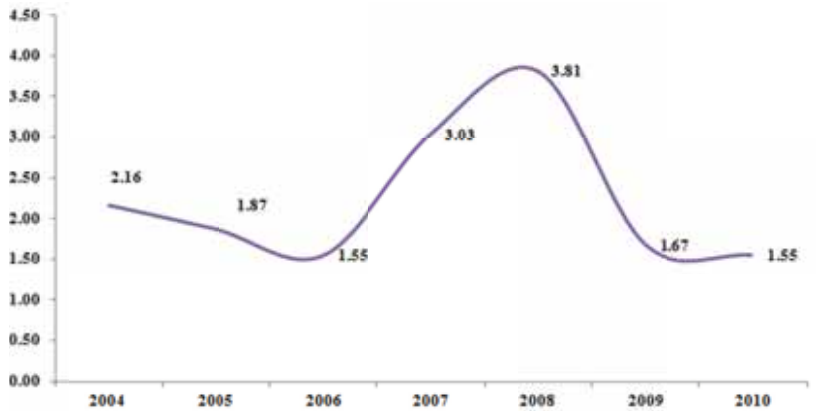

Figure 3. The evolution of standard deviation of inflation rate in EU Member States (%, 2004-2010)

Source: Eurostat, http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/themes, authors' calculations

The high value of standard deviation from the year 2008 signifies differences between countries regarding the dependence on oil import, but also the rate exchange rate fluctuations. For example, in the year 2008, the Czech koruna and the Polish zloty were appreciating very much against the euro, the exchange rate diminishing by over 10%, which means that it had a significant positive impact upon the imported inflation.

Also, the inflation differentials vis-à-vis the euro area highlight the process of inflation rates convergence which is supposed to follow the countries subjected to analysis.

Although the majority of EU member states register higher inflation rates than the euro area, there are some economies which reached very close to the euro area, in what concerns the price stability in the period 1997-2004 (Table 3).

Table 3. Inflation differential vis-à-vis the euro area (%, 1997-2010)

Country/Year	***1997 – 2004***		***2005 - 2010***	
	Average	**Standard deviation**	**Average**	**Standard deviation**
Cyprus	0.88	1.14	0.18	0.53
Czech Republic	2.08	3.61	0.68	1.38
Estonia	2.93	3.07	3.2	2.85
Hungary	7.88	4.94	3.68	1.53
Latvia	1.93	2.33	6.39	3.61
Lithuania	0.61	3.88	3.48	2.8
Malta	0.91	0.98	0.44	1.17
Poland	5.04	5.29	0.82	1.74
Slovakia	5.83	2.78	0.74	0.84
Slovenia	5.18	1.84	1.02	0.88

Source: Eurostat, http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/themes, authors' calculations

We remark a diminishment of inflation differentials in the 2005-2010 period, the Maastricht Treaty having a significant impact upon the inflation rate convergence, with the exception of the Baltic States. The rising of gap between the inflation rate in the Baltic States and the euro area can be explained on the basis of the exchange rate arrangements that characterises these states. Currency board arrangement (Estonia, Lithuania) or other conventional fixed peg arrangements (Latvia) assume the fixity of the exchange rate, respective its variations in a narrow margins of less than ± 1% around a central rate. This means the impossibility of the nominal appreciation of the national currency, the manifestation of the Balassa-Samuelson effect, which amplified after the EU accession, having consequences only on the inflation rate. Therefore, monetary policy strategy has an essential role in achieving price stability criterion.

5. Conclusions

Concluding, the countries which joined in 2004 have recorded significant reductions in the inflation rate before

EU accession, which signifies the importance of price stability in accession countries. The impact of accession on the inflation rate was both positive (the introduction of the Common Customs Policy and the free movement of goods) and negative (the adoption of the Common Agricultural Policy, the harmonization of the structure and rates of indirect taxes, the free movement of capital and the expected inflation).

The statistical data shows us that inflation rates in European Union states members are not convergent, the causes are the following: the price level convergence, the manifestation of the Balassa-Samuelson effect, the exchange rate, the oil price shocks, the different weight of goods and services in the consumer basket. From the analyses we have done, we can notice that the *exchange rate fluctuations, the dependence on oil import and the weight of Housing, water, electricity, gas and other fuels and of Transport* in the consumer basket were the *main causes of divergent inflation rates* in EU member states from Central and South-Eastern Europe. Among the analysed factors, the impact of exchange rate depends on monetary policy strategies in the Member States, which means that monetary strategies heterogeneity explains inflation differentials in the European Union.

Also, the results highlights the diminishment of inflation differentials vis-à-vis the euro area after the accession, with the exception of the Baltic States. The explanation is given by the intensifying of the Balassa-Samuelson effect after accession and the impossibility of appreciation of the national currency in these countries, the impact being only on the inflation rate.

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Inequality in Education and Economic Growth: Empirical Investigation and Foundations - Evidence from MENA Region

Aomar Ibourk[1] & Jabrane Amaghouss[1]

[1] Faculty of Law, Economics and Social Sciences, Cadi Ayyad University, Morocco

Correspondence: Jabrane Amaghouss, Massira 1, Bloc A No 633, Marrakech, Morocco. Tel: 21-266-709-1398. E-mail: jabrane_widadi@yahoo.fr

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Abstract

This paper investigates empirically the extent of educational inequality and its impact on economic growth. Based on Barro and Lee's (2010) data, we calculate two indicators measuring inequality of education. The sample comprises 15 countries from the MENA region over the period 1970-2010. As a second step, we applied the Kuznets curve of education for each country of the sample. As a third step, we examine the impact of education inequality on the economic growth in MENA region by using OSL and Instrumental Variables panel regressions with country fixed-effects.

The findings show a decline in the Gini index within all the countries, for men and women and also for all age groups. The results also indicate that the education distribution was more unequal in the middle-income countries than in the higher-income countries in 2010. The results suggested that the shape of the Kuznets curve depends basically on the measure used to approximate the inequality.

The results demonstrate also that the Gini index of men negatively and significantly affects the growth of higher-income countries. At the same time, the total Gini index influenced negatively and significantly the economic growth of all the countries, including those of high income. These results are therefore robust for the used econometric techniques.

In terms of economic policy, the results suggest policymakers to focus on educational policies apt to reduce educational inequalities, especially for women, to improve the well being of the population.

Keywords: educational inequality, Kuznets curve, economic growth, MENA

1. Introduction

Education plays a key role in the economic and social development processes of all countries. In fact, it helps to reduce poverty and to enhance the quality of social life. It is a basic ingredient within the strategies of improving health conditions. It also helps to decrease social, cultural and ethnic disparities among populations of the same country. From an economic perspective, the level of education and its distribution within the population plays a crucial role in the prospects of income distribution and consequently in economic growth. Indeed, an increased level of education of a person leads to increased skills held by the workforce, which makes it possible to improve labor productivity and therefore economic growth (Barro and Lee, 1993, 1997; Barro and Sala-I-Martin, 1995; Aghion and Howitt, 1998). Although the majority, if not all, of the countries in the world have been aware of the fundamental role that education may have in economic and social development processes, many of these countries are far from achieving mass education.

Does education encourage or discourage economic growth? A large body of empirical investigation has tried to response to this query during the last fifty years. As result, the literature so far has not provided a conclusive answer to the problematic. Over the past decade, many studies have accorded a huge importance to the possible role of equity in education in the development of countries and few of them have examined the impact of inequality in education on economic growth.

If education is not equally distributed among the population, a large part of the revenue will be owned by a well-educated minority, which engenders huge inequalities in the distribution of incomes which causes more poverty (Glomm and Ravikumar, 1992; Lopez et al., 1998). However, there is no agreement on the ideal measurement of inequalities in education. In this regard, the Gini index, developed by the statistician Gini, is the

most widely used measure. It has been used to describe the inequality of household income.

The Gini coefficient for education goes back to the 70s with the previous works of Ter Weele (1975), Rosthal (1978), Maas and Criel (1982) and Sheret (1982, 1988). In the same context, Maas and Criel's (1982) contribution is considered to be the first fully expressed attempt to allow the Gini coefficient to be calculated to measure educational inequalities. As a fact of matter, their work mainly focused on this coefficient on schooling data of 15 countries. Thomas, Wang and Fan (2002) defined the Gini coefficient as the weighted sum of absolute differences of education levels of a population. They applied this coefficient to 140 countries from 1960 to 2000, and the attained results demonstrated a drop in the level of educational inequalities for most of the countries of the world, but with a significant improvement for some countries such as South Korea, Tunisia and China, in contrast to countries like Mali and Afghanistan where the Gini index of education showed an unequal distribution of about 0.9. Zhand and Li. (2002) examined the international inequalities and the convergence of educational levels from 1960 to 1990. They showed that the difference in schooling level between the developed and the developing countries on the one hand, and between men and women on the other, was still increasing during the same period. However, as many studies have maintained, the schooling level dispersion, as measured by the coefficient of variation and the Gini coefficient, declined during this period irrespective of gender or the countries' stages of development. Qian and Smyth (2008) considered a measure of the educational inequality between the coastal and inland provinces of China. They compared it to the urban-rural educational inequality by using the Gini index of education. The findings strongly suggested that the major cause behind the educational inequality in China resulted from the access to schooling disparity between the rural and urban areas in 2000. Sahn and Younger (2007) agreed with the notion that Sen (1979, 1987) promoted. The latter confirms that income is not a sufficient measurement for welfare. In fact, both health care and education may constitute the intrinsic aspects that determine individual welfare. Thomas et al. (2002), meanwhile, used the results of the tests carried out by TIMSS in 1999 (38 countries) and in 2003 (49 countries). In the same order, Sahn and Younger used an alternative index named "Generalized entropy". The results show that more than half of the total inequality are due to intra-country differences. In a recent study, Morrison and Murtin (2010) calculated the global inequalities of education and incomes from 1870 to 2000 via an estimation of human capital distribution since 1870. They suggested that education inequality was quit large in the 1870s. The Gini coefficient reached 0.79. In 1870, 75% of the world population was illiterate. In 2000, the situation improved significantly so that the Gini index reached almost half of what it measured in 1870. This rapid decline refers basically back to the increase in the literacy rate which became 88% in 2000 compared to 15% in 1870.

This work differs from others in the sense that, to our knowledge, no work has attempted to develop a measure of inequality in education in the MENA region and no work has examined its impact on economic growth. To address this question, we combine tree approaches. First, we develop a new data set on educational inequality in order to place disparities between countries in a larger regional context. Second, we use the results to test the validity of the Kuznets curve hypothesis in the field of education. Third, we examine trends of educational inequality on economic growth. MENA countries concerned by this study are: Jordan, Turkey, Iran, Syria, Algeria, Tunisia, Egypt, Iraq, Morocco, Bahraîn, United Arab Emirates, Saudi Arabia, Kuwait, Libya and Qatar. To check the robustness of the results, we divided the sample into two groups: high-income countries and middle-income countries. The period analyzed runs from 1970 to 2010.

The paper is organized as follows. The second section of this paper will deal with the literature review about the impact of education inequalities on economic growth. The third section develops the Gini index of education and discusses the results of our calculations in the MENA region. The fourth section will test the Kuznets hypothesis in the field of education. The fifth will shed light on some empirical investigations which focus on the relationship between inequality in education and economic growth in MENA region. The last section is a conclusion.

2. Educational Inequality and Economic Growth: Literature Review

Several indicators have been used in the research papers to measure the impact of the different aspects related to education upon economic growth: enrollment rates in different education cycles, completion rates, survival rates to the last grade of primary education, the average years of schooling, and the obtained test scores following the international standards (Altinok, 2007). Otherwise, works that deal with the measurement of the impact of inequality in education on economic growth are less numerous. In fact, it is important to distinguish two types of impact studies: those related to gender inequalities (Barro and Lee, 1993, 1997; Lagerlöf, 1999; Klasen and Lamanna, 2008) and those related to distribution (Thomas et al., 2002).

Schultz (1993) affirmed that the low investment in girls' education is not economically effective. Schultz goes so

far as to emphasize the absence of studies that have proved that the performance of girls' schooling is lower than that of boys. Biredsall and Londoño (1997) used the standard deviation of schooling (SDS) in order to approximate inequalities in education. The study focuses on an estimation of a classical model of economic growth in cross section. The results show that the initial level of inequalities in education (measured by SDS) has a significant negative impact on economic growth. The Inter-American Development Bank (1999), for its part, used the standard deviation of schooling to measure the educational inequality in some Latin American countries. Lopez et al. (1998) calculated the Gini index of education by using the educational level of the population. The authors have tried to explain why the impact of education on economic growth is therefore uncertain. They have then constructed an allocation model which demonstrates the importance of education distribution in economic growth. They have used panel data from 12 Asian and Latin American countries from 1970 to 1994. The attained results have shown that the distribution of education is a key role in illustrating this tenuous connection between education and economic growth. They also show that the unequal distribution of education has a negative impact on GDP per habitat for most of the sample countries. Therefore, the effect of education on economic growth is very significant when the equality distribution of education is large. It is concluded, then, that economic policy which does not intend to reduce the inequality of education distribution will reduce or adversely affect the impact of human capital on economic growth. Kalsen (1999) has used cross-sectional and panel data to examine the effect of gender inequality in education on economic growth. The results suggest that there is a direct and negative impact on economic growth and development. This considerable impact is realized through the reduction of human capital quality. On the other hand, economic growth is indirectly affected by the impact of gender inequality on investment and population growth. The outcome also indicates that gender inequality impacts negatively on the reduction strategies of fertility and infantile morality rates. Castelló and Doménech (2002) constructed the Gini index for 108 countries from 1960 to 2000, and the results show a decrease of human capital. After that, they considered a standard economic growth model. The observed results suggest a negative effect of human capital inequalities on economic growth rates. These results are quite robust to the changes in explanatory variables, the exclusion of aberrant data, and the use of instrumental variables as controls of endogeneity problems. De Gregorio and Lee (2002) provided empirical evidence for the way that education can affect the distribution of incomes for a country panel from 1960 to 1990. The findings indicated that a high level of education and its more equal distribution permit a better distribution of incomes. Checchi (2004) studied the relationship between the inequality of education and incomes. The results highlighted that when the negative correlation between the average level of education and its dispersion is taken into consideration, the relationship between the inequality of income and the average years of schooling takes a U shape. In another, more recent study, Klasen and Lamanna (2008) tried to update the comprehensive body of previous works by analyzing the impact of gender inequality in education on economic growth. The outcome suggested that gender inequality reduces the progression potentiality of a country. This negative impact is seen in the MENA region and in South Asian countries. According to them, the rate of economic growth decreases to 0.1% while the gender inequality in education increases to 0.9%.

More recently, Klasen and Lamanna (2009), using cross-country and panel regressions for the period 1960-2000, investigate to what extent gender gaps in education (Female-male ratio of schooling & Female-male ratio of the growth in the years of schooling reduce economic growth. They find that gender gaps in education reduce economic growth through its effects on investment rates. Castelló (2010b), by using Gini index of education and the distribution of education by quintiles, find a negative effect of income and human capital inequality on economic growth, both in the sample as a whole and in the low and middle income economies, an effect that vanishes or becomes positive in the higher-income countries.

3. The Measure of Inequality in Education in The MENA Region

We relied on Thomas and al. (2002) formula to measure education inequality in the MENA region in order to construct the Gini index of education. This index considers the distribution of schooling years amongst the population:

$$Egini = \frac{1}{\mu}\sum_{i=2}^{n}\sum_{j=1}^{i=1} P_i \langle Y_i - Y_j \rangle P_j \quad (1)$$

With the *Egini* index of education, which depends on schooling level, μ is the average years of schooling of the population, P_i and P_j represent the parts of the population having *i* and *j* schooling levels, Y_i and Y_j are the accumulation of the school years according to each level of education, and *n* is the number of school levels. The classification of Barro and Lee (2010) identifies seven levels of schooling.

In this paper, we have assumed that the duration of each level *Yi* remains constant throughout the entire period

and is identical for all the countries.

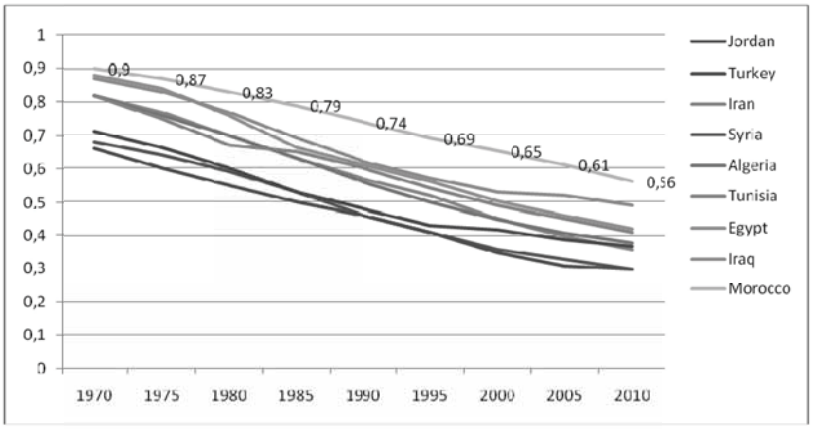

Figure 1. The evolution of the Gini index of education in the MENA region, 1970-2010

Source: Authors' realization based on our calculation and database of Barro and Lee (2010).

Figure 1 shows the evolution of the Gini index in 15 countries of the MENA region (distributed according to income level) in the period between 1970 and 2010. In fact, in 1970, the countries of the MENA region recorded very high indices in educational inequalities. For all the middle-income countries, the inequalities in education were very strong: for example, Morocco (0.90), Egypt (0.88) and Iraq (0.87). After that, in 2010, the situation clearly improved among all the countries of the MENA region. This is broadly in line with the outcomes of Thomas et al. (2002). The lowest values are seen in high-income countries. However, the decline rates of the Gini index of education vary from one country to another. Indeed, in countries like the United Arab Emirates, Bahrain, Egypt, Jordan and Algeria, the Gini index declined by at least 45% in the period between 1970 and 2010. However, for other countries like Morocco, the inequalities declined slowly within the same period.

The remarkable divergences between the countries of the MENA reflect the divergence of efficiency of efforts devoted by each country to reducing inequalities of access to different levels of education.

As can be deduced from Our calculation, Morocco is the country where the inequalities in education are most pronounced compared with the sample of this study. This outcome is easily understood when we take into consideration the fact that in Morocco we can find the highest illiteracy rates and the lowest average years of schooling of the sample.

Our results confirm those of Thomas et al. (2000), that even if the countries of the MENA region managed to reduce the Gini index of education between 1960 and 2000, they were still far from the performances achieved by countries in other regions of the world, especially those of East Asia and Latin America.

Our data shows also that the Gini index and illiteracy rates are positively correlated for the whole sample.

This outcome has strong implications in terms of education policy. This means that the literacy of individuals should be a priority in order to improve the distribution of education within a country and consequently increase the number of schooling years of its people.

The level of inequality in education among women was still obviously higher in 2010 for some middle-income countries of the MENA (Morocco (0.64) and Iraq (0.56)). The countries that managed to significantly reduce the inequality in education were Bahrain and the United Arab Emirates (high-income countries) with respective values of 0.22 and 0.28. Meanwhile, the other countries showed intermediate Gini index values that ranged from 0.3 to 0.5.

We can say that inequalities in education were higher for women than men in all middle-income countries and throughout the entire period of study. This mainly reflects the discrimination that affected women in the schooling process. In addition, it is revealed that the educative policies in the MENA region neglected female schooling. For some countries (especially high-income countries), the distribution of access to school for men was more unequal than for women at certain times: Kuwait (1985, 1990 and 2010); Libya (2005, 2010); Qatar (from 1980 to 2010) and the United Arab Emirates (from 1985 until 2010).

A gap analysis of the Gini index between men and women has shown that Morocco was the only country where

this gap (deviation) continued to increase. It doubled between 1970 and 2005 respectively from 0.08 to 0.17 before declining by one degree and eventually stabilizing at 0.16. This gap continued to narrow in some countries like Jordan, Libya, Syria and Turkey in the period between 1970 and 2010. However, for other countries the gap between the two indices continued to rise until the period 1985-1990. After that, it started to fall between the years 1990 and1995. Generally speaking, these inequalities were reduced between 1970 and 2010 for both genders and in all the countries (see Amaghouss and Ibourk, 2012).

The database of Barro and Lee (2010) has provided us with age-group data sets; these allow us to calculate the level of inequality by age groups.

In 2010, a highly increased Gini index for the 15-19 age group was noticed in Morocco (0.38) and a very low value in Qatar and Saudi Arabia (0.12), followed by Jordan (0.13) (see Figure 2). The most unequal age group was the 75 years and over group. This simply concerns old people who could not benefit from schooling in the sense that when they were young the majority of the MENA regions were European colonies. Figure 2 shows the evolution of inequality in education for two age group (75 and over, and 15-19 age group). It shows that inequality in education have remained high for older (the upper line is almost horizontal). The same trend is also observed in Algeria. For countries such as Turkey and Syria, inequality decreased significantly for older people. This demonstrates the divergence of political education systems. In both countries, mass schooling was accompanied with a literacy process. Morocco has long neglected adult literacy. Recently, efforts have been made but they remain insufficient given the magnitude of this phenomenon.

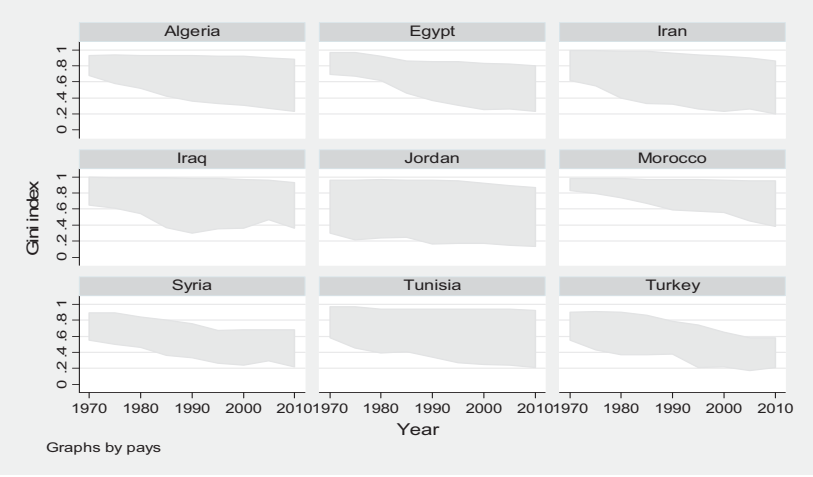

Figure 2. Educational inequality by age group (the upper line: 75and plus; the lower line: 15-19 age group), Middle-income countries, selected countries, 1970-2010

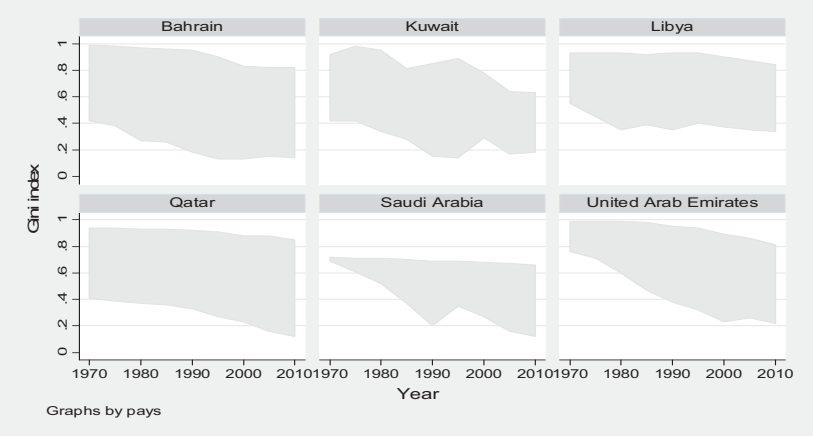

Figure 3. Educational inequality by age group (the upper line: 75and plus; the lower line: 15-19 age group), High-income countries, selected countries, 1970-2010

4. Macro-economic Foundations of Inequality in Education: Kuznets Curve of Education Approach

4.1 Foundations of the Kuznets Curve

The implementation of the Kuznets hypothesis in the area of education requires a process of mass schooling in order to achieve a reduction of inequality in access to schooling. This section investigates how the MENA region countries are positioned in relation to this hypothesis.

It is therefore of high interest to test the shape of the Kuznets curve of this region and subsequently establish a sufficiently informative estimation of the turning point. We extend these tests by taking into consideration two groups of countries: high-income and middle-income countries. This choice is more appropriate as the MENA region countries do not constitute a completely homogenous group.

Afterwards, we will carry out an empirical test on the relationship form that links the level of education inequalities and the average years of schooling. The specification of the Kuznets curve in the education field for a panel of countries is given by:

$$ei_{it} = a + b\mu_{it} + c\mu_{it}^2 + \varepsilon_{it} \tag{2}$$

Where *i* represents the countries and *t* indicates the date. In order to study the shape of the Kuznets curve in the field of education in the long term, we have constructed five-year data which last from 1970 to 2010. *ei* refers to the measure of inequality in the education field. The derivation of the turning point from the equation (2) is detailed in Amaghouss and Ibourk (2012). We have chosen two measures: the standard deviation of school enrollments (De Gregorio and Lee, 2002; Lim and Tang, 2008; Morrison and Murtin, 2010) and the Gini index (GI) as calculated above.

The standard deviation of the distribution of schooling (SDS) is given by the following formula.

$$SDS = \sqrt{\sum_{i=1}^{n} p_i (y_i - (\sum_{i=1}^{n} p_i y_i))^2} \tag{3}$$

4.2 Findings

4.2.1 The Standard Deviation of Schooling as a Measure of Inequalities

Figure 4 and 5 present the shape of the Kuznets curve in the field of education for the countries of the MENA region from 1970 to 2010. The figures analysis indicates to us the validity of the Kuznets curve of education for each group of countries. The high-income countries have already entered the second phase of reducing inequality while middle-income countries are still in the first phase of rising inequality except for Syria, Turkey, Jordan and Iran. The figure also provides us with an initial estimation of the turning point which lies between 5 and 7 years.

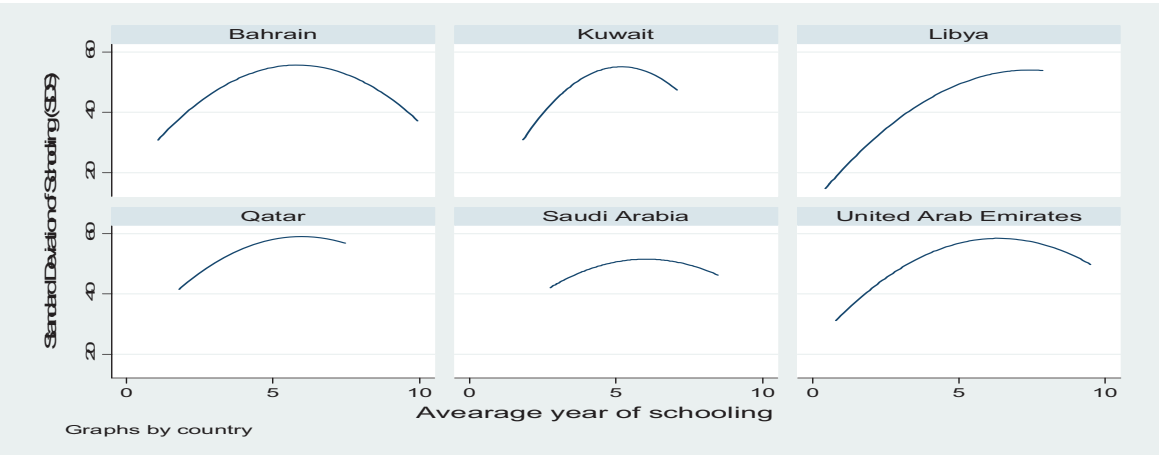

Figure 4. The Kuznets curve of education in 15 countries of the MENA region, 1970-2010

Source: Authors' realization based our calculations and database of Barro and Lee (2010)

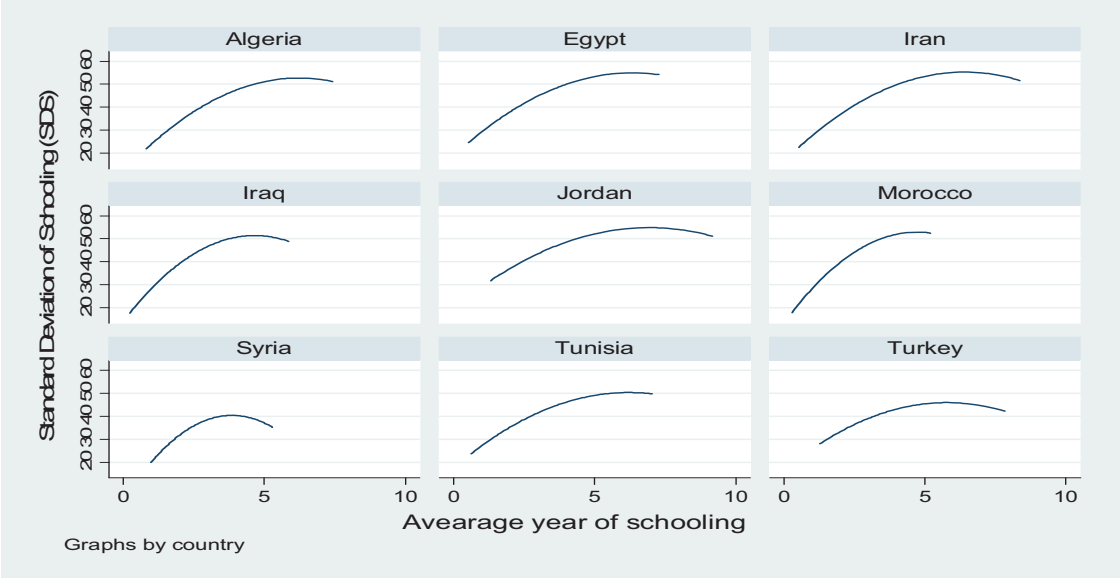

Figure 5. Kuznets curve of education, MENA middle-income countries, selected countries, 1970-2010

Source: Authors' realization based our calculations and database of Barro and Lee (2010)

4.2.2 The Gini Index as a Measurement of Inequality

When we use the Gini index as a measurement of inequality, the relationship between the Gini index and the average years of schooling is linear with a negative slope (Figures 6 and 7). The invalidity of the Kuznets curve in the education domain when the inequalities are measured by the Gini index is confirmed in each group of countries.

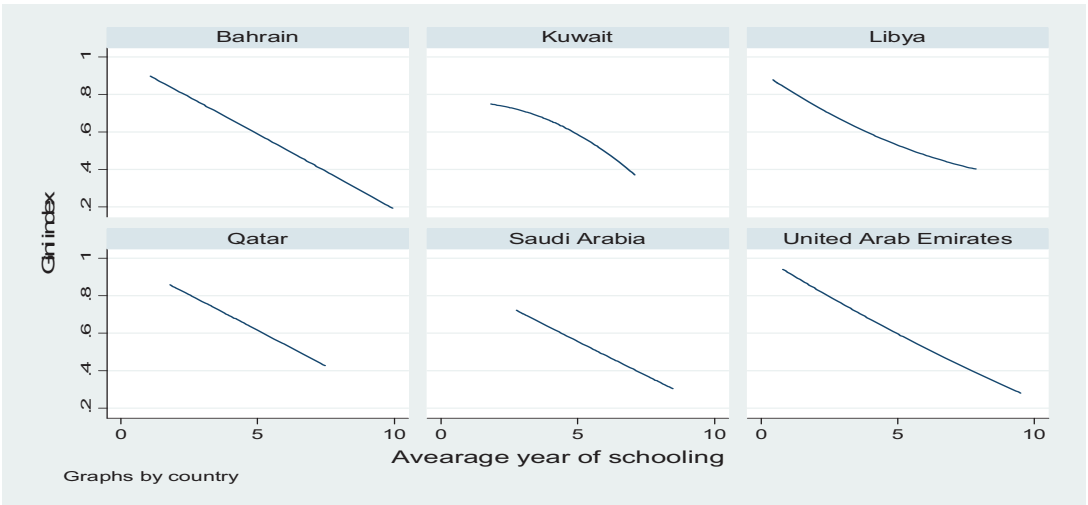

Figure 6. Gini index of education and average year of schooling, MENA high-income countries, 1970-2010

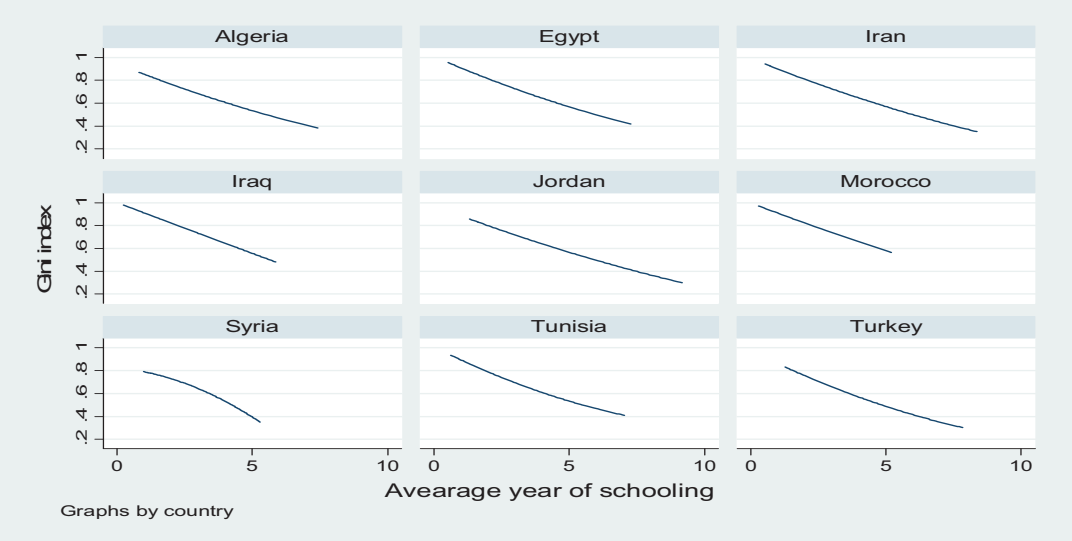

Figure 7. Gini index of education and average year of schooling, MENA middle-income countries, 1970-2010

Using panel regression, Amraghouss and Ibourk (2012) has empirically estimated the shape of the Kuznets curve in MENA region. The finding confirms those of graphical analysis. The results have also estimated the turning point. Its equal to 6.11 years for all the countries (the whole sample), which is equivalent to that argued in the empirical works. This value corresponds to 5.94 years in high-income countries, which is slightly below that observed in middle-income countries (6.28). Indeed, high-income countries are provided with substantial financial sources which permit them to invest more in education. They have managed to start a significant reduction of education dispersion for low levels of schooling year. To better analyze the extent of inequalities in education in the MENA region, we study its impact on economic growth. The following section examines this question.

5. Inequality in Education and Economic Growth

5.1 The Model and Data

The purpose of this section is to evaluate the impact of education inequality on the economic growth of the MENA region countries.

We use the Gini index of education which we have calculated as a measure of human capital inequality.

To do this, we estimate the following panel regression model with fixed-effects :

$$Lny_{it} = \beta_0 + \beta_1 \ln s_{kit} + \beta_2 \ln pop_{it} + \beta_3 S_{it} + \beta_4 G_{it}^{S} + \eta_i + \mu_t + \varepsilon_{it} \quad (4)$$

Lny_{it} : the logarithm of GDP per capita

lns k_{it}: the logarithm of the investment rate of physical capital

lnpop: the logarithm of the population

S_{it}: the average years of schooling

G_{it}^{S} : Gini index of education (for men S = m, for women S = w for all S = a)

n_i: individual's fixed effect

μ_t: temporal fixed effect

ε_{it}: idiosyncratic measurement error

The y_{it}, sk_{it} and popit data sets were taken from Penn World Table 6.3. The average years of schooling data were obtained from Barro and Lee (2010). The data about the inequalities of education are from our calculations. All the data are calculated in five-year averages from 1970 to 2010. The study has been applied to 15 countries, nine of which are middle-income countries and six are high-income countries.

To better understand the impact of inequality of education upon economic growth, consideration is also given to

calculating the impact of inequality in education in terms of gender.

The tests of Fisher confirm the existence of fixed effects for all the regressions that we have carried out (the values of the F- test are not carried forward).

5.2 The Empirical Results

The regressions (1), (2) and (3) concern the estimation of the model (1) for the whole sample under study by using three measures of inequality in education: the Gini index of men, women, and the total Gini index. The findings indicate that the effect of the physical capital stock is negative and significant irrespective of the chosen measure of inequality in education. This is due to the fact that the stock of physical capital over all the MENA region countries is lower than the long-run equilibrium.

The population effect has a negative sign which is not significant when we take into consideration the total Gini index. This is explained by the fact that in the MENA region, the population growth doesn't encourage economic prosperity in the sense that the additional population cannot find productive employment and therefore joins the millions of the already unemployed population. Indeed, the MENA region has one of the highest unemployment rates in the world (Salehi-Isfahani, 2010).

The education attainment level of the population and the distribution of education affect negatively and significantly the economic growth in regressions (1) and (3). These results reinforce the findings of Pritchett (2001) and Makdissi and al. (2006), to whom education in the MENA region does not contribute to the economic growth.

We have also tested equation (4) in high-income and middle-income countries to identify the disparities between the two sub-groups. For high-income countries, the results suggest that it is only the Gini index of men that has a negative and significant impact on economic growth. This result can be explained by the fact that the Gini index of women is much lower than that of men in some of the high-income countries. For its part, the educational level of the population has not changed sign and remained significant, while the impact of the stock of physical capital is no longer significant.

For the middle-income countries, the negative impact of educational inequality is significant when we take into consideration the total Gini index. Indeed, the distribution of education is highly unequal among women in middle-income countries. For instance, the level of inequality in education for women in Morocco in 2010 was 0.64 while it was only 0.32 for men. In addition, in these countries, the level of accumulation of physical capital does not help to generate economic growth. But when it comes to the population level, this impact is therefore negative and significant (Table 1).

Table 1. The results of fixed-effects model regression by OLS methods

	The whole sample			High-income countries			Middle-income countries		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ln(I/y)	-0.177**	-0.180**	-0.186**	-0.109	-0.075	-0.125	0.142*	-0.119	-0.128*
	(-2.49)	(-2.35)	(-2.51)	(-0.90)	(-0.59)	(-0.99)	(-1.84)	(-1.55)	(-1.71)
Ln(pop)	-0.171	-0.086	-0.223*	0.208	0.367**	0.248	-0.473	-0.814**	-0.873***
	(-1.377)	(-0.59)	(-1.67)	(1.22)	(2.07)	(1.39)	(-1.96)	(-2.58)	(-3.01)
S	-0.138**	0.108	-0.15**	-0.253***	0.064	-0.26**	0.053	0.065	-0.065
	(-2.47)	(1.49)	(-1.88)	(-3.48)	(0.48)	(-2.26)	(-0.63)	(-0.97)	(-0.67)
Gini^{m}	-3.005***	-	-	-2.306**	-	-	-1.643	-	-
	(-4.17)			(-2.30)			(-1.51)		
Gini^{w}	-	0.725	-	-	2.523	-	-	-2.055*	-
		(0.78)			(1.6)			(-1.91)	
Gini^{a}	-	-	-3.036***	-	-	-1.917	-	-	-4.004**
			(-2.84)			(-1.23)			(-2.61)
Const	13.426***	9.51***	14.175***	11.73***	6.14***	11.384***	14.093***	17.87***	20.36***
	(11.41)	(5.39)	(6.34)	(7.52)	(2.75)	(8.62)	(5.58)	(4.92)	(-5.47)
N. observations	135	135	135	54	54	54	81	81	81
F test	Prob>F= 0.0000	Prob>F= 0.0000	Prob>F= 0.0000	Prob>F= 0.0000	Prob>F= 0.0000	Prob>F= 0.0000	Prob>F= 0.0000	Prob>F= 0.0000	Prob>F= 0.0000
R-sq									
Within	0.2	0.09	0.14	0.26	0.21	0.2	0.4	0.41	0.43
Between	0.14	0.47	0.18	0.3	0.19	0.18	0.02	0.008	0.024
Overall	0.14	0.4	0.36	0.06	0.05	0.04	0.001	0.002	0.001

*** p<0.01, ** p<0.05, * p<0.1.

Source: author's estimation

By construction, the estimation of equation (4) has provided biased estimators in the measure where the investment rates in physical capital (explanatory variables) are dependent on the level of GDP per habitat (variable to be explained). We have furthermore used various panel data techniques, including instrumental variable ones, in order to control the problem of collinearity. We have also used the lagged value of investment rates in physical capital and the logarithm of the population as an instrument for investment rates in physical capital (Földvári and Van Leeuwen, 2011); and to ensure the correct choice of instruments, we have proceeded to the Sargent test. Anderson Canonical tests aim to judge quality of the instruments used in the models, both reported in the last columns of Table 2 give two important information about the regression. They determine the conditions for identification of the modèls and the validity of the exogenous variables not included in the second stage regression ("Excluded instruments"). The results of the estimations are reproduced in Table 2.

For the entire sample of countries, the achieved outcome of the double least squares method using panel data confirms the results obtained by the OLS method for the variables measuring the educational inequalities. However, the negative impact of education level is insignificant only in the presence of the Gini index of men. The findings confirm and amplify the scale of the negative coefficient associated with the stock of physical capital.

For the high-income countries, the statistical significance and the sign which have associated wih the coefficients measuring the educational inequalities, the education level of the population and the investment rates in the stock of physical capital are altogether not altered. Meanwhile, the positive coefficient associated with the population is the only one which has lost its statistical significance.

Table 2. The results of fixed-effects regressions by the method of panel data instrumental variables

	The whole sample			High-income countries			Middle-income countries		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ln I/y	-0.587**	-0.546**	-0.578**	-0.468	-0.376	-0.479	-0.65	-0.556	-0.558
	(-2.30)	(-2.08)	(-2.22)	(-1.57)	(-1.22)	(-1.50)	(-1.42)	(-1.23)	(-1.38)
Ln (pop)	-0.384*	-0.285	-0.455**	-0.122	0.069	-0.065	-0.344	-0.537	-0.69*
	(-1.95)	(-1.29)	(-2.17)	(-0.46)	-0.27	(-0.24)	(-1.03)	(-1.02)	(-1.83)
S	-0.123*	0.068	-0.145	-0.195**	0.025	-0.229*	-0.063	0.048	-0.075
	(-1.64)	(-0.82)	(-0.25)	(-2.22)	(-0.17)	(-1.68)	(-0.34)	(-0.6)	(-0.56)
Gini^{m}	-3.085***	-	-	-2.522**	-	-	-2.541	-	-
	(-3.46)			(-2.18)			(-1.21)		
Gini^{w}	-	0.0713	-	-	1.296	-	-	-1.236	-
		(-0.07)			(-0.74)			(-0.86)	
Gini^{a}	-	-	-3.483***	-	-	-2.461	-	-	-3.316*
			(-4.05)			(-1.33)			(-1.7)
Const	16.476***	12.959***	17.483***	14.97***	10.092***	14.81***	15.29***	15.98***	19.16***
	(-9.86)	(-5.77)	-6.589	(-6.8)	(-3.57)	(-5.11)	(-4.62)	(-3.09)	(-4.31)
N	120	120	120	48	48	48	72	72	72
F test	Prob>F= 0.0000	Prob>F= 0.0000	Prob>F= 0.0000	Prob>F= 0.0000	Prob>F= 0.0000	Prob>F= 0.0000	Prob>F= 0.0000	Prob>F= 0.0000	Prob>F= 0.0000
R-sq									
Within	0.15	0.14	0.12	0.003	0.02	0.01	0.2	0.25	0.27
Between	0.27	0.38	0.4	0.25	0.18	0.11	0.32	0.12	0.13
Overall	0.21	0.26	0.38	0.02	0.02	0.008	0.07	0.02	0.03
Anderson canon.	6.907	7.842	5.692	8.973	7.893	9.836	4.581	4.663	5.852
corr. test	(0.3296)	(0.3518)	(0.31872)	(0.4379)	(0.34619)	(0.4582)	(0.274)	(0.2826)	(0.3196)
Sargan statistic	23.248	24.654	22.251	18.691	17.348	14.894	21.372	20.652	19.258
	(0.0003)	(0.002)	(0.0025)	(0.0087)	(0.0096)	(0.0108)	(0.009)	(0.0104)	(0.0101)

*** p<0.01, ** p<0.05, * p<0.1

Source: author's estimation

For the middle-income countries, the negative impact of the physical capital stock coefficient becomes insignificant. At the same time, the coefficient associated with the population also becomes insignificant in the presence of the Gini index of men and women. After the correction of biases related to the presence of collinearity among some variables, the coefficient associated with the Gini index of women loses its statistical significance.

The results appear to suggest that the negative impacts of the Gini index of men on high-income countries and the negative impacts of the total Gini index on all the countries, including the middle-income ones, are robust in changing the estimation method, thereby confirming the heterogeneous performances of the countries of the MENA region as to the impact of educational inequality on economic growth. Thus, the weakly egalitarian distribution of education characterizing most MENA economies has certainly been an obstacle to the development process in the region.

Several causes explain the negative impact of inequality in education on economic growth. Lagerlöf (1999) confirm that inequality in education affect growth through fertility. The economic growth is indirectly affected through the impact of inequality in education on investment and population growth (King and Mason, 2001). The educational inequalities simultaneously affect growth and income inequality (Dallar and Datti, 1999; Rehme, 2007). More recently, Castelló (2010a) confirm that this negative impact is reinforced in the countries where individuals find it difficult to access credit. Unfortunately, the lack of data in MENA region does not allow us to explore the extent of the transmission channel.

6. Conclusion and Implications

The aim of this paper is to measure the extent of inequality in education in the MENA region and its impact on economic growth using the Gini index of education according to the criteria of gender, age and income levels. The results achieved have indicated that educational inequalities explicitly decreased for all the countries, for both men and women and for all age groups. The findings also show that the distribution of education was more

unequal in middle-income countries than in high-income countries in 2010 while they had almost the same level in 1970. This result is confirmed by the shape of the Kuznets curve. The high-income countries have already entered the second phase of reducing inequality while middle-income countries are still in the first phase of rising inequality.

Secondly, we have estimated the impact of educational inequality on economic growth in the MENA region. It is shown that the Gini index of men affects negatively and significantly the progression of high-income countries. Moreover, the total Gini index has the same impact on the economic growth of the whole MENA region, including the high-income countries.

These results have strong implications in terms of economic policy. For high-income countries, future efforts should be emphasized on the reduction of inequalities in men's education, whereas in middle-income countries, the educational policies should offer programs aimed at reducing the total inequality, with a particular focus on decreasing that of women.

To conclude, it is important to mention some limitations of this research. Firstly, the results show associations but cannot prove causality. Additional analyzes using micro-data will be able to demonstrate the importance of links explored here. Secondly, MENA region is mainly divided in three group: High-income countries, Middle-income countries and low-income countries (low-income countries are excluded due to lack of data). This analysis considered the first two groups to explore the patterns of educational inequalities. It is possible that this simplification might mask the existence of more localized educational growth trajectories. A general comprehension of geographic patterns can be required. It might be interesting to realize further studies regarding spatial inequalities and regional development especially for a country like Morocco. This point will be discussed in a future work.

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To Clear or Not: Examination of Mergers and Acquisition Cases from Small Economies

Bobby Maharaj[1] & Mahendra Reddy[2]

[1] Fiji Commerce Commission, Fiji Islands

[2] Fiji National University, Fiji Islands

Correspondence: Mahendra Reddy, Fiji National University, Fiji Islands. E-mail: mahendra.reddy@fnu.ac.fj

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Abstract

In an increasingly competitive market, the corporate sectors in small developing countries are adopting a number of strategies to deal with raising efficiency and productivity. One such strategy is consolidation, that is, mergers and acquisitions. One of the primary motive to undertake a merger is to gain the synergy that would accrue from more efficient management, economies of scale and scope, removal of duplication of resources, utilization of resources to their full potential, and improved production techniques. This study examines the basis of mergers and acquisitions (M&A) and utilizing two recent cases of M & A applications, provides a theoretical and practical basis to decide on whether mergers and acquisitions will be allowed or not. In doing so, we demonstrate the process and methodologies utilized to assess and examine an M & A application. The first case involves a conglomerate merger in the beverage industry while the other involves an acquisition in the same industry. In both the cases, the M & A application was cleared. In the first case, the merger involved two different kinds of beverage activity - alcoholic and soft drinks beverage hence there was no effect on the market share of the individual products. In the second case, while the acquisition was in the same industry, a detailed financial analysis of the acquired firm reveals that it is a "failing firm", and therefore, in the public interest, the acquisition needs to be cleared.

Keywords: mergers, acquisitions, failing firm, herfindahl-hirshman index (hhi), public interest

1. Introduction

The corporate sector in small developing countries, faced with inherent limitations of market size, externalities and external shocks, is facing major challenges in trying to remain competitive in a dynamic global market. The financial crisis in their major trading-partner countries has left smaller economies such as PICs with major challenges in trying to survive the trickling-in effects of the global fallout from the financial crisis.

Businesses in these small economies have adopted a number of strategies to deal with this scenario including downsizing and right sizing. However, more well established companies have also examined ways in which to reduce unit costs and increase growth and profitability. One such approach has been reorganization and consolidation, that is, mergers and acquisitions.

Mergers are defined as "any amalgamation of the undertaking or any part of the undertaking or interest of two or more companies or the undertaking or part of the undertakings of one or more companies and one or more bodies corporate" (Akinbuli, 2012: 686).

Acquisitions or takeovers, on the other hand, refer to the process of combining two or more firms and in which one firm acquires the assets and liabilities of the other in exchange for cash or shares, goods or debentures (Akinbuli, 2012:686). DePamphilis (2008) described acquisition to mean all the processes, terms, conditions and fulfillment adopted to purchase a small firm by a big and well established unit. These acquisitions can be either full or partial. In a full acquisition, the acquirer buys all the stock and capital of the purchase company while in a partial acquisition,the acquirer obtains a controlling interest, normally above 50% but below 100%.

The synergic gains from mergers and acquisition activity result in more efficient management, economies of scale and scope, removal of duplication of resources, utilization of resources to their full potential, improved production techniques, combination of complementary resources, redeployment of assets to more profitable uses, and, the exploitation of market power or any number of value enhancing mechanisms that fall under the rubric of

corporate synergy. However, mergers and acquisitions can also have a major detrimental impact on the economy via their effect on market structure, the subsequent effect on acquiring a dominant position and substantial market power to the firm(s) in the relevant market and thus abuse of this power. Given this issue, mergers and acquisitions have to be cleared by Competition authorities in countries where there are independent Competition Commissions. In the absence of this, the Ministry of Finance or Commerce is charged with examining and approving applications for mergers and acquisitions.

The legislation in Fiji that looks into mergers and acquisitions, Commerce Commission Decree 2010 (*vide* Section 72 and Section 73*)*, Section 72 stipulates that a merger cannot be authorized if it will substantially lessen competition or result in a monopoly. In determining if a merger is anti-competitive, regulatory agencies look at the markets served and the type of commerce involved. Several factors are considered, such as size of market, number of competing companies and financial condition of companies.

In light of the above regulatory requirement, we undertake a detailed examination of two applications for merger clearance. The first application is by a beverage firm to take over another firm in the same industry while the second application is from a hardware firm to acquire another firm in the same industry. In the following section, we provide an overview of mergers and acquisition literature. In the third section, we examine the two cases in detail and in the fourth section, we provide summary and conclusion.

2. Mergers and Acquisitions: An Overview

An organization's decision to merge with or acquire another organization is one that requires a lot of deliberation and consideration. Some of the considerations must involve: why merge? What are the problems associated with merging? How will the currents problems be resolved by a merger and what benefits will the organization derive from the strategy? Schenk (2000) argued that mergers and acquisitions often form part of the strategic options expected to transform company performances. Mergers usually arise when neither company has the scale to acquire the other on its own. While in mergers both firms lose their registering name to become a new company entirely, acquisitions involve the stronger organization swallowing the smaller or weaker one entirely without any changes to the stronger firm's identity. However, this decision to merge or acquire is not an easy decision. It is involves a complex process (Akinbuli and Kelilume, 2013) and requires and great deal of analysis to answer fundamental questions prior to a decision on whether to merge or not. Some of the issues to be dealt with include:

a) How the merger will be financed?

b) What to do with management staff?

c) How many other staff will be laid off and how are they to be compensated?

d) How to handle branding issues.

Some of the above decision to the above questions depends on the type of merger undertaken. The merger literature outlines three common types. The first are the horizontal mergers, which take place between actual and potential competitors in the same product and geographic markets, and at the same level of the production or distribution chain. Vertical mergers, on the other hand, occur where firms that operate at different levels of the production and distribution chain, merge. For example, two companies - a water bottling company and another that owns a retail network with vast distribution capabilities. Herein lies the perfect formula for a successful vertical merger, with the bottling plant concentrating on just extracting and bottling water while the other arm deals with labeling, marketing, distribution and retailing. The different stages of production delivery combine to create more efficiency, more productivity, more profitability and more value. Lastly, a conglomerate merger refers to mergers between companies in unrelated industries or in totally different markets, hence does not pose much of a concern to competition authorities. One objective of such a merger is to create a diversified portfolio which in turn could help in hedging against risk. This type of merger can create some operating efficiencies resulting from the combination and elimination of redundant departments. Mergers and acquisitions, if handled diligently, can become the key strategy for enhancing productivity and profitability. Referring to mergers and acquisition cases in Nigeria, in a recent study, Mandi (2003:3) notes the following:

"In the last three years, growth through acquisition has been a critical part of the success of many companies in the new economy. In fact, I would say that merger and acquisition has been the single most important factor in building up their market capitalization".

While lead firm engaging in this exercise does pursue major gains, policy makers and regulators and concerned about potential negative impact on industry, consumers and the economy. A major concern for policy makers and regulators is the increase in market concentration and therefore, the cumulative economic power of firms

involved in horizontal mergers. The level of market concentration is the main determinant in measuring the substantial market power and market dominance of a firm. If the merger leads to the creation of a monopoly, the new firm will not face any restrictions from competitors when it takes pricing decisions. Similarly, if the new firm becomes a dominant firm following the merger, then it can unilaterally set prices which others will have to adopt as the market price. For example, two of the three oil companies in Fiji would like to merge because they believe they can create efficiencies within the company and thus eliminate costs and improve profitability. Such mergers raise competition concerns because they may lead to a reduction in the number of rivals in the market, causing increased market concentration. In a study on the impact of mergers on consumer welfare, McAfee and Williams (1992) concluded that mergers, which resulted in a new firm at market and increased the concentration of the largest firm, would always reduce welfare.

There are several firm attributes that are hypothesized to explain why certain firms may be seen as prime candidates for mergers and acquisitions. The first is the size hypothesis. Smaller companies are more likely to become acquired than larger companies (Palepu, 1986; and Walter, 1994).

The authors cite the costs of competition with other bidders and costs associated with adapting the acquired company to the acquirer's culture, as examples of size-related costs. They base their argument on the premise that these costs increase with the size of the acquired company and therefore, that firms acquire those smaller than themselves because the size-related costs of acquisition will be lower.

Mane (1965) also argues, based on the inefficient management hypothesis, that inefficiently managed firms whose managers fail to maximize shareholder wealth, are more likely to be targets for mergers and acquisitions. The financial leverage hypothesis contends that low debt exposure also raises the likelihood of a firm becoming a target for acquisition (Stulz, 1988).

He argues that firms with a high unused debt capacity are regarded as attractive merger targets because low leverage reduces the risk of default and increases the debt capacity of the joint firm.

The liquidity hypothesis argues that the likelihood of being acquired increases with greater liquidity because excess liquidity gives the bidder the opportunity to finance the acquisition with the target firm's own resources (Song and Walkling, 1993).

The growth-resource imbalance hypothesis submits that firms with a mismatch between their growth opportunities and liquid financial resources are regarded as attractive for acquisitions (Palepu, 1986).

Lastly, the asset undervaluation hypothesis argues that firms with low market-to-book ratios are also attractive acquisition targets because they are viewed as undervalued (Hasbrouk, 1985). He suggests that companies that wish to expand through acquisitions compare the cost of new investment with the cost of acquisition of an existing firm and take the cheaper option.

There has been a massive increase in both the number and volume of M and A activity across the globe over the past four decades, driven by globalization, technological changes, factor market deregulation and liberalization, pegged on the new growth theory. However, the final story of this wave of M & A activity is not all so rosy. There have been a significant number of failures as well. There are a limited number of studies that have examined these cases. A recent study by Chakravorty (2012) identified a set of 30 factors which, if not addressed, could result in the failure of the M & A. A number of studies also highlight lack of cultural due diligence, cross cultural communication, connection and control as a major factor for Multinationals to fail in acquisitions across borders (Rottig, 2007, Askim, *et. al*., 2008 and Vaara, 2003).

3. Examination of M & A Applications

3.1 Case I: Beverage Company Merger

3.1.1 Background to Case - Coca Cola Amatil vs Foster's Group Pacific Ltd.

Coca Cola Amatil Limited (CCA): Coca Cola is the world's largest beverage company with more than 500 brands including the highly popular Diet Coke, Coke Zero, Fanta, Sprite and Powerade. It has its affiliate Coca-Cola Amatil (Aust) Pty Ltd, which are both Australian companies, entered into an agreement ("JV Agreement") with SABMiller plc (and its affiliates SABMiller Limited, SABMiller Africa & Asia BV (collectively "SABMiller") in or around 2006 to establish a joint venture called Pacific Beverages Pty Limited. The company has operations in five countries in the South East Asia/Pacific rim region – Indonesia, Papua New Guinea, Australia, New Zealand and Fiji – manufacturing, selling and distributing a diversified product portfolio including carbonated soft drinks, water, sports and energy drinks, fruit juice, flavoured milk, coffee and packaged ready-to-eat fruit and vegetable products. The Fiji operation is 50 years old. Foster's is an Australian

company focused on brewing activities through two divisions, Carlton United Brewers (***CUB***) and the Rest of World. CUB is Foster's largest division and the largest brewer in Australia, with almost 50% volume share of the Australian beer market.

CUB operates the Yatala Brewery in Queensland, the Abbotsford Brewery in Melbourne, the Cascade Brewery in Hobart and a craft beer facility in Melbourne, and produces cider in Campbelltown. It is also the largest brewer in Fiji.

FGPL owns two brewing plants in Fiji, one in Samoa, a distillery in Fiji and a series of well known beer, spirit and Ready-To-Drink brands in the two markets. Fiji Bitter for instance has been brewed since 1957 when Foster's entered Fiji through Carlton United Breweries, and together with its new brand Fiji Gold, commands an 80% hold on Fiji's beer market.

On 20 June 2011, Foster's received an indicative, non-binding, conditional proposal from SABMiller to acquire all Foster's shares under a scheme of arrangement. Subsequently, on 17 August 2011, SABMiller announced its intention to make a conditional, off-market, cash takeover offer. On 21 September 2011, Foster's Group Limited (*Foster's*) announced it had entered into the Scheme Implementation Deed under which it is proposed that SABMiller plc (*SABMiller*), through SABMiller Beverage Investments Pty Limited (its indirect wholly owned Australian subsidiary), will acquire all Foster's shares pursuant to a scheme of arrangement and, subject to receipt of a favourable ATO tax ruling, an equal capital reduction (*Transaction*).

The JV agreement was amended in 2008, and most recently varied on 20 June 2011. The 2011 variation gave SABMiller certain rights to purchase the Foster's Group of companies owned by the former Australian listed company Foster's Group Limited. Additionally the 2011 variation gave CCA various rights to purchase certain assets within the Foster's Group either directly or through an affiliate. SABMiller completed its acquisition of the shares in FGL on or about 18 December, 2011, and CCA (and its affiliate) became entitled to purchase FGL's interests in FPGL under a call option. Under the JV Agreement, SABMiller Beverage Investments granted CCA the right, if the Scheme is implemented, to acquire the following assets or operations of the Foster's Group:

(i) The Spirits Brands and the Spirits RTD Brands together with, at CCA's election, to the extent severable, all assets and trading liabilities (including contracts and employees) attributable to the production, marketing, distribution and/or sales of products commercialized under those brands in Australia (including any foreign registrations of those brands) (***Spirits Option***);

(ii) The non-alcoholic beverages brands (excluding Beer Product and non-alcoholic applications of alcoholic brands other than Cascade), either by way of transfer or exclusive perpetual licence (to the maximum extent possible under applicable laws or contractual terms), together with, at CCA's election, to the extent severable, all assets and trading liabilities (including contracts and employees) wholly attributable to those brands in Australia (***NABOption***); and

(iii) The beverages businesses in Fiji and the interest in Samoa Breweries Limited (***Fiji Option)***

Coca-Cola Amatil Limited ("CCA") vide a letter dated 26 March, 2012 through their legal counsel advised the Fiji Commerce Commission ("Commission) that CCA has now exercised its rights to proceed with the acquisition of Foster's Group Pacific Limited ("FPGL") through the acquisition of the 89.6% shareholding held by Foster's Australia Limited ("FAL") in FPGL for a total share price of A$ million (cannot disclose amount) for the 89.6% stake, subject to all regulatory approvals.

3.1.2 An Examination of the Acquisitions Impact on Competition and Market Outcome

3.1.2.1 Market Definitions

Relevant Product Market: The first step in analyzing the competitive position of any firm or firms in an industry is to define the relevant market in which the firm operates. In competition law, the relevant market defines the market in which one or more goods compete. Therefore, the relevant market defines whether two or more products can be considered substitute goods and whether they constitute a particular and separate market for competition analysis. In such a conglomerate merger, the two firms involved in the transaction are carrying out business activities in what can be broadly defined as the Beverages Market. However, CCA and FGPL are engaged in two different categories of beverages and as such it is essential to define the relevant product market differently.

CCA Fiji's core activities include production, distribution and export of carbonated and non-carbonated soft drinks. Therefore, CCA Fiji's activities are confined to the non-alcoholic beverages market. Given that, the Commission defines CCA's relevant product market (for the purpose of evaluating this acquisition) as

"***Ready-to-drink soft drinks of a carbonated and non-carbonated nature".***

FGPL on the other hand is involved in the production and distribution of alcoholic beverages. FGPL's major products in the local market include Fiji Bitter, Fiji Gold, Fiji Draught, Fiji Premium, Fiji Taki, Bounty Rum, Regal Gin, Regal Whisky, Zarina Vodka, Bounty Rum, Bulk Rum etc. The Commission's market survey results show FGPL's products such as Fiji Bitter and Fiji Gold account for around 80% of Fiji's alcoholic beverages market. Based on the Commission's analysis, the Commission has defined the relevant product market for FPGL products as: "***That of the distribution of beer and other alcohols in establishments selling alcoholic beverages for consumption".***

Relevant Geographic Market: The Commission has adopted to define the geographical extent of a market to include all of the relevant, spatially dispersed sources of supply to which buyers can turn should the prices of local sources of supply be raised. For each good or service combination, the overlapping geographic areas in which the parties operate are identified. Generally, the higher the value of the product to be purchased, in absolute terms or relative to total buyer expenditure as appropriate, the more likely buyers are to travel and shop around for the best buy, and the wider the geographic extent of the market is likely to be. Where transport costs are high relative to the final value of a product, a narrower geographic market is more likely to be appropriate. Where product preservation ability and other similar practical considerations limit the distance that a product may be transported, this may limit the geographic extent of the market. The timeliness of delivery from alternative geographic sources is similarly relevant. Although buyers and sellers of a particular good or service may interact in markets that are apparently local or regional in extent, those markets may themselves overlap and interrelate so as to form a market covering a larger geographical area. In these situations, the larger market is likely to be the appropriate one for analyzing the competitive effects of a business acquisition.

Non-alcoholic and alcoholic beverages are marketed Fiji wide and sold via outlets with a national presence. Distinctions can be made between supermarkets and route trade such as supermarkets, service stations, and dairies in that there is a difference in the way the product is packaged and sold as well as the customer need the product is addressing. Supermarkets stock primarily on-chilled large 'take home' packs of beverage at prices that are significantly below those charged at the route trade, whereas route trade premises target the 'drink now' market with the majority of products sold chilled in single serve packaging. However, supermarkets also have a route trade display, stocking chilled single serve products, and the route trade outlets also stock a limited amount of non-chilled take home packs. Therefore there is no precise distinction between the route trade and the supermarket trade. The geographic market is defined as: ***"National markets, with no separate sub-markets by type of wholesale and retail outlet".***

3.1.2.2 Definition of Functional Level

The production, distribution and sale of a product typically occur through a series of functional levels – for example, the manufacturing/import level, the wholesale/distribution level and the retail level. It is often useful to identify the relevant functional level in describing a market, as a proposed business acquisition may affect one horizontal level, but not others. Alternatively, some acquisitions, such as those involving businesses at different vertical levels, may raise issues related to vertical integration. Generally, the Commission will seek to identify separate relevant markets at each functional level affected by an acquisition and assess the impact of the acquisition on each. CCA is involved in the bottling and wholesaling of non-alcoholic beverages. FGPL on the other hand is involved in the bottling and wholesaling of non-alcoholic beverages. Should market power be expressed post acquisition, it is most likely to be expressed at the wholesale level. Therefore, the Commission concludes that the functional level affected by the proposed acquisition is the wholesale supply of product.

3.1.2.3 Change in Holdings Structure

CCA and FGPL are currently operating as separate legal entities. The current and post merger structure of FGPL are as follows:

Current FGPL: Foster's Australia (89.59%) and Minority Shareholders (10.41%)

Post Acquisition: Coca-Cola Amatil (Fiji) Ltd (89.59%) and Minority Shareholders (10.41%)

The Acquisition will not change the number of participants in the Alcoholic Beverages Market. CCA Fiji will simply replace Foster's Group/SABMiller as the majority owner of FGPL. Accordingly, the number of alternatives available to purchasers of alcoholic beverage products in the Alcoholic Beverage Market will remain unchanged. At the date of the application, CCA Fiji and FGPL were not in competition with each other in the market for alcohol beverages in Fiji ("**Alcoholic Beverages Market**"). As such it does not raise competition concerns. CCA's acquisition of FGPL is a case of a conglomerate merger between two firms in different

industries; the degree of competition within each industry is largely unaffected.

CCA and FGPL are currently operating in different product markets**.** This means that the acquisition will not:

(i) affect competition adversely in any relevant market; or

(ii) alter the existing structure of the relevant market; or

(iii) substantially lessen competition within the meaning of section 60 of the Decree; or

(iv) be detrimental to the consumers of Fiji or the Fiji economy ("**Adverse Effects**").

Because CCA Fiji does not currently compete with FGPL in the Alcoholic Beverages Market:

(i) there is no relevant competitive overlap (i.e. no close substitution) between the non-alcoholic beverages of CCA Fiji and the alcoholic beverages of FGPL which are the subject of the Acquisition; and

(ii) the Acquisition will not, therefore, increase the level of concentration among existing participants in the Alcoholic Beverages Market, or otherwise have any Adverse Effects on the level of competition in that market.

FGPL is the dominant participant in the Alcoholic Beverages Market in Fiji while CCA dominates the Non-Alcoholic Beverages market. CCA Fiji is not a currently a participant in the Alcoholic Beverages Market though it has asked Investment Fiji to permit it to be a participant on an interim basis only.

As CCA Fiji and FGPL do not currently compete with each other in the Alcoholic Beverages Market, the simple effect of the Acquisition would be to replace the existing owner of FGPL with a new owner not currently participating in that market. That is, there is no change to the existing structure of the relevant market.

For this reason, there is no basis to reject the application for Acquisition. In fact, the Acquisition is likely to bring the following benefits to the local economy.

(i) the proposed increases in the real value of exports after the Acquisition;

(ii) the proposed substitution of domestic products for imported goods after the Acquisition; and

(iii) the other relevant matters that relate to the international competitiveness of the Fiji beer industry.

Furthermore, CCA Fiji's current intention is to grow the combined FGPL and existing businesses with a strong export orientation. CCA Fiji believes that this was not a priority for FGL in light of potential conflicts of interest in its markets with Australian based brands. CCA Fiji currently has no such conflicts and regards growing exports of beer and spirits to Australia, New Zealand United States, Asia and European markets as a strategy worthy of pursuit. The acquisition will now make CCA's proposal quite viable, to invest capital ("Investment") into improving FGPL'S production facilities in Fiji enabling it to meet export quality standards and deliver superior everyday product quality and consistency.

CCA Fiji proposes to grow the volume of local Fiji alcohol products to be sold in the Fiji market. This includes increasing the local product portfolio to reduce imported products into Fiji. Any substitution of imports directly benefits Fiji's crucial foreign reserves when consumption of local products substitute foreign sourced products.

CCA Fiji is an internationally recognized company with internationally recognized brands, operating at world class standards in Fiji, and is a long term market participant in Fiji, and the Pacific. The Acquisition will provide an opportunity to provide further recognition of Foster's products in the international market.

Based on the above analysis, the acquisition of FGPL by CCA does not lessen competition and thus will not distort the market solution. In fact, given that both the companies have capital investment which deals with similar supply chain process, there is room for considerable efficiency gains. However, there could be three issues that need to be monitored. The first is that the minority shareholders should not be coerced into selling their shares. Secondly, given that the two products are entirely different, if the company engages in tying and bundling, this will impose severe burdens on those consumers who are not consuming either of the products or whose budget does not permit such bundled purchasing. Lastly, CCA must refrain from engaging in a conduct that restricts retailers from advertising or selling the products at below the RRP.

3.2 Case II: Hardware Company Merger

This case refers to the application of one of Fiji's largest hardware companies to acquire another company in the same industry. The analysis below shows the process adopted to reach a decision on whether to allow the acquisition.

3.2.1 Background of the Hardware Industry

3.2.1.1 The Market Players

There are six major hardware retail and wholesale outlets that supply a wide range of building products in Fiji.

These major players include: Vinod Patel, Suncourt, R. C. Manubhai and Company Limited, Kasabias, Carpenters Hardware and GMR Muhammad and Sons Limited. It is noted that R. C. Manubhai is considered to be one of the leading hardware dealers, importers and stockists of structural steel, special steel, industrial valve, pipes and fittings, bronze solid bars and bushings. Vinod Patel is considered to be the largest dealer in hardware retail and export. A survey of the market has revealed that these major operators have also set up their local manufacturing and wholesale businesses in a variety of hardware products. In addition to the six major players, there are two hundred and thirty (230) other players in the market. Of these players, some have only a single branch at a particular geographical location, selling only a few hardware items such as timber, while engaged in trade as small variety shops.

3.2.1.2 General Information about the Two Companies

Vinod Patel and Company Limited: The company is situated in the Fiji Islands, dealing in hardware retail and export for more than 40 years. Since opening its doors in early 1962 with a small outlet in Ba town, the company has grown to become Fiji's largest chain of hardware stores, with 10 branches nationwide. Vinod Patel is a primary exporter of hardware to island nations in the Pacific, making it the leading hardware retailer and exporter in the South Pacific region.

Vinod Patel's Export Division currently provides hardware such as PVC pipes, nails, galvanized pipes, etc and other household products like furniture, homeware, basic food items and clothing, to countries such as Kiribati, Wallis & Futuna, Tonga, Samoa, Tuvalu, Nauru, Cook Islands, Vanuatu and Samoa.

Vinod Patel has branches in all major towns and cities, employs over 700 staff and has a product range of more than 35,000 items. Branches are in Ba, Labasa, Lautoka, Nadi, Nausori, Rakiraki, Sigatoka, Suva.

In addition, associate manufacturing companies - Ba Industries Limited (BIL) and Tubemakers and Roofmart Limited (TRL) - provide quality roofing nails, galvanized and wire nails, PVC pipes and fittings, metal roofing and walling materials, farm fencing, chain link fence, barbed wire and a complete range of structural and reinforcing steel.

Suncourt Hardware: The company was established in 1979 and became one of Fiji's leading hardware merchants with a number of outlets. Suncourt Hardware also have a wholesale division which wholesales to other hardware merchants in Fiji and supplies to projects and sometimes also exports to other Pacific islands. The company has stocks of all types of building materials, hardware, plumbing, electrical, tools, timber, furniture, doors and other related items. Over the years, the company has shut down a number of its outlets and currently has two branches located in Nabua and Nausori.

3.2.1.3 Submissions by Vinod Patel and Company Limited and Suncourt Hardware

Vinod Patel, through their legal counsel wrote to Fiji's regulatory authority, the Fiji Commerce Commission on February 7, 2011, outlining their proposed purchase of Suncourt. In the letter, the legal counsel of Vinod Patel states that they propose that the acquisition will run as a Division of Vinod Patel. However, the business will be operated in the name of "**Suncourt Hardware"**. The two branches will be run as profit centers independently under the supervision of a representative of Vinod Patel and Company Limited (VPCL).

It is proposed that the Branch Management team will be selected from the present staff and they, together with VPCL's representative will be responsible for running the business in accordance with VPCL business policy and procedure. The two branches (Nabua and Nausori) will be 100% owned by Vinod Patel. The present Directors and Senior Managers of Suncourt will not be involved in the management and operations of the merged entity.

Suncourt Hardware also made a submission outlining the reasons for its decision to sell off its assets and business to Vinod Patel and Company Limited. Their arguments were based on the following:

(i) Absence of Directors: The company has 4 directors. Two directors have migrated from Fiji, one has died and one is imprisoned. Hence the company lack leadership and direction.

(ii) The company has incurred large trading losses and cash flow losses from 2007 following the coup in December 2006. Losses have been driven by reductions in turnover of $18m-$20m per annum to $12m in 2009. The company has also been exposed to large credit losses to contractors.

(iii) At 31 December 2010, the company had a net deficiency of capital compared to equity of $1.4m in 2009 and the directors will have to sell the remaining personal properties they have to pay off the creditors.

(iv) The sale of the business is imperative, the direct beneficiaries of which will be the staff members who will retain their jobs, as well as local banks and suppliers.

Suncourt's submission seems to suggest that it is a Failing Company and which needs to be salvaged.

3.2.1.4 Competitive Environment

Fiji's hardware market has many buyers and sellers, thus providing an appearance of a competitive market. However, actual competition in the market cannot be observed. An earlier in-depth study by the Fiji Commerce Commission (2010) revealed some glaring anti-competitive behaviour by hardware outlets. The key issues were:

(i) Price Fixing: The assessment of the economic market situation and behaviour patterns in marketing campaigns, suggest the opportunity to engage in anti-competitive behaviour such as the existence of price fixing.

(ii) Price Setting: The four large firms collectively hold substantial market power and possess the ability to control the market and hence dictate prices and availability of material amongst the hardware manufacturers, distributors, wholesalers and retailers of hardware products.

(iii) Supply Restriction: The Commission also noted the practice in the steel supply market to restrict certain players such as smaller retail stores, contractors and consumers from directly purchasing large quantities from the manufacturer, namely, Fletcher Pacific Steel (Fiji), a division of Fletcher Building Limited.

Local manufacturers and distributors are exposed to competition from suppliers based in Australia, New Zealand, China, Malaysia, Hong Kong, Indonesia, Europe, North America and Asian countries.

3.2.1.5 Market Entry

In essence, there are no artificial barriers (including tariff and regulatory barriers) imposed by any authority in Fiji, as far as entry into Fiji's hardware sector is concerned. Firms are free to enter and leave the market provided they have the capital for investment in the sector. New entrants are at ease to enter provided they meet all the requirements such as being able to obtain a licence, while existing firms are free to shut down. However, for any mergers and acquisitions, clearance is required from the Fiji Commerce Commission.

Barriers to entry into the hardware market in Fiji would appear to be relatively low. This is because:

(i) The sunk costs involved in setting up a retail outlet are relatively low. The function of retailing requires no specialist point of sale facilities, storage facilities or technological expertise - retailers simply require a shop front, storage facility and access to a supplier;

(ii) There are no regulatory restrictions on entry;

(iii) The main inputs for a retailing business are a shop front, labour and product supply, none of which are scarce;

(iv) While there is likely to be a certain degree of brand loyalty for some products (most likely to be more expensive, long life products), this is unlikely to be strong enough to allow an individual retailer to set substantially higher prices than its competitors;

(v) The minimum efficient scale of operation appears to be relatively low in each sub-market - for example there are a large number of small hardware suppliers across the country;

(vi) The price elasticity of demand would appear to be relatively high as all major competitors place advertisements in newspapers, radios and TV on a daily basis announcing discounted prices for a large range of products. Promotional activity of this kind suggests that a retailer in this market would lose customers if it were not able to match or undercut its competitors price;

(vii) The market appears to be growing - this is evident by the extent of new entries as well as expansion in the market over the past years, and

(viii) There is a high level of actual and potential import competition in the market in terms of product availability and substitutability.

3.2.2 An Examination of the Merger's Impact on Competition and Market Outcome

3.2.2.1 Exploring Vinod Patel's and Suncourt's Merger Motives

A firm wanting to pursue a merger and acquisition strategy must have some motive behind it. Berkovitch and Narayanan (1993) argue that there are basically three types of motive: Synergy, Agency and Hubris. They argue that the synergy motive is expected in most cases as this suggests that takeovers occur because of the incremental gains to be obtained. Agency motives are selfish as they prioritize the acquirer's interest over the acquired firm while the Hubris hypothesis suggests that takeovers occur because of an error in valuation of the potential merger. In the following section, this paper addresses the prevailing motive of the merger between Vinod Patel and Suncourt.

Vinod Patel's Motives: From its point of inception, Vinod Patel worked on a financial plan to generate funds through sales, cost reduction, overhead management and increased productivity and customer service. The company started with humble beginnings with two brothers, who worked in hardware stores until they were capable of setting up a business of their own. Learning from their experience as employees they wanted to improve customer service, competitive pricing and the hardware shopping experience in Fiji. The vision and the dedication of the two brothers' were to lead Vinod Patel into becoming the 'biggest name in hardware' in the South Pacific. The company's motto is to provide its customers, the widest range and highest quality products at competitive and affordable prices.

As Fiji's biggest hardware firm, Vinod Patel has accepted that the 21st century approach to consumers is to become a 'one-stop-shop' and hence the vision of 'progress through diversification'. Vinod Patel aims to be the consumer's complete first choice in products for modern living – from laying the initial foundation of the house, to providing the décor, furnishings and necessities to turn the house into a home.

Considering the competitive retail hardware industry in Fiji, Vinod Patel needs a differentiation strategy that would set it apart from *mass retailers*. The opportunity to do so came with the merger. Therefore the motives of Vinod Patel to merge are: expansion, diversification, quality and customer satisfaction. The merger will allow Vinod Patel to acquire a greater market share, greater revenue and profit over the same fixed costs such as distribution and infrastructure, using their existing marketing strategies.

Suncourt's Motives: Suncourt has not seen a healthy financial performance and position since 2007. The company has incurred large trading and cash flow losses following the coup in December 2006. Losses have been driven by reductions in turnover from $18m-$20m per annum to $12m in 2009. The company has also been exposed to large credit losses to contractors.

Suncourt's continued poor performance in the past four years led the auditors to remark in 2008 that: "The ability of the company to continue as a going concern for the foreseeable future depends on the continued financial support by the shareholders".

Based on Suncourt's submission, the company falls within the definition of a "Failing Firm" and the motives for Suncourt to merge were to "salvage the business, pay off its liabilities and obligations, and provide an opportunity for the staff to retain their jobs".

3.2.2.2 Competition Issues and Analysis

As per the Commerce Commission Decree 2010 (*vide* Section 72 and Section 73*)* Section 72, a merger cannot be authorized if it will substantially lessen competition or result in a monopoly. In determining if a merger is anti-competitive, regulatory agencies look at the markets served and the type of commerce involved. Several factors are considered, such as size of the market, number of competing companies, the financial condition of companies, etc.

The size of the newly merged company in relation to the market is very important. A common test used by regulatory bodies known as the Herfindahl-Hirshman Index (HHI) is to determine if action should be taken to challenge the merger. The HHI measures the impact the merger will have on increased concentration within the total marketplace. HHI is calculated by summing the squares of individual market shares for all companies and categorizing market concentration into one of the three categories. The three categories are:

Less than 1000: Unconcentrated market, merger is unlikely to result in antitrust action.*

1000 - 1800: Moderate concentration. If the change in the HHI exceeds 100 points, there could be concentration in the marketplace.

Above 1800: Highly concentrated market. If the change in the HHI exceeds 50 points, there are significant anti-trust concerns.

There are six major hardware retail and wholesale outlets that supply a wide range of building products. These major players include: Vinod Patel and Company Limited, Suncourt Hardware, R. C. Manubhai and Company Limited, Kasabias, Carpenters Hardware and G.M.R. Muhammad and Sons Limited. Apart from these major players, the hardware industry in Fiji also has many other smaller retailers applying their trade in the industry.

Market Share and Market Concentration

The market shares of Vinod Patel, R.C. Manubhai & Company Ltd, Suncourt, Kasabias Limited, G.M.R. Muhammad & Sons (PTY) Limited, Carpenters Hardware, and other small retailers has been calculated based on the annual sales figures obtained from the company's annual reports for the purpose of calculating the HHI. The motive behind calculating the HHI is to determine and decide on the application for merger authorization. The

results of the analysis are presented in Appendix 1. The results demonstrate that of the total market, Vinod Patel has a market share of 35% while Suncourt has a market share of 5%. Therefore, with the acquisition, Vinod Patel's market share will rise to 40%. Based on the 2009 market share (as a percentage of total market sales), the Commission calculated the HHI results which are presented in Appendix 2. In summary, results show that Pre-Merger HHI was 2093 which increases to 2443 post merger, a difference of 350. The HHI still remains within the second category which is the threshold for significant concern.

Examination of Vertical Effects

Both Vinod Patel and Suncourt have shares in Asian Paints. Asian Paints is India's largest paint company and ranked among the top ten decorative coatings companies in the world with a turnover of INR 66.80 billion. Asian Paints along with its subsidiaries have operations in 17 countries across the world with 23 paint manufacturing facilities, servicing consumers in 65 countries through Berger International, SCIB Paints – Egypt, Asian Paints, Apco Coatings and Taubmans. Asian Paints operates in Fiji under the brand name of Apco Coatings.

The total value of shares for Asian Paints is $475,000.00. Of this, fifty one (51%) percent is held by Asian Paints India and forty nine (49%) percent is held by local shareholders. The number of shares currently held by Suncourt is 1.8% and Vinod Patel is 4.6%. Post merger, Vinod Patel's share will increase to 6.45%. Under this scenario, Vinod Patel will own 13.24% of the domestic shareholding of 49% (see Appendix 3) and thus will result in the company becoming the second largest domestic shareholder and in turn can have voting rights.

However, based on the results above, the Commission infers that the proposed acquisition of Suncourt by Vinod Patel does not raise any serious vertical competition issues as Vinod Patel will hold only a fraction (less than 10%) of shareholding in Asian Paints however it may qualify for or increase its voting rights.

Examining the Acquisition based on the Failing Firm Theory

The jurisprudence of competition law recognizes what has become known as the 'failing firm doctrine' to sanitise a merger that might otherwise raise competition concerns. The defense first emerged in US law in a 1930 decision; International Shoe v FTC, wherein the US Supreme Court recognized that the acquisition of a failing firm did not violate Section 7 of the Clayton Act (this forms part of the legislation on Competition Law in the US).

Influenced by the US approach, the defence has also found its way into European law albeit in an altered form. As in the US, the European Merger Regulation contains no express recognition of the doctrine, but it has been recognized now in case law and the practice of the European Commission ('EU Commission). In the judgment given by the European Court of Justice ('ECJ') in the case of France v Commission, the ECJ accepted the failing firm test applied by the EU Commission, in approving the merger between the only two German producers of potash.

The Competition Authority in Australia and Canada also recognizes the failing firm doctrine. There is thus no doubt that the failing firm doctrine is widely recognized in competition law jurisprudence, and regardless of whether the doctrine has become part of the case law or enjoys an express statutory recognition, has been applied with a degree of uniformity.

While it is not explicitly stated in Fiji's Competition Law, the failing firm doctrine must be recognized in the public interest as long as the acquired firm would have withdrawn from the market if not taken over by the other firm; the acquirer would gain the market share of the acquired firm if the latter were to exit the market; and, no alternatives were available that were less anti-competitive.

3.2.2.3 Is Suncourt Hardware a Failing Firm? An Examination of It Financials

Suncourt Hardware was established in 1979. It became one of the leading hardware merchants with a number of outlets in Fiji. It quickly spread its operations and opened up branches in Nausori, Suva, Nadi and Pacific Harbour (Sales Contact Office) and also established a Wholesale Division. At that stage the company was involved in import, wholesale, distribution, retail and export in some cases.

The firm started to have major managerial setbacks following the departure of directors. There were four directors, of whom, two directors migrated, one died and one was imprisioned. The void in leadership began to have its toll on the financials of the firm so much so that the auditors in 2009 forewarned of the impending disaster should nothing be done. The audit report noted:

"The ability of the company to continue as a going concern is dependent on several factors, which inter alia include the profitability and cash flows of the company over the next twelve months and the company meeting its debt covenants with the financiers".

In the following section we examine, in detail, the financial position of the firm which led the auditors to make this statement.

Profitability Ratios: Profitability is the single most important goal of any firm. This section examines the key profitability ratios of Suncourt for the period 2006 to 2009. Full details of the analysis are presented in Appendix 6. The result of the analysis depicts a very dark picture of the business, indicating that the firm could have been experiencing major financial problems. Apart from the Gross Profit Margin and Operating Expense-to-Sales ratio, all the other four ratios have moved to negative since 2007. The summary results are as follows:

(i) Gross Profit Margin: This indicator shows the gross profit for every dollar of sales. The results reveal that it is on the decreasing trend. This ratio was 18.37% in 2006 and which fell to 16.89% in 2009.

(ii) Operating Profit Margin: This indicator shows the operating profit for every dollar of sales. The ratio was 6.03% in 2006 and which worsened to -0.38% in 2009;

(iii) Net Profit Margin: This indicator takes all expenses into account including interest paid. It measures the profitability of the business and is an indicator of a company's pricing strategies and how well it controls costs. The net profit margin decreased from 2007, following slight variations in the ratio thereafter. This may be due to abnormal conditions or high expenses.

(iv) Retained Profit Margin: This ratio is a measure of accumulated profits and losses of a company over time against the turnover. Decreases in the levels of retained profit margin are noted over the years.

(v) Profit Mark Up: Profit Mark Up measures the profit earned during the year against the costs involved. It is deduced that profit markup has fallen from 2006 (4.62%) to negative levels. In 2009, the markup profit recorded was at -20.48%.

Rate of Return Ratios: The following section deals with Rate of Return ratios. The full results of the analysis are presented in Appendix 7. The results from the analysis again reveal a precarious financial position of the business. In summary, the results are as follows:

(i) The Return on Capital Employed (ROCE): This ratio compares earnings with capital invested in the company taking into account sources of financing. ROCE is used to prove the value of business gains from its assets and liabilities. Over the period 2006 to 2009, ROCE significantly reduced to negative amounts.

(ii) The Return on Total Assets before Tax: This ratio indicates how effectively the assets of the business are working to generate profit. Due to decrease in the operating profit before income tax and total assets, it illustrates that management is ineffectively using its assets to generate earnings. A decline is noted from 2007 (-10.93%) with a slight improvement in 2009 to -5.59% from the previous year of -11.69%.

(iii) The Return on Total Assets after Tax: This ratio takes into account interest and tax has a fluctuating return. With comparison of 2009 to 2006, the return on total assets has reduced significantly with a decline from 1.6% in 2006 which worsened to -6.93% in 2009.

(iv) The Return on Fixed Assets: It measures how fixed assets are being used to generate profits. The percentage has decreased from 2007, with a further fall in 2008 (-30.59%), while a rise was observed in 2009 (-12.91%) due to a lower level of profit before income tax (7.92%) in 2006 and which worsened to -12.91% in 2009;

(v) The Return on Working Capital: This ratio gives an indication of the ability of the business to pay its dues. A fluctuating trend was observable in the return for working capital over the period. The return decreased from 2008 to 2009 determining that Suncourt did not have enough working capital to meet its obligations. The percentage was 12.30% in 2006 and which improved in 2008 to 619.28% and then declined to 413.77% in 2009;

Liquidity Ratios: There are two ratios that need to be computed to examine the liquidity position of a firm. These two ratios are the Current Ratio and the Acid Test Ratio (see Appendix 8). The current ratio is an indication whether the business is able to meet its liquidity (short term) obligations. Suncourt's current ratio reduced from 1.3441 in 2006 to 1.1877 in 2007 with a further decline in 2008 to 0.9703 with a rise in 2009 to 0.9767. This indicates that Suncourt does not have sufficient current assets to cover its current liabilities, posing the risk of liquidation. The acid test ratio is an indication of the level of liquid assets that can be used to meet short term liabilities and assets to be easily converted into cash. A decreasing trend is notable from 2006 (0.8068) to 0.5017 in 2009.

Asset Usage/Efficiency Ratios: The Asset usage ratios aim to demonstrate the how efficiently the assets of the firm are utilized over the years. An increase in the ratio will indicate that the firm is, over the period of time, making better utilization of its assets. In this study, we examine 8 ratios and note that except for two ratios, all the rest reveal a worsening trend with regard to Asset Use Efficiency. Specifically the following is a summary of

the analysis while full details are presented in Appendix 9.

(i) Total Asset Turnover: The Total Asset Turnover is the amount of sales generated for every dollar's worth of assets. From the year 2006, this ratio declined from 1.3413 to 1.1532 in 2009. This represents a 14% decline in Total Assets Turnover in 4 years.

(ii) Fixed Asset Turnover: The Fixed Asset Turnover is the amount of sales generated for every dollar's worth of fixed assets. This ratio declined from 4.7175 in 2006 to 2.6620 in 2009. This represents a decrease of 43.6 % over a four year period.

(iii) Current Asset Turnover: The Current Asset Turnover is the amount of sales generated for every dollar's worth of Current assets. This ratio increased from 1.8742 in 2006 to 2.0347 in 2009.

(iv) Capital Employed Turnover: The Capital Employed Turnover is the amount of sales generated for every dollar's worth of Shareholders Equity Funds. This ratio increased from 4.25 in 2006 to 17.89 in 2009. The increasing ratio is contributed to decreasing sales and Shareholders' equity as due to losses in the last three years, Suncourt has not had a negative retained earnings.

(v) Working Capital Turnover: The Working Capital Turnover is the amount of sales generated for every dollar's worth of Working Capital. This ratio has decreased drastically from 7.32 in 2006 to -85.23 in 2009. This is contributed to decreasing sales and worsening working capital. A negative working capital indicates that the firm's Current Assets are less than its Current Liabilities.

Management Efficiency Ratios: Management's efficiency can be measured in a number ways. One of these is to examine the trend in three key ratios of Stock Turnover, Debtor's Turnover and Creditor's Turnover. The full analysis is presented in Appendix 11. In summary, the results are as follows:

(i) Stock Turnover Ratio: Stock turnover ratio indicates the number of times the stock has been turned over during the period and evaluates the efficiency with which a firm is able to manage its inventory. This ratio has increased significantly in 2009 compared to 2006. This is a case of high inventory turnover. A too high inventory means higher carrying costs and higher risk of stock becoming obsolete whereas too low inventory may mean the loss of business opportunities.

(ii) Debtors' Turnover Ratio: Indicates the number of times average debtors are turned during the year. The debtors' turnover measured in days for Suncourt increased from 61.67 days in 2006 to 79.02 days in 2009. This indicates that debtors were taking a longer time to pay off their debts. High debtors' turnover ratio (days) implies inefficient management of debtors or less liquid debtors and increases the risk of bad debts.

(iii) Creditors' Turnover: It signifies the average credit period enjoyed by the firm in paying creditors. This ratio increased from 90.98 days in 2006 to 198.49 days in 2009. This low creditors' turnover ratio or a higher credit period ratio signifies that the Suncourt's creditors were not being paid promptly.

Gearing/Leverage Ratio: The gearing ratio compares owner's equity (or capital) to borrowed funds. It is a measure of financial leverage, demonstrating the degree to which a firm's activities are funded by owner's funds versus creditor's funds. Generally, companies with higher leverage as determined by a leverage ratio are thought to be more risky because they have more liabilities and less equity. Suncourt's Gearing Ratio increased by 1049% in four years, signifying that a significant level of Suncourt's activities are financed through external financing rather than equity financing (Appendix 12). This poses considerable risks to Suncourt's continuance as a Going Concern. The same picture is evident from the examination of the equity payout ratio. This ratio shows how well earnings support the dividend payments. Dividend payout ratios provide valuable insight into a company's dividend policy and can also reveal whether those payments appear "safe" or are in jeopardy of possibly being reduced.

In light of the above analysis, it is clear that Suncourt is a failing firm. The question that arises then is while the proposed acquisition will further strengthen Vinod Patel's market power, should we disallow the merger and let the firm become insolvent or should we allow the acquisition and let Vinod Patel further strengthen its hold in the relevant market? The answer lies in what option will be in the best interests of the public.

Based on the above analysis, the decision on whether the acquisition should be allowed or not will depend on what options will safeguard the public interest best. Reflecting on the above analysis, we note the following three issues:

(i) That the acquisition will further strengthen Vinod Patel's Market Power but not will not alter the market so much that the company will emerge as the single most dominant firm in the sector;

(ii) That Suncourt Hardware is a "failing firm", and if allowed to continue in its current form, could become financially insolvent within a very short period of time;

(iii) That should the firm become insolvent, the closure of the firm would result in hundreds of job losses and absence of any supply of hardware products from its Nabua branch while supply from Nausori Branch would also fall signicantly.

Taking the above issues into account, it is clear that the public interest will be better protected with the acquisition being allowed to proceed.

4. Summary and Conclusion

This study examines the basis of mergers and acquisition and utilizes two recent cases of applications for M & A to provide a detailed methodology to examine the applications for a decision.

Mergers and Acquisitions are strategies to reduce unit costs, increase growth and profitability of firms. In this study, we demonstrate that the motive behind both the Mergers and Acquisition were Synergy rather than Agency or Hubris. The synergic gains by mergers and acquisitions activity accrue from more efficient management, economies of scale and scope, removal of duplication of resources, utilization of resources to their full potential, improved production techniques, combination of complementary resources, redeployment of assets to more profitable uses, the exploitation of market power or any number of value enhancing mechanisms that fall under the rubric of corporate synergy. Both the companies, Coca Cola Amatil and Vinod Patel, already have significant expertise in the acquired business area and infrastructure on the ground to achieve economies of scale and scope.

However, mergers and acquisitions can also have major detrimental impact on an economy via their effect on market structure, their subsequent effect on acquiring a dominant position and substantial market power to the firm(s) in the relevant market and thus abuse of this power. Given this issue, mergers and acquisitions have to be cleared by Competition authorities is countries where there are independent Competition Commissions.

In this paper, we have demonstrated the process and methodologies utilized to access and examine a M & A application. In doing so, we examined two recent cases in Fiji. The first case involves a conglomerate merger in the beverage industry while the other involves acquisition in the same industry.

In both the cases, the M & A applications were cleared. In the first case, the merger involved two different finds of beverage activity - alcoholic and soft drinks - hence there would be no effect on the market share of the individual products. In the second case, while the acquisition was in exactly the same industry, a detailed financial analysis of the acquired firm reveals that it is a "failing firm", and therefore, in the public interest, that the acquisition was cleared.

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Appendices

Appendix 1. Market Share of Hardware Retailers in Fiji based on Annual Sales Figures

Market Share	2009	2008	2007	2006	2005	Ratio (2009)
GMR	$15,858,338	$13,953,980	$13,377,787	$14,787,145	$12,883,765	7%
Kasabias	$18,704,385	$11,819,729	$10,185,732	$11,675,657	$9,055,935	8%
Carpenters Hardware	$27,881,451	$30,859,716	$28,388,413	$34,367,060	$35,619,775	12%
R C Manubhai	$45,000,000	$47,000,000	$51,000,000	$57,000,000	$63,840,000	19%
Vinod Patel	$84,314,608	$76,808,680	$70,797,117	$67,747,194	$61,497,056	35%
Suncourt	$12,048,521	$15,561,732	$14,606,527	$20,224,750	$19,114,538	5%
Other Retailers	$36,610,940	$34,992,970	$33,622,227	$36,764,825	$35,815,806	15%
Total Sales	$240,418,243	$230,996,807	$221,977,803	$242,566,631	$237,826,875	100%

Appendix 2. HHI

Step 1: Calculate the Pre- Merger HHI

Company		HHI
GMR	7*7	**49**
Kasabias	8*8	**64**
Carpenters Hardware	12*12	**144**
R C Manubhai	19*19	**361**
Vinod Patel	35*35	**1225**
Suncourt	5*5	**25**
Other Retailers	15*15	**225**
Pre-Merger HHI		**2093**

Step 2: Calculate the Post-Merger HHI

Company		HHI
GMR	7*7	**49**
Kasabias	8*8	**64**
Carpenters Hardware	12*12	**144**
R C Manubhai	19*19	**361**
Vinod Patel/Suncourt	40*40	**1600**
Other Retailers	15*15	**225**
Post-Merger HHI		**2443**

Appendix 3. Pre-Merger Vs Post Merger Shares in Asian Paints

Pre-Merger			Post-Merger		
Company	Number of Shares	Total Share Value of Asian Paints Issued Capital(%)	Company	Number of Shares	Total Share Value of Asian Paints Issued capital (%)
Vinod Patel	21,875	4.6%	VPCL/Suncourt	30,625	6.45%
Suncourt	8,750	1.8%			

Appendix 4. Top 5 Shareholders of Asian Paints

Name of Company/Business	Number of Shares Held	Percentage Shareholding
Asian Paints (International) Limited	243,695	51.3
Fijian Holdings Limited	42,655	8.98
Vinod Patel/Suncourt	30,625	6.45
RC Manubhai	26,250	5.53
Arvind Kasabia	25,463	5.37

Appendix 5. Suncourt (Wholesalers) Limited: Profitability Ratios for the period ending 31 December 2006 to 2009

Ratio	2006	2007	2008	2009
Gross Profit Margin	3,715,374	2,607,976	2,628,348	2,034,960
	20,224,750	14,606,527	15,561,732	12,048,521
	18.37%	17.85%	16.89%	16.89%
Operating Profit Margin	1,218,942	(632,952)	(1,112,729)	(46,310)
	20,224,750	14,606,527	15,561,732	12,048,521
	6.03%	-4.33%	-7.15%	-0.38%
Net Profit Margin	241,393	(741,207)	(1,075,920)	(724,488)
	20,224,750	14,606,527	15,561,732	12,048,521
	1.19%	-5.07%	-6.91%	-6.01%
Retained Profit Margin	(2,907,865)	271,520	(804,400)	(691,886)
	20,224,750	14,606,527	15,561,732	12,048,521
	-14.38%	1.86%	-5.17%	-5.74%
Profit Mark up	241,393	(741,207)	(1,075,920)	(724,488)
	5,223,920	4,397,978	4,354,904	3,537,403
	4.62%	-16.85%	-24.71%	-20.48%
Operating Expenses to Sales	4,344,677	3,580,671	3,869,290	2,995,050
	20,224,750	14,606,527	15,561,732	12,048,521
	21.48%	24.51%	24.86%	24.86%

Appendix 7. Suncourt (Wholesalers) Limited: Rate of Return Ratios for the period ending 31 December 2006 to 2009

Ratio	2006	2007	2008	2009
Return on Capital Employed (ROCE)	241,393	(741,207)	(1,075,920)	(724,488)
	4,763,065	3,204,113	2,128,193	673,498
	5.07%	-23.13%	-50.56%	-107.57%
Return on Total Assets before Tax (ROTA)	339,699	(1,450,259)	(1,598,343)	(584,250)
	15,078,538	13,263,793	13,670,547	10,447,562
	2.25%	-10.93%	-11.69%	-5.59%
Return on Total Assets after Tax (ROTA)	241,393	(741,207)	(1,075,920)	(724,488)
	15,078,538	13,263,793	13,670,547	10,447,562
	1.60%	-5.59%	-7.87%	-6.93%
Return on Fixed Assets (ROFA)	339,699	(1,450,259)	(1,598,343)	(584,250)
	4,287,173	4,909,594	5,224,593	4,526,114
	7.92%	-29.54%	-30.59%	-12.91%
Return on Working Capital (ROWC)	339,699	(1,450,259)	(1,598,343)	(584,250)
	2,762,460	1,320,484	(258,095)	(141,201)
	12.30%	-109.83%	619.28%	413.77%

Appendix 8. Suncourt (Wholesalers) Limited: Liquidity Ratio's for the period ending 31 December 2006 to 2009

Ratio	**2006**	**2007**	**2008**	**2009**
Current Ratio	10,791,365	8,354,199	8,445,954	5,921,448
	8,028,905	7,033,715	8,704,049	6,062,649
	1.3441	**1.1877**	**0.9703**	**0.9767**
Acid Test Ratio	6,478,051	3,738,114	4,727,090	3,041,499
	8,028,905	7,033,715	8,704,049	6,062,649
	0.8068	**0.5315**	**0.5431**	**0.5017**

Appendix 9. Suncourt (Wholesalers) Limited: Asset Usage/Efficiency Ratios for the period ending 31 December 2006 to 2009

Rate	2006	2007	2008	2009
Total Asset Turnover	20,224,750	14,606,527	15,561,732	12,048,521
	15,078,538	13,263,793	13,670,547	10,447,562
	1.3413	**1.1012**	**1.1383**	**1.1532**
Fixed Asset Turnover	20,224,750	14,606,527	15,561,732	12,048,521
	4,287,173	4,909,594	5,224,593	4,526,114
	4.7175	**2.9751**	**2.9786**	**2.6620**
Current Asset Turnover	20,224,750	14,606,527	15,561,732	12,048,521
	10,791,365	8,354,199	8,445,954	5,921,448
	1.8742	**1.7484**	**1.8425**	**2.0347**
Capital Employed Turnover	20,224,750	14,606,527	15,561,732	12,048,521
	4,763,065	3,204,113	2,128,193	673,498
	4.25	**4.56**	**7.31**	**17.89**
Working Capital Turnover	20,224,750	14,606,527	15,561,732	12,048,521
	2,762,460	1,320,484	(258,095)	(141,201)
	7.32	**11.06**	**(60.29)**	**(85.33)**

Appendix 10. Suncourt (Wholesalers) Limited: Management Efficiency Ratio's for the period ending 31 December 2006 to 2009

Ratio	2006	2007	2008	2009
Stock Turnover	4,313,314	4,464,699.50	4,167,473.50	3,299,405.50
	55,410	40,018	42,635	33,010
	77.84	**111.57**	**97.75**	**99.95**
Debtors' Turnover	3,417,361.00	2,823,193	2,676,883	2,608,367
	55,410	40,018	42,635	33,010
	61.67	**70.55**	**62.79**	**79.02**
Creditors' Turnover	5,190,011	4,839,866	5,415,867	4,989,360
	57,048	33,702	32,976	25,136
	90.98	**143.61**	**164.24**	**198.49**

Appendix 11. Suncourt (Wholesalers) Limited: Gearing/Leverage Ratio's for the period ending 31 December 2006 to 2009

Ratio	2006	2007	2008	2009
Gearing	2,286,568	3,025,965	2,838,307	3,711,417
	4,763,065	3,204,113	2,128,191	673,496
	0.4801	0.9444	1.3337	5.5107
Equity ratio	4,763,065	3,204,113	2,128,193	673,498
	15,078,538	13,263,793	13,670,547	10,447,562
	0.3159	0.2416	0.1557	0.0645

Appendix 12. Suncourt (Wholesalers) Return on Investment Ratios for the period ending 31 December 2006 to 2009

Ratio	2006	2007	2008	2009
Earnings per share	241,393	(741,207)	(1,075,920)	(724,488)
	1,365,384	1,365,384	1,365,384	1,365,384
	0.18	**(0.54)**	**(0.79)**	**(0.53)**
Dividend payout ratio	4,000,000	-	-	-
	241,393	(741,207)	(1,075,920)	(724,488)
	16.57	**-**	**-**	**-**

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Empirical Performance of Option Pricing Models: Evidence from India

Vipul Kumar Singh

Correspondence: Vipul Kumar Singh, Institute of Management Technology (IMT), 35 Km Milestone, Katol Road, Nagpur - 441502, India. Tel: 91-712-280-5138. E-mail: vksing@imtnag.ac.in

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Abstract

This paper empirically investigates the comparative competitiveness of the family of option pricing models categorized as deterministic and stochastic. Forecasting effectiveness of the models is judged on the basis of pricing accuracy of the models. For same this paper categorically examine the out-of-sample moneyness-maturity forecasting performance of models. Data set of Nifty index options of India is especially chosen for analyzing the effectiveness of models. Pricing imperfections of models is compare and contrasted with the market price of the options. Cross competitiveness of the models is empirically testifies with the benchmark Black-Scholes but relative to market using well-known technique of error metrics. Expected price of the models inferred analytically by estimating the parameters of the models continuously, almost every day. The models are inter-pass through the recent waves of financial upheavals and has been put into a practical implication of fastest descending movement of Indian capital market. We found that the Practitioner Black-Scholes and Heston model has smaller out of sample valuation errors in pricing Nifty Index options than the Constant Elasticity of Variance, Gram-Charlier, and Hull & Whit models, but no models eliminates price bias completely.

Keywords: black-scholes, call options, deterministic, implied volatility, nifty index, stochastic

JEL: C01, C13, C52, C53, G17

1. Introduction

The history of option pricing is century old, dates back to 1900 when the French mathematician Louis Bachelier (1900) first applied the concept of Brownian motion in pricing of stocks. Over the years, his conceptual framework becomes the norm in mathematical finance. Initially the option pricing was deriving by taking the discounted expectation of underlying payoff until its maturity. In 1973, Fisher Black, Maryon Scholes and Robert Merton provided major breakthrough and discovered the formula that revolutionized the pricing and trading of options. The pricing framework of trio also set the new benchmark in the history of mathematical finance and set the foundation of new area widely known as financial engineering.

Though the BS formula become the prime tool for pricing options but its empirical deficiencies (BS model shows systematic price bias across moneyness and maturity) provoked researchers for the development of advance models (Rubinstein, 1985; Hull and White, 1987; Wiggins, 1987; Dumas, Fleming and Whaley, 1998). The flock reveals that the two unrealistic assumptions of the model: the asset return follow log-normal distribution and volatility of the underlying remains constant throughout the life of the options is mainly responsible for deviation between model and market (Cont, 2001). The pricing deficiency of the BS model can also be depict by plotting a graph between following three: BS implied volatilities, strike price (X) or moneyness (X/S) and time to expiry. Instead of a neutral facial expression, the plot exhibits a parabolic shape, skewed largely to out-of-the-money and higher maturity options. The plot is widely known as the volatility smile/smirk pattern. Rubinstein (1994) and Heynen (1993) examine the same for the S&P 500 index and European Options Exchange.

Together, the theoretical and practical underpinnings of BS model induce researchers to pursuit the development of more realistic models, incorporating non-lognormal and stochastic features of the stock price and its volatilities. In the past four decades, researchers have suggested numerous models to price options with non-constant asset price volatility (Abken and Nandi, 1996). The proposed models divided in two veins: deterministic and stochastic volatility models (Ball and Roma, 1994). Deterministic volatility models are based on the framework that volatility is determined by some variables observable in the market whereas stochastic

volatility models are based on the framework that volatility is itself stochastic whose parameters are not directly observable in the market (Stein and Stein, 1991). Though several models has been suggested but only few managed to gain the popularity and retain the attention of practitioners. In stochastic family, model of Hull & White (1987), Heston (1993) and Heston and Nandi GARCH (2000) are the most popular while in deterministic category Constant Elasticity of Variance (CEV) model of Cox (1976), Deterministic Volatility Functions (DVF's) of Dumas, Fleming and Whaley (1998) and Gram-Charlier model of Backus, Foresi, and Wu (2004) managed to gain the popularity. Deterministic CEV expressed the volatility as a function of the price of the underlying asset, DVF modeled parabolic shape of the volatility smile and Gram-Charlier model incorporated excess skewness and kurtosis. Stochastic HW modeled the correlation of underlying return and volatility, and in addition Heston's (1993) focuses on non-lognormal distribution of the assets return, leverage effect and mean-reverting property of volatility.

Nifty index option is the most traded instrument on the browse of National Stock Exchange (NSE) of India and accounts more than 75% trade of the NSE alone. Due to Nifty index options NSE manage to rank among the top five exchanges of the world. In order to price Nifty index options this research work focuses on the entwined relation of option pricing and volatility of the underlying instrument (Scott, 1987). Like other stock exchanges, National Stock Exchange (NSE) of India is also using the BS model as a benchmark tool to fix the base prices of options underlying Nifty index and stocks, despite of its shortcomings. Therefore, this paper focuses on the empirical effectiveness of deterministic and stochastic models and tries to testify their applicability relative to market prices. This work is an extension of the empirical research work of Brockman and Chowdhury (1997) and explores the effectiveness of models of deterministic and stochastic families in the current scenario of financial upheavals.

To testify the comparative competitiveness of option pricing models we imposed four restrictions on the data set employed. The first one is instead of intra-daily closing prices are used. This restriction should however not affect the results in a significant way since Nifty index options is highly liquid implying that the closing prices of the options and the stock index is reasonably synchronous. The second restriction is regarding the estimation of models parameters and uses of numerical technique of non-linear least square for same as the method requires the simultaneous uses of market and model option prices. The third restriction is that dividends are not taken into account. This should in general not have any significant effects on the results since many of the stocks in the Nifty 50 index pay dividends only once or twice in a year. The fourth and final restriction is that only call options are valued. However, utilizing put-call parity put options can also be easily valued using the put-call parity.

In this research, models will be simulated using Excel VBA and Eviews. We will specifically look at the relative errors produced by the model prices with respect to the market prices. By comparing the relative errors, we expect to find the best model that can fully describe the market. The objective of this research is to discuss empirical techniques employed in testing option-pricing models, and to summarize major conclusions from the empirical literature.

The rest of the paper is organized as follows. Section 2 describes the data. Section 3 presents the relevant deterministic and stochastic volatility models. Section 4 provides the process of estimation of parameters of models. Section 5 compare and contrast the results of the models, besides that the section also briefly discussed the pattern of implied volatility exhibited by models across moneyness and maturity. Section 6 finally concludes our study

2. Data Description

This research work requires the collection of historical data of models parameters namely index price, strike price, time to maturity and risk free rate of interest. Except risk free rate of interest, all others are readily available from the official website of NSE. Since, there is direct data matching of risk free interest rate for the purpose of this research we utilized the yield of T-bill of 91-day duration issued by Reserve Bank of India (RBI) considered as risk free. The data is collected from the electronic database of the RBI.

2.1 Data Screening Procedure

Before making the real applicability of call options data collected from the bourse of NSE, all option data set is first inter-pass through following four series of exclusionary filters. First, option data set checked for lower boundary condition

$$S_t - Ke^{-rt} \leq C(S_t, t)$$

where S_t *is* the current asset price, K is the strike price, r is the risk-free interest rate, and $C(S_t, t)$ is the call price at time t. Call option data set not satisfying the lower boundary condition is considered as an invalid observation and thus plucked out. Second, since very deep out-of-the-money and very deep in-the- money options are not traded actively on NSE and their price quotes generally not reflect the true option value hence data of moneyness greater (less) than 15% (-15%) is excluded. We found that option with maturities greater than 90 days is very less actively traded on the bourse of NSE thus rejected. Since options with less than five days of maturity are highly sensitive to price-volatility bias, we discarded them also from the database. The final set of remaining data is figured into7455 call option.

2.2 Option Categories

The filtered set of data is then arranged categorically moneyness-maturity wise in fifteen categories: five moneyness and three maturities. Each market option data is placed in one of the fifteen categories depending on their time to expiration and ratio of the asset price to the strike price. Three ranges of time to expiration are distinguished as short maturity (0–30 days or below one month), medium maturity (30 to 60 days or between one to two months), long maturity (60 to 90 days or between two to three months). Since option prices are very sensitive to their exercise price and time to maturity, for the purpose of this research we divided the option data into five categories of moneyness: at-the-money (ATM) if the moneyness is in between (-5%, 5%), in-the-money (ITM) if the moneyness is in between (5%, 10%), out-of-the-money (OTM) if the moneyness is in between (-10%, -5%) and deep in-the-money (DITM) if the moneyness is greater than 10% and deep out-of-money (DOTM) if the moneyness is less than -10%.

2.3 Methodology

Since volatility is the most crucial and only unknown parameter in the classical BS model; the implied volatility inferred reciprocally from the BS can also be used to justify the accuracy of the BS and other related option-pricing models. For same, the out-of sample forecasting performance of the models has been compare and contrasted. In order to have sustainable input parameters, models parameters is computed analytically by optimization techniques (Coleman and Li, 1996) which further use as an input to figure out the effectiveness of the models against benchmark BS model for pricing Nifty index option contract with market value. This paper adopted an effective statistical tool for evaluating the performance of option pricing models that involves calculating the error metrics. To see how well a model performs, we look at the relative error generated by the models.

To provide a distinctive framework instead of comparing the results of the models with the classical BS we have compared them with market and checked the competitiveness of the models relative to market. For same we utilized the two well-known error metrics, percentage mean error (*PME*) and mean absolute pricing error (*MAPE*), described as

Percentage Mean Error (*PME*)

$$PME = \frac{1}{K}\sum_{i=1}^{K}(C_i^{Model} - C_i^{Market})/C_i^{Market}$$

Mean Absolute Pricing Error (*MAPE*)

$$MAPE = Mean \quad \left[\left|C_i^{Model} - C_i^{Market}\right|\right]$$

where C_i^{Model} is the expected price and C_i^{Market} is the actual price of the call option of the ith observation and k is the number of total observations. The sign and magnitude of the relative error of PME and MAPE will decide the competency of the models. In case of PME, the sign and magnitude together will decide the quality of the model. A large negative (positive) relative PME would mean that the model under prices (overprices) the specific option whereas in case of MAPE magnitude will decide the degree of overpricing and under pricing i.e. good or bad approximation to the market.

3. Option Pricing Models

3.1 The Black-Scholes Option Pricing Model

The model hardly requires any introduction, due to its simplicity, closed-form solution, and ease of implementation it is the most popular option-pricing model. The BS option pricing formula for a stock paying no dividend is

$$C_{BS} = SN(d_1) - Ke^{-rt}N(d_2)$$

where

$$d_1 = \frac{\ln[S/K] + [r + 0.5\sigma^2]t}{\sigma\sqrt{t}}$$

$$d_2 = \frac{\ln[S/K] + [r - 0.5\sigma^2]t}{\sigma\sqrt{t}} = d_1 - \sigma\sqrt{t}$$

C denotes the price of a call option, *S* denotes the underlying Index price, *K* denotes the option exercise price, *t* is the time to expiry in years, *r* is the risk free rate of return, *N(d)* is the standard normal distribution function, and σ^2 is the variance of returns on the Index. The important specification of the formula is that it can also be used to price variety of options underlying different assets class with little modification in the base framework.

3.2 The Practitioner Black-scholes Model

The ample of empirical evidences proving the existence of parabolic smile/skew shape of the implied volatility and its serial dependence on moneyness and maturity, violating the non-constant volatility assumption of BS had motivated practitioners to explore the dependence of implied volatility on moneyness and maturity. Dumas, Fleming, and Whaley (1998) modeled that as the liner quadratic function of three. Researchers named it deterministic volatility functions (DVF's). For the purpose of this research, we focused on only following three specifications of DVF:

DVF 1 $\sigma_{iv} = a_0 + a_1K + a_2K^2 + a_3T + a_4T^2$

DVF 2 $\sigma_{iv} = a_0 + a_1K + a_2K^2 + a_3T + a_4KT$

DVF 3 $\sigma_{iv} = a_0 + a_1K + a_2K^2 + a_3T + a_4T^2 + a_5KT$

where σ_{iv} = Black-Scholes implied volatility. *K* = strike price. *T* = time to maturity and a_0, a_1, a_2, a_3, a_4, a_5 are model parameters. In case of constant volatility assumption DVF model converges to BS $\sigma_{iv} = a_0$.

3.3 The Constant-Elasticity-of-Variance (CEV) Option Pricing Model

Utilizing and extending the framework of BS, Cox and Ross (1976) proposed the constant elasticity of variance (CEV) model. The CEV model assumes the diffusion process for the stock is

$$dS = \mu dt + \delta S^{\beta/2} dz,$$

and the instantaneous variance of the percentage price change or return, σ^2, follows deterministic relationship:

$$\sigma^2(S,t) = \delta^2 S^{(\beta-2)}$$

If β =2, prices are lognormally distributed and the variance of returns is constant. This is the same as the well-known Black-Scholes model. If β <2, the stock price is inversely related to the volatility. When β <2, the nondividend-paying CEV call pricing formula is as follows:

$$C = S\left[\sum_{n=0}^{\infty} g(S' \mid n+1)G(K' \mid n+1+\frac{1}{2-\beta})\right] - Ke^{-r\tau}\left[\sum_{n=0}^{\infty} g(S' \mid n+1+\frac{1}{2-\beta})G(K' \mid n+1)\right]$$

When β >2, the CEV call pricing formula is as follows:

$$C = S\left[1 - \sum_{n=0}^{\infty} g(S' \mid n+1+\frac{1}{2-\beta})G(K' \mid n+1)\right] - Ke^{-r\tau}\left[1 - \sum_{n=0}^{\infty} g(S' \mid n+1)G(K' \mid n+1+\frac{1}{2-\beta})\right]$$

where

$$S' = \left[\frac{2re^{r\tau(2-\beta)}}{\delta^2(2-\beta)(e^{r\tau(2-\beta)}-1)}\right]S^{2-\beta}$$

$$K' = \left[\frac{2r}{\delta^2(2-\beta)(e^{r\tau(2-\beta)}-1)}\right]K^{2-\beta}$$

$g(x \mid m) = \dfrac{e^{-x} x^{m-1}}{\Gamma(m)}$ is the gamma density function

$$G(x \mid m) = \int_x^{\infty} g(y \mid m) dy$$

C is the call price; *S*, the stock price; τ, the time to maturity; *r*, the risk-free rate of interest; *K*, the strike price; and β and δ, the parameters of the formula. As a special case when β of the model is equal to 2, the model reproduces the BS. The CEV model is complex enough to incorporate the dynamics of changing volatility but at the same time simple enough to provide a closed form solution for options with only two parameters (Ang and Peterson, 1984; Lee, Wu and Chen, 2004).

3.4 The Gram-Charlier Model

The Gram-Charlier (2004) model provides a simple way to account non log-normality of asset return and accounts both excess skewness and kurtosis. Gram-Charlier model provides expansion up to the fourth order in the distribution of returns of the underlying asset. The model is derived on the conceptual framework of BS i.e. volatility is constant over time. The Gram-Charlier formula is

$$C_{GC} \approx S_t \phi(d) - Ke^{-Rt} \phi(d - \sigma t) + S_t \phi(d) \sigma t \left[\frac{\gamma_{1t}}{3!} \phi^{(3)} (2\sigma t - d) - \frac{\gamma_{2t}}{4!} (1 - d^2 + 3d\sigma t) - \sigma_t^2 \right]$$

Where r is continuously compounded n-period interest rate, K is the strike price of the option and d is identical to that of BS formula. In the case if skewness and excess kurtosis are both zero, the terms inside the square brackets become zero, and the GC formula for the call price $\boldsymbol{C_{GC}}$ *will* reduces to the BS call price.

3.5 Hull and White Uncorrelated Stochastic Volatility Model

Extending the constant volatility framework of BS (1973), and utilizing their year old concept of stochastic, Hull and White (1988) develop a closed form approximation for European options under new framework. However, contrary to Hull-White (1987), the 1988 version model modeled the instantaneously correlation of volatility to the asset price. They assume a square root stochastic volatility processes for a security price S and its return volatility:

$$\frac{dS}{S} = \phi dt + \sqrt{V} dZ$$

$$dV = \eta dt + \xi \sqrt{V} dw$$

where *S* is a stock price, *V* is an instantaneous stock return variance and *dz*, *dw* are Wiener processes with correlation ρ. ξ is the instantaneous standard deviation of $dV / \sqrt{V}$. ϕ is the exponential drift rate of *S* and $\eta(V) = a + bV$ is the instantaneous drift rate of *V*, where *a* and *b* are constants. Mean-reverting volatility assumes that *b* is negative with a long-run reversion value of -*a*/*b*, where *a* must be positive to maintain a positive variance.

Hull and White (1988) provide an accurate approximation from a second-order Taylor series expansion around a constant volatility specification ($\xi = 0$). Using this expansion, they derived the formula

$$C_{HW} = C_{BS}(V) + Q_1 \rho \xi + (Q_2 + Q_3 \rho^2) \xi^2 + o(\xi^2)$$

Where C_{BS} is the BS call price and rest other is the bias term added to yield the stochastic-volatility adjusted call price

3.6 Heston Model with Closed-form Solutions

Heston's provided the another stochastic framework and derived a closed-form solution of a European call option on a non-dividend paying asset. His formulas is

$$C(S_t, V_t, t, T) = S_t P_1 - Ke^{-r(T-t)} P_2$$

where $P_1, and\ P_2$ are two probability functions, and

$$P_j(x, V_t, T, K) = \frac{1}{2} + \frac{1}{\pi} \int_0^{\infty} \mathrm{Re} \left(\frac{e^{-i\phi \ln(K)} f_j(x, V_t, T, \phi)}{i\phi} \right) d\phi$$

$x = \ln(S_t)$

$$f_j(x, V_t, T, \phi) = \exp\{C(T-t,\phi) + D(T-t,\phi)V_t + i\phi x\}$$

$$C(T-t,\phi) = r\phi ir + \frac{a}{\sigma^2}\left[(b_j - \rho\sigma\phi i + d)\tau - 2\ln\left(\frac{1-ge^{dr}}{1-g}\right)\right]$$

$$D(T-t,\phi) = \frac{(b_j - \rho\sigma\phi i + d)}{\sigma^2}\left(\frac{1-e^{dr}}{1-ge^{dr}}\right)$$

$$g = \frac{b_j - \rho\sigma\phi i + d}{b_j - \rho\sigma\phi i - d}$$

$$d = \sqrt{(\rho\sigma\phi i - b_j)^2 - \sigma^2(2u_j\phi i - \phi^2)}$$

For j=1,2 where,

$$u_1 = \frac{1}{2}, u_{21} = -\frac{1}{2}, a = \kappa\theta, b_1 = \kappa + \lambda - \rho\sigma, b_2 = \kappa + \lambda$$

Theoretically such a formula looks daunting, but in reality its quite easy to evaluate. The only part that can pose a little problem in computation is the limits of the integral. As the integral cannot be evaluated exactly, but with the advancement in computational techniques it can be approximated with reasonable accuracy.

4. Calibration of Models

In the BS world, the implied volatility is the only parameter, which needs to be calibrated. To get an undisputable volatility parameter the best method is to infer it from the market itself which will incorporate all the available information contained in various option prices. Since all the models have one or more unknown parameters which need to be determine implicitly, for the purpose of this research we inferred all in similar way. For same we employed the non-linear least square (NLLS) loss function to imply option-related parameters from the market. The method of NLLS is a widely acceptable procedure to procure the implied parameters of the models that govern the underlying asset distribution purely from the underlying asset return and option data. The optimal set of parameters is then used to compute the models price. By using the same loss function, NLLS, we tried to provide a level playing field to all models. The idea of estimating the volatility process first and then estimating the option related parameters have been utilized here. Using this procedure, parameter estimates of all the models are obtained. The volatility and other parameters estimates obtained for day *i* is used to value options of day *i+l*. Equation (1) exhibits the square loss objective fu*n*ction $f(\Omega)$

$$f(\Omega) = \min_{\Omega} \sum_{i=1}^{n} \left[C_{obs,i}(K,T) - C_{Model,i}(a_1, a_2, ...a_n)\right]^2 \quad (1)$$

where Ω is the set of parameter to be determined implicitly from the market data.

5. Results

This section reports the empirical comparison of model performances. Table 1- 4(a) explicitly states the pattern of implied volatility and out-of-sample forecasting performance of models.

5.1 The Implied Volatility Pattern

To determine the pricing bias between the BS model price and the market price a convenient method is to plot the BS implied volatility as a function of the exercise price. Previous studies of researchers have acknowledged the volatility smile pattern which means that the implied volatility tends to vary across exercise prices. Results of Table 1 & 1(a) clearly exhibits that results are inline with the previous empirical facts, reports implied volatility is higher for OTM and ITM options but lower for ATM options, moves systematically, increases in either way from ATM. The existence of volatility smile shows the BS model systematically misprices options across moneyness-maturity groups. Incorporation of stochastic volatility in BS model might improve its performance in terms of more stability in volatility and lower price error. Thus, study of the implied volatility sets the first stage to judge the empirical performance of family of option pricing models.

5.2 Out-of-Sample Pricing Performance

Black-Scholes Model

Table 2, 2(a), 3 and 3(b) exhibits that the BS model over prices medium and long term OTM and DOTM call options and under prices short term DOTM, OTM, ITM and DITM call options. Across all groups of moneyness and maturity, PME is least for ITM and DITM call options. Its evident from the tables that BS model prices ATM, ITM and DITM call options with error less than equal to 7% in all moneyness-maturity groups. Degree of pricing bias is increases systematically and moves from short-term to long-term options for short and medium term call options. We found that the BS model prices short term ATM, ITM and DITM options more accurately with pricing error varying from 0% to -2% only.

Deterministic Volatility Functions

We found that the DVF models under prices short term DOTM and overprices long-term DITM options. Among the three variants of DVF, DVF 1 and DVF 2 models outperforms the benchmark BS and GC model in 13 out of 15 moneyness-maturity groups. Amazingly the pricing bias of DVF 2 and DVF 3 is least in 11 out of 15 moneyness-maturity groups, outperforms all other models. For DVF models PME is generally high for DOTM call options for all maturity and low for short and medium term ITM and DITM call options. Since, incorporation of DVF 1-3 does not add any computational complexities to the BS option pricing, we suggest that this modified approach could be use as an alternative of BS.

Gram-Charlier Model

Table 2-4(a) strongly suggest that the incorporation of skewness and kurtosis into the option pricing formula yields values closer to market prices, outperformed BS in 12 out of 15 categories of moneyness-maturity . Results also justify the weakness of BS model which does not incorporate same.

The Constant Elasticity of Variance Model

Results reveals that the CEV model under prices short term OTM, ATM, ITM and DITM call options and medium term DOTM call options. The model also overprices long-term call options with percentage mean error ranging 4-9%. The model performs better than the BS model in 9 out of 15 moneyness-maturity groups. The results of Table 2-4(a) displays that the PME of CEV model closely matches with the results of stochastic volatility models in short and medium term moneyness-maturity category, but in rest other its performance is not good. However, the pricing performance of CEV model is better than the Heston and HW model in DOTM category. The degree of mispricing of CEV model is ranging between 26% and 34% in all maturity.

Hull and White Model

HW model under prices DOTM, OTM, ITM and DITM call options with maturities less than 30 days and ITM, DITM call options of maturity less than or equal to 60 days, while over prices DOTM options for maturity group greater than 30 and 60 days. The model deeply under-prices short term DOTM and OTM options, error varies from 27% and 6%. HW model prices short and medium term ATM, ITM and DITM options more accurately with 0-3% degree of price bias. For all moneyness-maturity groups, HW model generally produces prices that are very close to BS prices, this may be due to fact that HW model is merely an stochastic extensions of BS model. MAPE of HW model is higher in case of ATM options for short maturity options as compared to CEV and Hestion while lower for short-term DOTM options compared to Heston.

Heston Model

Table 1 reveals that the implied volatility of the Heston model matches the market-implied volatility better than the BS, GC CEV and HW models. However Table 1(a) evident that implied volatility computed from the Heston model price is always higher than the implied volatility computed from the market price for in-the-money but lower for out-of-the-money options. The out-of-sample forecast ability of the Heston model is superior to classical BS model in 12 out of 15 moneyness-maturity groups (PME is lower in 12 whereas MAPE is lower in 13 out of 15 moneyness-maturity groups). Our results strongly support the view that addition of volatility as a random variant improves the pricing bias significantly, but inclusion of higher numbers of unknown parameters makes the computational process complex and even after that the pricing bias is not eliminating completely. Despite the computational complexity, the Heston Model is the most widely used stochastic volatility (SV) models today. Its attractiveness lies in the powerful duality of its tractability and robustness relative to other models.

After cross-comparison, we found that none of the models dominates the others. In other words, no model reproduces market prices that give relative errors lower than the other models for all strikes and maturities. Thus,

our key objective, which was to found the best model, not achieved. Therefore we shifted our focus on the identification of finding the best alternative among the family of models producing lowest error across moneyness and maturity. The DVF, CEV and the Heston model appear to be pricing better than the rest others in the short maturity ITM category. For short maturity and ATM category, the error of HW is lowest. However, the classical BS model also comes in handy at least for ATM, ITM and DITM options. For medium and long maturity results are not as diverse as for short maturity options. Although, performance of all the models are closely competitive but pricing performance of DVF and Heston model appears to be better in peer group as their relative errors are much lower. After rigorous churning of specific data taken across various models we deduced that the best model to be used for option pricing is the deterministic DVF and stochastic Heston model as they outperformed and surpassed other models in most of moneyness-maturities.

5.3 Choosing between Models

Since all the models found to be produce relative errors with respect to the market in all option categories, therefore we conclude that there is no model that can fully approximate the market. The possible reasons are either estimated parameter values are incorrect or models are not capable of capturing the variations of the option market. Both the possibility is highly likely in this research. The second possibility is more likely as in reality option prices are determined by non-quantifiable factors such as demand and supply, than just the quantifiable underlying assets. Table 5 lists the models categorically best for option pricing.

6. Conclusion

Our result shows that the DVF and Heston model improves pricing error significantly compared to others model. From the results of the simulation, we have found that, for Nifty index options: None of the models can fully reproduce the market prices since all of them produce relative errors with respect to the market. Judged on internal parameter consistency, all models are mis-specified, with the DVF and Heston model the least and the BS the most misspecified. There is no model that dominates the others by producing prices that are in closer agreement with the market prices in all option categories (moneyness-maturity category). Out-of-sample (OTM) pricing errors are the highest for the Black-Scholes and Hull white Stochastic Volatility model, the second highest for the Gram-Charlier, and the lowest for the Heston Stochastic model. Out of all the models, Practitioner Black-Scholes, Constant Elasticity of Variance, and Heston model is one of the best for pricing short and medium term in-the-money and deep-in-the-money Nifty index options. Overall, the stochastic volatility model typically reduces the BS pricing errors by 20% to 30%. Stochastic Volatility models do not significantly improve the performance over deterministic volatility models of the BS, DVF, CEV, Gram-Charlier models. The Heston model, comparing to other models, is good in for both short and long maturity, deep-out-of-the-money and short maturity, in-the-money and deep-in-the-money option categories. In the realm of financial option pricing the model is most popular and trustworthy because of its simplicity and analytical tractability and thus used globally to fix the base price of options traded on the bourses of almost all the option exchanges.

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Appendix

Table 1. Black-Scholes and Alternate Option Pricing Models average implied volatility moneyness-maturity bias

Models	Implied Volatility																	
	Time to maturity (T≤30)						Time to maturity (30<T≤60)						Time to maturity (T>60)					
	DOTM	OTM	ATM	ITM	DITM	All	DOTM	OTM	ATM	ITM	DITM	All	DOTM	OTM	ATM	ITM	DITM	All
BS	0.39	0.37	0.35	0.36	0.37	0.36	0.39	0.37	0.35	0.37	0.39	0.37	0.40	0.36	0.33	0.38	0.42	0.35
	0.12	0.12	0.11	0.12	0.13	0.12	0.12	0.12	0.12	0.12	0.14	0.12	0.13	0.11	0.09	0.10	0.11	0.11
DVF 1	0.43	0.40	0.38	0.39	0.41	0.40	0.43	0.39	0.37	0.39	0.43	0.39	0.43	0.39	0.35	0.42	0.49	0.38
	0.14	0.14	0.13	0.14	0.14	0.14	0.15	0.15	0.14	0.15	0.17	0.15	0.15	0.13	0.12	0.14	0.16	0.13
DVF 2	0.42	0.39	0.38	0.39	0.40	0.39	0.42	0.39	0.37	0.39	0.43	0.39	0.42	0.38	0.35	0.41	0.49	0.37
	0.15	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.14	0.15	0.17	0.15	0.15	0.13	0.12	0.14	0.16	0.13
DVF 3	0.42	0.40	0.38	0.39	0.41	0.39	0.43	0.40	0.38	0.39	0.43	0.39	0.43	0.39	0.35	0.41	0.49	0.38
	0.15	0.14	0.14	0.15	0.15	0.14	0.15	0.15	0.15	0.15	0.18	0.15	0.15	0.13	0.12	0.15	0.17	0.14
GC	0.40	0.37	0.36	0.37	0.38	0.37	0.40	0.37	0.35	0.37	0.41	0.37	0.39	0.36	0.32	0.37	0.40	0.35
	0.26	0.21	0.21	0.25	0.25	0.23	0.24	0.17	0.18	0.12	0.32	0.19	0.13	0.11	0.09	0.09	0.10	0.11
CEV	0.32	0.30	0.28	0.29	0.30	0.30	0.32	0.30	0.28	0.30	0.32	0.30	0.33	0.29	0.26	0.31	0.34	0.29
	0.11	0.10	0.10	0.10	0.11	0.10	0.11	0.11	0.10	0.11	0.12	0.11	0.11	0.10	0.08	0.09	0.10	0.10
HW	0.39	0.37	0.35	0.36	0.37	0.36	0.39	0.37	0.35	0.37	0.39	0.37	0.40	0.36	0.33	0.38	0.42	0.35
	0.12	0.12	0.11	0.12	0.13	0.12	0.12	0.12	0.12	0.12	0.13	0.12	0.13	0.11	0.09	0.10	0.11	0.11
Heston	0.45	0.42	0.40	0.41	0.43	0.42	0.45	0.41	0.39	0.42	0.45	0.42	0.47	0.41	0.37	0.46	0.52	0.40
	0.17	0.16	0.15	0.16	0.17	0.16	0.17	0.16	0.15	0.15	0.19	0.16	0.17	0.15	0.13	0.16	0.17	0.15
No. of Observations	772	938	1697	414	222	4043	491	632	1085	233	120	2561	153	235	432	22	9	851

Table 1(a). Black-Scholes and Alternate Option Pricing Models average implied volatility moneyness bias

Models		Moneyness (x=S/K-1)					
		DOTM	OTM	ATM	ITM	DITM	Overall
BS	Average	0.39	0.36	0.35	0.36	0.38	0.36
	Std Dev	0.12	0.12	0.11	0.12	0.13	0.12
DVF 1	Average	0.43	0.39	0.37	0.39	0.42	0.39
	Std Dev	0.14	0.14	0.14	0.14	0.15	0.14
DVF 2	Average	0.42	0.39	0.37	0.39	0.41	0.39
	Std Dev	0.15	0.14	0.14	0.15	0.16	0.15
DVF 3	Average	0.43	0.39	0.37	0.39	0.41	0.39
	Std Dev	0.15	0.14	0.14	0.15	0.16	0.14
GC	Average	0.40	0.37	0.35	0.37	0.39	0.37
	Std Dev	0.24	0.19	0.19	0.21	0.27	0.21
CEV	Average	0.32	0.30	0.28	0.30	0.31	0.30
	Std Dev	0.11	0.10	0.10	0.10	0.11	0.10
HW	Average	0.39	0.36	0.35	0.36	0.38	0.36
	Std Dev	0.12	0.12	0.11	0.12	0.13	0.12
Heston	Average	0.45	0.41	0.39	0.42	0.44	0.41
	Std Dev	0.17	0.16	0.15	0.16	0.18	0.16
Total		1416	1805	3214	669	351	7455

Table 2. Black-Scholes and Alternate Option Pricing Models out of sample Percentage Mean Error (PME) moneyness-maturity bias

Models	PME																	
	Time to maturity (T≤30)						Time to maturity (30<T≤60)						Time to maturity (T>60)					
	DOTM	OTM	ATM	ITM	DITM	All	DOTM	OTM	ATM	ITM	DITM	All	DOTM	OTM	ATM	ITM	DITM	All
BS	-0.27	-0.07	-0.03	-0.04	-0.03	-0.09	0.10	0.10	0.00	-0.01	-0.02	0.04	0.15	0.11	0.07	0.00	0.04	0.09
	0.53	0.42	0.17	0.05	0.04	0.34	0.34	0.35	0.11	0.07	0.05	0.25	0.44	0.24	0.50	0.10	0.12	0.42
DVF 1	-0.06	0.02	0.02	0.00	0.00	0.00	0.01	0.03	0.00	0.02	0.02	0.01	0.02	0.05	0.04	0.01	0.06	0.04
	1.25	0.48	0.17	0.06	0.05	0.61	0.37	0.30	0.11	0.07	0.06	0.23	0.47	0.31	0.51	0.12	0.13	0.44
DVF 2	-0.16	-0.05	0.01	0.00	0.00	-0.04	0.01	0.03	0.01	0.01	0.02	0.01	0.00	0.01	0.03	0.00	0.04	0.02
	1.09	0.53	0.15	0.06	0.05	0.55	0.36	0.30	0.11	0.08	0.06	0.23	0.41	0.22	0.51	0.10	0.10	0.42
DVF 3	-0.08	0.00	0.03	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	-0.02	0.03	0.04	-0.01	0.05	0.03
	1.11	0.52	0.16	0.07	0.05	0.56	0.38	0.29	0.11	0.07	0.06	0.24	0.44	0.26	0.53	0.09	0.10	0.44
GC	-0.62	-0.28	-0.02	-0.02	-0.02	-0.20	-0.06	0.04	0.00	0.00	0.00	0.00	0.07	0.08	0.07	0.01	0.03	0.07
	0.64	0.46	0.17	0.07	0.06	0.44	0.34	0.33	0.11	0.07	0.05	0.24	0.41	0.23	0.50	0.09	0.09	0.42
CEV	-0.47	-0.21	-0.05	-0.02	-0.01	-0.16	-0.08	0.01	0.00	0.02	0.02	-0.01	0.04	0.06	0.09	0.04	0.08	0.07
	0.39	0.34	0.15	0.06	0.04	0.30	0.26	0.30	0.10	0.07	0.05	0.20	0.38	0.21	0.48	0.09	0.12	0.39
HW	-0.27	-0.06	-0.03	-0.04	-0.03	-0.08	0.10	0.10	0.00	-0.01	-0.02	0.04	0.15	0.11	0.07	0.00	0.04	0.10
	0.53	0.42	0.17	0.05	0.04	0.34	0.34	0.35	0.11	0.07	0.05	0.25	0.44	0.24	0.50	0.10	0.12	0.42
Heston	-0.01	0.07	0.03	-0.01	-0.02	0.02	0.08	0.06	0.00	0.00	-0.01	0.03	0.02	0.00	0.03	-0.01	0.02	0.02
	1.03	0.46	0.18	0.06	0.04	0.51	0.33	0.31	0.11	0.07	0.05	0.23	0.36	0.21	0.50	0.09	0.11	0.40
No. of Observations	772	938	1697	414	222	4043	491	632	1085	233	120	2561	153	235	432	22	9	851

Table 2(a). Black-Scholes and Alternate Option Pricing Models out of sample Percentage Mean Error (PME) moneyness bias

Models		Moneyness (x=S/K-1)					
		DOTM	OTM	ATM	ITM	DITM	Overall
BS	Average	-0.10	0.02	-0.01	-0.03	-0.02	-0.02
	Std Dev	0.50	0.39	0.23	0.06	0.05	0.33
DVF 1	Average	-0.03	0.02	0.02	0.01	0.00	0.01
	Std Dev	0.96	0.41	0.23	0.07	0.06	0.49
DVF 2	Average	-0.08	-0.02	0.01	0.01	0.00	-0.01
	Std Dev	0.85	0.43	0.23	0.07	0.06	0.45
DVF 3	Average	-0.05	0.01	0.02	0.01	0.00	0.00
	Std Dev	0.86	0.43	0.24	0.07	0.06	0.46
GC	Average	-0.35	-0.12	0.00	-0.01	-0.01	-0.10
	Std Dev	0.61	0.43	0.23	0.07	0.06	0.39
CEV	Average	-0.28	-0.10	-0.01	0.00	0.00	-0.08
	Std Dev	0.41	0.33	0.22	0.06	0.05	0.30
HW	Average	-0.09	0.02	-0.01	-0.03	-0.02	-0.02
	Std Dev	0.50	0.39	0.23	0.06	0.05	0.33
Heston	Average	0.02	0.05	0.02	-0.01	-0.01	0.03
	Std Dev	0.79	0.39	0.23	0.06	0.05	0.42
Total		1416	1805	3214	669	351	7455

Table 3. Black-Scholes and Alternate Option Pricing Models Mean Absolute Pricing Error (MAPE) moneyness-maturity bias

Models	MAPE																	
	Time to maturity (T≤30)						Time to maturity (30<T≤60)						Time to maturity (T>60)					
	DOTM	OTM	ATM	ITM	DITM	All	DOTM	OTM	ATM	ITM	DITM	All	DOTM	OTM	ATM	ITM	DITM	All
BS	6.36	8.75	14.24	17.25	17.75	11.96	13.58	15.98	16.78	20.76	19.71	16.47	26.26	22.51	26.45	34.26	43.22	25.71
	10.34	10.13	15.86	19.65	21.31	15.14	17.10	19.13	21.80	20.23	24.37	20.40	30.51	23.06	31.74	26.85	44.19	29.47
DVF 1	6.49	8.79	12.89	15.47	16.49	11.18	12.60	13.76	16.41	20.63	22.27	15.68	23.60	25.91	26.71	40.11	40.03	26.42
	10.81	10.85	15.40	18.73	21.71	14.86	17.06	16.64	22.43	20.53	27.42	20.43	29.04	31.67	29.40	30.74	54.12	30.41
DVF 2	6.88	8.03	11.97	15.29	15.91	10.64	11.95	13.03	16.69	22.11	22.25	15.63	19.50	20.65	26.08	35.23	28.11	23.66
	10.99	9.73	14.37	19.32	21.88	14.31	16.91	16.64	24.47	26.05	28.01	22.03	22.35	20.58	31.04	25.54	43.25	27.21
DVF 3	6.73	8.82	13.29	15.91	16.04	11.42	12.70	13.73	16.71	21.03	21.91	15.84	21.84	22.85	27.94	30.98	29.02	25.53
	10.69	9.93	15.43	20.25	22.49	14.99	18.58	17.45	22.25	22.09	27.55	20.92	24.79	25.71	33.04	22.39	42.33	29.72
GC	9.13	11.47	13.77	18.20	18.95	13.09	13.39	14.96	16.64	20.09	19.54	16.05	22.38	21.25	27.00	33.16	31.95	24.80
	11.83	11.31	16.15	22.11	24.29	16.01	16.62	19.27	21.83	20.26	25.43	20.43	24.63	22.36	31.32	22.05	31.41	27.82
CEV	6.19	8.36	13.48	14.74	13.89	11.05	10.54	12.64	15.72	19.86	19.99	14.54	20.06	19.95	27.02	31.85	54.18	24.23
	9.96	9.25	14.97	17.97	19.17	14.01	12.22	15.59	20.31	20.99	22.81	18.33	23.33	20.08	30.84	27.05	39.30	27.32
HW	6.29	8.73	14.28	17.25	17.76	11.96	13.52	16.03	16.85	20.77	19.69	16.50	26.02	22.51	26.20	34.26	43.22	25.54
	10.32	10.14	15.85	19.66	21.31	15.15	17.11	19.12	21.84	20.23	24.38	20.42	30.51	23.06	31.75	26.85	44.19	29.46
Heston	7.15	9.00	12.86	14.35	15.17	11.15	13.00	14.65	16.25	19.48	19.01	15.66	20.92	20.24	24.52	33.45	34.02	23.02
	11.40	10.64	15.25	18.14	19.67	14.51	16.55	18.64	21.44	20.33	24.74	20.06	23.97	20.12	30.38	21.77	36.84	26.73
No. of Observations	772	938	1697	414	222	4043	491	632	1085	233	120	2561	153	235	432	22	9	851

Table 3(a). Black-Scholes and Alternate Option Pricing Models Mean Absolute Pricing Error (MAPE) moneyness bias

Models		Moneyness (x=S/K-1)					
		DOTM	OTM	ATM	ITM	DITM	Overall
BS	Average	11.01	13.07	16.74	19.03	19.07	15.08
	Std Dev	17.28	16.57	21.08	20.35	23.44	19.62
DVF 1	Average	10.46	12.76	15.93	18.08	19.07	14.47
	Std Dev	16.85	17.87	20.77	20.39	25.28	19.78
DVF 2	Average	10.00	11.43	15.46	18.32	18.39	13.84
	Std Dev	15.32	14.80	21.50	22.52	24.97	19.49
DVF 3	Average	10.43	12.37	16.41	18.19	18.38	14.55
	Std Dev	16.46	16.28	21.50	21.22	25.08	19.81
GC	Average	12.04	13.96	16.52	19.35	19.49	15.44
	Std Dev	15.93	16.48	21.18	21.62	24.88	19.59
CEV	Average	9.19	11.37	16.05	17.09	17.01	13.75
	Std Dev	13.51	14.02	20.12	19.72	22.11	17.99
HW	Average	10.93	13.08	16.75	19.04	19.07	15.07
	Std Dev	17.26	16.57	21.07	20.35	23.44	19.62
Heston	Average	10.67	12.44	15.57	16.76	16.97	14.05
	Std Dev	15.72	15.77	20.40	19.42	22.24	18.67
Total		1416	1805	3214	669	351	7455

Table 4. Moneyness-Maturity Statistics of S&P CNX Nifty 50 Index Call Options (prices in INR) for the period of Jan 1, 2008 to December 31, 2008 (Moneyness is defined as $x = S / K - 1$, where S denotes the closing value of the S&P CNX Nifty 50 index and K denotes the exercise price of the option)

Models	MAPE																	
	Time to maturity (T≤30)						Time to maturity (30<T≤60)						Time to maturity (T>60)					
	DOTM	OTM	ATM	ITM	DITM	All	DOTM	OTM	ATM	ITM	DITM	All	DOTM	OTM	ATM	ITM	DITM	All
BS	14.06	35.12	138.50	347.89	498.72	131.97	59.69	99.83	219.86	399.59	525.45	190.20	111.74	150.96	265.86	442.87	542.40	213.92
	19.32	31.23	74.95	82.31	115.37	145.21	43.36	51.20	80.10	72.91	106.15	140.15	66.46	50.36	73.67	73.07	53.55	106.04
DVF 1	15.87	38.82	147.30	360.35	510.54	138.80	53.49	93.97	221.04	409.80	541.72	189.76	97.90	142.42	259.49	444.37	551.82	205.98
	19.56	34.35	79.44	84.63	114.58	149.32	37.55	48.80	82.58	73.86	105.44	145.64	56.20	56.92	79.92	77.17	46.00	110.79
DVF 2	14.32	36.69	146.54	361.60	510.94	137.84	54.96	94.87	222.12	409.04	541.34	190.63	95.22	137.69	257.23	442.42	545.38	202.93
	17.69	32.19	78.96	84.52	113.98	149.83	40.64	49.78	82.85	76.38	106.15	145.63	47.83	46.58	79.50	79.24	34.31	108.94
DVF 3	14.98	38.27	148.04	362.15	511.59	139.06	53.85	93.33	220.46	409.48	539.93	189.31	92.50	138.98	258.63	437.74	546.13	203.39
	18.22	33.16	79.22	84.26	113.52	149.77	40.58	50.79	83.41	74.90	108.35	146.05	46.38	49.09	78.69	74.13	36.51	109.14
GC	8.62	31.00	143.28	354.26	503.20	132.89	52.96	95.92	221.44	404.99	532.24	189.42	103.76	147.52	265.99	444.38	538.33	211.60
	16.09	33.70	79.53	84.56	114.40	149.56	41.83	51.80	81.75	72.50	105.53	143.95	59.57	49.91	75.14	70.16	44.25	107.65
CEV	11.22	31.80	138.44	354.78	507.09	131.80	51.71	93.95	222.38	413.00	542.20	190.29	102.79	146.59	270.51	459.74	562.75	214.12
	16.19	29.58	77.44	84.28	116.24	148.92	39.42	51.35	84.15	74.29	106.47	147.32	60.16	53.31	78.03	74.47	48.06	112.39
HW	14.13	35.19	138.59	347.88	498.71	132.04	59.79	99.93	219.94	399.59	525.43	190.28	111.96	150.96	266.14	442.87	542.40	214.11
	19.33	31.26	74.94	82.31	115.37	145.19	43.34	51.18	80.05	72.91	106.16	140.11	66.40	50.36	73.55	73.07	53.55	106.02
Heston	17.68	39.71	146.51	356.81	505.12	138.35	58.45	97.13	220.93	404.40	530.39	190.42	99.45	137.06	255.97	436.42	535.08	202.61
	22.46	33.88	76.79	83.24	115.21	147.02	42.16	51.40	81.19	72.45	107.35	142.35	58.67	47.50	77.04	62.91	44.32	107.23
No. of Observations	772	938	1697	414	222	4043	491	632	1085	233	120	2561	153	235	432	22	9	851

Table 4(a). Moneyness Statistics of S&P CNX Nifty 50 Index Call Options (prices in INR) for the period of Jan 1, 2008 to December 31, 2008

Models		Moneyness (x=S/K-1)					
		DOTM	OTM	ATM	ITM	DITM	Overall
BS	Average	40.44	72.86	183.08	369.02	508.98	161.33
	Std Dev	48.86	59.52	91.02	83.58	111.76	143.29
DVF 1	Average	37.78	71.62	187.27	380.33	522.26	163.97
	Std Dev	42.12	57.04	91.75	84.83	111.17	146.80
DVF 2	Average	37.15	70.21	186.93	380.78	522.21	163.40
	Std Dev	41.80	55.47	91.65	85.27	110.82	146.96
DVF 3	Average	36.83	70.66	187.36	381.12	522.16	163.66
	Std Dev	40.97	55.85	91.43	84.38	111.14	146.91
GC	Average	34.28	68.90	186.16	374.89	514.03	161.29
	Std Dev	46.16	60.49	92.73	84.50	110.90	146.85
CEV	Average	35.15	68.51	184.53	378.51	520.52	161.29
	Std Dev	44.41	58.88	94.71	86.39	112.96	148.32
HW	Average	40.53	72.93	183.20	369.01	508.97	161.42
	Std Dev	48.87	59.51	91.02	83.58	111.76	143.27
Heston	Average	40.65	72.49	186.34	376.00	514.52	163.57
	Std Dev	45.08	55.92	89.59	82.83	111.79	144.07
Total		1416	1805	3214	669	351	7455

Table 5. Categorical Segregation of Option Pricing Models

	DOTM	OTM	ATM	ITM	DITM
Short Maturity (T≤30)	Heston	DVF	BS, DVF, GC, Heston	BS, DVF, CEV, Heston	BS, DVF, CEV, Heston
Medium Maturity (30<T≤60)	DVF, GC, CEV	DVF, CEV	DVF, GC, CEV, HW, Heston	BS, DVF, GC CEV, HW	BS, DVF, GC, CEV, HW
Long Maturity (T>60)	DVF, GC, CEV, Heston	DVF, Heston	Heston	BS, DVF, GC, HW, Heston,	Heston

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Consequential Effects of Defence Expenditure on Economic Growth of Saudi Arabia: 1970-2012

Mohammed M Ageli[1] & Shatha M Zaidan[2]

[1] Assistant Professor, King Saud University, Kingdom of Saudi Arabia

[2] Lecturer, Princess Nora University, Kingdom of Saudi Arabia

Correspondence: Mohammed M Ageli, Assistant Professor of Economics, King Saud University, Kingdom of Saudi Arabia. E-mail: m.m.ageli@gmail.com

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Abstract

This study investigates the causality relationship between defence expenditures and Non Oil economic growth in Saudi Arabia over the period 1970-2012. Using Unit root tests, Johansen's co-integration test and Granger Causality test. In this paper we found the existence of bi-directional causality relationship running from Non Oil-GDP to defence expenditure. The results show that, in Saudi Arabia, the model of defence expenditure is found to hold for Non Oil-GDP.

Keywords: defence expenditure, economic growth, unit root test, co-integration test, Granger causality and Error Correction Models (ECM)

1. Introduction

Defence expenditure is the large and significant sectors of government expenditure in all countries. It is used as a measure of the burden imposed on the people and the national economy by defence policy. The causality relationship between defence expenditure and economic growth shows a clearly causality in all countries. According to, Al-Jarrah (2005), defence expenditure diverts resources away from productive activities and leave adverse impact on economic growth. Devoting a large proportion of government expenditure to the military would leave other important sectors like education and health with less financial resources. Moreover, defence expenditure has not only economic implications, but also, and more importantly, defence as well as political aspects.

The ultimate Goal of the paper is to examine the causality relationship between defence expenditure and Non Oil-GDP in Saudi Arabia. The objectives are:

1) To determine whether a stationary long-run relationship exists between defence spending and Non Oil economic growth in Saudi Arabia.

2) To examine the causality between these two variables.

3) To determine how defence expenditures affected Non Oil economic growth in Saudi Arabia.

Therefore, the following hypotheses are:

H0: defence expenditure has no significant impact on Non Oil-GDP in Saudi Arabia.

H1: defence expenditure has significant impact on Non Oil-GDP in Saudi Arabia.

In addition, as part of the time-series analysis, the stationary properties of the data using the ADF test real Non Oil GDP and other variables were conducted. Followed by an analysis to test whether the variables are co-integrated. Finally, we have used the Error Correction Model (ECM) to discuss the short run adjustment to equilibrium.

The paper is organised as follows: section two, presents some empirical results of relevant theoretical and empirical literature on the relationship between government expenditure and economic growth. In section three of this paper, the defence expenditure model presented. Section three, investigates the data and empirical results and analysis by using identified methods. In addition, section four, presents results of the analysis by using time series techniques, while section five, concludes the paper and presents the finding.

2. Defence Expenditures in Saudi Arabia

Defence affairs are expenses related to the administration and operation of defence. Considering the geopolitical importance of the Middle East and the Gulf region and the instability associated with these regions, Saud Arabia has been investing in a great amount for the development of its defence and security forces. As mentioned previously, Gulf Wars had a huge impact and resulted in large burdens on Saudi Arabia's budget.

The ratio of defence expenditures in GDP has not shown secular trends, but rather followed ups-and-downs. As can be seen, in 1970 the ratio was about 6%, which increased to 8% in 1973. However, with the enormous increases in oil revenues in 1974 after the first oil shock and increased GDP, encouraged government to develop infrastructure projects in line with the increased GDP and therefore immediate adjustment witnessed in defence expenditure with the share of defence expenditure increasing to 9.5% in 1975, which reached a pick at about 10% in 1978. However, in 1980 it declined to 7% since 1975 due to the global recession as a result of oil prices. Immediately, in 1981 the increasing trend in the share of defence expenditures to GDP set in and reached to 9.5% in 1983. The declining trends in the ratio were observed from 1984 to 1989, falling to 7% in 1989 only with a pick in 1987 with 9%. The impact of defence expenditures can immediately see in 1990 and 1991 with the share of defence expenditures in GDP increasing to 12% and 13% respectively. Since then, a decreasing trend observed in the ratio of defence expenditures to GDP, until the present times. The share of defence expenditure in real GDP in Saudi Arabia was 13%, since 1991. The ratio of defence spending on defence fluctuated during 1990s. As we know the Gulf has witnessed three wars, which was a reason to increase the expenditures of defence in the Gulf.

Immediately after the war, the ratio fell down to about 10% and then followed a decreasing trend to 6% in 2009. In such a declining trend, rather than defence expenditures, growth in absolute level declining, high increases in GDP as the denominator due to the oil price plays an important role.

3. Literature Review

According to the previous empirical studies we have the different results namely, positive, negative and neutral. Regarding to that we had divided their findings into three groups:

The First group of empirical studies found positive effects of defence expenditure on economic growth. Atesoglu (2002) examined the relationship between the defence expenditure and aggregate output in the United State economy, by implementing a quarterly data for the period 1970 to 2000. He found a positive relationship between the variables. Most recently, in Turkey, Halicioglu (2004) also found a high correlation relationship between the level of economic growth and defence expenditure, by using data from 1950 to 2002. Benoit (1973, 1978) analysed the nexus between defence expenditure and GDP in 44 less developing countries. He found that defence military was positive correlated with economic growth. Aizenman and Glick (2003) examine the non-linear interactions between defence expenditure and growth, for 99 countries. They found that the effect of defence expenditure on growth is positive. Moreover, Brumm (1997) analysed the casualty relationship between defence expenditure and economic growth in 88 countries for the period 1974 to 1989. He used cross-section Barro regressions. His results indicated that there is a positive correlation between the growth nexus defence expenditure. Hassan et al. (2003) investigated the relationship between defence expenditure and economic growth and FDI in some countries in South Asian Regional Cooperation Council nations (SARCC) for the period 1980 to 1999. His results present a strong support for a positive relationship between defence expenditure and economic growth. Finally, Frederiksen and Mcnab (2001) studied the causality relationship between military expenditure and economic growth in Malaysia. They proofed that there is a clear positive relationship between military and growth.

The Second group found negative effects of defence expenditure on economic growth. Yildirim and Selami (2005) investigated the relationship between the defence expenditure and the degree of democracy for the period 1987-1997, on data for up to 92 countries. They found that there is a negative implication between the variables. Deger (1986) found a negative correlation between defence expenditure and economic growth in some developed countries. Lim (1983), Degree and Sen (1983), Faini et al. (1984) and others have found a negative relation between defence and growth. Moreover, Moon and Hyun (1992) in the context of Asia found negative implications between defence and growth. Klein (2004) found a negative effect of military expenditure on economic growth in Peru, indicating the existence of crowding-out effect. Also, Lipow and Antinori (1995) argue that defence expenditure has a negative causality on economic growth. Finally, most recently, Kentor, Kick (2008) explored a relationship between military expenditure and economic growth, by using cross-national panel data regression for developed and less developed countries from 1990 to 2003. The results show the negative relationship between military expenditure and GDP.

The Third group found mixed effects of defence expenditure on economic growth, which reached inconclusive results on the direction of causality relationship between economic growth and military expenditure, concluding. Selami and Yildirim (2002) examined the demand for Turkish defence expenditure for the period 1949-1998. They found that there is a mixed result. Their results suggested that the Turkish defence expenditure determined NATO's defence expenditure, and the short-run estimates have a significant relationship. Abu Bader and Abu Qarn (2003) examine the causality between defence expenditure and economic growth in Egypt, Syria and Israel. They found a negative impact between the military expenditure and economic growth in Egypt and positive caused in Syria and Israel. Also, Kollias et al. (2004a) found mixed results in the term of causal relationship between defence expenditure and economic growth on 15 EU countries. As well as, Study for Chowdhury (1991) who examined data for 55 developing countries and could not find any case supporting the relationship between defence expenditure and economic growth. Finally, Kim (1996) analysed "the relationship between military expenditure, the quality of life, and economic growth for 101 countries." He also found that military expenditure have no significant on economic growth.

4. Methodology and Data

The study will cover Saudi Arabia for the period from 1970 to 2011. The data sources are the Saudi Arabia Monetary Agency (SAMA), SIPRI defence expenditure database and International Monetary Fund Yearbook (IMF). (DEX) is measured by the Defence Expenditure as a percentage of GDP, for economic growth, it is measured by real Non Oil GDP (RGDP). All the data used in the study were transformed into logarithm. The data used in this study consist of the following variables (table 1).

Table 1. Variables Definitions

Variable	Definition
RNGDP	Real Non Oil Economic Growth
DEX	Defence Expenditure as % of GDP

In this study we have to use the model (equation 1):

$$LDEX = a + b\ LRNGDP \tag{1}$$

4.1 Stationarity and Unit Root Tests

The most widely used Unit Root analysis test is Augmented Dickey-Fuller (ADF) (1981) tests. ADF test is performed by estimating the following equation (2):

$$\Delta Y_t = a_0 + a_1 t + a_2 Y_{t-1} + \sum_{i=1}^{k} a_i Y_{t-1} + e_t \tag{2}$$

where ΔY = the first difference of the series; Y_t = is the series under consideration (GDP, government expenditures, or government revenues); t is the time trend, k is the number of lag and e_t is a stationary random error (white noise residual).

According to Charemza and Deadman (1992: 135) "the practical rule for establishing the value of [φ] ... is that it should be relatively small in order to save degrees of freedom, but large enough not to allow for the existence of autocorrelation in e_t. For example, if for [φ] =2 the Durbin-Watson autocorrelation statistic is low, indicating first order autocorrelation, it would be sensible to increase m with the hope that such autocorrelation will disappear". The simple formula in Dickey-Fuller tests establish whether β = 1 in the model (3):

$$Y_t = \beta Y_{t-1} + e_t \tag{3}$$

By deducting Y_{t-1} from each side of the equation in re-writing (4), the following form is established:

$$\Delta Y_t = \Omega\ Y_{t-1} + e_t \tag{4}$$

where $\Omega = \beta - 1$

Testing the hypothesis with β = 1 is equivalent to testing the hypothesis Ω = 0 (Enders, 1995:221). The hypothesis are:

$$H_0: \Omega = 0$$

$$H_1: \Omega \neq 0$$

These procedures are applied to each data time series in order to examine their stationary properties by conducting the tests in levels and first difference. It should be noted that failing to reject the null (H0) hypothesis

implies unit root process. However, if the outcome indicates that the series is stationary after the first difference; the series integrated of order one I(1), then the process is continued with the co-integration test.

In testing defence expenditure, the non-stationary property of the series must be considered first. There are many alternative tests available to examine whether the series are stationary or non-stationary. If the variables under investigation are stationary, this means that the variables do not have unit roots, then the series said to be 1(0). If the variables under investigation are non-stationary in its level form, but stationary in its first-difference form, which means that the variables do have unit roots, then they are said to be 1(1). In recent years, the many macroeconomic time series are non-stationary which means that they contain unit roots that cause many econometric problems. To test the relationship between defence expenditures and Non Oil economic growth in the case if Saudi Arabia; we used Augmented Dickey Fuller (ADF) (1979) method to test the unit root (equation 5).

$$\Delta y_t = \alpha + \beta y_{t-1} + \sum_{t-i}^{k} \Delta y_{t-i} + \varepsilon_t \tag{5}$$

4.2 Co-integration Test

In the time-series modelling, the co-integration test is carried out if there exists a stationary linear combination of non-stationary random variables. The aim of this test is to examine whether the data demonstrate a long-run relationship.

In brief, this test refers to the situation where multiple series integrate of order (d), or in other words, I(d) where (d) represent the number of unit roots contained in the series. These can combine to produce series integrated of order (k), where k can range from zero to d-1.

According to Engle and Granger (1987), the two series are said to be co-integrated of order (d, b) if Y_t is integrated of order (d) and there exists a vector, β, such that $\beta' Y_t$ is integrated of order (d-b).

An example of two co-integrated series behaves as in equation (6).

$$Y_t = \alpha + \beta X_t + e_t \tag{6}$$

If the residuals (et) from the regression are I(0), then Xt and Yt are said to be co-integrated and non-stationary. However, the linear combination is stationary. Thus, the series need to be in integration of the same order for co-integrated to be possible. In this research, the co-integration test is used to substantiate the econometric process in relation to each of the model tested.

Co-integration tests used to test the relationship between economic growth and defence expenditure. Granger (1980) was the first to propose a connection between non-stationary series and long-run equilibrium. The purpose of conducting co-integration is to explore whether the data exhibit a long-run relationship. Engle and Granger (1987) developed and introduced the theory of co-integration.

Johansen (1988), and Johansen and Juselius (1990) presented that the variables under investigate are performed for each version of Wagner's Law to search for the existence of a long-run equilibrium relationship between the two variables GE and Non Oil GDP.

4.3 Granger Causality Test

Granger Causality test is used for testing the long-run relationship between defence expenditure (DEX) and Non Oil GDP (NGDP) will be tested using time series data of Saudi Arabia data for the period 1970-2012. The Granger procedure is selected because it consists the more powerful and simpler way of testing causal relationship assuming that the two series contain all the information necessary for prediction X Granger-causes Y if lagged X's helps predict Y (Granger, 1980) equations (7), (8).

$$x_t = \alpha_0 + \sum_{i=1}^{r} \beta_{xt-i} x_{t-i} + \sum_{i=1}^{s} \beta_{yt-i} y_{t-i} + \varepsilon_t \tag{7}$$

$$y_t = \alpha_0 + \sum_{i=1}^{r} \beta_{yt-i} y_{t-i} + \sum_{i=1}^{s} \beta_{xt-i} x_{t-i} + \varepsilon_t \tag{8}$$

For equation 7, the following hypotheses are constructed:

$H_{0:}\ \beta_{xt-i} = 0$, for i = 1, 2,....., k

$H_{1:}\ \beta_{xt-i} \neq 0$, for at least one i

Thus, equation 7 is used to test whether (Y_t) Granger causes (X_t). For equation 8, on the other hand, the hypotheses to be tested are:

$H_{0:}\ \beta yt - i = 0$, for i = 1, 2,.....,k

$H_{1:}\beta yt - i \neq 0$, for at least one i

Consequently, equation 8 is used to test whether (X_t) Granger causes (Y_t). For variables under investigate in our study, we tested individually for the causality between the dependent variables defence expenditure DEX and Non Oil GDP (equation 9 and 10). But before doing that we have to check for the time series properties and especially co-integrating properties of the time series involved. As Oskooee and Alse (1993: 536) pointed out, "Standard Granger or Sims tests are only valid if the original time series from which growth rates are generated are not co-integrated."

$$RNGDP_t = \alpha_0 + \sum_{i=1}^{r} \alpha_{xt-i} RNGDP_{t-i} + \sum_{i=1}^{s} \alpha_{yt-i} DEX_{t-i} + \varepsilon_t \quad (9)$$

$$DEX_t = \beta_0 + \sum_{i=1}^{r} \beta_{yt-i} DEX_{t-i} + \sum_{i=1}^{s} \beta_{xt-i} RNGDP_{t-i} + \varepsilon_t \quad (10)$$

4.4 Error Correction Model (ECM)

When variables are co-integrated, a mechanism is required to correct their state, for which Engle and Granger (1987) provide such a procedure known as the 'Error-Correction Models' (ECM). The aim of ECM is to determine whether co–integration exists between two variables; there must be Granger causality in at least one direction, but the most valuable aspect is that co-integration does not reflect the direction of causality between the variables. The ECM is expressed as in equation (11) and (12):

$$\Delta Y_t = a_1 + \beta_1 ECT_{t-1} + \sum_{i=1}^{n} \delta_i \Delta Y_{t-1} + \sum_{i=1}^{n} \Omega_i \Delta X_{t-1} + e_t \quad (11)$$

$$\Delta X_t = a_2 + \beta_2 ECT_{t-1} + \sum_{i=1}^{n} \mu_i \Delta Y_{t-1} + \sum_{i=1}^{n} €_i \Delta X_{t-1} + e_t \quad (12)$$

where (ECT_{t-1}) is the error correction term lagged one period, is equivalent to $e_t = Y_t - \alpha - \beta X_t$, which represents the disequilibrium residual of a co-integration equation (Fasana and Wang, 2001).

According to Enders (1995: 376), the causality in the ECM is applied in three stages:

(a) Joint Hypothesis:

$H_{0:}\beta_1 = 0$, $H_{0:}\delta_i = 0$, for all (i) in equation (11),

or

$H_{0:}\beta_2 = 0$, $H_{0:}\mu_i = 0$, for all (i) in equation (12);

(b) Test the significance of (δ_i) and (μ_i) to check for the possibility of short run causality;

(c) Analysis of the direction of the $(\beta's)$ to see if they infer a long-run equilibrium relationship.

5. Empirical Results

In this paper, the empirical results introduced strong evidence in support of the relationship between defence expenditures and Non Oil economic growth in the case of Saudi Arabia.

5.1 Stationarity and Unit Root Tests

Unit-root tested for Augmented Dickey-Fuller test (ADF), as summarised in the table 2. According to the results, each variable for the period 1970–2011 indicates that the series are non-stationary in level but stationary after the first difference.

Table 2. Unit Root Tests for Non Oil GDP

Variables	ADF (0)	ADF (1)
L (Non Oil GDP)	–1.8562	–5.4882
L (DEX)	–2.5371	–4.5332
5% C-Value	-2.9565	-3.5953

Table 2, presents the stationary tests results showing that the variables are non-stationary in levels, but become stationary with the first difference; in other words, they are integrated in order one, when their first differences 1(1) are stationary. These results are consistent with the standard theory, which assumes that most macroeconomic variables are not static, but become stationary in the first difference (Enders, 1995).

5.2 Co-integration Test

In the next step, the co-integration test is applied to examine a long-run relationship between the variables by using the OLS test, and the results of which are illustrated in Table 3 for Non Oil real GDP.

Table 3. Co-integration Results for Non Oil-Real GDP, 1970–2011

Dependent Variables	Coefficient	T-Stat	Probability	R^2	DW
L (DEX)	1.451	37.12	0.005	0.903	0.890

Table 3 presents the co-integration test results for the time-series data 1970–2011 used in this study. They show that there is a long-run relationship between government expenditure (DEX) and economic growth (GDP) for Non Oil real GDP in Saudi Arabia. The variable used for the period 1968–2011 indicates that the series are non-stationary in level, but stationary after the first difference, which suggests that they are I (1).

The following section tests and reports the findings after the co-integration test for Non Oil real GDP using the Johansen co-integration test. The existence of a co-integration vector is pointed out by a trace test since the t-test value exceeds the critical value of 5% level of significance. This means that co-integration tests are statistically significant at 5% level of significance for determining the long-run relationship between all variables. Otherwise, there is a long-run equilibrium relationship between real Non Oil GDP and DEX.

Table 4 shows that there is a long-run equilibrium relationship between Non Oil real GDP and defence expenditure at 5% levels. Thus, the null hypothesis of co-integration is rejected with respect to Non Oil real GDP because the trace statistics values are greater than the critical value of 5%. Co-integrated relationships exist with respect to real Non Oil GDP in the case of Saudi Arabia, an even stronger result indicating that the defence expenditure and real Non Oil GDP are subject to an equilibrium relationship in the long run.

Table 4. Johansen Co-integration Test Results with Non Oil-GDP

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	Critical Value 5%	Prob
None	0.2417	21.1923	15.41	0.0000
At most 1	0.1966	7.5360	3.76	0.0000

The Johansen and Juselius (1990) test reveals a co-integration relationship in all versions. Therefore, Granger-Causality in the framework of the Error Correction Model is applied.

5.3 Granger Causality Test

For supporting defence expenditure model for Non Oil GDP, causality analysis is considered to apply for testing the directions of the variables. Granger causality tests used to confirm the causality direction between the variables. In the long run, we found statistically significant evidence in favour of GDP Granger-causing the share of defence expenditures in GDP. The result of causality test indicated that the existence of strong feedback causality for all variables of defence expenditure model in the long run.

In relation to the aims of research, the analysis showed clear evidence and consistent results across the model of defence expenditure that there is a significant or causal relationship between, defence expenditure and Non Oil GDP, in the case of Saudi Arabia.

The results established for the causality from defence expenditures (DEX) to economic growth. Therefore, in such cases, bi-directional causality is found.

Table 5. Standard Granger Causality Test Results

Null Hypothesis	F-Stat	Prob
LRNGDP does not Granger Cause LDEX	4.2451	0.041
LDEX does not Granger Cause LRNGDP	2.7453	0.152

5.4 Error Correction Model (ECM)

The next section extends the analysis into Error Correction Mechanism (ECM) in order reveal the short-run adjustment. Thus, the model of defence expenditure has found to hold for Non Oil-GDP in table 6 in the case of Saudi Arabia.

Table 6 shows a bi-directional causality that runs from Non Oil-GDP to DEX this product of empirical analysis indicates that the variables used in each of the models DEX, and Non Oil-GDP is statistically significant at the 5% level. Thus, in Saudi Arabia, the model of defence expenditure is found to hold for Non Oil-GDP.

Table 6. Causality with ECM Test with Non Oil-GDP

Variables	ECT_{t-1}	T-stat
L (DEX)	-0.575341	-3.631
L (Non Oil GDP)	-0.186450	-1.728

6. Conclusion

Our major aim in this paper was to investigate the relationship between defence expenditure (DEX) and Non Oil economic growth (NGDP) using annual data for period 1970 to 2011.

In extending the analysis, the unit root test in the form of Augmented Dickey-Fuller is utilised to examine stationary of the time-series of all the variables. The results indicate that the levels of all series are non-stationary, and hence all the variables are co-integrated at the first order [I(1)].

The results suggest that there is a co-integrating relationship between defence expenditure and Non Oil GDP, and holds in the case of Saudi Arabia through the co-integration analysis. Therefore, the equilibrium relationship indicates that the major determinant of defence expenditure in Saudi Arabia, in the long run, is national income.

The econometric analysis further employs the Granger causality test in order to verify the causality and its direction between the variables. The results demonstrate statistically significant evidence in favour of Non Oil GDP for the long-run relationship. In addition, it is found that Granger-causing the share of defence expenditure in GDP. This finding is consistent with the expectation of the model of defence expenditure. Thus, the result of the causality test indicates the existence of strong feedback (bi-directional) causality for all variables of the model of defence expenditure in the long run.

Lastly, by using the Error Correction Model (ECM), it is established that the variables of the model of defence expenditure are significant for Non Oil-GDP in the case of Saudi Arabia. This suggests a short-run adjustment process towards long-run equilibrium.

In conclusion, the government should focus on the other sectors and activities such as education, health, and other social programmes. The development plan must take into account how the function of each group complements the functions of the others.

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Inflation Dynamics and Returns on Equity: The Nigerian Experience

Prince C. Nwakanma[1] & Arewa Ajibola[2]

[1] Department of Finance and Banking, University of Port Harcourt, Nigeria

[2] Department of Banking and Finance, Lagos State University, Nigeria

Correspondence: Prince C. Nwakanma, Senior Lecturer and the immediate past Head of Department of Finance and Banking at the University of Port Harcourt, Nigeria. E-mail: nwakanma5@yahoo.com

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Abstract

Inflation in a developing economy is a dynamic force that shapes equity investment decisions. Equity being a variable income security has the potential of hedging inflation. This study examines inflation dynamism and equity returns using monthly data sourced from the various volumes of Central Bank of Nigeria (CBN) Statistical bulletin and Nigerian Stock Exchange (NSE) daily official list for a period of thirty- six months. The study utilizes the unrestricted vector autoregressive (UVAR) mechanism to examine the nature of the relationship between inflation and rate of return on equity. It was observed that inflation rises faster than rate of return on equity; and the nature of the relationship between inflation and return is found to be inconsistent over time. Furthermore, there are no causal effects between past inflationary rates and rate of return; though such effect is evident between current rates of inflation and immediate previous stock returns. Thus, the study recommends that Nigerian government should attempt to synchronise its monetary and fiscal policies in order to achieve stability in the economy. Also private sector productivity should be enhanced to reduce inflation and make returns on equity more attractive.

Keywords: inflation, return on equity, UVAR

1. Introduction

Conceptually inflation refers to the persistent rise in prices of goods and services over a period of time. A moderate presence of inflation in the economy is considered a necessary condition because of its positive effect on economic activities. However a high rate of inflation can be detrimental to investment. The import of this is that the return on investment (i.e. equity, bond or real estate) can be significantly influenced by inflation. The notion about the relationship between inflation and return on asset/equity was first developed and celebrated by (Fisher, 1930). This was called the Fisher effect which explained the relationship between asset returns and inflation. For a period of forty years, starting from 1930 to 1970, this effect remained as the logical explanation for equity-inflation relationship, as it reinforced the doctrine that an asset's underlying value can be maintained in the presence of inflation. Ely and Robinson (1997) used the data extracted from 16 industrialized economies to test the nature of the relationship between stock return and inflation, and found that stock market prices maintain their value in the face of inflation. Similarly, Luinted and Paudyal (2006) based their analysis of inflation-return relationship on the different sectors within the UK stock market and established an evidence to support the Fisher economic hypothesis, which is referred to as the "Fisher effect".

However, many studies seem to cast doubts on the empirical standing of Fisher's hypothesis as conflicting results trail the return-inflation relationship. These apparent inconsistencies in findings are well documented (Nelson, 1975; Jaffee and Mandelker 1976; Bodie 1968; Fama and Schwert, 1977; Modigliani and Cohn, 1979). The implication of these findings is that stock returns and inflation are inversely related. More recent studies tend to support the evidence of negative relationship between stock return and inflation, Sharpe (2002), Campbell and Vuolteenaln (2004), Chordia and Shivakumar (2005) and Basu et al (2005). This extant relationship is commonly referred to as the "Fed Model" of stock pricing (Estrada, 2009). In this respect, Estrada (2009) suggests that this negative relationship between the stock market price-earnings ratio and government bond yields is now seen by practitioners as conventional. Practitioners have argued that bond yields plus risk premium equate to nominal yield on stocks and that actual stock yield tends to revert to this nominal yield,

Campbell and Vuolteenaln (2004). It is proposed by Asness (2003) that the model erroneously compares the real magnitude of the earnings-price ratio to nominal government bond yields.

Given the divergent opinions regarding the Fisher effect and Fed model, the aim of this study is to shade more light on the relationship between inflation dynamics and stock returns in Nigeria, as an example of a developing economy. Having introduced the study, the rest of the paper takes the ensuing structure: section two is a review of literature. Section three dwells on methodology and data; while empirical results, conclusion and recommendation are respectively presented in sections four, five and six.

2. Literature Review

Traditionally, it was believed that stocks provide a good hedge against inflation because as variable income securities their returns should compensate for any changes in inflation. In recent years, empirical research shows that inflation affects stock returns negatively (Sharpe 1999). In the United States, high expected inflation and accelerating inflation have been associated with decreasing price/earnings ratios. Stocks seem to be better hedges against inflation in the medium-term and long- term compared to the short-run.

However, Fisher (1930) argues that return on assets move one – for – one with anticipated inflation. That is, stocks should be inflation neutral but stock prices react negatively to high unexpected inflation. Fisher reasons that real stock retunes are related to real factors and those stocks should maintain their purchasing power in the long-term. Fama and Schwert (1977) argue that anticipated inflation negatively affects stock returns during the period 1953-1971 and conclude that stocks are not good hedges against inflation. Cohn and Modigliani (1979) argue that U.S investors undervalue stocks because they discount (mistakenly) future real cash flows by using nominal rates of return. They use quarterly data over 1953-1977 on price /earnings ratios and inflation rates in their analysis.

Lansing (2004) confirms the behavioral anomaly of investors discounting future real cash flows by nominal rates of return. It is well established in the literature that rising inflation and future real economic growth are negatively correlated. During the 1970s, the U.S. experienced a decline in economic activity when inflation was rising, (Hoguet, 2009). This view is confirmed by Fama (1981), who argues that stock returns are positively related to the expected real rate of economic growth. Future real economic growth is on the other hand, associated with low inflation rates. When future economic growth (in real terms) is expected to decline due to high inflation, investors required higher risk premiums on their stocks.

The negative short-term relationship between stock returns and anticipated and unanticipated inflation is reported by Geske and Roll (1983) and Jaffe and Mandelker (1976) and Wei (2009). Wei observes that the negative reaction of stock returns to unanticipated inflation is higher during economic contractions than expansions. On the other hand, the long – run positive relationship (Fisher effect) is reported by many authors. Jaffe and Mandelker report positive relationship over a long period (1875 -1970). Boudoukh and Richardson (1993) confirm the same result applying one-year and five- year holding period returns during 1802-1990 in both the United Kingdom and the United States.

Anari and Kolari (2001) use stock prices and goods prices instead of the first difference in order to overcome the problem that the first difference eliminates the long – run information. They use monthly stock price indices and goods price indices for Canada, France, Germany, the United Kingdom and the United states during 1953-1998. They employ the co-integration technique developed by Johansen (1988) for the goods prices and stock prices which they discover are co-integrated and stationary at level data, confirming the long memory Fisher effect which says that stocks are good inflation hedges over a long holding period. However, they also report the negative initial effect in all six countries. Luintel and Paudyal (2006) support previous results and report the existence of the long – run hedging relationship in the UK stock market.

Although the short-run negative effect (the inflation illusion as named by Modigliani and Chon (1979)) and the long – run hedging Fisher effect are well established in empirical research, Ely and Robinson (1997) do not find any long – run relationship. They apply the Johansen's (1988) method on sixteen countries during 1957-1992. Aga and Kocaman (2006) tested the impact of price/earnings ratios, industrial price indices (IPI) and the consumer price indices (CPI) on returns of stocks traded in Istanbul stock Exchange. They claim that macroeconomic variables such as inflation rates should have two possible effects. The direct effect hypothesis implies that stock markets normally react negatively to bad news and positively to good news. The policy signaling hypothesis implies that it is possible for the market to react positively to adverse movements in macroeconomic variables due to anticipated government remedial actions.

Their findings indicate that only the price/earnings ratio appears to be significant in explaining the movements in stock returns, while industrial price indices and consumer price indices are not. Exponential GARCH model was applied to test the impact of CPI and IPI on stock return and volatility. They also found that these variables are not statistically significant in explaining stock returns and volatility.

3. Methodology and Data

This study adopts an unrestricted vector autoregression (UVAR) frame work which was pioneered by Sims (1980) as a dynamic model that shows time series relationship among macroeconomic variables. Thus, in this study UVAR technique is used to analyse the dynamic relationship between inflation and stock returns. The stochastic form of the model is stated below:

$$In = \lambda_0 + \lambda_1 \sum^{n}_{t=0} \quad In_{(1-t)} + \lambda_2 \quad \sum^{n}_{t=0} \quad \prod_{(1-t)} + \varepsilon_t \; ; \; t=1,2,\ldots\ldots\ldots n$$

Where: In presents rate of inflation

$\prod$ represents return on equity

$\sum$ represents summation

λ_0, λ_1 and λ_2 are the regression parameters

And ε_t is the error term.

This study covers the Nigerian equity market and uses monthly consumer price index (CPI) and monthly stock returns which are respectively obtained from CBN Statistical bulletin and Monthly stock Review of Nigerian Stock Exchange (NSE). The sample period begins in January 2007 and ends in December 2009 with a total number of observations of 36. Based on the literature on this subject, Aga and Kocaman (2006); we infer that our sample size is relatively large to provide robust and reliable results on our UVAR test.

4. Estimation and Empirical Results

In order to gain deeper insight into the dynamic relationship between inflation and stock returns in Nigeria, the study adopts a two-stage analysis comprising of descriptive statistics and inferential statistics. The essence of the descriptive view of the nature of inflation and stock returns is to have an impression of the general behaviour of the variables. The descriptive statistics for the study include mean, minimum, maximum, skewness, kurtosis and Jarque-Bera. The outputs results obtained in respect of these statistics are reported in Table 1 below.

Table 1. The results of selected descriptive statistics

Statistic	In	In(-1)	In(-2)	In(-3)	$\prod$(-1)	$\prod$(-2)	$\prod$(-3)
Mean	73.31	65.52	58.06	50.87	0.24	0.27	0.24
Minimum	2.36	2.15	1.89	1.87	-0.46	-0.16	-0.16
Maximum	181.3	173.50	167.40	157.10	0.58	0.58	0.51
Skewness	0.44	0.54	0.64	0.72	-0.99	-0.54	-0.46
Kurtosis	1.83	1.98	2.16	2.31	3.49	2.28	2.02
Jarque-Bera	2.04	2.13	2.28	2.28	4.00	1.61	1.74
Probability	0.36	0.34	0.32	0.32	0.14	0.45	0.42
Observation	23	23	23	23	23	23	23

Source: Computed from E-View Programm

Table 1 shows the values of skewness, kurtosis and Jarque –Bera statistics for inflation and return on equity at levels and at different lag structures. The values are not found to be significant as revealed by their probabilities which are obviously larger than five percent (5%). This means that overtime the rates of inflation and returns on equity are not normally distributed in Nigeria. The minimum and maximum values in Table 1 shows that inflation rates and returns on equity have been increasing persistently over time in Nigeria; the average values of returns on equity under the period of analysis are found to be very low: while the average value of inflationary rates appears to be high for an emerging economy like Nigeria to sustain growth (see these values in Table 1). It can be seen from these results that inflation increases at faster rate than return on equity, which is an indication that equity investors in Nigeria are not getting adequate protection from the ravages of inflation in the economy.

The next phase of the study is to determine the relationship between inflation and return on equity. Since the study uses time series data it is important to test for stationarity to avoid the use of non-stationary data and the

spurious results that will arise. In doing this, Im Pesaran and Shin W-stat, Augumented Dickey Fuller (ADF)-Fisher Chi-Square and Philip Paron-Fisher Chi-square Tests are conducted. As can be seen from Table 2, the probability values at levels I(0) are 0.49, 0.04 & 0.05 for Im Pesaran and Shin W-Stat, ADF-Fisher-Chi-Square and PP-Fisher-Chi-Square respectively. Also, the probability values at first difference I(1) for these three tests are 0.07, 0.06 & 0.07 respectively. In all cases the probability values are larger than one percent (1%).This indicates that the Null hypothesis that there is no unit root is not rejected. But however, considering the 5% level of significance, the series are stationary at levels and at first difference, except in the case of Im Pesaran and Shin W-Statistical Test. Based on this test the series of the specified variables fail the condition of testing for cointegration. We therefore utilize the Unrestricted Vector Autoregressive (UVAR) mechanism for analyzing the nature and magnitude of the relationship between inflationary rates and returns on equity at different lags.

Table 2. The unit root test results

Test Type	Lag(-1) Stat Value	P.V	Lag (0) Stat Value	P.V
Im Perasan and Shin W-Stat	-1.49	0.07	-0.03	0.49
ADF-F isher Chi-Square	9.02	0.06	9.79	0.04
PP-Fisher Chi-Square	8.68	0.07	9.54	0.05

Note: PV means probability value

Source: Computed from E-view Programm

The nature of the relationship between inflation and equity return is an important determinant of economic growth. Thus, the analysis and estimation of this relationship is carried using UVAR mechanism. The results obtained are presented in Table 3

Table 3. Unrestricted vector autoregressive results

Variables	In(-1)	In(-2)	∏(0)	∏(-1)	∏(-2)
coefficient	1.55	-0.52	9.23	-3.61	4.98
	(0.21)	(0.22)	(3.95)	(4.30)	(4.46)
	[7.55]*	[-2.34]*	[2.34]*	[-0.84]	[1.12]

R-square= 0.99, F-Statistic =912.98; Note- the figures in parenthesis are the standard error and t-values, * denotes significant at 5%.

Table 3 reports the results of the estimated UVAR equation at five percent level of significance using one tale test. The coefficients of inflationary rate at lag one is 1.55 and at lag two is -0.52 and their corresponding t-values are 7.55 and -2.34 respectively. In comparism, t-values are larger than the critical t-value 2.10 at 5%. This implies that previous rate of inflation are significantly related, reveal that the nature of the relationship between the present and past inflationary rates are inconsistent over time; since the coefficient of the lag rate is positive while that of the lag two is negative. This could be as a result of policy implementation to tame inflation. Thus, in Nigeria, present and past inflationary rates are both positively and negatively related. In the same token, current return on equity has a coefficient of 9.23 with observed t-value of 2.34 at 5% level of significant. This equally suggests to us that moderate level of inflation is significant to boost stock returns in Nigeria. However, the previous stock returns are found to be inconsistent in their nature of relationships with inflationary rates. This instability is probably due to faulty and mal-adjusted monetary/fiscal policy.

It is plausible to determine the direction of between inflation rate and return on causality between inflation rate and return on equity. In view of this, the study employs Granger Causality test to investigate whether inflation Granger causes return or vice-versa. The results obtained from this test are presented in Table 4

Table 4. Granger causality test results

Null Hypothesis	Obv	F-Statistic	P.V
∏ does not Granger cause In	24	0.30	0.74
In does not Granger cause ∏		1.32	0.29
∏(-1) does not Granger cause In	23	0.09	0.91
In does not Granger cause ∏(-1)		5.28	0.02
∏(-2) does not Granger cause In	22	0.28	0.76
In does not Granger cause ∏(-2)		0.03	0.97
∏ does not Granger cause In	23	2.50	0.11
In (-1) does not Granger cause ∏		1.39	0.28
∏(-1) does not Granger cause In(-1)	23	0.72	0.50
In (-1) does not Granger cause ∏(-1)		1.43	0.27
∏(-2) does not Granger cause In (-1)	22	0.18	0.83
In (-1) does not Granger cause ∏(-2)		1.24	0.31
∏ does not Granger cause In(-2)	22	1.20	0.32
In(-2) does not Granger cause ∏		2.09	0.15
∏(-1) does not Granger cause In (-2)	22	1.49	0.25
In (-2) does not Granger cause ∏(-1)		1.69	0.25
∏(-2) does not Granger cause In (-2)	22	0.78	0.48
In (-2) does not Granger cause ∏(-2)		0.68	0.52

Source: Computed from E-View Programm

A quick view of the Granger Causality Test results on Table 4 shows that the observed F-Statistics are smaller than the critical F-value (2.74) at 5% level of significance in all the rows except in row two where the observed F-value is found to be 5.28. The results depicted in the second row imply that there is unidirectional causality effect between current inflation and return on equity at lag one with the direction of flow tricking down from the rate of inflation. Conversely, the results obtained in all other rows indicate that there is no causality between lagged inflation and return. It simply means that previous inflationary rates do not Granger cause previous/ past returns on equity. Thus, maintain zero causality.

5. Summary and Conclusion

The study examines the relationship between inflationary rates and returns on equity using the UVAR mechanism. The results obtained provide an evidence to support the assertion that there is inconsistency in the nature of the relationship between inflation and returns on Equity in Nigeria. Our findings further shows that the rates of inflation and returns on equity have been increasing over time; but inflation rates rise faster than the returns on equity. In fact, the margin is found to be significant and detrimental to economic growth in Nigeria. Finally, we discover that there is no causal effect between previous inflationary rates and previous returns. This means that past rates of inflation do not Granger cause past return. However, a unidirectional effect is evident between current inflation and return at lag one with the direction of flow trickling down from inflation. Thus, current inflation Granger cause immediate past return on equity in Nigeria.

6. Recommendations

The study recommends that Nigerian government should attempt to synchronise the nation's existing monetary and fiscal policies so as to achieve greater economic stability. The Nigerian private sector should enhance productivity in order to rein in on inflation and generate real growth in return on equity. If the divergence between inflation and return on equity can be narrowed down it will stimulate economic growth and development. It will also create greater impetus for capital market activities in Nigeria.

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Boards' Gender Mix as a Predictor of Financial Performance in Nigeria: An Empirical Study

Victor Chiedu Oba[1] & Musa Inuwa Fodio[2]

[1] Department of Accounting, Nasarawa State University, Keffi, Nigeria

[2] Department of Accounting ,University of Abuja, Nigeria

Correspondence: Victor Chiedu Oba, Department of Accounting, Nasarawa State University, Keffi, Nigeria. Tel: 234-70-5742-0645. E-mail: oba156@yahoo.com

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Abstract

This study investigates the predicting power of a board's gender mix on financial performance by using a cross sectional data analysis. Existing literature on this subject is scanty in emerging economies and to the best of the authors' knowledge; this is the first of its kind in the Nigerian context. Return on capital employed was utilized as measure for financial performance while female director presence and proportion of female directors were proxies for gender mix. The findings show that both female director presence and proportion have positive impacts on financial performance while the board size, a control variable had a neutral effect. The study recommends that managerial and legislative efforts be made to strike a fair gender balance in boards and further research be carried out along this line.

Keywords: gender, resource dependency, corporate governance, performance, agency

1. Introduction

Corporate Governance has long been a popular issue among corporations, governments, investors and scholars; especially after the recent corporate scandals of the Enron, World com and Halliburton to mention a few. It has now been established that corporate governance is a very important issue for organizations, investors, and even governments and has aroused interest and awareness globally (Man and Kong, 2011).

A study by McKinsey and Company (2002) revealed that majority of investors are prepared to pay a premium for companies with higher corporate governance standards; consequently, the corporate governance rankings of companies are also one of the considerations of investors when evaluating stock prices (Berthelot, Morris, and Morrill, 2010). In the context of Corporate Governance, board of directors is the shareholder's first line of defense. Board members are the individuals that shareholders rely on to ensure that their investment is protected and well managed (Brennan, 2010). This makes the board of directors one of the most critical internal Corporate Governance mechanisms. The composition of corporate boards is of vital importance within corporate governance as it pertains to identifying structures that align the interests of management and stakeholders (Rose, 2007). According to Fama and Jensen (1983) and Hermalin and Weisbach (2003), the firm's board is by far the most important internal control device seeking to control management and deter it from opportunistic behavior. The discussion of board composition has focused extensively on various board attributes and how to ensure the independence of corporate boards; however, in recent years, the issue of governance diversity has gained tremendous interest in governance literature.

It is believed that good corporate governance is positively associated with board diversity (Carter, Simkins, and Simpson, 2003). Proponents of board diversity claim that diversity at the boardroom improves decision making process and financial performance (Rhode and Peckel, 2010).Observable attributes of board diversity according to Milliken and Martins (1996) refer to gender, age, race and ethnic background. Accordingly, gender diversity becomes one of the focuses of the studies. In recent years, gender diversity has become a highly debated governance issue which has caught the attention of policy makers, shareholders, and academia (Johansen, 2008). The academia and policy makers are more interested in the financial implications of gender diversity. Gender diversity in boardrooms has been associated with corporate Governance and firm performance and has become an issue of investigation.

This is an area in which little is known: - If a possible link exists between a board's gender mix and performance of the firm.

Certain countries have begun implementing a gender quota system in their business settings. This is a recent development. In an exploratory study, Hoel (2008) identifies Norway as the most widely known example of corporate board quotas where a 40 percent gender quota for public limited and state owned companies was introduced in December, 2003. Other countries that have introduced such legislated gender quotas are inter alia Span (2007), see De Anca (2008); France, Iceland and Netherlands (2010), see Marinova , Platenga, and Remery(2010).

The gender quota issue is also being discussed in Belgium, Canada and Italy where laws are pending at different stages of the ratification process (Sealy, Singh, and Vinnicombe, 2008).

This development seems alien to the developing economies. In Nigeria, no such law exists or is being deliberated. The vision 2020 (National Technical Working Committee on Corporate Governance and Corporate Social Responsibility) which was discarded before implementation only advocated for greater participation in Corporate Governance matters but was without specifics. However, the world has been termed a global village and as such 'what goes around, comes around'. It is expected that this phenomenon would be an issue for consideration and deliberation in the nearest future. It is therefore timely at this point to ascertain in clear and empirical terms if board gender mix has an impact on firm financial performance or if it is just a symbol without bottom line effects.

2. Prior Research and Hypotheses Development

Carter et al. (2003) were one of the first to analyze the impact of board diversity on firm performance. Shortly after, Catalyst (2004), the leading U.S non profit organizations working to advance women in business, studied the effect of gender diversity in top management on firm performance. Subsequently, numerous academics engaged in analyzing the relationship between gender diversity on the board of directors and firm performance. Bernardi and Thread Gill (2010) in their study reveal that the benefits of having female directors translate into financial success as well. In other words, new ideas and perspectives trigger sales and eventually profits.Nguyen and Faff (2007) reveal the positive relation between female presence at boards and financial performance in Australian firms. Researchers who studied Spain and Holland found similar results that exhibit the positive relation between financial performance and female board representation (Campbell and Minguez-Vera, 2008; Luckererath and Rovers, 2010). Carter et al (2003) argue that the level of gender diversity on a board of directors is directly associated with shareholder value.

The presence of multiple women directors is associated with higher revenues, according to a study by catalyst (1997) of the fortune 500 firms, where the top 100 firms by revenue are twice likely to have multiple women on board compared to the top 100 bottom companies. Similarly, Campbell and Vera (2008) studied the Spanish firms using panel data analysis; they found that gender has a positive effect on firm value and that the opposite casual relationship is not significant. In the same vein, Kang, Ding, and Charoenwong (2010) have found that investors generally respond positively to the appointment of women directors in Singaporean firms. Their study examines whether investors react systematically to the different positions that women directors hold on corporate boards, a question that has received little attention in prior studies.

Erhardt, Werbel and Shrader (2003) point out a positive link between gender diversity and firm performance (using ROA and ROI as proxies) for a sample of large firms in fortune magazine. Similar results are found with Hussein and Kiwia (2009) who employ the Shannon index as a proxy for gender diversity. On the other hand, Shrader, Blackburn, and Iles (1997) find no significant influence of the percentage of women on board in relation to financial performance as measured by the profitability ratio. Darmadi (2011) documents a negative effect of the level of female board representation on accounting based performance of ROA. Using ROA and cumulative stock returns as measures of performance, Dobbin and Jung (2011) conclude that gender diversity has a negative and neutral effect on performance.There are also several studies that find negative or no relation between gender diversity and firm performance (Zahra and Stanton, 1988; Adams and Ferreira, 2009, Wang and Clift, 2009).

The role of board gender mix has been ignored in developing economies where gender discrimination is a wide spread cultural ill (Mirza, Mahmood, Andleeb, and Ramzan, 2012). Empirical evidence on impact of women directors on finance performance in emerging economies like Nigeria is non-existent. This present study is thus poised as a humble attempt in fertilizing the virgin minds of researchers along this line and providing solid statistical evidence of the impact of boards' gender mix on firm performance. To achieve the objective of this study, it is reasonable at this point to state the following hypotheses in their null form:-

H_1: The presence of a female director has no significant impact on financial performance.

H_2: The proportion of women directors has no significant impact on financial performance.

H_3: The blau's index of heterogeneity has no significant impact on financial performance.

H_4: Board size has no impact on the gender mix financial performance relationship

2.1 Theoretical Underpinnings

Resource dependency theorists examine the provision of resources as the main function of the boards of directors as they explore the relationship of the board capital as the antecedent of this function with firm performance (Gkliatis, 2009). According to Terjesen, Sealy, and Singh (2009), resource dependency theory views firms as operating in an open system that needs to exchange and acquire certain resources in order to survive.

Diversity scholars use the resource dependency lens to argue that today's increasingly complex business terrain requires leadership from individuals who can make available resources which include legitimacy and diversity. On the other hand, the agency theory describes the relationship that exists between the principal and the agent. A common assumption of this theory is that a diverse board will act independently and objectively and would also serve as good monitors for shareholders' interest (Hillman and Dalziel, 2003).

This study is anchored on both the resource dependency and agency theorists.

3. Methodology

This study uses a survey research design. The population of the study is made up of companies listed on the floor of the Nigerian stock exchange; however, firms belonging to the financial and utility services are excluded from the population. This is because of the special regulatory environment in which they operate. A sample of thirty (30) quoted companies for the period 2005-2007 was used. This sample is considered a good representation of quoted companies in Nigeria since it covers all sectors on the exchange except the financial and utility services. More so, the sample selection conforms to the arguments of Emory and Cooper (2003), that the ultimate test of a sample design is how well it represents the characteristics of the population it purports to represent. Also, the sample size is in line with Hair, Anderson, and Tatham (1987) sample size determination. Data was obtained from annual reports of sample firms.

3.1 Dependent Variable

Financial performance in this study is represented by ROCE-Return on capital employed. This is measured as profit before interests and tax to Net Capital employed. The choice of this performance measure arises because it has evolved considerably over the course of the past decade and has enjoyed periods of popularity.

3.2 Independent Variables

1. Female director presence is measured as a dummy with a value of O if none and 1 if any female director exists.
2. Proportion of female directors on the board to board size
3. Blau's index: This is the degree of heterogeneity of the gender mix named after Blau, P.M (1977). It is a commonly used diversity index to measure evenness and heterogeneity. It is specified as follows:-

$$1-\sum_{i=1} P_i^2 \quad (1)$$

Where P_i= Percentage of board members in each category.

And n = Number of categories

Gender is a dichotomous variable and as such the range of the Blau index is 0 to 0.5 which means the closer to 0, the less diverse; and the closer to 0.5, the more diverse.

3.3 Control Variable

Schnake, Williams, and Fredenberger (2006) argue that the number of women on boards of directors interacts with board size such that the fewer the number of women on boards and the larger the board, the poorer the financial performance of the firm. Board size is measured as the number of directors on the board. This study controls for board size using the combinatorial method.

3.4 Model Specification

The regression model employed to test the relationship between the Board gender mix and firm performance is as follows:-

$$ROCE_{it} = \beta_0 + \beta_1 PRESENCE_{it} + \beta_2 PROPORTION_{it} + \beta_3 BLAU_{it} + \beta_4 SIZE_{it} + eit. \quad (2)$$

Where:-

ROCE = Return on Capital Employed

B_o = Intercept Coefficient

PRESENCE = Presence of a Female Director

PROPORTION = Proportion of Women directors to board size

BLAU = Blau's Index of Heterogeneity

SIZE = Board Size

eit = Gaussian white noise

4. Discussion on the Results

Based on the descriptive statistics (refer to Table 1), Return on capital employed (ROCE) with mean value (0.26) shows that return on every 100 Naira of capital employed in sample firms is 0.26 Naira.

There was an average of 9 directors on each sample firm's board while 44.4% of the sampled firms had a female director on the board of directors. However, the extent of gender heterogeneity derived by the Blau's index was found to be an average of 10.1 while the proportion of non-executive directors on the boards was an average of 60% of total directors.

Table 1. Descriptive statistics

	MEAN	STD.DEVIATION	N
ROCE	.2355	.44024	90
FPRES	.4444	.49969	90
BLAU	.1014	.12387	90
PROPORTION	9.0667	2.43477	90
SIZE	.0599	.8057	90

A normality test was performed to determine that the dependent variable was normally distributed. The kolmogorov-smirnov and Shapiro-Wilk Normality test was conducted. However, emphasis was placed on the Shapiro-Wilk test since the sample is not asymptotic.

Table 2. Tests of normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig	Statistic	df	Sig
ROCE	.206	90	.000	.797	90	.000

a, Liliefors significance Correction.

Both Kolmogorov-Smirnov and Shapiro-Wilk Test revealed that Return on capital employed measures was not normally distributed with the significant values less than 0.05. In general, significant values less than 0.05 is considered as good evidence that the data set is not normally distributed. A violation of the assumption of normality invalidates many other statistics like correction coefficient, t-test and related statistics (Brown, 1997). To treat such non-normality, a logarithmic (base 10) transformation was performed.

$ROCE = Log_{10}$ (ROCE)

Another normality test (Table 3) revealed that the transformed measures produce normal distribution with significant values well above 0.05. Furthermore, values of skewness and kurtosis also fell within the permitted range of below two.

Table 3. Tests of normality after logarithmic transformation

	Kolmogorov-Smirnov (a)			Shapiro-Wilk		
	Statistic	df	Sig	Statistic	df	Sig
ROCE	.077	80	.200*	.792	80	0.71

a. Liliefors significance correction

*This is a lower bound of the true significance

Table 4. Correlations

	ROCE	FPRES	BLAU	PROPORTION	SIZE
ROCE	1	.201	.139	-.230*	.042*
SIG. (2TAILED)		.058	.190	.029	696
FPRES	.201	1	.721**	.333*	.197
SIG. (2TAILED)	.058		.000	.001	.063
BLAU	.139	.721**	1	.328***	.089
SIG (2TAILED)	.190	.000		002	.404
PROPORTION	-.230*	.333**	.328**	1	-.202
SIG (2TAILED)	.029	.001	.002		.057
SIZE	.042	.197	.089	-.202	1
SIG(2TAILED)	.696	.063	.404	.057	

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

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

The correlation matrix in Table 4 reveals a number of significant correlations among the variables. As shown, the highest Pearson correlation coefficient was between the female director presence and the Blau's index of heterogeneity (r: 0.72).

Gujarati (1995) and Kennedy (1999) demonstrate that a correlation matrix is free from multicollinearity when correlation coefficients fall below 0.8 or 0.9. In this study, multicollinearity does not appear as a problem in interpreting the results since the highest Pearson correlation is below the threshold of 0.8.

However, the Variance Inflation factor and Tolerance values on Table 5 go to corroborate our findings. They both demonstrate acceptable levels going by Hair et al, (1987).

Table 5. Coefficients

	Unstandardized Coefficients		Standardized coefficients			Collinearity statistics	
Model	B	Std Error	Beta	t	Sig	Tolerance	VIF
Constant	.433	.187		2.319	.023		
FPRES	.571	.238	.648	2.397	.019	.135	7.416
BLAU	-1.157	.932	-.325	-1.241	.218	.143	6.980
PROPORTION	1.997	601	.365	3.324	.001	.814	1.228
SIZE	-.024	020	-.131	-1.200	234	.832	1.202

Results on Table 5 show that only two of our predictor variables had significant impact on return on capital employed. Female director presence had a positive statistical significance on financial performance. The P Value was <0.05 and as such permits the rejection of the null hypothesis and acceptance of the alternative that female director presence has a significant impact on financial performance measured by ROCE. This result tends to support the findings of Man and Kong (2011), and Burke (2000) that the presence of a women director and firm performance are interrelated.

Likewise, the proportion variable has a positive statistical significant impact on financial performance. This finds support in the works of Smith, Smith and Verner (2006) who found that the proportion of women in top

management jobs tends to have positive effects on firm financial performance. It however contradicts the findings of Farrell and Hersch (2005), and Rose (2007). They do not document female gender proportion as a significant determinant to firm performance.

The Blau's index of gender diversity had no significant impact on financial performance. Results were not significant at the 5% level of significance. Man and Kong (2011) document a negative relation between the blau's index and Tobin's Q while Campbell and Minguez-Vera (2008) find a positive impact of the Blau index and Shanon index on firm performance.

Board size also had no tangible impact on performance. This conflicts with the findings of Schnake et al (2006) whose work shows that the larger the board, the poorer the financial performance of the firm. However, the average board size stood at (9) which is the recommended and optimal size also found in related studies (Jensen, 1993; Coleman, Adjasi, and Abor 2007).

Table 6. ANOVA

Model	Sum of squares	df	Mean square	F	Sig
Regression	2.814	4	.704	4.14	.004
Residual	14.435	85	.170		
Total	17.249	89			

Table 7. Model summary

R	R Square	AdjustedR Square	Std. error of estimate	Durbin Watson
.404	.163	.124	.41210	2.053

Adjusted R^2 of the model was 0.124. This suggests that only 12.4% of the variation in performance is explained by the gender variables. This is not a commendable fit but is a reasonable one since firm performance certainly has other unrelated variables that explain its variation.

The Durbin Watson statistic stood at 2.053. It supports the assumption of absence of autocorrelation in the model since it falls within the threshold of '2' (Hair et al, 1987). While the F statistic shows the overall significance of the plane; its P value < 0.05 guarantees the statistical significance of the model.

5. Conclusion and Recommendations

The goal of this paper was to examine boards' gender composition and how it influences firm performance. The presumption was that gender is vital for the financial success of firms. The findings of this study show that the presence of a female director and proportion of female directors on a board have a positive significant impact on the firm's performance. This indicates that the presence of multiple female directors is associated with higher revenues. It only goes to confirm the arguments of the study.

The female segment of top management around the globe more specifically in developing economies is very negligible. This study reveals that 56% of the sample firms do not even have a single female director on their boards. This is not equitable. The inclusion of women in boards should not particularly be restricted to their contribution to financial performance. Promoting women on top management is a social equity issue and as such, socially responsible firms would avoid any discriminatory acts on women. However, based on the findings of this study, constructive efforts should be made both at firm and governmental levels to improve on boards' gender balance since it has bottom line effects. This area of research would require further investigation as to the actual or optimal number of women on boards that actually trigger improved performance and also testing other forms of financial performance such as market measures. Future research might be extended by observing the characteristics, qualifications and traits of female directors on performance; how other board characteristics interact with this possible relationship and the role the firm's sector or industry might play in influencing these interactions.

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APPENDIX 1: SAMPLE COMPANIES

1. CAP NIGERIA PLC
2. THOMAS WYATI NIGERIA PLC
3. NIG. AVIATION HANDLING COMPANY
4. UNITED NIGERIA TEXTILES PLC
5. CAPPA AND D'ALBERTO PLC
6. A.G LEVENTIS NIGERIA PLC
7. TRANS NATION WIDE EXPRESS
8. ASHAKA CEM PLC
9. 7. UP BOTTLING COMPANY PLC
10. DN. MEYER PLC
11. GLAXO SMITH KLINE CONSUMER
12. BETA GLASS CO PLC
13. ACADEMY PRESS PLC
14. MOBIL OIL NIG. PLC
15. IKEJA HOTELS
16. ADSWITCH PLC
17. B.O.C GASES PLC
18. MAY & BAKER NIG PLC
19. RT. BRISCOE PLC
20. NIG. WIRE & CABLE PLC
21. UACN PLC
22. JAPAUL OIL & MARITIME
23. OKOMU OIL PALM PLC
24. C & I LEASING PLC
25. GUINNESS NIG PLC
26. ETERNA OIL AND GAS
27. NIG. GERMAN CHEMICALS
28. AVON CROWN CAPS AND CONTAINERS PLC
29. NESTLE NIG. PLC
30. CADBURY NIG. PLC

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The Influence of Capital Adequacy on Asset Quality Position of Banks in Tanzania

Dickson Pastory[1] & Marobhe Mutaju[2]

[1] School of Management and economics, Dalian university of Technology, China

[2] School of Economics and Estate, Ardhi university, Tanzania

Correspondence: Dickson Pastory, c/o school of cultural and international exchange, Dalian University of technology, P.O.BOX 116024, Lingong Road 2 ganjingzi district, China. E-mail: passtory1@yahoo.co.uk

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Abstract

This paper has extensively analyzed the relationship between the capital adequacy and asset quality of commercial the banks in Tanzania. The study employed Panel secondary data from 33 banks in the period (2006-2011) and the linear Regression model was used to test for the relationship between the two variables. The findings indicate that capital adequacy has a great influence on the asset quality. The increase in capital ratios has sometimes reduced the asset quality productivity and in most cases the levels of non-performing loans and non-performing asset have been increased with the increase in capital ratios. CAEL analysis indicated the banks financial position to be stable and meet the regulatory requirements. It has been recommended that the bank of Tanzania (BOT) should foster their strength in supervision as the two categories have been viewed to be very crucial and do increase the stability of the banking system.

Keywords: capital adequacy; asset quality, BOT

1. Introduction

The recent growing competition among banks has forced the bank of Tanzania (BOT) to review its minimum capital requirement of the banks in general. The minimum capital has been heightened to the balance of Tanzanian Shillings 20 billion from 5 billion to each commercial bank. This increment has been made so as to foster the asset quality of the commercial banks and also to enable these banks to absorb unforeseen circumstances in future. Furthermore, the increase will help commercial banks to promote the sound financial system and to protect themselves from the risk of failure (BOT, 2011).

The asset quality position measures the financial efficiency of the commercial banks while the capital adequacy position measures the going concern of the commercial banks. However the capital adequacy position depends on asset quality due to great risks facing commercial banks, decline in asset quality do increase the capital adequacy position in order to offer the banking protection against risk (Mitchell, 1984).

There are several contradictory arguments as to whether the increase in capital adequacy influences the asset quality of the banks or not. Other studies reveal that well capitalized banks in terms of capital adequacy tends to increase the asset quality and meanwhile other studies indicate that undercapitalized banks have good asset quality.

Therefore this study aimed at examining whether capital adequacy influences the asset quality position. Regression model was run used to test the effects of asset quality on capital adequacy and similarly how capital adequacy affects the asset quality.

The topic is of particular interest in Tanzania as the governing board has introduced the new capital ratio measures to all commercial banks, many studies have been conducted at international level and substantial literature have focused on influence of banking regulations on capital ratios, therefore to fill the above void the paper examined the influence of capital adequacy on asset quality.

The paper is structured as follows : section two entails the theoretical review and empirical review of the studied literature, section three discusses the methodology of the study, section four the findings of the study and lastly section five summarizes the conclusion of the study.

2. Capital Adequacy Position Analysis

This is a measure of the banks solvency and ability to absorb risk, it includes Core capital to TRWA + OBSE, and this ratio is calculated by taking core capital divided by sum of risk weighted assets and risk weighted off balance sheet exposures. This is intended to measure capital adequacy of the bank relative to risk profile of the bank. This measures the financial stability and reliance on debt. It normally deals with the capital structure of the firm (Berger, 1997).

A minimum capital of total risk weighted assets to core capital has been imposed to 10% in all banks and it has been beyond 19.1% in all banks which is above the minimum requirement for all banks. Meanwhile the minimum reserve has been raised to Tanzanian Shillings 20 billion from 5 billion to ensure the solvency of the banks (BOT, 2011).

2.1 The Strength of Capital Adequacy Position

According to BOT (2011), the final outcome of the Capital adequacy position analysis will show the level and quality of capital and overall financial conditions of the institutions, ability of the management to address the emerging needs for additional capital, access to capital markets, the adequacy of underwriting standards, soundness of credit administrations, the existence of assets concentrations, the extent of the management to administer and control the assets, the adequacy of loans and investment portfolio, the adequacy of internal control and management information system, the level of earnings, including trends and stability, quality and sources of earnings, the level of expenses in relation to operations, adequacy of the provisions to maintain the allowance of the probable losses, the adequacy of liquidity sources compared to present and future needs, the availability of assets readily convertible to cash without undue loss, access to money market and sources of funding, the degree of reliance on short term and volatile source of funds.

2.2 The Banking Financial Regulations Had Put the Benchmark for the Performance Analysis Which Has Been Used to Assess the Performance of the Commercial Banks in Terms of Capital Adequacy

Capital adequacy rating criteria.

	Core capital to RWA +OBS	Core leveraging (core capital to average asset)	Total capital to RWA + OBS
Ratings			
1	Above 16%	Above 12%	Above 18%
2	14%-16%	9%-12%	16%-18%
3	12%-14%	6%-9%	14%-16%
4	10%-12%	3%-6%	12%-14%
5	Below 10%	Below 3%	Below 12%

Source; BOT, 2011

2.3 Asset Quality Ratios

This measures the efficiency in utilizing the assets, it is expressed as a ratio of NPL to gross loans, this is calculated by dividing the value of non-performing loans (all loans classified as substandard or worse) with the total value of loan portfolio (including NPLs and before the deduction of specific loan loss provisions) as a denominator. This ratio is intended to identify problems in loan portfolio; an increasing ratio may signal deterioration in the quality of credit portfolio hence increase in credit risk, Also in this category there is large exposures to core capital this ratio is calculated by taking the sum of all loans with outstanding balances of 10% or more of the bank's core capital divided by core capital, this ratio is intended to identify vulnerabilities arising from the concentration of credit risk. Large exposure refers to one or more credit individual or group that exceeds 10% of core capital. The last measure in this category is NPLs net of provisions to core capital; this is calculated by dividing the value of non-performing loans less the value specific loan loss provision with the core capital. This intended to compare the potential impact on capital of non-performing loans, net of provisions. It provides an indication of the capacity of the bank to withstand NPL related losses (Bank of Tanzania regulation, 2011).

2.3.1 The Banking of Tanzania Uses the Following Standard as the Measure of Asset Quality

	Non-performing loan to gross loans	Large exposure to core capital	Non-performing loans net of provision to core capital
RATINGS	**NPLs to Gross loans**	**Large exposure to core capital**	**NPLs net of provision to core capital**
1	Below 5%	Below 150%	Below 20%
2	5%-10%	150%-250%	20%-30%
	10%-15%	250%-350%	30%-40%
3			
4	15%-20%	350%-400%	40%-50%
5	Above 20%	Above 400%	Above 50%

2.4 Empirical Literature

The study revisits the following literature, although not exhaustive;

Abdioglu and Ahmet (2011) investigated the determinant of capital adequacy in Turkish banks. They pointed out that there is a positive relationship between asset quality and capital adequacy, especially the ratio of loan to total asset.

Mpuga (2002) found out that there is a positive relationship between the asset quality and capital adequacy, especially the loan loss reserve.

Mitchell (1984) in his article of capital adequacy in the commercial banks pointed out that, the ultimate aim of increasing capital adequacy is due to the fluctuation in asset quality and therefore to maintain the asset quality there is a need to maintain the capital level.

Kendall (1992) indicated that the increase in capital level tends to lower the level of Non-Performing loans and hence improve the capital ratios.

Koehn and Santomero (1980) showed that an increase in capital adequacy may increase or decrease the portfolio risk which is held by the bank.

Shrieves and Dahl (1992) in their study of US commercial banks, they confirm that asset quality is associated with an increase in capital adequacy and finally Keeton (1989), Avey and Berger (1991) pointed out that an increase in capital adequacy reflects the increase in asset quality.

Santomero and Watson (1977) pointed out that the higher and tighter capital regulations tend to reduce asset quality as it tends to decrease the investment potential through lower loan growth rate and credit offers. Studies by Blum (1999), Calem and Rob (1999) indicate that higher capital requirements may increase the risks to the banking sector and finally may affect the asset quality of the banks.

Moreover Basel II stress that the increase in capital rations tends to protect the banks and increase the asset position, therefore the restructuring of Basel II will model the bank's asset quality.

Santomero and Kim (1998) in their study of Risk in banking and capital regulation indicates that increase in capital ratios tend to lower banking risks and hence improve the asset quality , since the banking risk is associated with the asset quality. Therefore the capital ratios are the buffer against the asset quality deteriorations.

Shrieves and Dahl (1992) studied the relationship between the risks and capital requirement in commercial banks. The study confirmed that there is a positive relationship between the asset quality as measured by risks and the capital requirements. Banks with the higher capital above the regulatory requirements are expected to reduce risks exposure hence accelerate banks growth in terms of asset quality while banks with minimum capital requirements are greatly exposed to the higher risk.

3. Methodology of the Study

This study employed secondary data from the 33 banks and the main source of information was published accounts which were audited and issued to shareholders and other stakeholders for the public consumption. Section 47 of the banking and financial institutions Act of 1995 requires all banks and financial institutions to publish their quarterly balance sheet and statement of income and expenses in a newspaper in Tanzania. The objective is to keep the public informed on the financial position of banks and financial institutions operation in Tanzania, the same section similarly requires banks to file return weekly, monthly, and quarterly in the directorate of banking supervision. On the other hand the bank of Tanzania is empowered to carry out onsite physical implications and operations to ascertain compliance with prudential guidelines. The data were therefore

clean, valid and reliable and represented the actual performance of these banks. In the first case, the regression model was used to analyze the effects of asset quality on the level of capital adequacy as measured by Comparative Core Leveraging (core capital to total assets) and Comparative Core Capital to RWA and off Balance Sheet Exposure.

$$y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon \quad (1)$$

y = is the dependent variable capital adequacy measured by Comparative Core Leveraging (core capital to total assets) and Comparative Core Capital to RWA and off Balance Sheet Exposure.

X1 is the non-performing loans to Gross loans

X2 is the large exposure to core capital

X3 is the Non-performing loans net of provision to core capital

Both Comparative Core Leveraging (core capital to total assets) and Comparative Core Capital to RWA and off Balance Sheet Exposure are used as dependent variables in different to see how it is affected by the level of asset quality

Moreover because each variable is affecting the other variable, asset quality is also being treated as the dependent variable to see how it is being affected by the capital adequacy.

$$y = \alpha + \lambda_1 X_1 + \lambda_2 X_2 + \varepsilon \quad (2)$$

y is the asset quality measured by the non-performing loans to gross loans, large exposure to core capital and Non-performing loans net of provision to core capital.

X1 and X2 are Comparative Core Leveraging (core capital to total assets) and Comparative Core Capital to RWA and off Balance Sheet Exposure respectively.

4. Findings and Results

4.1 CAEL Results of the Individual Bank

The individual banks were evaluated in terms of capital adequacy, asset quality, liquidity and earnings. In each category the banks were rated depending on the performance level. The study took trend analysis from 2006-2011.

In 2006 capital adequacy for CBA, FBME, KCB, I&M, BBRODA, KCBC, UCCB, and NIC had indicated a strong capital level relative to the institution's risk profile. AZB, NMB, STB and AKIBA had indicated a satisfactory capital level relative to the institution's risk profile. HABIBU, NBC, TPB and DIAMOND banks had the rating indicating level of capital that does not fully support the institution's risk profile and therefore a need for improvement, even if the institution's capital level exceeds minimum regulatory and statutory requirements. BBALTD and CRDB had indicated a deficient level of capital, in light of the institution's risk profile, viability of the institution may be threatened. Assistance from shareholders or other external sources of financial support may be required. Finally EXIM and PBZ had indicated a critically deficient level of capital such that the institution's viability is threatened so immediate assistance from shareholders or other external sources of financial support is required. The asset quality for the all banks had indicated strong asset quality and credit administration practices. Identified weaknesses are minor in nature and risk exposure is modest in relation to capital protection and management's abilities. Asset quality in such institutions is of minimal supervisory concern but STB and BBA LTD had indicated that asset quality or credit administration practices are less than satisfactory. Trends may be stable or indicate deterioration in asset quality or an increase in risk exposure. The level and severity of classified assets, other weaknesses, and risks require an elevated level of supervisory concern. There is generally a need to improve credit administration and risk management practices. In the context of liquidity in 2006, HABIBU, PBZ, NMB, NBC, TPB, UCCB, CRDB and AKIBA had strong liquidity levels and well-developed funds management practices. The institution has reliable access to sufficient sources of funds on favorable terms to meet present and anticipated liquidity needs. On other hand ICB, KCB.I&M, BBRODA, STB, EXIM B, NIC and DIAMOND had satisfactory liquidity levels and funds management practices. The institution has access to sufficient sources of funds on acceptable terms to meet present and anticipated liquidity needs. Modest weaknesses may be evident in funds management practices while BBALTD and KCB had liquidity levels or funds management practices in need of improvement and finally FBME and AZB had deficient liquidity levels or inadequate funds management practices.

In the other important aspect of earnings, ICB, HABIBU, NMB, NBC, NMB, I&M, BARODA, KCBC, CRDB, EXIM, NIC and DIAMOND had earnings that are strong. Earnings are more than sufficient to support operations and maintain adequate capital and allowance levels after consideration is given to asset quality, growth, and other factors affecting the quality, quantity, and trend of earnings. AZB, PBZ and AKIBA had earnings that are satisfactory. Earnings are sufficient to support operations and maintain adequate capital and allowance levels after consideration is given to asset quality, growth, and other factors affecting the quality, quantity, and trend of earnings while FBME, BBALTD, KCB, TPB, UCCB and STB had earnings that need to be improved. Earnings may not fully support operations and provide for the accumulation of capital and allowance levels in relation to the institution's overall condition, growth, and other factors affecting the quality, quantity, and trend of earnings and finally CBA had earnings that are deficient. Earnings are insufficient to support operations and maintain appropriate capital and allowance levels. Institutions so rated may be characterized by erratic fluctuations in net income or net interest margin, the development of significant negative trends, nominal or unsustainable earnings, intermittent losses, or a substantive drop in earnings from the previous years.

In 2007 capital adequacy for CBA, FBME, ICB, KCB, BBRODA LTD, KCBC, BANK M, AKIBA, NIC and DIAMOND was strong relative to the institution's risk profile. NMB, NBC and I &M had a satisfactory capital level relative to the institution's risk profile, in another category AZB, BBA LTD, HABIBU and TPB had indicated level of capital that does not fully support the institution's risk profile and therefore a need for improvement, even if the institution's capital level exceeds minimum regulatory and statutory requirements. UCCB, CRDB and STB indicated a deficient level of capital, in light of the institution's risk profile, viability of the institution may be threatened. Assistance from shareholders or other external sources of financial support may be required and finally EXIM B had indicated a critically deficient level of capital such that the institution's viability is threatened. Immediate assistance from shareholders or other external sources of financial support is also required. The asset quality of the banks had been strong with exceptional to ICB, CRDB, and STB which had showed deficient asset quality or credit administration practices. The levels of risk and problem assets are significant, inadequately controlled, and subject the institution to potential losses that, if left unchecked, may threaten its viability.

In another aspect of liquidity level PBZ, NMB, NBC, TPB, UCCB, CRDB had indicated strong liquidity levels and well-developed funds management practices. The institution has reliable access to sufficient sources of funds on favorable terms to meet present and anticipated liquidity needs, ICB, I&M,KCBC,STB,EXIM B, and AKIBA had showed satisfactory liquidity levels and funds management practices. The institution has access to sufficient sources of funds on acceptable terms to meet present and anticipated liquidity needs. Modest weaknesses may be evident in funds management practices while CBA, KCB BANK M, NIC and DIAMOND had showed liquidity levels or funds management practices in need of improvement. Institutions rated 3 may lack ready access to funds on reasonable terms or may evidence significant weaknesses in funds management practices and finally FBME and AZB had showed deficient liquidity levels or inadequate funds management practices. Institutions rated 4 may not have or be able to obtain a sufficient volume of funds on reasonable terms to meet liquidity needs. In the context earnings, BBALTD, HABIBU, PBZ, NMB, NBC, I&M, KCBC, UCCB, CRDB, TPB, AKIBA, NIC and DIAMOND had indicated earnings that are strong. Earnings are more than sufficient to support operations and maintain adequate capital and allowance levels after consideration is given to asset quality, growth, and other factors affecting the quality, quantity, and trend of earnings. On the other hand FBME, ICB, AZB and BARODA had indicated earnings that are satisfactory. Earnings are sufficient to support operations and maintain adequate capital and allowance levels after consideration is given to asset quality, growth, and other factors affecting the quality, quantity, and trend of earnings while CBA, KCB and STB had indicated earnings that need to be improved. Earnings may not fully support operations and provide for the accumulation of capital and allowance levels in relation to the institution's overall condition, growth, and other factors affecting the quality, quantity, and trend of earnings and finally BANK M had indicates earnings that are deficient. Earnings are insufficient to support operations and maintain appropriate capital and allowance levels. Institutions so rated may be characterized by erratic fluctuations in net income or net interest margin, the development of significant negative trends, nominal or unsustainable earnings, intermittent losses, or a substantive drop in earnings from the previous years.

In 2008 the capital adequacy for FBME, ICB, HABIBU, I&M, BOIND, AKIBA, BANK M, UCCB and NIC indicated a strong capital level relative to the institution's risk profile. On other hand KCB, PBZ, NMB, BANK M, and CRDB indicated a satisfactory capital level relative to the institution's risk profile. While AZB, BBALTD, NBC, STB and DIAMOND had indicated level of capital that does not fully support the institution's risk profile and therefore a need for improvement, even if the institution's capital level exceeds minimum regulatory and

statutory requirements. Finally TPB, KCBC and EXIM B had indicated a deficient level of capital. In light of the institution's risk profile, viability of the institution may be threatened. Assistance from shareholders or other external sources of financial support may be required. Asset quality and credit administration practices had been strong in these banks. Identified weaknesses are minor in nature and risk exposure is modest in relation to capital protection and management's abilities. Asset quality in such institutions is of minimal supervisory concern to all banks, but KCBC and UCCB had deficient asset quality or credit administration practices. The levels of risk and problem assets are significant, inadequately controlled, and subject the institution to potential losses that, if left unchecked, may threaten its viability. In the context liquidity HABIBU, PBZ, NMB, NBC BARODA, TPB, UCCB, and CRDB had indicated strong liquidity levels and well-developed funds management practices. The institution has reliable access to sufficient sources of funds on favorable terms to meet present and anticipated liquidity needs. In the other hand ICB, BBALTD, I&M, KCBC, BOIND, STB, EXIM B, AKIBA, NIC and DIAMOND B had indicated satisfactory liquidity levels and funds management practices. The institution has access to sufficient sources of funds on acceptable terms to meet present and anticipated liquidity needs. Modest weaknesses may be evident in funds management practices, while CBA, KCB, ACCBANK, and BANK M had indicated liquidity levels or funds management practices in need of improvement. Finally FBME and AZB had indicated liquidity levels or funds management practices so critically deficient that the continued viability of the institution is threatened. Earnings indicated that KCB, NMB, NBC, I&M, BBRODA, KCBC, CRDB, UCCB, STB, EXIM B, NIC and DIAMOND B had earnings that are strong. Earnings are more than sufficient to support operations and maintain adequate capital and allowance levels after consideration is given to asset quality, growth, and other factors affecting the quality, quantity, and trend of earnings. On other hand AKIBA, AZB, ICB, FBME, and CBA had indicated earnings that are satisfactory. Earnings are sufficient to support operations and maintain adequate capital and allowance levels after consideration is given to asset quality, growth, and other factors affecting the quality, quantity, and trend of earnings. Meanwhile BBALTD, HABIBU, PBZ, TPB and BOIND had indicated earnings that need to be improved. Earnings may not fully support operations and provide for the accumulation of capital and allowance levels in relation to the institution's overall condition, growth, and other factors affecting the quality, quantity, and trend of earnings. Finally BANK M and ACCBANK had indicated earnings that are deficient. Earnings are insufficient to support operations and maintain appropriate capital and allowance levels. Institutions so rated may be characterized by erratic fluctuations in net income or net interest margin, the development of significant negative trends, nominal or unsustainable earnings, intermittent losses, or a substantive drop in earnings from the previous years.

In 2009 capital adequacy for FBME, ICB, PBZ, AKIBA, NIC, NMB, I&M, BBRODA, CRDB, ACCBANK and UCCB showed a strong capital level relative to the institution's risk profile, BBA LTD, KCB, CBA, HABIBU, NBC, TPB, STB, EXIM B and DIAMOND had indicated level of capital that does not fully support the institution's risk profile and therefore a need for improvement, even if the institution's capital level exceeds minimum regulatory and statutory requirements. Finally AZB and BANK M had a critically deficient level of capital such that the institution's viability is threatened. Immediate assistance from shareholders or other external sources of financial support is required. In the context of asset quality, it indicated strong asset level except for NBC, BBALTD, ICB and FBME which showed deficient asset quality or credit administration practices. The levels of risk and problem assets are significant, inadequately controlled, and subject the institution to potential losses that, if left unchecked, it may threaten its viability. In the aspect of liquidity it shows that BBA LTD, HABIBU, STB, PBZ, NMB, NBC, TPB, KCBC, and CRDB had strong liquidity levels and well-developed funds management practices. The institution has reliable access to sufficient sources of funds on favorable terms to meet present and anticipated liquidity needs, while NIC, DIAMOND B, EXIM B, UCCB, BBRODA, I&M and ICB had satisfactory liquidity levels and funds management practices. The institution has access to sufficient sources of funds on acceptable terms to meet present and anticipated liquidity needs. Modest weaknesses may be evident in funds management practices. CBA, FBME, KCB, UBA, BOIND, and ACCBANK had liquidity levels or funds management practices in need of improvement. Institutions rated 3 may lack ready access to funds on reasonable terms or may evidence significant weaknesses in funds management practices. Finally BANK M and AZB had deficient liquidity levels or inadequate funds management practices.

In 2010 and 2011 , the performance has been indicated that most banks has meet the regulatory requirements and they operated above the regulatory levels with exception to Access Bank, Bank ABC, CBA, Ecobank, FNB, UBA, Advans, Amana, Efatha, TCB and TWB which recorded losses before and after tax. The institution demand closes monitoring and supervisory requirements. The highest performing banks on ROAA are NMB. DCB, Mbinga, Citibank and Standard Chartered. The performance was higher as it indicated strongest profit relative to the institution's risk profile.

4.2 The CAEL Industry Analysis

In this regard the industry as whole was evaluated in terms of capital adequacy, earnings and liquidity.

Capital adequacy as measured by core capital to RWAs and off balance sheet has been 16% which was above the regulatory requirements of 10% while the Total capital to RWAs has been averaged to 17% which was above the regulatory requirements of 10%. In general trend the performance has been slowed down in 2011 compared to 2010. Capital adequacy measure the solvency of the banks. The whole industry the banks are well capitalized and they operate above the requirements.

Table 1. General trend

	2007	2008	2009	2010	2011
Total capital to RWAs	17.8%	17.3%	19.0%	18.4%	16.9%
Core capital to RWAs	16.4%	15.8%	17.8%	17.4%	16.1%
Capital ade (exposure)	11.3%	11.8%	12.7%	12.3%	12.2%

Capital adequacy (exposure)

Banks	2006	2007	2008	2009	2010	2011
Large	9%	11%	11%	12%	11%	11%
Medium	13%	14%	13%	13%	12%	13%
NBFIs	20%	16%	18%	22%	30%	27%
Regional & Small	14%	14%	20%	22%	17%	25%

Table 2. Total capital to RWA

Large	14%	16%	16%	18%	16%
Medium	23%	23%	21%	21%	21%
NBFIs	44%	34%	29%	40%	47%
Regional and small	20%	21%	30%	27%	43%

Table 3. Core capital to RWA

Large	13%	15%	15%	17%	16%
Medium	20%	20%	20%	19%	20%
NBFIs	24%	32%	21%	36%	44%
Regional and small bank	18%	26%	30%	24%	39%

4.2.1 The Asset Quality

This evaluates the quality and productivity of the assets, it normally forecast whether the needs of the customers will be met and to what extent portfolio assets has been utilized to generate the revenue of the banks. The asset quality has been good for regional and small banks, followed by the medium banks, then the large banks and finally the NBIFs. NBIFs has recorded the poorest asset quality as compared to the other banks , this may be due to the large schemes of loan they offer to the customers, on other hand the small and regional banks has recorded the good asset quality level may be due small size of the loans they offer. In general the asset quality has not matched with the capital adequacy, as descriptive analysis show that when the capital adequacy increase it tends to deteriorate the asset quality. The bank with the higher capital adequacy has shown the lower asset quality. In this regard it indicates that bank with higher capital level have the tendency to increase the loan size and expand portfolio and sometimes increase the chance of the customers failure.

Table 4. Non-performing to gross loans

	2006	2007	2008	2009	2010	2011
Large	5.8%	6.4%	5.0%	7.0%	9.6%	6.5%
Medium	2.3%	4.4%	1.5%	2.2%	4.3%	5.9%
NBFIs	3.9%	7.6%	0.0%	16.7%	8.4%	15.1%
Regional & Small	0.8%	2.9%	0.8%	1.2%	2.9%	8.5%

4.2.2 Liquidity Analysis

Liquidity indicates the ability of the banks to meet its shortem obligation; the industrial average has indicated that liquidity ratio as measured by liquid assets to total assets of about 45% and liquid assets to deposit liabilities of about 54%. There was a reduction in liquidity in 2011 as compared to 2010. This has been facilitated by the reduction by governments in investment securities and money market instruments.

Table 5. Liquid assets to total assets

Year	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**average**
Regional small	36%	37%	36%	44%	47%	39%	40%
NBIF	58%	59%	40%	44%	47%	39%	48%
Medium	53%	53%	46%	45%	51%	42%	48%
Large	54%	54%	44%	49%	50%	46%	50%

This is a ratio of liquid asset of the banks to the total assets. Medium banks have the highest ratio due increase in number banks, the largest banks were ranked in the second position followed by the NBIF and the last were Regional and Small banks**.** The higher the ratio the better as it indicates the ability of the banks to meet its daily working capital requirements. Large banks have recoded higher average score, followed by the medium and NBIF and the last was the regional and small banks.

Table 6. Liquid assets to total deposit liabilities

Year	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**average**
Regional small	43%	45%	53%	58%	59%	55%	52%
NBIF	76%	76%	56%	54%	60%	50%	62%
Medium	64%	67%	52%	66%	71%	55%	63%
Large	62%	64%	47%	60%	55%	63%	59%

The NBIF was having higher ratio, medium bank was the second followed by the large banks and the last was the Regional and small banks. The ratio indicates the ability of the liquid assets to cover the customer deposit. The higher the ratio indicates the efficiency of the banks and the lower the ratio indicates the inefficiency of the bank. The medium bank has recorded the higher average ratios, followed by the NBIF, then the large banks and the last was the regional and small banks.

4.2.3 Earning Analysis

This indicates the ability of the institutions to maintain and increase the net worth through the earning operations and also indicates the ability of the banks to generate the earnings using given assets**.**

Table 7. ROA

Year	2006	2007	2008	2009	2010	2011	average
Regional small	1.5%	3.1%	2.2%	0.7%	0.4%	0.5%	1.40%
NBIF	2.1%	1.5%	1.5%	1.0%	1.1%	2.1%	1.55%
Medium	1.2%	2.3%	1.7%	0.9%	1.1%	0.5%	1.28%
Large	2.7%	3.7%	3%	2.8%	2.0%	2.1%	2.72%

With analysis of table 2, The large banks have maintained higher percentage of ROA compared to the other banks, this is because higher average earnings compared to the other banks associated with greater investments in loans and other securities, and the NBIF was ranked second followed by the medium banks and lastly the Regional and small banks. This aspect is very important as it measures the efficiency of the management in utilizing the assets of the banks in generating revenue and the greater the ratio the better. The lower percentage in the other banks has been attributed to the increase in non-interest expenses which is not matched with the increase to in income and the increase in loan loss provision. On average the large banks recorded the higher efficiency level, followed by the NBIF, then the regional and small banks and the last was the medium banks.

Table 8. Return on equity (ROE)

Year	2006	2007	2008	2009	2010	2011	average
Regional small	11.4%	22.2%	12.5%	3.4%	1.9%	2.1%	8.92%
NBIF	10.4%	8.3%	8.6%	5%	4.3%	7.6%	7.37%
Medium	9.3%	16.8%	13.0%	7.3%	9%	3.9%	9.88%
Large	29.35	37.0%	27.3%	23.7%	16.9%	18.5%	25.46%

With analysis of table 3, large banks maintained higher ROE compared to the other banks and this has the advantage of attracting potential shareholders as their return are well capitalized and maintained, medium banks were ranked the second , regional and small banks were the third one and the last one was NBIF. This ratio shows how the equity investors are earning from their investments. The large banks have substantially maintained their equity income compared to their banks and it was fairly stable. On average the large banks have higher Return on equity, followed by the medium banks, then the regional and small banks and the last was the NBIF.

4.3 Results of the Regression Model

When capital adequacy measured by Comparative Core Capital to RWA and off Balance Sheet Exposure is used as a dependent variable, the results shows that Non-performing loan to gross loan and Non-performing loan to core capital tend to increase the level of capital adequacy as they have the positive coefficient but large exposure to core capital analysis has a negative coefficient which means it tends to decrease the level of capital adequacy. The overall significance F statistic, R square and Adjusted R square show that the asset quality does not have great significance in influence the capital adequacy as measured by Comparative Core Capital to RWA and off Balance Sheet Exposure. When the results were again tested using Core Leveraging (core capital to total assets) as the dependent variable, it was revealed that capital adequacy has great influence on asset quality, the value of F statistic R square and adjusted R square show great significance in influencing capital adequacy, the value of R square is 0.794 and adjusted R square is 0.631. The NPL to gross loan and NPL net of provision to core capital are positive as they tend to increase the level of capital adequacy; meanwhile large exposure to core capital is negative which indicate that it tends to reduce the value of capital adequacy (See appendix i). In other case when asset quality are used as the dependent variable measured by the level of non-performing loan it indicates that Comparative Core Capital to RWA and off Balance Sheet Exposure tends to decrease the level of Non-performing loan to gross loan where Core Leveraging (core capital to total assets) tends to increase the level of Non-performing Loan to gross loan. The independent variable are significance in the determination of the level of NPL to gross loan , as the value of F statistic, R square and adjusted R square being significance. Moreover Comparative Core Capital to RWA and off Balance Sheet Exposure and Core Leveraging (core capital to total assets) indicate a significance influence on the level of large exposure to core capital as the value of R square is 0.714 and adjusted R square is 0.510. They both show the positive coefficient which indicate that they are good predicator of asset quality.

5. Conclusion

The recent increase in capital ratios to the commercial banks will tend to increase the asset quality and it will protect depositors for uncertain changes that will mirror the banking sector. The regression model evidenced the relationship between capital adequacy and asset quality. On other case it can be noted that an increase in non-performing loans has a tendency to worsen capital ratio. Bank regulators should accentuate to reduce the level of Non-performing loans and non-performing assets. Hence banks can withstand the competition level and enhance efficiency for future performance. Meanwhile the governing body should strengthen the banking system with tight regulations to empower their surviving situation. In general the asset quality has not matched with the capital adequacy, as descriptive analysis show that when the asset quality increase in terms of non-performing loans tends to increase the capital adequacy. The bank with the higher capital adequacy has shown the lower asset quality in terms of non-performing loans. This shows that bank with higher capital level have the tendency to increase the loan size and expand portfolio and sometimes increase the chance of the customer's failure. This is the context of the classification between large, small, medium and NBIFs but for the individual banks it has been revealed that the increases of assets quality in terms of large exposure to core capital tends to reduce capital adequacy as they are inversely related. While Non-performing loans a increases the capital adequacy.

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Appendix 1.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
2	.794[a]	.631	.588	2.16155%

model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.394[a]	.155	.057	5.68257%	2.249
a. Predictors: (Constant), NPL tocore, NPL to GR, Lextcore b. Dependent Variable: core RWA					

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	207.448	3	69.149	14.800	.000[a]
	Residual	121.480	26	4.672		
	Total	328.927	29			
a. Predictors: (Constant), NPL tocore, NPL to GR, Lextcore b. Dependent Variable: Core to A						
Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.656	.658		8.590	.000
	NPL to GR	-.002	.004	-.078	-.597	.000
	Lextcore	.578	.197	.460	2.932	.007
	NPL tocore	.055	.020	.447	2.789	.000

YEAR	BANK	CCR_{WA}	CCA	TCR_{WA}	Rating	NPlGl	Lecc	NPccc	assrating
2006	CBA	41.61%	21.28%	43.15%	**1**	104.08%	6.40%	12.00%	**2**
2006	FBME	104.67%	51.24%	102.04%	**1**	0.00%	-13.26%	2.93%	**1**
2006	ICB	18.37%	9.23%	18.37%	**1**	259.88%	102.10%	25.96%	**1**
2006	AzB	14.38%	12.26%	14.88%	**2**	0.00%	-2.96%	2.88%	**1**
2006	BBALtd	9.98%	8.08%	11.98%	**4**	690.00%	46.19%	13.40%	**4**
2006	HBIBC	13.51%	7.65%	13.51%	**3**	337.31%	-3.86%	0.00%	**1**
2006	KCB	39.67%	24.58%	39.67%	**1**	123.70%	-5.24%	1.72%	**1**
2006	PBZ	-3.44%	-1.31%	-3.44%	**5**	-682.69%	-16.52%	1.92%	**1**
2006	NMB	24.48%	6.56%	24.48%	**2**	0.00%	-1.23%	5.86%	**1**
2006	NBC	12.68%	8.24%	12.68%	**3**	318.19%	15.69%	4.41%	**1**
2006	I&M	17.03%	12.58%	17.03%	**1**	238.68%	2.38%	62.00%	**1**
2006	BBRODA	47.74%	29.85%	47.74%	**1**	90.39%	7.53%	3.76%	**1**
2006	TPB	13.95%	6.51%	13.95%	**3**	0.00%	20.55%	11.11%	**2**
2006	KCBC	23.48%	18.43%	23.48%	**1**	0.00%	-32.02%	0.00%	**1**
2006	UCCB	21.06%	15.64%	21.06%	**1**	139.87%	13.61%	2.68%	**1**
2006	CRDB	11.71%	5.02%	12.26%	**4**	487.12%	-9.57%	0.00%	**2**
2006	STB	14.12%	9.94%	16.12%	**2**	447.73%	82.34%	23.55%	**5**
2006	EXIMB	6.98%	5.45%	8.31%	**5**	248.71%	-63.00%	1.33%	**1**
2006	AKIBA	14.44%	9.02%	14.44%	**2**	0.00%	-6.22%	3.14%	**1**
2006	NIC	19.79%	12.53%	19.79%	**1**	320.08%	-16.78%	0.00%	**1**
2006	DMNDB	11.63%	9.56%	12.40%	**3**	320.08%	-16.78%	0.00%	**1**
2007	CBA	13.14%	13.83%	13.28%	**1**	350.07%	8.49%	5.66%	**2**
2007	FBME	53.93%	37.56%	44.84%	**1**	22.80%	-13.25%	2.70%	**1**
2007	ICB	32.34%	14.09%	32.34%	**1**	91.13%	56.83%	27.72%	**5**
2007	AzB	11.34%	9.70%	11.71%	**3**	18.31%	-1.71%	1.74%	**1**
2007	BBALtd	12.81%	10.30%	12.88%	**3**	0.00%	25.81%	8.07%	**2**
2007	HBIBC	15.91%	8.36%	15.91%	**3**	207.46%	11.30%	3.35%	**1**
2007	KCB	21.47%	17.48%	21.47%	**1**	132.97%	4.27%	5.04%	**1**
2007	PBZ	3.07%	1.12%	3.16%	**5**	242.29%	-39.78%	0.83%	**1**
2007	NMB	19.38%	8.21%	19.38%	**2**	34.96%	12.09%	4.51%	**1**
2007	NBC	14.34%	10.86%	14.34%	**2**	290.21%	9.33%	4.18%	**1**
2007	I&M	16.71%	11.60%	16.71%	**2**	291.20%	2.04%	41.00%	**1**
2007	BBRODA	50.71%	22.32%	50.71%	**1**	121.05%	0.45%	7.99%	**1**
2007	TPB	12.03%	7.08%	12.03%	**3**	0.00%	15.25%	4.04%	**1**
2007	KCBC	20.17%	13.72%	20.17%	**1**	16.97%	-38.13%	0.00%	**1**
2007	BANK M	19.50%	13.39%	19.50%	**1**	0.00%	0.00%	0.00%	**1**
2007	UCCB	10.27%	8.75%	10.27%	**4**	139.87%	13.61%	2.68%	**1**
2007	CRDB	11.64%	6.40%	11.98%	**4**	278.78%	46.32%	6.07%	**3**
2007	STB	10.82%	7.25%	12.42%	**4**	239.47%	64.92%	23.73%	**4**
2007	EXIMB	9.06%	5.47%	10.24%	**5**	0.00%	11.80%	2.55%	**1**
2007	AKIBA	31.25%	22.35%	31.25%	**1**	729.30%	-9.86%	8.04%	**2**
2007	NIC	23.38%	11.92%	23.38%	**1**	125.54%	1.87%	4.19%	**1**
2007	DMNDB	17.41%	14.23%	18.06%	**1**	125.54%	1.87%	4.19%	**1**
2008	CBA	9.93%	7.61%	10.02%	**4**	471.65%	-1.03%	3.25%	**2**
2008	FBME	49.02%	33.86%	42.23%	**1**	38.35%	25.31%	15.30%	**3**
2008	ICB	25.56%	11.84%	25.56%	**1**	192.16%	50.27%	31.12%	**4**
2008	AzB	8.48%	8.05%	8.71%	**3**	37.72%	39.86%	4.09%	**1**
2008	BBALtd	12.88%	10.22%	13.76%	**3**	198.41%	15.51%	8.35%	**2**
2008	HBIBC	21.13%	10.22%	21.13%	**1**	153.42%	9.48%	3.05%	**1**
2008	KCB	13.56%	12.08%	13.56%	**2**	310.78%	10.78%	3.69%	**1**
2008	PBZ	21.54%	9.27%	21.62%	**2**	59.34%	-4.02%	0.31%	**1**
2008	NMB	17.81%	9.27%	17.81%	**2**	151.19%	16.72%	7.13%	**2**
2008	NBC	13.37%	11.52%	13.37%	**3**	80.25%	12.91%	4.13%	**1**
2008	I&M	24.44%	12.81%	24.44%	**1**	265.79%	0.84%	16.00%	**1**
2008	BBRODA	43.16%	20.39%	43.16%	**1**	128.37%	0.12%	6.45%	**1**
2008	TPB	10.89%	7.25%	10.89%	**4**	0.00%	20.32%	4.43%	**1**
2008	KCBC	10.98%	7.92%	12.98%	**4**	335.82%	147.88%	24.76%	**5**
2008	TANDHB	165.76%	89.53%	165.76%	**1**	0.00%	0.00%	0.00%	**1**
2008	BOIND	99.46%	43.43%	99.46%	**1**	47.08%	0.00%	0.00%	**1**
2008	ACCBANK	59.64%	59.64%	59.64%	**1**	0.00%	-1.37%	1.54%	**1**

2008	MBCB	16.95%	11.40%	16.95%	**2**	15.29%	2.38%	5.82%	**1**
2008	BANK M	13.16%	12.26%	13.16%	**2**	338.96%	0.00%	0.00%	**1**
2008	UCCB	27.11%	18.17%	27.11%	**1**	10.84%	56.44%	18.81%	**4**
2008	CRDB	14.16%	9.02%	14.39%	**2**	169.16%	24.09%	4.47%	**2**
2008	STB	12.22%	7.98%	13.97%	**3**	328.61%	77.65%	20.48%	**1**
2008	EXIMB	11.65%	7.35%	13.65%	**4**	85.46%	17.76%	4.44%	**1**
2008	AKIBA	31.25%	22.35%	31.25%	**1**	0.00%	10.63%	6.57%	**1**
2008	NIC	19.06%	12.48%	19.06%	**1**	105.06%	2.70%	2.24%	**1**
2008	DMNDB	15.83%	13.11%	16.54%	**3**	105.06%	2.70%	2.24%	**1**
2009	CBA	13.49%	9.03%	15.49%	**3**	0.00%	-1.28%	2.84%	**2**
2009	FBME	31.55%	26.56%	26.58%	**1**	0.00%	38.83%	26.88%	**3**
2009	ICB	27.64%	9.34%	27.64%	**1**	95.62%	50.10%	36.33%	**4**
2009	AzB	8.58%	7.85%	8.75%	**4**	10.77%	31.69%	3.91%	**2**
2009	BBALtd	16.13%	9.84%	16.58%	**2**	138.21%	44.99%	17.00%	**3**
2009	HBIBC	14.70%	9.00%	14.70%	**3**	128.50%	10.46%	2.72%	**1**
2009	KCB	15.79%	11.78%	15.79%	**2**	26.11%	-4.90%	1.89%	**1**
2009	PBZ	18.91%	9.26%	18.97%	**1**	0.00%	-6.14%	1.90%	**1**
2009	NMB	19.54%	10.07%	20.64%	**1**	0.00%	0.38%	3.73%	**1**
2009	NBC	13.01%	10.48%	13.01%	**3**	23.72%	41.18%	17.06%	**3**
2009	UBA	366.24%	61.12%	366.24%	**1**	0.00%	0.00%	0.00%	**1**
2009	I&M	19.96%	12.78%	19.96%	**1**	51.03%	0.56%	0.17%	**1**
2009	BBRODA	36.03%	19.58%	36.58%	**1**	87.32%	1.62%	5.49%	**1**
2009	TPB	13.68%	6.85%	13.68%	**3**	0.00%	15.37%	5.11%	**1**
2009	KCBC	2.15%	1.62%	2.15%	**5**	0.00%	384.70%	32.55%	**4**
2009	EFATHAB	266.94%	35.12%	266.94%	**1**	0.00%	0.00%	0.00%	**1**
2009	TWB	129.46%	41.20%	129.46%	**1**	0.00%	-8.47%	0.00%	**1**
2009	BOIND	32.96%	45.77%	32.96%	**1**	0.00%	0.01%	0.12%	**1**
2009	ACCBANK	32.24%	32.85%	32.24%	**1**	0.00%	0.81%	1.10%	**1**
2009	BANK M	11.84%	8.56%	11.84%	**4**	84.40%	4.45%	0.55%	**1**
2009	UCCB	25.65%	18.83%	25.65%	**1**	0.00%	21.26%	8.90%	**2**
2009	CRDB	18.01%	10.53%	18.21%	**1**	20.90%	19.18%	6.17%	**1**
2009	STB	12.22%	7.98%	13.97%	**3**	224.42%	30.96%	12.18%	**3**
2009	EXIMB	12.12%	7.68%	14.12%	**3**	0.00%	15.65%	4.11%	**1**
2009	AKIBA	26.05%	16.60%	26.05%	**1**	0.00%	21.93%	8.51%	**2**
2009	NIC	30.49%	19.49%	30.49%	**1**	0.00%	4.72%	8.97%	**1**
2009	DMNDB	13.51%	11.14%	13.95%	**3**	0.00%	4.72%	8.97%	**1**
2010	CBA	13.19%	6.82%	15.19%	**3**	205.48%	11.18%	5.41%	**1**
2010	FBME	9.38%	7.03%	9.38%	**4**	0.00%	303.51%	73.83%	**4**
2010	ICB	26.52%	13.07%	26.52%	**1**	10.22%	3.01%	4.84%	**2**
2010	AzB	17.34%	11.72%	17.52%	**2**	0.00%	7.47%	3.59%	**1**
2010	BBALtd	19.74%	12.25%	19.74%	**1**	142.58%	33.42%	21.02%	**1**
2010	HBIBC	18.77%	9.42%	18.77%	**1**	67.08%	8.04%	3.40%	**1**
2010	KCB	13.19%	8.40%	13.19%	**2**	255.21%	16.45%	12.23%	**2**
2010	PBZ	20.31%	9.65%	20.37%	**1**	0.00%	8.08%	4.50%	**1**
2010	NMB	20.00%	10.24%	20.00%	**1**	74.76%	7.93%	3.68%	**1**
2010	NBC	13.01%	10.48%	13.01%	**3**	55.40%	33.91%	9.25%	**2**
2010	UBA	151.35%	43.66%	151.35%	**1**	0.00%	0.01%	2.90%	**1**
2010	ECOBANK	25.25%	13.73%	25.25%	**1**	0.00%	-0.49%	0.00%	**1**
2010	TPB	9.57%	6.27%	9.57%	**4**	0.00%	7.74%	1.63%	**1**
2010	KCBC	3.46%	1.90%	3.46%	**5**	1267.06%	-278.17%	36.47%	**3**
2010	EFATHAB	3.19%	2.31%	3.19%	**5**	0.00%	-45.19%	0.00%	**1**
2010	TWB	29.59%	27.66%	29.56%	**1**	0.00%	4.71%	3.79%	**1**
2010	BOIND	43.94%	30.40%	43.94%	**1**	52.46%	0.01%	0.11%	**1**
2010	ACCBANK	34.98%	27.18%	34.98%	**1**	0.00%	5.12%	3.53%	**1**
2010	BANK M	9.99%	8.34%	9.99%	**4**	422.79%	22.59%	2.97%	**2**
2010	UCCB	11.82%	7.24%	11.82%	**4**	187.96%	134.98%	24.61%	**4**
2010	CRDB	15.74%	9.61%	15.89%	**2**	77.16%	51.28%	11.39%	**3**
2010	STB	13.52%	10.25%	14.83%	**3**	197.87%	-0.10%	2.58%	**1**
2010	EXIMB	12.70%	9.79%	14.70%	**3**	223.65%	-2.04%	1.54%	**2**
2010	AKIBA	12.01%	8.74%	12.65%	**1**	81.33%	25.11%	6.41%	**1**
2010	NIC	20.14%	15.32%	20.14%	**1**	18.27%	6.24%	5.92%	**1**

2010	DMNDB	13.58%	9.82%	13.58%	**3**	18.27%	6.24%	5.92%	**1**
2011	CBA	17.42%	7.58%	17.69%	**1**	191.47%	9.84%	4.07%	**2**
2011	FBME	0.58%	0.29%	0.58%	**5**	0.00%	2365.41%	53.22%	**5**
2011	ICB	34.00%	14.49%	34.00%	**1**	45.65%	12.27%	17.06%	**1**
2011	AzB	24.30%	15.67%	24.47%	**1**	33.44%	7.69%	4.64%	**1**
2011	BBALtd	18.15%	10.23%	17.90%	**2**	0.00%	16.25%	9.88%	**1**
2011	HBIBC	17.56%	9.82%	17.56%	**2**	79.01%	7.08%	2.02%	**1**
2011	KCB	14.83%	9.67%	14.83%	**3**	243.88%	24.21%	11.31%	**2**
2011	PBZ	19.75%	9.89%	19.80%	**1**	0.00%	0.13%	66.00%	**1**
2011	NMB	18.81%	11.05%	18.81%	**1**	38.03%	4.88%	2.39%	**1**
2011	NBC	12.07%	9.00%	12.07%	**3**	55.40%	33.91%	9.25%	**2**
2011	ECOBANK	14.91%	15.10%	15.08%	**2**	0.00%	4.51%	1.23%	**1**
2011	UBA	45.65%	28.74%	45.65%	**1**	29.34%	-0.30%	0.42%	**1**
2011	AMANI	576.05%	67.72%	576.05%	**1**	0.00%	0.00%	0.00%	**1**
2011	I&M	15.58%	12.42%	15.58%	**2**	333.79%	1.35%	0.58%	**1**
2011	MERCB	218.54%	80.25%	218.54%	**1**	220%	0.00%	0.00%	**1**
2011	FNBT	97.97%	57.66%	97.97%	**1**	0.00%	1.03%	0.00%	**1**
2011	ADVBT	186.37%	92.22%	186.37%	**1**	0.00%	-1.12%	4.13%	**1**
2011	NJCB	15.43%	19.98%	15.43%	**2**	0.00%	64.40%	16.17%	**4**
2011	BBRODA	35.23%	18.49%	36.38%	**1**	182.90%	-3.21%	4.18%	**1**
2011	TPB	12.21%	6.98%	12.21%	**3**	0.00%	6.22%	2.48%	**1**
2011	KCBC	2.37%	2.19%	2.37%	**5**	2324.58%	7.07%	26.46%	**3**
2011	EFATHAB	4.56%	2.65%	4.56%	**5**	0.00%	-51.05%	5.34%	**1**
2011	TWB	19.69%	12.97%	19.69%	**1**	0.00%	46.02%	20.10%	**4**
2011	BOIND	34.87%	24.73%	34.87%	**1**	203.57%	4.75%	2.80%	**1**
2011	ACCBANK	19.78%	18.11%	19.78%	**1**	0.00%	2.86%	1.23%	**1**
2011	BANK M	13.20%	10.40%	14.67%	**3**	223.65%	-2.04%	1.54%	**1**
2011	UCCB	21.30%	12.55%	21.30%	**1**	41.91%	44.41%	21.19%	**4**
2011	CRDB	14.24%	9.19%	14.35%	**2**	90.87%	49.71%	10.84%	**3**
2011	STB	12.70%	9.79%	14.70%	**3**	247.53%	25.97%	7.27%	**1**
2011	EXIMB	11.81%	8.38%	13.33%	**4**	247.53%	25.97%	7.27%	**2**
2011	AKIBA	16.44%	11.11%	16.44%	**2**	0.00%	18.62%	3.93%	**1**
2011	NIC	13.23%	11.73%	13.23%	**3**	21.52%	7.73%	3.88%	**1**
2011	DMNDB	13.00%	9.89%	15.00%	**3**	21.52%	7.73%	3.88%	**3**

Asset quality and earning table

YEAR	BANK	CCTF	LADL	GLTD	rating liquid	ROA	NIM	NAVEX	ear rat
2006	TIB	30.22%	120.27%	61.36%	**2**	3.72%	8.08%	5.52%	**1**
2006	CBA	19.98%	41.16%	64.36%	**3**	-3.70%	8.46%	10.71%	**4**
2006	FBME	48.56%	19.55%	103.75%	**4**	-1.58%	5.18%	48.91%	**3**
2006	twiga	10%	12.10%	32%	**3**	4.04%	7.88%	11.28%	**1**
2006	ICB	45.81%	42.63%	42.48%	**2**	3.74%	8.20%	6.07%	**1**
2006	AzB	34.42%	27.89%	107.52%	**4**	1.30%	7.00%	6.17%	**2**
2006	BBALtd	34.02%	25.80%	72.40%	**3**	1.30%	5.32%	4.90%	**3**
2006	HBIBC	60.58%	58.55%	40.93%	**1**	4.50%	12.74%	5.14%	**1**
2006	KCB	36.32%	70.01%	54.13%	**2**	-1.23%	5.80%	8.40%	**3**
2006	PBZ	68.78%	70.84%	21.32%	**1**	2.45%	8.75%	4.56%	**2**
2006	NMB	95.70%	76.51%	13.58%	**1**	6.28%	12.27%	7.18%	**1**
2006	NBC	77.64%	54.71%	53.88%	**1**	5.03%	9.72%	4.72%	**1**
2006	I&M	43.02%	44.01%	58.27%	**2**	5.43%	5.43%	7.94%	**1**
2006	BBRODA	58.04%	46.32%	73.87%	**2**	5.23%	9.11%	3.43%	**1**
2006	TPB	93.06%	48.12%	39.51%	**1**	2.05%	12.01%	14.39%	**3**
2006	KCBC	88.05%	36.90%	91.25%	**3**	0.23%	9.64%	7.47%	**1**
2006	MBCB	85.94%	77.75%	45.15%	**1**	1.32%	19.62%	14.94%	**3**
2006	UCCB	87.73%	53.40%	55.19%	**1**	-8.96%	16.28%	87.73%	**3**
2006	CRDB	70.77%	50.23%	51.96%	**1**	4.64%	7.86%	4.80%	**1**
2006	STB	54.18%	55.39%	70.81%	**2**	-2.73%	5.40%	6.82%	**3**
2006	EXIMB	38.12%	40.23%	55.00%	**2**	4.70%	7.69%	3.74%	**1**
2006	AKIBA	74.09%	46.30%	64.53%	**1**	3.00%	19.05%	14.67%	**2**
2006	NIC	43.71%	40.39%	71.99%	**2**	3.33%	8.02%	5.65%	**1**
2006	DMNDB	51.02%	38.31%	67.03%	**2**	4.61%	9.96%	6.36%	**1**

2007	TIB	14.80%	115.79%	45.17%	**3**	5.18%	8.80%	5.23%	**1**
2007	CBA	57.00%	59.83%	66.62%	**3**	5.23%	4.82%	5.03%	**3**
2007	FBME	48.91%	18.75%	110.97%	**4**	1.20%	4.16%	46.53%	**2**
2007	twiga	8.09%	11.58%	45.17%	**3**	1.67%	8.09%	11.58%	**2**
2007	ICB	54.70%	73.60%	43.27%	**2**	3.19%	6.93%	12.29%	**2**
2007	AzB	34.63%	31.19%	99.46%	**4**	2.13%	8.65%	6.35%	**2**
2007	BBALtd	33.42%	34.22%	63.76%	**2**	3.71%	6.74%	5.76%	**1**
2007	HBIBC	66.81%	66.22%	33.53%	**1**	4.53%	12.58%	4.36%	**1**
2007	KCB	35.66%	42.74%	75.19%	**3**	0.01%	6.90%	9.46%	**3**
2007	PBZ	68.78%	70.84%	21.32%	**1**	4.78%	10.90%	3.83%	**1**
2007	NMB	94.87%	67.90%	20.58%	**1**	5.71%	13.10%	7.61%	**1**
2007	NBC	79.99%	50.59%	60.79%	**1**	5.72%	10.30%	5.33%	**1**
2007	I&M	37.45%	44.30%	59.14%	**2**	6.16%	7.89%	3.40%	**1**
2007	BBRODA	53.04%	67.12%	40.25%	**2**	1.32%	6.48%	3.06%	**2**
2007	TPB	93.54%	35.69%	50.36%	**1**	6%	12.78%	14.46%	**3**
2007	KCBC	83.76%	58.93%	81.30%	**2**	-4.14%	15.95%	9.91%	**1**
2007	MBCB	76.51%	46.42%	63.09%	**1**	2.29%	12.90%	16.29%	**3**
2007	BANK M	24.28%	41.32%	75.96%	**3**	-6.70%	1.60%	9.11%	**4**
2007	UCCB	81.02%	41.86%	68.59%	**1**	4.57%	17.21%	9.13%	**1**
2007	CRDB	77.41%	50.49%	59.50%	**1**	5.07%	8.95%	5.43%	**1**
2007	STB	43.12%	68.74%	50.34%	**2**	2.68%	5.87%	5.75%	**3**
2007	EXIMB	37.80%	50.71%	54.09%	**2**	4.02%	7.41%	4.03%	**1**
2007	AKIBA	79.42%	27.45%	74.82%	**2**	2.33%	20.67%	15.40%	**3**
2007	NIC	41.30%	43.71%	78.98%	**3**	3.16%	8.43%	5.89%	**1**
2007	DMNDB	43.77%	32.27%	72.55%	**3**	4.61%	9.96%	6.36%	**1**
2008	TIB	13.12%	41.08%	87.16%	**4**	3.37%	6.59%	4.46%	**1**
2008	CBA	57.44%	61.40%	57.44%	**3**	1.84%	5.23%	7.51%	**2**
2008	FBME	46.53%	15.90%	109.22%	**4**	2.24%	4.23%	53.67%	**2**
2008	twiga	113.45%	7.34%	3.52%	**4**	1.73%	5.05%	11.21%	**2**
2008	ICB	51.75%	73.11%	46.46%	**2**	3.23%	9.29%	6.02%	**2**
2008	AzB	32.80%	14.67%	102.13%	**5**	0.96%	7.93%	7.12%	**2**
2008	BBALtd	47.32%	31.92%	65.55%	**2**	0.04%	8.87%	9.26%	**3**
2008	HBIBC	71.19%	63.07%	36.86%	**1**	4.08%	8.60%	3.94%	**3**
2008	KCB	33.10%	29.45%	74.07%	**3**	0.66%	7.38%	9.40%	**1**
2008	PBZ	70.49%	72.73%	29.13%	**1**	4.49%	8.46%	4.15%	**3**
2008	NMB	96.60%	61.45%	34.49%	**1**	4.86%	11.98%	6.59%	**1**
2008	NBC	74.91%	38.92%	75.80%	**1**	5.26%	9.67%	6.39%	**1**
2008	I&M	45.55%	31.04%	64.60%	**2**	6.27%	7.49%	2.95%	**1**
2008	BBRODA	62.05%	66.30%	43.76%	**1**	3.56%	13.22%	16.65%	**1**
2008	TPB	83.31%	30.78%	58.88%	**1**	1.24%	17.10%	9.36%	**3**
2008	KCBC	92.43%	32.71%	78.96%	**2**	-4.25%	17.10%	9.36%	**1**
2008	TANDHB	96.62%	564.94%	86.65%	**3**	-6.05%	17.65%	14.90%	**3**
2008	BOIND	29.57%	103.08%	62.88%	**2**	0.00%	0.33%	0.33%	**3**
2008	ACCBANK	76.84%	83.19%	116.16%	**3**	-14.82%	23.15%	-14.28%	**4**
2008	MBCB	76.30%	35.60%	80.76%	**3**	0.33%	23.08%	18.03%	**4**
2008	BANK M	24.28%	41.32%	75.96%	**3**	-2.06%	5.19%	10.18%	**4**
2008	UCCB	74.85%	51.60%	72.09%	**1**	4.87%	18.58	8.65%	**1**
2008	CRDB	66.40%	40.03%	66.91%	**1**	4.63%	9.02%	5.53%	**1**
2008	STB	2.80%	61.31%	41.50%	**2**	5.45	5.45%	4.64%	**1**
2008	EXIMB	43.87%	48.89%	55.91%	**2**	3.63%	7.14%	3.89%	**1**
2008	AKIBA	76.34%	42.01%	75.12%	**2**	4.29%	21.22%	14.22%	**2**
2008	NIC	33.78%	47.49%	59.42%	**2**	3.67%	7.19%	5.47%	**1**
2008	DMNDB	50.42%	33.95%	73.54%	**2**	3.40%	6.85%	5.06%	**1**
2009	TIB	34.99%	59.96%	83.60%	**3**	2.21%	8.22%	4.31%	**2**
2009	CBA	13.15%	63.46%	47.46%	**3**	1.91%	4.98%	5.59%	**2**
2009	FBME	53.67%	24.54%	82.13%	**3**	-4.37%	6.43%	56.33%	**3**
2009	twiga	10%	12.10%	32%	**3**	0.67%	6.91%	11.56%	**2**
2009	ICB	57.34%	85.42%	28.42%	**2**	1.26%	10.69%	5.91%	**3**
2009	AzB	29.18%	19.42%	90.11%	**4**	1.27%	8.24%	6.36%	**2**
2009	BBALtd	62.41%	31.43%	73.29%	**1**	-0.67%	7.75%	6.92%	**1**
2009	HBIBC	61.89%	47.95%	42.22%	**1**	3.78%	7.07%	3.58%	**1**

2009	KCB	34.84%	21.77%	71.74%	**3**	-0.65%	9.01%	34.84%	**3**
2009	PBZ	71.89%	66.50%	40.65%	**1**	1.86%	**8.42%**	**5.69%**	**2**
2009	NMB	97.89%	70.80%	47.41%	**1**	4.38%	**10.88%**	**6.17%**	**1**
2009	NBC	73.59%	43.18%	68.03%	**1**	4.75%	10.29%	6.06%	**1**
2009	UBA	16.93%	220.88%	2.64%	**3**	1%	3.64%	5.81%	**3**
2009	I&M	38.54%	36.83%	63.63%	**2**	4.87%	7.07%	2.99%	**1**
2009	BBRODA	37.05%	55.53%	55.90%	**2**	2.69%	3.87%	2.34%	**2**
2009	TPB	86.24%	44.87%	44.41%	**1**	15.74%	11.96%	15.74%	**3**
2009	KCBC	84.57%	65.17%	63.43%	**1**	-5.69%	14.33%	11.41%	**1**
2009	EFATHAB	53.79%	81.22%	9.08%	**2**	-23.11%	2.58%	24.53%	**4**
2009	MKOMZB	54.83%	300.20%	17.25%	**2**	-7.39%	2.72%	9.72%	**4**
2009	TWB	30.56%	155.54%	10.44%	**2**	-11.40%	1.40%	12.90%	**4**
2009	TANDHB	15.97%	28.23%	106.89%	**5**	-25.57%	16.87%	42.28%	**4**
2009	BOIND	20.75%	62.75%	76.49%	**3**	2.00%	7.77%	6.32%	**2**
2009	ACCBANK	52.58%	41.71%	102.05%	**3**	-6.38%	32.96%	28.04%	**4**
2009	MBCB	72.23%	41.83%	60.10%	**1**	2.88%	15.41%	19.95%	**2**
2009	BANK M	28.02%	21.83%	81.18%	**4**	0.95%	5.81%	7.96%	**2**
2009	UCCB	76.36%	49.30%	74.51%	**2**	4.01%	16.10%	8.59%	**1**
2009	CRDB	67.07%	47.72%	60.85%	**1**	3.64%	8.45%	5.23%	**1**
2009	STB	62.75%	49.11%	47.69%	**1**	3.02%	6.21%	5.80%	**2**
2009	EXIMB	34.95%	51.08%	56.78%	**2**	3.53%	5.95%	3.67%	**1**
2009	AKIBA	67.17%	45.25%	71.13%	**2**	1.62%	17.52%	13.76%	**3**
2009	NIC	43.31%	73.63%	59.96%	**2**	-1.00%	5.41%	6.06%	**3**
2009	DMNDB	47.36%	31.52%	74.17%	**2**	3.05%	6.85%	5.06%	**1**
2010	TIB	16.56%	101.82%	88.14%	**4**	1.76%	9.72%	5.22%	**2**
2010	CBA	12.75%	39.06%	54.38%	**3**	1.75%	4.62%	4.80%	**2**
2010	FBME	56.33%	37.96%	69.24%	**2**	-17.41%	6.00%	64.72%	**4**
2010	twiga	10%	12.10%	32%	**3**	1.67%	7.19%	13.56%	**2**
2010	ICB	59.45%	60.81%	46.02%	**4**	1.85%	3.22%	6.44%	**4**
2010	AzB	34.09%	39.57%	68.83%	**4**	1.04%	7.22%	5.55%	**2**
2010	BBALtd	65.56%	45.65%	59.12%	**1**	-1.02%	7.72%	9.54%	**3**
2010	HBIBC	61.49%	51.81%	39.00%	**1**	4.42%	5.78%	3.25%	**1**
2010	KCB	53.67%	21.88%	75.81%	**2**	1.11%	8.81%	56.48%	**3**
2010	PBZ	75.64%	69.00%	36.89%	**1**	2.71%	6.74%	4.75%	**1**
2010	NMB	95.14%	71.99%	48.18%	**1**	4.16%	9.25%	6.44%	**1**
2010	NBC	74.46%	43.43%	64.43%	**1**	0.39%	9.67%	7.18%	**3**
2010	UBA	21.30%	65.40%	13.84%	**3**	-10.67%	4.35%	17.19%	**4**
2010	ECOBANK	19.75%	62.85%	36.61%	**2**	-22.65%	0.39%	28.64%	**4**
2010	NJCB	96.70%	29.07%	74.91%	**2**	2.42%	2.42%	49.81%	**4**
2010	I&M	30.79%	29.81%	65.86%	**3**	4.93%	5.73%	2.81%	**1**
2010	BBRODA	44.37%	56.70%	51.81%	**2**	2.86%	5.84%	4.44%	**2**
2010	TPB	83.51%	27.34%	59.59%	**1**	0.80%	11.08%	14.85%	**3**
2010	KCBC	83.98%	91.37%	52.60%	**1**	1.47%	12.95%	12.32%	**1**
2010	EFATHAB	54.78%	54.33%	42.46%	**2**	-14.77%	7.81%	21.13%	**4**
2010	MKOMZB	40.39%	34.64%	40.41%	**2**	-3.85%	6.83%	11.29%	**3**
2010	TWB	29.54%	59.98%	61.50%	**2**	-9.80%	8.13%	18.30%	**4**
2010	TANDHB	17.88%	50.13%	59.03%	**3**	-39.07%	6.69%	42.94%	**4**
2010	BOIND	27.98%	52.88%	56.88%	**2**	1.52%	5.84%	4.44%	**2**
2010	ACCBANK	51.91%	52.67%	91.05%	**3**	0.19%	29.25%	21.33%	**4**
2010	MBCB	57.05%	52.04%	50.61%	**2**	-1.54%	10.88%	15.46%	**3**
2010	BANK M	34.61%	36.18%	73.12%	**3**	3.14%	7.62%	6.63%	**1**
2010	UCCB	70.71%	43.34%	75.73%	**2**	2.46%	15.42	10.41%	**2**
2010	CRDB	70.33%	47.81%	57.98%	**1**	3.16%	7.88%	5.30%	**1**
2010	STB	60.35%	32.88%	69.94%	**1**	2.31%	5.23%	6.56%	**1**
2010	EXIMB	58.80%	31.08%	78.02%	**2**	3.20%	7.19%	4.12%	**1**
2010	AKIBA	39.51%	30.20%	62.83%	**2**	3.64%	19.43%	16.13%	**3**
2010	NIC	27.48%	54.58%	60.89%	**2**	3.03%	6.65%	6.87%	**1**
2010	DMNDB	46.29%	41.20%	68.16%	**2**	2.99%	7.83%	5.08%	**2**
2011	TIB	29.45%	43.16%	103.02%	**4**	2.11%	7.60%	6.27%	**2**
2011	CBA	25.04%	31.54%	63.07%	**2**	-0.55%	5.31%	8.97%	**2**
2011	FBME	64.72%	55.51%	44.68%	**1**	-6.41%	2.52%	6.00%	**4**

2011	twiga	10%	12.10%	32%	**3**	-3.29%	7.19%	13.56%	**3**
2011	ICB	73.16%	87.34%	22.92%	**2**	-2.73%	4.24%	6.23%	**2**
2011	AzB	38.66%	19.13%	82.02%	**4**	2.19%	7.78%	6.28%	**2**
2011	BBALtd	60.78%	44.48%	61.00%	**1**	0.29%	6.41%	8.73%	**3**
2011	HBIBC	68.42%	44.61%	48.40%	**1**	3.68%	6.59%	3.65%	**1**
2011	KCB	56.48%	34.97%	59.69%	**3**	-1.09%	7.43%	53.67%	**3**
2011	PBZ	79.40%	52.11%	44.32%	**1**	1.53%	7.61%	6.77%	**2**
2011	NMB	94.40%	54.24%	63.19%	**1**	4.81%	11.66%	7.15%	**1**
2011	NBC	79.74%	46.08%	55.85%	**1**	1.10%	8.54%	8.13%	**2**
2011	ECOBANK	28.86%	35.67%	71.02%	**3**	-13.32%	7.65%	21.58%	**5**
2011	UBA	34.79%	54.35%	52.09%	**2**	-8.10%	6.83%	15.84%	**3**
2011	AMANI	92.60%	329.23%	11.27%	**1**	-3.04%	0.00%	3.07%	**4**
2011	I&M	25.42%	20.97%	71.26%	**3**	3.28%	5.29%	3.15%	**2**
2011	MERCB	29.48%	694.64%	0.00%	**2**	-13.41%	0.00%	13.42%	**5**
2011	FNBT	9.97%	168.99%	27.37%	**3**	-18.34%	1.41%	26.01%	**5**
2011	ADVBT	25.42%	12.48%	29.63%	**4**	-12.59%	12.48%	29.63%	**5**
2011	NJCB	47.53%	14.39%	82.22%	**4**	0.75%	29.47%	27.93%	**3**
2011	BBRODA	44.37%	56.70%	51.81%	**2**	2.39%	3.87%	2.34%	**2**
2011	TPB	84.45%	33.89%	55.59%	**1**	2.98%	12.07%	13.72%	**2**
2011	KCBC	75.16%	42.09%	68.04%	**1**	2.01%	14.33%	11.41%	**2**
2011	EFATHAB	45.50%	51.12%	50.87%	**2**	-5.25%	8.80%	13.47%	**3**
2011	MKOMZB	40.77%	40.39%	53.57%	**2**	-0.37%	8.57%	8.22%	**3**
2011	TWB	34.99%	55.28%	64.49%	**2**	-1.62%	11.50%	12.93%	**3**
2011	TANDHB	30.20%	24.08%	82.29%	**4**	-21.52%	17.39%	34.91%	**4**
2011	BOIND	30.29%	51.97%	53.80%	**2**	1.86%	4.89%	3.62%	**2**
2011	ACCBANK	33.19%	35.58%	83.94%	**4**	-1.17%	28.54%	23.04%	**4**
2011	MBCB	58.70%	25.98%	89.48%	**4**	3.35%	13.53%	11.81%	**2**
2011	BANK M	42.09%	36.82%	73.61%	**2**	3.59%	8.00%	5.16%	**1**
2011	UCCB	76.75%	45.86%	80.70%	**3**	4.47%	14.17%	8.47%	**1**
2011	CRDB	67.90%	42.08%	62.69%	**1**	2.82%	8.37%	5.35%	**1**
2011	STB	58.80%	31.08%	78.02%	**3**	3.20%	7.30%	6.70%	**1**
2011	EXIMB	39.93%	33.08%	73.64%	**3**	2.62%	7.23%	4.34%	**1**
2011	AKIBA	77.87%	23.05%	75.20%	**3**	1.42%	19.33%	17.35%	**2**
2011	NIC	24.54%	35.80%	77.72%	**3**	2.37%	6.64%	5.91%	**2**
2011	DMNDB	51.78%	36.35%	72.57%	**2**	3.45%	8.47%	5.24%	**1**

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