INVESTIGATING THE RELATIONSHIP BETWEEN STOCK PRICES AND EXCHANGE RATES IN ZAMBIA

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE

REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE IN ECONOMICS

OF

UNIVERSITY OF NAMIBIA

BY

CHILINDA MUNTHALI

JANUARY 2013

Main Supervisor: PROF. O.A. AKINKUGBE

Co-supervisor: DR. R. CHIFAMBA

Abstract

This study sets out to investigate the relationship between stock prices and exchange rates in Zambia. The relationship between the two variables is well explained by the portfolio balance and the traditional approaches to exchange rates determination. The portfolio balance explains that stock prices lead exchange rates by affecting investors' wealth and interest rates in an economy; on the other hand the traditional approach explains that exchange rates leads Stock prices. There have been many empirical studies on the relationship between the variables but no consensus has been reached at as to which variable causes the other. Many of these studies have been motivated by the movements of the variables in times of financial crises in different parts of the world, such as global financial crisis of 2007/8. This study is motivated by the fact that there has been no study on the subject using Zambian data set; hence the study adds to the body of knowledge in this regard.

The study employs Johansen cointegration test and the results show that there is no long run relationship between stock prices and exchange rates in Zambia; that is, the variables do not move together in the long run. Furthermore, Granger causality test show no causality from stock prices to exchange rates and from exchange rates to stock prices. The EGARCH estimation results show that volatility in stock market persists and that positive shocks in the stock market generate more volatility than negative shocks. The government should use political atmosphere to create a favourable investment climate and expand its traditional exports. Data for stock exchange was collected from the Lusaka Stock exchange and nominal exchange rates from the Bank of Zambia.

Table of Contents

List of Figures

List of Tables

ACKNOWLEDGEMENTS

All praises are attributed to Almighty God, the Compassionate and Merciful, who conferred upon me the knowledge, ability and wisdom to accomplish this thesis. I have seen his hand lead me all through this program, granting me sustenance all the days of my life.

I want to express my gratitude to my sponsors, African Economic Research Consortium (AERC) and the coordinating Department at the University of Zambia, the Department of Economics, for awarding me this graduate scholarship. I shall forever be indebted to them for granting me a rare opportunity to study and financially support me all throughout my programme.

My special thanks go out to my supervisors Professor Oluyele Akinkugbe and Dr Ronald Chifamba for their inspiring guidance and incessant encouragement for writing this manuscript. Dr R Chifamba, I am very grateful to you for going an extra mile to encourage me and being a father figure to me and knowing that I can always ask for whatever kind of help from you. My warmest gratitude goes out to the Head of Department Dr Esau Kaakunga for effortlessly ensuring that my stay at the University and in Namibia at large was worthwhile. Thank you for the support and pushing me to finish my program on time.

My fondest and profound gratitude to my beloved parents: Nicholas and Rosemary Lombe Munthali. No amount of words can ever match up and express how grateful and blessed I am to have you as my parents. Thank you for bringing me up to a person I am today, for encouraging and believing in me to come this far in my academics and in life. Your words of wisdom will always be a treasure. I thank my entire family members for their emotional and spiritual support rendered to me. Knowing you were always praying for me strengthened me.

To my colleagues Elifas Iilyambula, Muine Samahiya, Erica Siyoto, Sera Ingo and Florence Samandengu, I thank you for being there during my stay in Namibia. My friends Kacana Sipangule, Fungai Chiteta, Edna Kabala and many more, too numerous to mention, I am very grateful to you for words of encouragement and advice rendered to me when times were really hard.

To my one and only love, my husband Mwiya Katukula Muya, you are such an adorable person, thank you for your support, advice, prayers and patience during my stay in Namibia and absence from you.

To the people mentioned and those omitted I thank you and may God richly bless you.

DEDICATION

I dedicate this dissertation to my beloved parents (Mr. & Mrs. Munthali) and to my lovely husband Mr. Mwiya K. Muya. With all my love.

DECLARATIONS

I, Chilinda Munthali, declare hereby that this study is a true reflection of my own research, and that this work, or part thereof has not been submitted for a degree in any other institution of higher education.

I, Chilinda Munthali, grant the University of Namibia the right to reproduce this thesis in whole or in part, in any manner or format, which the University of Namibia may deem fit, for any reason or institution requiring it for study and research; providing that the University of Namibia shall waive this right if the whole thesis has been or is being published in a manner satisfactory to the university.

Chilinda Munthali   Date…January 2013

CHAPTER ONE

1.1 Introduction

One of the striking features of the international economy is the high degree of integration between the financial and the currency markets. Individuals, firms and governments hold assets domestically and abroad, linking together yields in capital markets. In the literature, three types of exposure under floating exchange rates regimes are identified as being associated with these dealings; economic, translation and transaction. Translation and transaction exposures are accounting based and defined in terms of the book values of assets and liabilities denominated in foreign currency. Economic exposure is the sensitivity of company value to exchange rates movements. At the corporate level, changes in exchange rates affect the firm's value, because future cash flows of the firm will change with exchange rates (Abbas, 2010).

Exchange rates are an important element in macroeconomic management and a key measure of the value of tradable goods relative to non-tradable goods with reference to price. It reveals the relative competitiveness of exported goods from the domestic economy to the rest of the world. The stock market, on the other hand, brings together various economic agents in its core function of moving resources from surplus units of the economy to deficit units. With the growing importance of stock markets in global economics and finance and the liberalization of capital account, research on the link between exchange rates movement and stock prices has escalated.

Azman-Saini *et al* (2006), Doong and Lee (2008), Shew (2008), and Kasman (2003) have estimated the relationship between stock prices and exchange rates around the period of a financial crisis; this is because financial crises are characterised by fluctuations in stock prices and exchanges rates. Azman-Saini *et al* (2006) found that stock prices and exchange rates in Malaysia move together in the long run and that during the crisis changes in exchange rates tend to lead changes in stock prices. However, Shew (2008) found that changes in stock prices lead to changes in exchange rates in Singapore.

There are two main approaches that explain the relationship between stock prices and exchange rates; the traditional and portfolio balance approaches to exchange rates determination. Dimitrova (2005) on the other hand uses the Mundell-Fleming approach. The movements in exchange rates, according to the traditional approach, is said to influence the competitiveness of exporting firms as well as non-exporting firms. For instance, an appreciation of the Kwacha would lead to reduced competitiveness of Zambian firms, because foreign consumers have to pay more of their currency to buy the Zambian commodity. On the other hand, domestic consumers will find imports to be relatively cheaper. This reduces the demand for domestic commodities and domestic firm’s profitability. The reduced profitability is then reflected in the fall of stock prices of the concerned firms. The portfolio balance approach explains how an investor’s decision to hold assets influences the exchange rates. Investors can decide either to hold domestic and foreign assets depending on the risk return profile of the investor. It is assumed that an increase in stock prices leads to an increase in wealth as well as attract more capital. This is because the demand for money will increase, which would result in increased interest rates and foreign capital inflow inducing the exchange rates to appreciate. However, empirical studies undertaken to test this proposition have produced inconclusive results.

This study aims to examine the relationship between exchange rates and stock prices in Zambia. Empirical studies of the relationship between stock prices and exchange rates in Zambia are limited. It is in light of this that the general objective is to investigate the long run relationship between stock prices and exchange rates movement with the view to contributing to existing literature.

1.2 Statement of the Problem

Exchange rates are an important element in macroeconomic management and a key determinant factor of the prices of tradable goods relative to non-tradable goods. It shows the competitiveness of domestic goods relative to foreign goods. In Zambia since the early 1990s when exchange rates was left to float it has been very volatile due to external shocks and other factors such as international copper prices. These currency movements make it difficult to achieve the major goals of the government and companies such as; faster growth rate, economic diversification and poverty reduction. This volatility has also created uncertainty for the private sector and increased their transaction costs. It discourages the production of tradables by raising their risk premium compared to non-tradables. The exchange rate volatility is also transmitted to the stock market which brings about loss of confidence and unpredictability in the economy. Investors need a predictable environment to secure their investments. According to Weeks et al (2007) the main objective of exchange rate policy should be to foster economic diversification through export competitiveness. As such, in the long run, the exchange rate should be in line with productivity levels in the sectors producing non-copper tradables, rather than fluctuate with international copper prices. Until the financial system develops private sector instruments for hedging against exchange rate risk, it is appropriate for the government and Bank of Zambia to act in the public interest to reduce such risk. There have been research on how stock prices and exchange rates relate, Adjasi et al (2011) found that, in Tunisia, in the long run stock prices and exchange rates move together and that a depreciation of exchange rate drives down stock prices. Aydemir et al (2009) found positive and negative causality between exchange rates and sectorial indices. In Zambia most research has been concentrated on examining the relationship of exchange rates and other macroeconomic variables; however, from the literature reviewed we are not aware of any previous study that examined the relationship between stock prices and exchange rate movements in Zambia. Therefore, this paper examines how changes in exchange rates affect the stock market and changes in stock market affect the exchange market.

1.3 Objectives of the Study

The main objective of the study is to examine the relationship between stock prices and exchange rates in Zambia.

Specific objectives are to:

- Investigate whether the Zambian domestic stock prices have a long run relationship with exchange rates;
- Examine whether there is a short run relationship between stock prices and exchange rates;

- Investigate the direction of causality between stock prices and exchange rates; and;
- Investigate the asymmetric volatility in the stock prices and exchange rates.

1.4 Hypotheses of the study

This research has the following null hypotheses:

H_0 : There is no long run relationship between stock prices and exchange rates;

H_1: There is no short run relationship between stock prices and exchange rates;

H_2: Stock prices do not Granger cause exchange rates;

H_3: Exchange rates do not Granger cause stock prices;

H_4; There is no asymmetric volatility in stock return and exchange rates.

1.5 Significance of the study

Movements in exchange rates affect a firm or an investor that deals in international transactions due to exposure of fluctuating currencies. According to Abbas (2010) the stability of exchange rates reduces the transaction exposure of firms and they may conduct international business without spending huge sums of money on hedging their exposure. Firms can decide whether to hedge their international debt and credit as a result of uncertain expected future exchange rates. Knowing the relationship between exchange rates and stock prices and their volatility helps an investors' decision to hedge their investments. Similarly, knowing the causal relationship between stock prices and exchange rates would help policy makers to take appropriate policy measures to stabilize exchange rates and create a favourable environment for investors. In addition the direction of causality helps predict the behaviour of one market vis-á-vis changes in another market; this may moderate the vulnerability of emerging economies to the vagaries of global economic uncertainties such as financial crises.

1.6 Organization of the Study

The rest of the thesis is organized as follows; chapter Two reviews exchange rate and stock market in Zambia. Chapter Three explores the theoretical and empirical literature on the relationship between stock prices, and exchange rates and the volatility spillover effects of the markets. The methodology used in the study is presented in Chapter Four. Empirical estimations and interpretations of results are presented in Chapter Five, while the conclusion, policy implications and recommendations are discussed in chapter Six.

CHAPTER TWO

ZAMBIA: AN OVERVIEW OF THE EXCHANGE RATES SYSTEM AND THE LUSAKA STOCK MARKET

2.1 Introduction

After independence in 1964, Zambian emerged very strong economically; however, during the early 1970s when world copper prices fell dramatically the economy suffered severe economic instability. According to the African Forum and Network on Debt and Development (AFRODAD), in 1973, the Zambian government negotiated a standby credit facility to cover the perceived short term falls in revenue due to the drop in copper prices. The credit facility was granted with rather strict conditionalities from the International Monetary Fund (IMF) and the World Bank; which in 1987 the government attempted to extricate itself from by the unilateral repudiation of the 1986 facility agreement. The government was required among other things, to adopt a flexible exchange rate through the auctioning of the Kwacha. The auctioning regime resulted in a sharp and severe depreciation of the Kwacha from US$1=K2.2 to K21/US$. This depreciation created severe macro-economic instability and social and economic restiveness.

In the early 1990s the Structural Adjustment Programme (SAP) was introduced. The reform package included a variety of measures such as; interest rate liberalisation, removal of credit ceiling, restructuring and privatization of state owned banks, along with supervisory and regulatory schemes, promotion and development of capital markets, including money and stock markets (Senbet and Otchere, 2008). The liberalization of the economy resulted in a free float exchange rates regime whereas the privatization of state owned companies resulted in the formation of the Lusaka Stock Exchange (LuSE) in 1994. In what follows we present a broad overview of the exchange rates regimes operated over the years, as well as the growth and development of the stock market in Zambia.

2.1.1 Overview of the Zambian Stock Market

The stock market is an economic institution that is common in most countries, both developed and developing. It essentially brings together various economic agents in its core function of moving resources from surplus units to deficit units of the economy. It enables these economic agents, particularly the government and firms, to raise long-term funds for financing new projects, expanding and modernizing industrial /commercial concerns (Osinubi, 1998). This raising of funds is done in two ways; raising equity capital by issuing shares and raising debt capital by issuing bonds. When a company issues shares, it obtains perpetual capital for investment. A company obtains cheaper borrowing through debt capital than conventional commercial bank channel. The stock market affords investors the dual advantage of easy liquidity and better information gathering. This makes it easy for resources to be mobilised because investors are willing to commit themselves to long-term projects under these conditions.

In Zambia, the Lusaka Stock Exchange (LuSE) was launched in 1994. The formation of the Exchange was part of overall government's economic reform programme aimed at developing the financial and capital markets in order to support and enhance private sector initiatives. The Lusaka Stock Exchange is also expected to attract foreign investment portfolio through recognition of Zambia and the region as an emerging capital market with potentially high investment returns. Another important role of the Lusaka Stock Exchange is to facilitate the divestiture of Government ownership in parastatals and realization of the objectives of creating a broad and wide shareholding ownership by the citizenry via a fair and transparent process. (LuSE FACTBOOK, 2008).

The LuSE is regulated by the 1993 Securities Act, which also created the Securities and Exchange Commission (SEC) to enforce the Act. The LuSE is incorporated as a limited liability company, owned by its broker members. Its operational costs are covered by government grants, brokers' commission fees paid by companies that want to list their shares and subscription fees for the economic reports produced by the LuSE. To participate in the Zambia securities market, the first requirement is to incorporate as a company and apply with the SEC for qualification as a licensed dealer. Licensed dealers are qualified to provide financial advisory services to issuers and investors. To buy or sell securities on behalf of clients (secondary market trading), licensed brokers apply for membership in the LuSE. The LuSE is, therefore, a broker dealer market in which broker members have dual capacities; acting as agents (brokers), as well as being qualified to act as principles (dealers) for their own accounts.

LuSE has a two tier market structure. The top tier is for (listed) companies that meet the criteria for a full listing. The second tier is for (quoted) companies that do not meet the full listing requirements. Both tiers may nonetheless trade on the exchange. The stock market has no price and exchange controls. There are neither controls nor restrictions on interest rates and credit allocation. There is free entry to investment in all sectors and a 100 percent repatriation of profits and dividends.

The LuSE has made great strides since inception. It is now more than a platform for trading shares and bonds as demonstrated by some companies from across the spectrum of industry that have used it to raise the public capital for expansion and in the process sustained and created new products and jobs. The number of listed companies has increased from 4 companies at inception in 1994 to 21 listed companies and 9 quoted companies as at July 2011.

Table2.1. Performance of the Stock Exchange

Year	Trades (no)	Turnover (Kbillions)	Market capitalisation (USDmillions)	market cap/GDP ratio
1999	1923	32	280	12.96%
2000	1826	25	236	13.10%
2001	2141	189	248	10.67%
2002	1565	10	246	8.05%
2003	2103	49	768	21.22%
2004	1993	33	1650	38.06%
2005	2519	69	2456	28.65%
2006	3662	87	3188	40.04%
2007	4750	225	4149	47.99%
2008	6921	554	6532	56.72%
2009	6619	225	5273	38.77%
2010	7610	962	6302	48.06%
2011		29	9409	63.54%

Source; LuSE database, December 2011

Table 2.1 shows the end of year statistics of the stock market from 1999 to 2011. The number of trades on the exchange has increased over the years from 1923 in 1999 to 7610 in 2010. The turnover increased from K32 billion in 1999 to K962 billion in 2010. This however declined to K29 billion by December 2011. On the other hand, market capitalisation also increased significantly reaching US$9409 million in 2011. Though the stock exchange remains relatively small, it is improving tremendously. Figure 2.1 shows how the LuSE all-share index performed over the period from January 1999 to July 2011. It reveals that the prices had been increasing steadily until 2008 when the index suddenly fell. The LuSE all-share index is a price weighted index including prices of all companies that are listed on the exchange. The companies listed are involved in a number of productive activities ranging from mining, banking, hostels, manufacturing and insurance companies. Therefore, a change in the index is as a result of a change in a high weighting stock price.

Figure 2.1: Trend in all share index 1999-2011

Source: LuSE database, constructed by author.

According to Ndulo *et al* (2009) the fall in the prices of stock can clearly be attributed to the global financial crisis, which negatively affected demand for domestic equities. The decline in demand for equities pushed down the prices of most stocks. This resulted in a consistent decline of the LuSE all-share index, as shown in Figure 2.1 between March and December 2008, at an average of 5% per month.

2.1.2 Overview of the Zambian Exchange rates System

The exchange rates policy in Zambia is broadly characterized by two distinct regimes, namely fixed and flexible. There were two periods in the past during which a fixed exchange rates regime operated; 1964 to 1982 and 1987 to 1991. From 1983 to 1985, a crawling peg was adopted. An initial floating system was adopted between

1985 and 1987. A more flexible exchange rates regime was adopted early in the 1990s as the process of economic reforms gained momentum. The decision to choose each of these exchange rates regimes was largely influenced by conventional economic and political arguments. A fixed exchange rate was sustained by official decree reflected in occasional adjustments of the exchange rates and administrative controls such as issuance of import licenses as opposed to official interventions in the foreign exchange market (Mkenda, 2001). At the time of independence in 1964, a fully convertible currency, the Zambian pound, was introduced and pegged to the British pound. However, in January 1968, the Zambian pound was replaced by the Zambian Kwacha (hereinafter referred to as Kwacha) at an official rate of K0.714 per US dollar or K1.7 per British pound sterling. The peg of the Kwacha to the British pound remained in place until December 1971 when the Kwacha was linked to the US dollar.

In February 1973, the Kwacha was re-valued by 11.1 per cent to K0.643 per US dollar. The rate was maintained until July 1976, when the Kwacha was devalued by 20 per cent against the US dollar, and consequently linked to the Special Drawing Rights (SDR) at an official rate of SDR1.0848. This was necessitated by the continued deterioration in the external balance position induced by the strong US dollar relative to other currencies and deterioration in Zambia's terms of trade as the price of copper fell significantly while at the same time oil prices surged (oil shock). A series of devaluations followed thereafter with 10 per cent in March 1978 to SDR0.9763, and a further 20 percent in January 1983 to SDR0.7813. These devaluations were done on an ad hoc basis without specific reference to economic fundamentals (Aaron and Elbadawi, 1992). In July 1983, the Kwacha was de-linked from the SDR and pegged to a weighted average basket of five major trading partner currencies. The Kwacha was allowed to adjust but within a narrow range (i.e. a 1 per cent devaluation every month).

The external position deteriorated further as reflected in the drastic fall in copper revenues and mounting external debt, hence the auction system was adopted in October 1985. The auction system was designed to eliminate the parallel market for foreign exchange which had emerged during the fixed regime; improve the allocation of foreign exchange previously allocated on non-price criteria; and allow for the interaction of supply and demand in determining the external value of the Kwacha (Mungule,2004). According to Aaron and Elbadawi (1992) the rate to the dollar on 3rd October was K2.2, reaching K5.01 in the first of the weekly auctions, on 11th October, and K8.30 a year later on 11th October, 1986 in the 53rd auction. Thereafter the rate declined sharply reaching K15.25 in the 60th auction on 29th November, 1986 (an 86 per cent depreciation of the Kwacha from the inception of the system).

From the 41st auction, new documentation was required to accompany bids, and from the 43rd auction (2nd August, 1986) a "Dutch Auction" replaced the former system. The Central Bank increased the amount of foreign exchange for auction three-fold from 2nd August, but this policy was not sustainable. These modifications failed to arrest the Kwacha rate of depreciation. Following riots on the Copperbelt and in Lusaka on 5th December, 1986, with the rate at K14.92 in the 68th auction, the auction was temporarily suspended (28th January, 1987). The rate was set at K9.00. Thereafter six auctions were held, beginning on the 28th March, 1987, under a two-tier auction system: an official window at K9.00 was restricted to debt service, essential imports and receipts of loans and grants, whilst the auction rate was allowed to fluctuate between this rate and an upper ceiling of K15.00 (this restriction was abandoned after four weeks). In the fifth of theme auctions on the 24th April, the Kwacha rate fell to its lowest value, K21.02; President Kaunda abolished the system on 1st May, after a final auction which served only to allocate foreign exchange at the rate of K15.00.

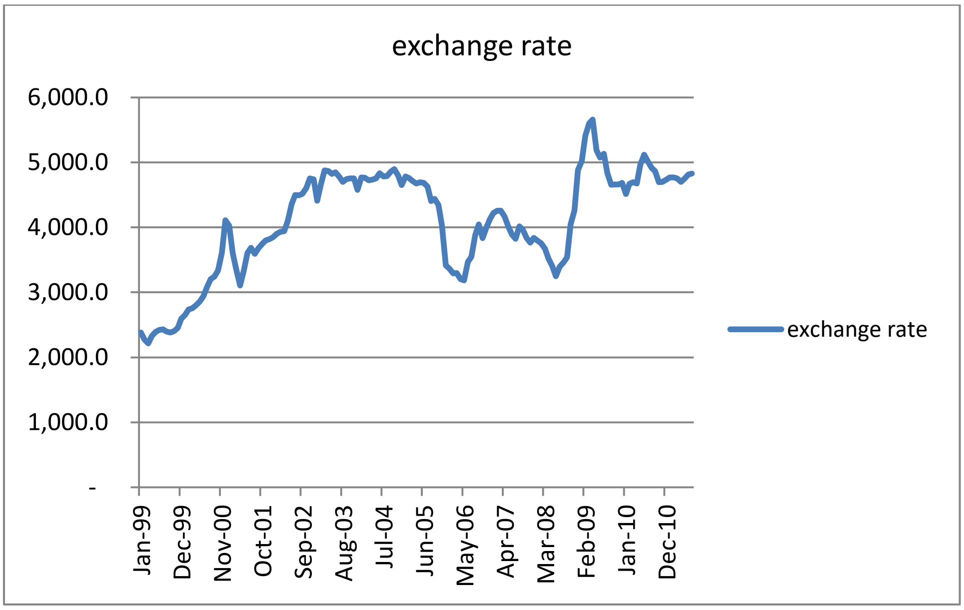
The auction was replaced by a fixed exchange rate system administered by the Foreign Exchange Management Committee (FEMAC). The Kwacha was fixed to the US dollar again at K9.00 on 5th may 1987. In November 1988, the Kwacha was devalued by 20 per cent and re-linked to the SDR. In July 1989, the Kwacha was devalued by 49 per cent accompanied by a monthly crawl, and a further 50 per cent devaluation in December the same year (Mkenda, 2001).

A dual exchange rate system managed by FEMAC was adopted in 1990; an official rate of exchange was initiated at K27.80 per US$1, with the "market exchange rates" at K40.00 per US$1. The system included a retail window for importers, an open general license system (OGL), and an official window with a lower rate. In 1991, the OGL retail and official exchange rates were unified when the process of economic liberalisation commenced. The exchange rate was let to float freely.

In 1992, the OGL list was expanded, non-traditional exporters were allowed 100 per cent foreign exchange earnings retention; bureau de change system allowed to operate in October in order to widen foreign exchange participation; and Zambia Consolidated Copper Mines (ZCCM) earnings were allowed to be sold at the `market rate' in order to integrate the foreign exchange market (ibid). Furthermore, the official exchange rate was devalued by 30 per cent and the rate of crawl accelerated to 8 per cent per month. In 1993, the OGL system was further modified and most exchange controls were transferred to commercial banks. In December 1993, the dealing system was established. In January 1994, the Exchange Control Act of 1965 was suspended and all import restrictions removed paving way for a full convertibility of the Kwacha.

Moreover, both current and capital accounts were liberalised and the public was allowed to open foreign currency accounts with local commercial banks. Additional changes to the foreign exchange regime were made after 1994. In April 1995, the frequency of trade between commercial banks and the central bank changed from three times a week to daily. In 1996, ZCCM retention scheme was abolished and it was allowed to transact its foreign exchange directly in the market. However, in January 2001, the dealing system was re-established having suspended it in 1996 as the government announced measures to stabilize the foreign exchange market following a sharp depreciation of the domestic currency. Nonetheless, volatility in the exchange rates increased and multiple exchange rates emerged. Consequently, a broad-based interbank foreign exchange market (IFEM) system was introduced in July 2003 (currently in operation) to address the weaknesses in the previous systems.

Figure 2.2.Trend in Exchange rates (Kwacha/USD) from 1999-2011



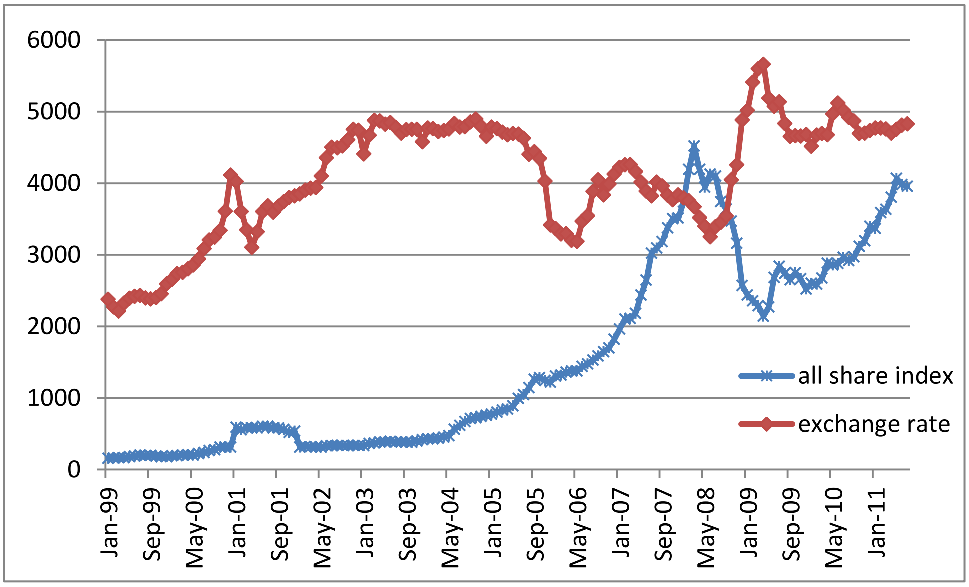
Source: Authors construct using data from Bank of Zambia.

The graph shows exchange rates pattern from January 1999 to July 2011. The exchange rate is the bilateral exchange rate of Kwacha per US$. From the graph it can be observed that the exchange rate depreciates[1] by up to K4110.3 per USD1 in December 2000 then eventually appreciates in 2001. Another pattern is the appreciation in July 2005 to April 2006 and then depreciates during the period from June 2008 to March 2009. According to Bova (2009), the Zambia exchange rates follow the copper prices. Since Zambia's main export is copper, changes in copper prices influence exchange rates; as a result, copper booms provide a concrete basis to evaluate exchange-rate regimes. The boom in 2005 elicited an influx of foreign exchange that, together with speculative capital inflows and debt relief, sharply

[1] An increase in K/USD means depreciation whereas a decrease is an appreciation

appreciated the Kwacha, first in November 2005 and then during mid-2007 to mid-2008*(ibid)*. The sharp depreciation in 2008 is attributed to the global financial crisis, during the financial crisis copper prices fell reducing investors' confidence thus resulting in reduced foreign exchange from copper mines and a depreciation of the Kwacha to K5660.3 in April 2009 (Ndulo *et al*, 2009)

Figure 2.3. Trend in exchange rates and in all share index (1999-2011)



From figure 2.3 it can be observed that the exchange rates and stock price seem to have a pattern. Exchange rates appreciated between January 2006 and September 2008 whilst the stock index increased gradually to reach a high value of K4394.46 in April 2008. However in the year 2009 when the exchange rates depreciated significantly and the stock prices fell. The graph shows an inverse relationship between stock prices and exchange rates. Thus, as the currency appreciates the stock prices tend to rise and when the currency depreciates stock prices tend to decline.

CHAPTER THREE

LITERATURE REVIEW

3.1 Theoretical literature

There are theories that link exchange rates and stock prices; the portfolio balance approach and the traditional approach of exchange rates determination are two of the most important ones. Furthermore, two variants of the portfolio model have been used to explain the transmission mechanism; the "Flow oriented" model developed by Dornbusch and Fischer (1980) and the "Stock oriented" model by Branson (1983) and Frankel (1983). The "Flow-Oriented" model posits that exchange rates movement affects the output levels of firms and the trade balance of an economy and that share price movements on the stock market also affect aggregate demand through wealth, and liquidity effects, and indirectly the exchange rates. Dornbusch and Fischer (1980) explains the mechanism as follows; an increase in the value of external assets (stock prices) raises real income, real money demand, and therefore, through a decline in the price level, the equilibrium real money stock. In the goods market, equilibrium terms of trade is a function of the given level of external assets, real wealth is a function of the terms of trade and external assets thus, an increase in external assets raises real wealth directly and through the induced change in real balances. There is accordingly an increase in demand for domestic output. To restore equilibrium the terms of trade must improve and the relative price of imports must decline. The decline in the terms of trade falls proportionately short of the increase in assets. This is to say that an increase in stock prices results in an appreciation of currency.

In the "Stock-Oriented" model, the stock market and exchange rates linkage is explained through a country's capital accounts. According to Branson (1983), expectations of relative currency movements have a significant impact on price movements of financially held assets, assuming exchange rates equates demand and supply for assets (bonds and stocks). Thus, stock price movements may influence or be influenced by exchange rates movements. For example, the depreciation of a domestic currency increases returns on the foreign currency, making investors to shift funds from domestic assets (stocks) towards foreign currency dominated assets, depressing stock prices. Therefore, a depreciating currency has a negative impact on stock market returns.

Granger *et al* (2000) explains that as the capital market becomes more and more integrated, changes in stock prices and exchange rates may reflect more of capital movement than current account imbalance. The central point of such a portfolio approach lies in the following logical deductions: A decrease in stock prices causes a reduction in wealth of domestic investors which in turn leads to lower demand for money with ensuring lower interest rates. The lower interest rates encourage capital outflows holding everything constant, which in term is the cause of currency depreciation. The inverse relation between stock prices and exchange rates in the portfolio approach runs counter to the positive relation in the traditional approach.

Pavlova and Rigobon (2003), marries assets pricing model with the Richardian trade theory. For example, all things considered, a positive shock to a country's output leads to a deterioration of the terms of trade it enjoys and exchange rates depreciation (consistent with the comparative advantages theory of the international trade literature). At the same time, the national stock market sees a positive return (in line with the asset pricing literature). On the other hand, a positive demand shock in a country leads to an exchange rates appreciation (as in the open economy macroeconomics literature). Unifying all these implications in one model of a two country case, a positive output shock leads to a positive return on the domestic stock market; however, it has to be accompanied by exchange rates depreciation. The depreciation implies a strengthening of the foreign currency, leading to a rise in the value of the foreign country's output, thereby boosting its stock market. The foreign exchange market thus acts as a channel through which shocks are propagated across countries' stock markets.

On the other hand, a positive shift in domestic demand causes an exchange rate appreciation. A strengthening of the domestic currency relative to the foreign leads to divergence in world financial markets: it provides a boost to the domestic stock and bond markets, while asset prices abroad fall. The Luo and Visaltanachoti (2010) model is related to Pavlova and Rigobons, the only difference with Luo and Visaltanachotis model is the introduction of non-tradable goods which shows that terms of trade reduce the benefits of portfolio diversification, because they assume that the tradable goods are used to produce the non-tradable goods.

Pavlova and Rigobon (2003*)* assume uncovered interest parity which link local interest rate, foreign interest and expected exchange rates (terms of trade). Uncovered interest rate parity is a relationship which assumes that arbitrage will enforce equality of returns on the following two investment strategies: one is investing in a home market and the other is investing in a foreign market and converting proceeds into home goods value using the prevailing terms of trade. This shows that a theoretical link between exchange rates and stock prices is also derived within an efficient market environment. It is important to note that in an efficient market environment the equity market should reflect company valuations. Hence expectations of future variables should incorporate all available information at the time the expectations are formed. Therefore, in an efficient market no expected risk-adjusted arbitrage should be profitable. A parity condition frequently used in such situations is the uncovered interest parity (UIP), which is based on the efficient markets hypothesis. From this viewpoint, exchange rate change is expected to give rise to stock price change. Dieci and Westerhoof (2010) explain the stylized model of interacting financial markets; the connection between stock and exchange market is because the trading decisions of stock market traders abroad are based also on expected exchange rates movements, which are influenced by observed exchange rates behavior. The orders placed by stock market traders generate increased transactions in foreign currency and lead to consequent exchange rate adjustments.

In their contribution to the theoretical debate, Ma and Kao (1990) explain that the required rate of return of stock reflects two types of foreign exchange risks. Firstly, the investment is inherently affected by the transaction exposure from foreign exchange rate changes. This is mainly due to gains or losses arising from the settlement of investment transactions stated in foreign currency terms. Secondly, the expected return is also determined by the economic exposure which is attributed to variations in firms' discounted cash flows when exchange rates fluctuate. Thus, the equilibrium relative stock price is related to both exchange rates levels and exchange rates changes.

For a firm heavily involved in exports, depreciation in the exchange rates makes its products competitive, increasing both its performance and stock price. This may be useful in so far as the exporting firm's products remain competitive on the international market. For heavily importing firms, exchange rates depreciation makes imports expensive, dampening firm performance and reducing their stock prices. The impact of the exchange rates depreciation on a firm heavily involved in both exports and imports will however depend on the effect on each side of the traded item. According to Ma and Kao (1990), for an import dominant economy an appreciation of the exchange rates boosts stock market returns and in the case of an export dominant economy, an appreciation of the exchange rate would dampen the stock market returns.[2]

3.2 Empirical literature review

Empirical studies on the relationship between stock prices and exchange rates in developed and developing countries give different results. In some cases a positive long run relationship between exchange rates and stock prices has been found, while in other cases the relationship has been negative. It has been found that stock prices lead to changes in exchange rates and exchange rates lead to change in stock prices.

[2]see also Aydemir and Demirhan (2009)

In conducting such studies, different methodologies have been employed in different cases, and results obtained have varied from country to country, from time to time and region to region. In what follows we have pooled together some of these views from earlier studies, in so far as they relate to the issues under consideration in this research.

3.2.1 Differences in results

Long run relationship was found to exist between stock prices and exchange rates by Yau and Nieh (2009) for Japan and Taiwan, Adjasiet al (2011) for Tunisia; Aydemir and Dermirhan (2009) for Turkey; Phylaktis and Ravazzolo (2005) for Indonesia, Malaysia, Singapore, Thailand and Philippines; Staverak (2004) for Austria, Germany, Hungary, Poland, the United Kingdom and the United States of America; Kasman (2003) for Turkey; and Morales (2007) for Slovakia. Results for these and similar studies show that stock prices and exchange rates move together in the long term. This makes it possible to predict one market from another. Most of these studies used a number of countries to see how their financial markets behaved at a particular time. The study by Staverak (2004) explored the interaction of the USA stock market and the European Union before and after the formation of the union. It used both real effective exchange rates (REER) and nominal effective exchange rates (NEER) to see which one offers a best estimate of exchange rates. After dividing the time period into groups, it was found that stock prices and exchange rates were not co-integrated before the formation of the European Union, but were co-integrated in Austria, Germany, Hungary, Poland, UK and the US. The REER proved to be a better representation of exchange rates as more cointegration was found with it than NEER.

Diamandis and Drakos (2011) investigated the relationship in the four Latin America countries (Argentina, Brazil, Chile and Mexico). In this study they included a third variable, the USA stock prices and dummies. They found that exchange rates and stock prices are co-integrated and that the USA stock prices influenced the stock markets in Latin America. Related to this, Phylaktis and Ravazzolo (2005) found that the American stock market acted as a conduit link in the basin pacific region. Wu *et al* (2012) found cointegration between the same set of variables in the Philippines; the results showed that stock prices and exchange rates had a short and long run relationship. The relationship was negative implying that a fall in stock prices increases the currency (depreciates) in the Philippines. This is in support of the portfolio balance approach.[3]

However there are studies that do not show any long run relationship between stock prices and exchange rates. Tabak (2006) for Brazil; Granger *et al* (2000), Zhao (2010) for China; Kutty(2010) for Mexico; Samanta and Nath (2003) for India; Shew(2008) for Singapore; Adjasi (2011) for Nigeria, South Africa, Mauritius, Kenya; Qayyman and Kemal (2006) for Pakstan, Doong and Yang(2004), Li and Huang(2009) for China and; Morales (2007) for Czech Republic, Poland and Hungary. The results of these set of studies revealed that stock prices and exchange rates do not move together in the long-run and that it is not possible to predict one market with the information from another market. A study by Morales (2007)

[3]see also Tsai, 2012

includes three variables that would offer an international environment to the countries under study which are; Germany Stock Index, UK Index and the US Index. However even with the inclusion of three variables cointegration is not found.

The results of causality also differ across countries. Some studies that found causality running from stock prices to exchange rates include: Abbas (2009) for Pakstan; Tabak (2006) for Brazil, Aydemir and Demirhan (2009), Granger *et al* (2000) for South Korea, Taiwan; Azman-saini et al (2006); Kasman (2003); Kutty (2010) and; Shew (2008). These studies show that changes in stock prices have an impact on the changes in exchange rates and that exchange rates are influenced by past values of stock prices. On the other hand the studies that found causality running from exchange rates to stock prices include: Li and Huang (2009); Granger *et al* (2000); Abbas (2010); Morales (2007); Tabak (2006) and; Wu *et al* (2012). Furthermore, studies by Aydemir and Dermihan (2009) and Kasman (2003) found bidirectional causality. This means that stock prices lead exchange rates and exchange rates lead stock prices. Information from both markets can be used to predict the other market. Samanta and Nath (2003), and Rahman and Uddin (2009) did not find any causality in their studies. This implies that neither stock prices nor exchange rates cause the other.

The studies that measured volatility between stock prices and exchange rates include: Choi et al (2008); Morales (2008); Doong and Lee (2008); Bonga-Bonga and Hoveni (2011); Morales and O'Donell (2006, 2007), Qayyum and Kermal (2006); Walid*et al* (2011); Yang and Doong (2004); Lin (2012) and; Walid *et al* (2012). Choi *et al* (2008) used daily data to estimate the volatility spillover effects between stock prices and exchange rates in New Zealand. Volatility persistence was significant and asymmetry was negative and significant. This implies that positive shocks (good news) generated less volatility than negative shocks (bad news). Investors in New Zealand react to bad news. The spillover effects showed that volatility spillovers from the stock market to the foreign exchange market in New Zealand change over time. Before the 1997 stock crash, the spillover effects from stock returns to exchange rates changes are significant. However, the spillovers vanish after the crash. They also found significant volatility spillovers from the foreign currency movements to stock returns in New Zealand in both sub periods.

Morales (2008) used data for Latin America divided into groups of; before the Euro was introduced, during the introduction of the Euro but before it was in circulation, and immediately after the Euro was physically introduced. It was found that the introduction of the Euro did not affect the volatility persistence because it had different impacts on financial markets in Latin American markets. Doong and Lee (2008) examined how the forces of stock returns' volatility affect the conditional correlations between stock prices and exchange rates. There were significant price spillovers from stock returns to exchange rates changes for Indonesia, Korea, Malaysia, Thailand and Taiwan. The correlation between stock market and foreign exchange market was affected by the volatility of stock returns.

Bonga-Bonga and Hoveni (2011) results showed that volatility shocks to equity returns influenced positively the conditional volatility of the change in exchange rates. Volatility persistence and negative asymmetry was found significant, meaning negative shock generate more volatility than positive one.[4]Morales and O'Donnell (2006 and 2007) found that the volatility spillover run from stock returns to exchange rates, implying that volatility is transmittable from stock markets to exchange rates market. Saha and Chakabrarti (2011), and Doong and Yang (2005) found no asymmetric impact between stock prices and exchange rates. This implies that there is no difference between negative and positive innovations irrespective of the markets.

3.2.2 Methodological Differences

The Johansen and Juselius (1990) cointegration test and Engel and Granger's (1987) cointegration test are the methods for testing for cointegration. No model of estimation for cointegration performs better than the other or rather offers the best results. Morales (2007), Staverak (2004), Adjasi (2011), Samanta and Nath (2003), Shew (2008) and Doong and Yang (2005) used Johansen cointegration technique and results from their analyses differ from country to country. Others like Tabak (2006), Qayyum and Kermal (2009), Li and Huang (2009) and Dimitrova (2005) used two stages Engle Granger cointegration test. Causality is estimated using Granger causality test. Aydemir and Dermirhan (2009), Tabak (2006) and Adjasi *et al* (2011) used a Vector Autoregressive Model.

According to Malmsten and Terasvirta (2004) the methods used to model and forecast volatility in financial time series, such as stock prices and exchange rates,

[4]see also Morales and O'Donell (2006&2007) and Qayyum and Kermal (2006)

are the Generalised Autoregressive Conditional Heteroscedasticity (GARCH), the Exponential GARCH and the Autoregressive Stochastic Volatility models. These models well reproduce the characteristics features of financial time series which are called stylized facts.

From the literature the most commonly used estimation model is the GARCH and the Exponential GARCH. Choi *et al* (2008), Morales (2008, 2007, 2006), Qayyum and Kemal (2006) use the EGARCH to model volatility spillover effect and asymmetric impact between stock prices and exchange rates. On the other hand Bonga-Bonga and Hoveni (2011), Walid *et al* (2012) and Saha and Chakrabrati (2011) used a multi variate GARCH. However, Walid *et al* (2012) posits that FIAPARCH and CCC-FIAPARCH provide more accurate in-sample estimates and out-of-sample forecasts than the other competing GARCH-based specifications. There is evidence to support the suitability of the FIAPARCH model in forecasting portfolio's market risk exposure and the existence of diversification benefits between stock and foreign exchange markets.

It is worth noting that the data used in the varying studies cited are different. Some studies used daily, weekly and monthly data for both exchange rates and stock prices. The studies by Yau and Nieh (2009), Ma and Kao (1990), Choi *et al* (2008) used monthly data because daily data had more fluctuations. Morales (2008), Azman-Saini (2006), Samanta and Nath (2003), Shew (2008) and Kasman (2003) used daily data because it better captures the fluctuations in the series and give a better outcome. On the other hand Kutty (2010), and Doong and Lee (2008) used weekly data.

3. 3 Conclusions

This chapter has reviewed both theoretical and empirical literature. Some strands of theoretical literature propose a positive relationship between exchange rates and stock prices, and others propose a negative relationship. The traditional approach postulates that exchange rates cause stock prices through its effects on assets and liabilities of firms, and its effect on demand for firm's output by foreign consumers. This ultimately affects the output of firms as well as profit levels and stock prices. The relationship conceptualized by the traditional approach is a positive one. The portfolio balance approach explained by the "flow oriented" as well as the "stock oriented" approaches posits that stock prices cause exchange rates. Changes in stock prices affect the wealth of investors and the interest rates which lead to investors holding of stock change and thus affecting the exchange rates. The relationship that is explained by the approach is a negative one.

From empirical studies reviewed, there appears to be no consensus as to which variable causes the other and what kind of relationship exists between them because the outcomes are different for different countries. Researchers like Morales (2009), Kutty (2010), Staverak (2004), Tabak (2006), Shew (2008) and many others found no cointegration among stock prices and exchange rates. This shows that exchange rates and stock prices don't move together in the long run. Causality has been found in some countries whilst in other countries there was no causality. Explaining the relationship further, researchers like Choi *et al* (2008), Morales and O'Donell (2006, 2007), Bonga-Bonga and Hoveni (2011) and Doong and Yang (2005) employed EGARCH models to investigate the volatility of stock prices and exchange rates. Equally the results are different in different countries. Asymmetry was found positive in some countries and in other countries it was negative. This shows that positive (negative) shocks produced more volatility than negative (positive) shocks in other countries.

Given the differences in methods and results of previous studies as exhaustively discussed in this chapter, the conjecture seems to be that the data, method, country, region and so on play a large role in the relation and direction of causality among the variables. As it were, the results of the analysis in this research should also work out within this diversity of views.

.

CHAPTER FOUR

CONCEPTUAL FRAMEWORK AND METHODOLOGY

4.1 Theoretical Framework

4.1.1 The Traditional Approach

The traditional approach argues that currency depreciation will result in higher exports and therefore higher corporate profits leading to higher stock prices in the short run. In this approach the transmission mechanism works through the competitiveness of firm's exports, resulting in changes in the value of the firm's assets and liabilities, culminating in higher profits and reflecting in its stock prices. This relationship between stock market returns and exchange rates movement can also be explained within the context of exporting and importing firms. For a firm heavily involved in exports, depreciation in the exchange rates makes its products competitive, increasing both its performance and stock price. This may be useful in so far as the exporting firm's products remain competitive on the international market. For heavily importing firms, exchange rates depreciation makes imports expensive, dampening firm performance and reducing their stock prices. The impact of the exchange rates depreciation on a firm heavily involved in both exports and imports will however depend on the effect on each side of the traded item (Adjasi *et al*, 2011)

4.1.2 The Portfolio Balance Approach

Another theoretical argument in the relationship between stock prices and exchange rates is the Portfolio Adjustment Approach. The portfolio balance model is a dynamic model of exchange rates determination based on the interaction of assets, markets, current account balance, prices and the rate of asset accumulation (Sarno and Taylor 2002, p115). It allows us to distinguish between short run, or flow equilibrium, and the dynamic adjustment to the long run stock equilibrium (a static level of wealth and no tendency of the system to move away from equilibrium). The theory assumes that people hold and demand domestic and foreign bonds, or rather people diversify portfolios of securities except that foreign investors hold only foreign assets. The other assumption is a free float of exchange rates, so that current account surplus must be matched by a capital account deficit. It divides wealth (*W*) of the private sector into three components; money (*M*), domestically issued bonds (*S*) and foreign bonds denominated in foreign currency and held by domestic residents (*S**).With foreign and domestic interest rate given by *i** and *i* respectively, the definitions of wealth and domestic demand functions are expressed as follows (MacDonald R. 1988, p120)

$$W \equiv M + S + rS^{*} \tag{1}$$

$$M = m(i,\ i^{*} + \Delta r^{e}, \Delta p_{d}^{s})W \qquad m_{i} < 0\ ,\ M_{2} < 0 \tag{2}$$

$$S = s(i,\ i^{*} + \Delta r^{e}, \Delta p_{d}^{s})W \qquad s_{i} > 0\ ,\ s_{i+\Delta r^{e}} < 0 \tag{3}$$

$$rS^{*} = s^{*}(i,\ i^{*} + \Delta r^{e}, \Delta p_{d}^{s})W s_{i}^{*} < 0\ ,\ s_{i+\Delta r^{e}} > 0 \tag{4}$$

$$m_{i} + s_{i} + s_{i}^{*} = 1$$

Where Δr^{e} denotes the change in expected rate of depreciation of the domestic currency, *m* (), *s* (), *s** ( ) are functions and Δp_{d}^{s} is the change in stock prices.

Further assumptions are that; the supply of foreign and domestic stocks are exogenous, and that domestic dividends yield equals to domestic interest rates and foreign dividends yield equals to foreign interest rates, so as to make investors indifferent between investing in bonds and stocks. Exchange rates are linked to interest rates through the covered interest parity with risk premium, expresses as;

$i - i^{*} - \Delta r^{e} = \lambda$ where λ is the risk premium.

The portfolio adjustments (movements in the foreign capital- inflows and outflows of foreign capital) occur whenever there is a change in the stock prices. A decline in the stock prices will result in diminished corporate wealth, leading to the reduction in the country's wealth. This reduction in wealth may lead to a fall in the demand for money and monetary authorities reduce the interest rates to alleviate this situation. The lower interest rates will lead to an incipient capital out flow from the country, to take advantage of higher interest rates in other parts of the world, resulting in currency depreciation. The converse is true when there is an increase in stock prices. Therefore, according to portfolio balance approach, lower stock prices may lead to currency depreciation; that is, there is a negative relationship between stock prices and exchange rates.

4.2 Model specification

The relationship between stock prices and exchange rates can be represented by

$$S_t = a_0 + a_1 E_t + e_t \text{.........................}(4)$$

Where S_t is stock prices index and E_t is the exchange rates and e_t is the disturbance term. On the basis of economic theory, the coefficient α_0 can either be positive or negative. According to the portfolio balance approach a fall in stock prices reduces investors' wealth which leads to a reduction in money demand, a fall in interest rate and consequently depreciation in the currency. The relationship is said to be positive if there is rise in stock prices while currency depreciates and a negative relationship if there is a rise in stock prices while exchange rates appreciates. Therefore, the portfolio approach postulates a positive relationship between stock prices and exchange rates.

4.3 Unit root test

This is a test to ascertain whether data series are stationary or non-stationary. According to Asteriou and Hall (2007; p288), in stationary series, shocks will be temporary and over time and their effects will be eliminated as the series revert to their long run mean-values. On the other hand, non-stationary time series will necessarily contain permanent component, the mean or the variance will depend on time which leads to cases where a series has no long-run mean to which it returns and the variance will depend on time and will approach infinity as time goes to infinity. Most macroeconomic time series are non-stationary and may give spurious regressions resulting in incorrect conclusion.

To test for stationarity, Augumented Dickey Fuller test and Philips Perron test is usually employed. The lag length is determined by Akaike Information Criterion (AIC) and Schwartz Bayesian criterion (SBC). According to Enders (2004), it is important to choose the appropriate model because additional lags reduce the sum of squared of the estimated residuals. However, adding such lags entails the estimation of additional coefficients and an associated loss of degrees of freedom. A model is said to be a better fit than the others if the Akaike Information Criteria and the Schwartz Bayesian Criteria values are smaller than that of the others. For each criterion, as the number of regressors increase, the sum of squared reduces. And if a regressor has no explanatory power, adding it to the model would reduce both Akaike Information Criteria and Schwartz Bayesian Criteria. Of the two criteria, the Schwartz Bayesian criterion chooses a more parsimonious model than the Akaike Information Criteria.

4.3.1 Augumented Dickey Fuller

The augmented Dicker-Fuller is an extension of the simple Dicker-Fuller (1981), this is because if a simple AR(1) DF is used when in fact y_t follows an AR(p) process then the error would be auto-correlated to compensate for misspecification of the dynamic structure of y_t. The ADF includes extra lags of the dependant variable in order to eliminate auto-correlation. The lag lengths are determined either by Akaike Information Criterion (AIC) or Schwartz Bayesian criterion (SBC). DF equation of

$$\Delta \mathrm{y}_{\mathrm{t}} = \alpha_o + \rho y_{t-1} + \varepsilon_t \text{.........................(5)}$$

With ADF it is assumed that the error term is independently and identically distributed. It is specified as;

$$\Delta \mathrm{y}_{\mathrm{t}} = \alpha_o + \rho y_{t-1} + \sum_{i=1}^{p} y_{t-i} + \varepsilon_t \text{.........................(6) with intercept}$$

$$\Delta y_t = \alpha_o + \alpha_2 t + \rho y_{t-1} + \sum_{i=1}^{p} y_{t-i} + \varepsilon_t \text{.........................(7)} \text{ with intercept and trend}$$

$$\Delta y_t = \rho y_{t-1} + \sum_{i=1}^{p} y_{t-i} + \varepsilon_t \text{..............................(8)} \text{ without intercept and trend.}$$

Where ρ is (α-1). Thus we test

$H_0;\ \rho = 0$; α= 1 implying that there is non-stationarity or there is unit root

$H_1;\ \rho < 0$; α ≠ 1 there is stationarity or there is no unit root.

- The rejection of the null hypothesis means that the series are stationary.
- The failure to reject the null hypothesis implies that there is non-stationarity and the series has to be integrated of order one or two to make it stationary.

4.3.2 Phillips Perron Test

This is also used to test the existence of unit root in the series. Null hypothesis of Phillip Peron test is the same as that of ADF, which states that there is unit root in the series. ADF test is different from PP test in a sense that the former offers comparatively better size properties while the latter contains better power. Secondly, PP test also adjusts the heteroscedasticity of covariance as well as possible autocorrelation. Interpretation of both ADF and PP test is similar. Unlike ADF, PP test is non parametric and it tests for the existence of higher order serial correlation unlike ADF, which tests for first order serial correlation. (Asteriou and Hall, 2007, p 297)

4.4 Volatility measure

The volatility of stock prices is measured using the generalised autoregressive conditional heteroscedasticity (GARCH) introduced by Bollerslev (1986). The GARCH (1, 1) includes both the information about volatility observed in the previous period, that is, the short run volatility (ARCH term) and forecasted variance from last period, i.e. the GARCH term. The GARCH (p, q) model is;

$$\sigma^2 = w + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}^2 + \sum_{i-1}^{q} \beta_i \sigma_{t-i}^2 \text{.........................}(9)$$

$$y_t = \beta + \delta y_{t-1} + \varepsilon_t \text{.......................}(10)$$

Where w is the mean equation given by equation (10). It holds that the error term ε_t has zero mean, a constant unconditional variance E (ε_t^2) = σ^2 , and is not correlated. However the variance is allowed to be autocorrelated. ε_{t-i}^2 is the lag of the squared residuals from the mean equation and measures news about volatility in the previous period(ARCH term) and σ_{t-i}^2 is the last periods forecast variance (GARCH term). If (α+β) =1, the volatility shocks will be persistent. The rule of thumb given by Choudhry (2005) is that if:

- $\alpha + \beta$ is close to unity (1), then volatility is present and persistent.
- $\alpha + \beta < 0.5$ it indicates that there is no volatility.
- $\alpha + \beta > 1$ it indicates a case of exchange rates overshooting

The volatility series obtained from the GARCH is then incorporated into the co integration equation, to check whether the volatility affects stock prices.

4.5 Johansen cointegration test

The next step is to test whether there is a long run linear relationship between the dependent variable and the explanatory variables. There are two methods of testing cointegration namely Engle-Granger (1987) methodology and The Johansen (1988) test. Each method has advantages and disadvantages.

Engle-Granger methodology is easily implemented and useful when dealing with small sample size. As a sample grows infinitely larger, it is possible to find that one regression indicates that the variables are cointegrated but when its order of variables are reversed (making one of the independent variables as dependent variable) indicates that the variables are not co-integrated. This is an undesirable feature since the test for cointegration should be invariant to the choice of variables selected for normalization[5]. Another disadvantage is that, it involves two stages of estimation; therefore any error introduced in the first stage is carried on to the second stage. Furthermore, the method cannot test for the presence of multiple cointegrating vectors.

The Johansen (1988) Test solves the problems of Engle-Granger methodology as it is useful in a large sample size and also uses maximum likelihood estimators which avoid the problem of two-stage estimators. In addition, the Johansen (1988) Test can test the presence of multiple co-integrating vectors. However, the Johansen test has two main limitations. First it is not easy to implement. Second, it is unreliable in small samples.

[5] See Enders(1995) for details

This study has 151 observations and therefore, Johansen's cointegration has been employed to check the existence of long-run relationship among variables. Two variables are cointegrated if they move together over time. To undertake the test, the variables of the same order must be integrated. Johansen's cointegration is based on Eigen Values and trace Statistics. The basic model is;

$$y_t = a_0 + \sum_{j=1}^{k} \beta_j y_{t-j} + \gamma_j \sigma_t + u_t \text{.........................}(11)$$

where $\alpha_0$is $n\ x\ 1$ vector of constants,y_t is $n\ x\ 1$ vector of variables, which contain unit root and are stationary at first difference, k is number of lags, β_j is vector of coefficients, σ_t is the volatility series and $\varepsilon_t$is vector of error terms. The above equation can be reformulated into the following vector error correction model as

$$\Delta y_t = C + \sum_{\mathrm{j=1}}^{\mathrm{k=1}} \beta_j \Delta y_{t-j} + \prod y_{t-k} + \gamma_j \sigma_t + u_t \text{..................}(12)$$

Where $\prod = -I + \sum_{i=j+1}^{k} \beta_j$

Δ is first difference operator, I is an $n\ x\ n$ identity matrix. y_t is a vector of non-stationary variables and C is the constant term. The information on the coefficient matrix between the levels of the $\prod$ is decomposed as $\prod = \alpha\beta$ where the relevant elements the α matrix are adjustment coefficient and the β matrix contains co-integrating vectors. Johansen and Juselius (1990) specify two likelihood ratio test statistics to test for the number of cointegrating vectors. The first likelihood ratio statistics for the null hypothesis of exactly r cointegrating vectors against the alternative $r+1$ vectors is the maximum Eigen value statistic, given by

$\lambda_{\max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1})$. The second statistic for the hypothesis of at most r co-integrating vectors against the alternative is the *trace statistic,* given by;

$\lambda_{trace} = -T \sum_{r=1}^{p} (1 - \hat{\lambda})$.

The critical values for both test statistics are tabulated in Johansen and Juselius (1990).

4.6 Granger causality

To test whether there is any association between stock and currency markets, Granger causality test has been used. Granger causality test is used when it is known that some relationship exists between two variables but not sure which variable causes the other to move.

In the absence of any cointegration relationship between the variables, the standard test based on Granger (1988) method is applied. The Granger method seeks to determine how much of a variable, *S*, can be explained by the past values of S and whether adding lagged values of another variable, *E*, can improve the explanation. The following is the equation;

$$\Delta S_t = \beta_0 + \sum_{i=1}^{q} \beta_{1i} \Delta S_{t-i} + \sum_{i=1}^{q} \beta_{2i} \Delta E_{t-i} + \varepsilon_{1t} \text{..........................} (13)$$

Application of Granger causality test requires two tests to run at the same time to check the relationship in each direction. The second test is

$$\Delta E_t = \alpha_0 + \sum_{i=1}^{r} \alpha_{1i} \Delta E_{t-i} + \sum_{i=1}^{r} \alpha_{2i} \Delta S_{t-i} + \varepsilon_{2t} \text{...........................} (14)$$

The ε_{1t} andε_{2t} are uncorrelated stationary random process, and *t* denotes the time period. Failing to reject the hypothesis: $H_0 = \beta_{21} = \beta_{22} = \beta_{23} = ... = \beta_{2q} = 0$ implies that exchange rates do not Granger cause stock prices. On the other hand, failing to reject:

$H_0 = \alpha_{21} = \alpha_{22} = \alpha_{23} = ... = \alpha_{2r} = 0$ implies that stock prices do not Granger cause exchange rates.

Equation (14) is test of causation running from stock market to currency market and equation (13) is causation test running from exchange market to stock market. The null hypothesis of Granger Causality test is that coefficient of *S* (*α*) in equation (14) and coefficients of *E* (*β*) in equation (13) are jointly zero. Rejection of null hypothesis in equation (14) means stock market Granger causes exchange market while rejection of null hypothesis in equation (13) means that causation runs from exchange market to stock market. The number of lags in specification of Granger Causality needs to be selected on the basis of their significance for accuracy of the result. Lags will drop until the last lag will be significant. The results of Granger causality test are carefully interpreted as it just shows the statistical relationship between variables. It does not mean that one series which comes first causes the other to move.

4.7 Generalised Autoregressive Conditional Heteroscedasticity (GARCH)

To understand the volatility pattern of stock prices and exchange rates the exponential GARCH model by Nelson (1991) is used. The EGARCH model gives asymmetry and leverage of the volatility.

4.7.1 .EGARCH

When using this technique the variables are in first difference of their natural logarithms; that is, percentage changes in stock prices and exchange rates.

$lnS_t = 100*(lnS_t - lnS_{t-1})$

$lnE_t = 100*lnE_t - lnE_{t-1}$

$$r_i = \alpha + \beta_i r_{i,t-1} + \xi_{i,t} \text{.........................}(15)$$

$$\xi_{i,t} = \sigma_t^2 z_{i,t}$$

$$\ln \sigma_t^2 = \omega + \gamma \frac{u_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \alpha \left[\frac{|u_{t-1}|}{\sqrt{\sigma_{t-1}^2}} - \sqrt{\frac{2}{\pi}} \right] \text{....................}(16)$$

Where r_i is the return from market *i* i.e. either return from stock market or exchange market. σ_t^2 is known as the conditional variance since it is a one period ahead estimate for the variance calculate on any past information thought relevant. Equation (16) defines a variance, *β, α, γ, ω* are parameters to be estimated. Since the $\ln \sigma_t^2$ is modeled, then the significant advantage of EGARCH models is that even if the parameters are negative, σ_t^2 will be positive. The *α* parameter represents a magnitude effect or the symmetric effect of the model, the "GARCH" effect. *β* measures the persistence in conditional volatility irrespective of anything happening in the market. When *β* is relatively large, then volatility takes a long time to die out following a shock in the market.

The γ parameter measures the asymmetry or the leverage effect, the parameter of importance so that the EGARCH model allows for testing of asymmetries. If $\gamma = 0$, then the model is symmetric. When $\gamma < 0$, then positive shocks (good news) generate less volatility than negative shocks (bad news). When $\gamma > 0$, it implies that positive innovations are more destabilizing than negative innovations.

CHAPTER FIVE

ESTIMATION, INTEPRETATION AND ANALYSIS OF RESULTS

5.1 Introduction

This chapter presents empirical estimation and analysis of the results. The chapter is divided into seven sections. Descriptive statistics are presented in section 5.2 before proceeding to estimation. Section 5.3 presents unit root tests for all variables while volatility estimation is presented in section 5.4. Cointegration analysis, Granger causality, and interpretation are presented in section 5.5 and section 5.6 presents EGARCH estimation and their interpretations. Comparison with other studies is drawn in section 5.7 while section 5.8 summarizes the chapter. Eviews 6 software has been adopted for all the data analysis as it is an improved and superior version compared to Eviews 5.

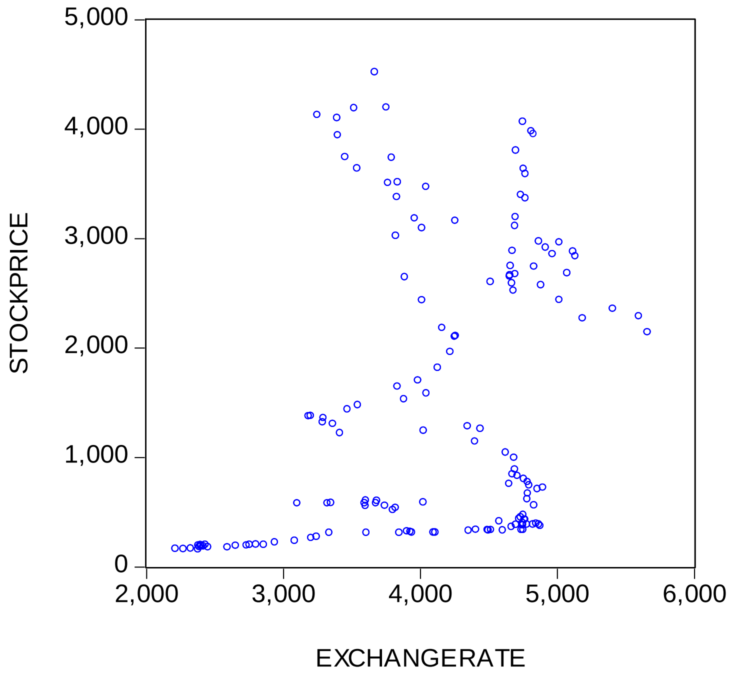
5.2 Data

The study uses monthly time series data from January 1999 to July 2011. The sample period is chosen because data for all share indexes is available from 1999. Nominal exchange rate of the Zambian Kwacha to the US dollar is obtained and stock prices are measured using the LuSE all share index. Nominal exchange rates and all share stock index data were obtained from the Bank of Zambia (BOZ) and the Lusaka Stock Exchange (LuSE) respectively.

5.3 Descriptive Statistics

Presenting the data in Graphs gives an idea of how the series are distributed. A scatter plot of stock price and exchange rates is presented in figure 5.1.

Figure 5.1.Scatter plot of stock prices and exchange rates

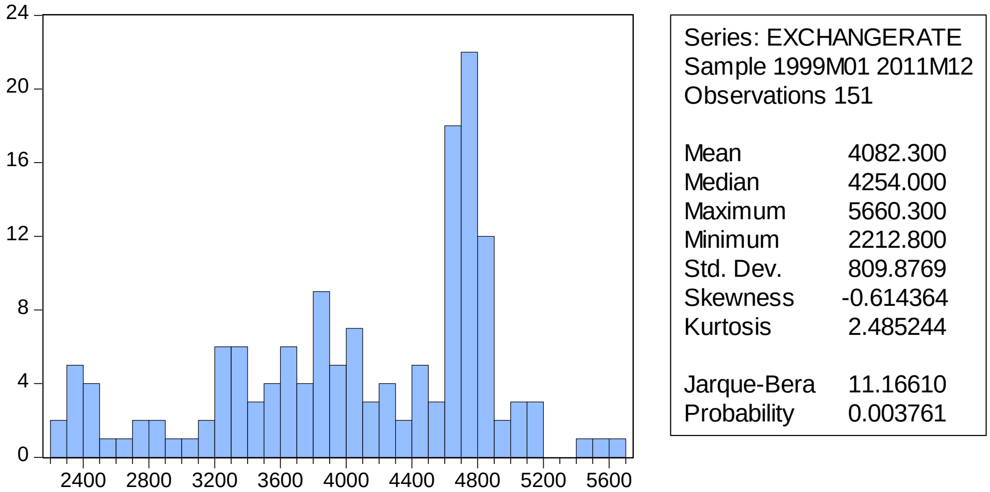


The scatter plot gives a visual inspection of how the variables are related. From Figure 5.1 it can be seen that stock prices and exchange rates do not follow a specific pattern. There is no relationship that can be drawn from the graph. Stock prices between 0 to1000 tend to have a different pattern from the stock prices between 1000 upwards.

Descriptive statistics

Following the power of ladders for exchange rates and stock prices (*see appendix 1*), the stock prices have been transformed into natural logarithms while the exchange rate is not transformed. This is because exchange rates are closer to normal distribution in identity form than when transformed in any way possible. Therefore, in the analysis all values of stock prices are in natural logarithms.

Figure 5.2: Histograms and descriptive statistics for exchange rates and stock prices.



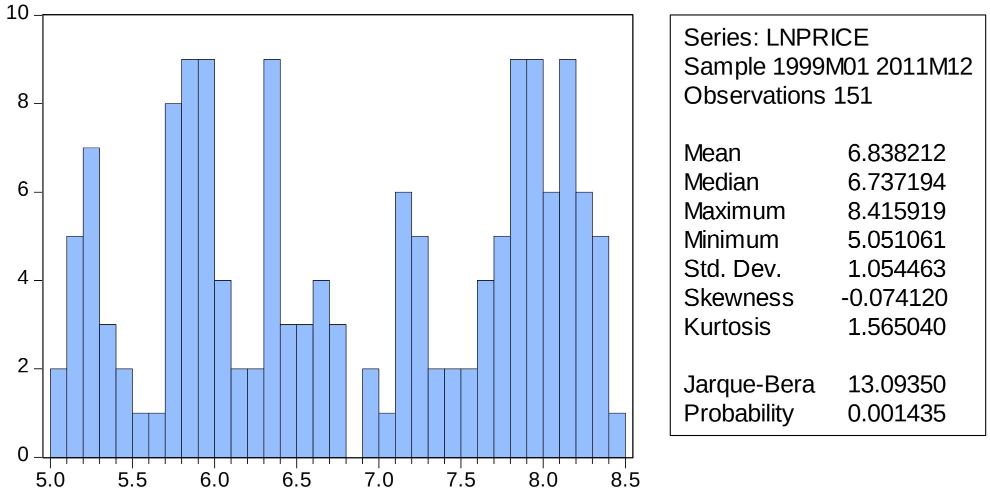


Figure 5.2 shows some descriptive statistics of stock prices and foreign exchange rates. The series are said to be negatively skewed and the kurtosis is less than the normal distribution kurtosis of 3. The Jarque-Bera test is performed for stock market index and exchange rates returns in order to check the normality of each series. The results confirm that the distribution of stock index and exchange rates returns are not normal. We therefore can no longer assume normal distribution in our dataset. Ordinary least squared regression tests are not appropriate in testing the relationship between stock returns and exchange rates changes.

5.3 Results of Unit root tests

From Figure 2.1 and 2.2 in chapter two, it can be observed that both exchange rates and the all share index are increasing; showing that they have unit root and are non-stationary. Formal investigation is undertaken using Augmented Dickey Fuller test as well as the Phillip Peron test. For both Augmented Dickey Fuller and Phillip Peron tests, lag has been selected using Schwartz information criteria. Both ADF as well as Phillip Peron Tests test the null hypothesis of unit root in the series. They report test statistics, which are compared to McKinnon Critical values. If ADF statistics or PP statistics exceed critical value, null hypothesis of unit root in the series cannot be accepted and if test statistics do not exceed critical value, then null hypothesis of unit root in the series cannot be rejected and series is said to be non-stationary.

The data is first tested for seasonality; the results find that stock prices have seasonal effects. Thus the natural log of stock prices is adjusted for seasonality. Therefore seasonal adjusted series of stock prices are used to test for unit root while exchange rates are not adjusted for seasons. The ADF and PP tests are used, with constant and linear trend as suggested by Engle and Granger (1978). The lag length is selected by Schwartz Bayesian criterion. Table 5.1 shows the ADF and Philips Peron test first at levels and in difference.

Table 5.1: Unit Root Test Results.

Series	Model	Variables in levels		Variables in first difference	
		ADF	PP	ADF	PP
log Stock prices	Constant	-1.118	-1.119	-11.337	-11.807
		(0.7080)		(0.000)	(0.000)
	Constant& trend	(0.7077)		-11.337	-11.803
		-1.322	-1.934	(0.000)	(0.000)
	None	(0.8786)		-4.514	-11.563
		(0.6316)		(0.000)	(0.000)

		2.932 (0.992)	2.098 (0.992)		
Exchange rates	Constant	-2.491 (0.12)	-2.207 (0.205)	-8.445 (0.000)	-8.418 (0.000)
	Constant& trend	-2.586 (0.288)	-2.306 (0.428)	-8.459 (0.000)	-8.427 (0.000)
	None	0.414 (0.802)	0.457 (0.812)	-8.402 (0.0000	-8.379 (0.000)

Figures in parenthesis are *p*-values

Both exchange rates and all share indexes contain unit root at level since from the *p*-values, the null hypothesis cannot be rejected. Thus, it can be concluded that the series are integrated of order one. The variables are said to be stationary in first difference because the test statistics are highly significant, from the *p*-values the null hypothesis of unit root is rejected. With this finding, cointegration test between the variables are then undertaken.

5.4 Volatility Estimation

The volatility series is generated using GARCH (1, 1). Before estimating volatility, stock prices are tested for the presence of the ARCH effect. The mean equation is specified as follows;

$$y_t = \beta + \delta y_{t-1} + \varepsilon_t \text{.......................(10)}$$

Where y_t denotes the logarithm of stock prices, y_{t-1} is the lagged values of stock prices, β is a constant representing the expected stock price and ε_t is the uncorrelated error term.

In testing for ARCH effect, Ordinary Least Square was employed on Equation (10) and then LM-ARCH test was employed on its residuals. The results are presented in table 5.2.

Table 5.2; ARCH test results for stock prices

ARCH Test:

F-statistic	2132.508	Probability	0.000000
Obs*R-squared	144.0683	Probability	0.000000

The probability of the F-statistic is low signifying that there is a presence of ARCH effect in the series thus, GARCH (1,1) is used to estimate volatility. The GARCH output (see appendix) using mean equation as equation (10). The coefficient of the GARCH term is positive thus it is in line with the non-negativity condition. In the diagnostic test, the null hypothesis of no ARCH is not rejected implying that GARCH is suitable to estimate volatility. The volatility series is then used as an exogenous explanatory variable in the cointegration equation (11).

$$y_t = a_0 + \sum_{j=1}^{k} \beta_j y_{t-j} + \gamma_j \sigma_t + u_t \text{.........................(11)}$$

5.5 Cointegration and Granger Causality tests

5.5.1 Johansen cointegration test results

After testing for unit root, cointegration test is carried out.

Table 5.3; cointegration results

Null hypothesis	Alternative hypothesis	Max-Eigen statistic	Critical values 5%	probability	Trace statistic	Critical values 5%	Probability
r=0	*r*=1	11.10	14.26	0.149	15.33	15.49	.053
r≤1	*r*=2	4.23	3.84	0.039	4.23	3.84	.0398

The results show that there is no cointegrating equation found because from the probability we fail to reject the null hypothesis of no cointegration. Therefore, it is concluded that there is no long run relationship between stock prices and exchange rates. The variables do not move together in the long term, thus, none of the variables is predictable on the basis of the past values of the other variables. These results of no cointegration between stock prices and exchange rates are similar to what Abbas (2009) and Adjasi *et al* (2011) found in their studies.

5.5.2 Granger causality test

In the absence of any cointegrating relationship between the variables the standard Granger causality test is undertaken to check for any causal relationship between stock prices and exchange rates. To find out the causal relationship between the variables which are non-stationary, the data series should be transformed into stationary (first difference). The results show that there is neither causal relationship from stock to exchange nor from exchange to stock prices. So it can be said that stock prices do not influence exchange rates and past values of stock prices cannot be used to improve the forecast of future exchange rates.

Table 5.4; Granger Causality Test results

Null hypothesis	F-statistics	Probability
Stock prices does not Granger cause exchange rates	1.40828	0.24791
Exchange rates does not Granger cause stock prices	0.35235	0.70364

Source; author's computation

Given that there is no long run relationship between the stock prices and exchange rates, and that they do not Granger cause each other, a further investigation into their volatility is done using the Exponential Generalised Autoregressive Heteroscedasticity condition (EGARCH) technique. According to Malmsten and Teräsvirta (2004) most financial series, stock price and exchange rates, are volatile, therefore the study explores further the volatility of the variables.

5.6 EGARCH Results

To understand the volatility and asymmetric effects in the markets, EGARCH is estimated. EGARCH allows the difference in the way bad news and good news affect the variance of the series. Volatility patterns are estimated in both exchange rates and stock market. Therefore the series are differenced in their natural logs and multiplied by 100 to get percentage changes.

a. Descriptive statistics of the series

When examining volatility, especially under the hypothesis that the series exhibits volatility clustering, it is important to examine some general characteristics of the residuals that may suggest the presence of heteroscedastic ARCH disturbances. The descriptives are examined and the results of tests for kurtosis, skewness and normality for the returns of stock prices and the Zambian Kwacha are reported.

As illustrated in the two figures 5.5a and 5.5b, the series are still non normal even after differencing; this is because the probability for the Jarque Bera test is very low indicating that the null hypothesis of normality is rejected. Also the coefficient for kurtosis indicates that the two series are leptokurtic meaning the kurtosis is high, this is usually typical of ARCH disturbances (see also to Malmsten and Teräsvirta, 2004). Both series are negatively skewed (large left tail).

Figure 5.5a Histogram and Descriptive statistics differenced values of stock prices and exchange rates.

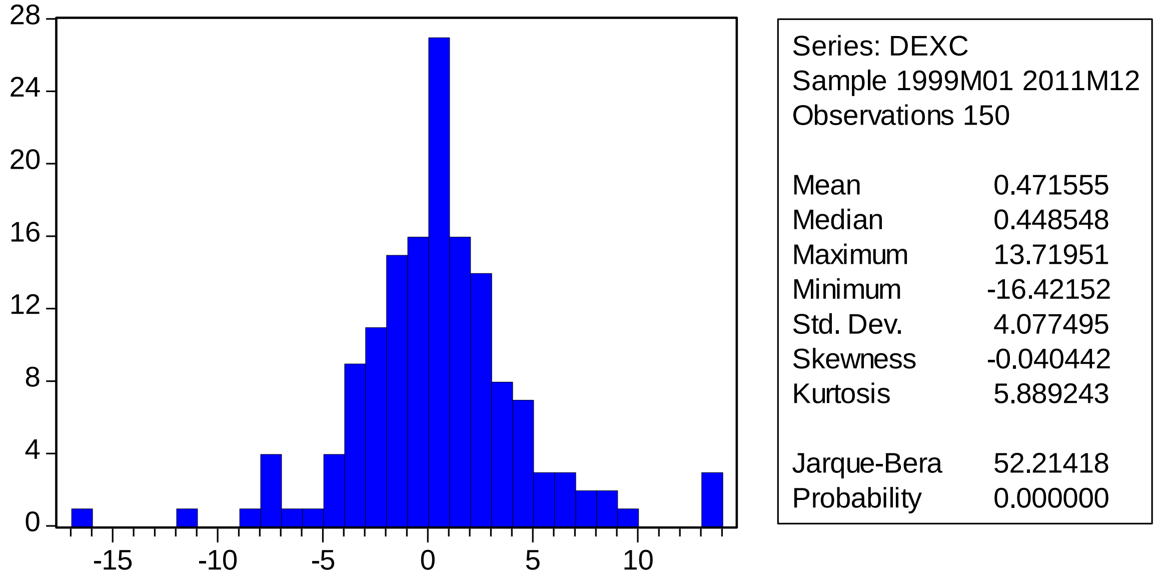


Figure 5.5b

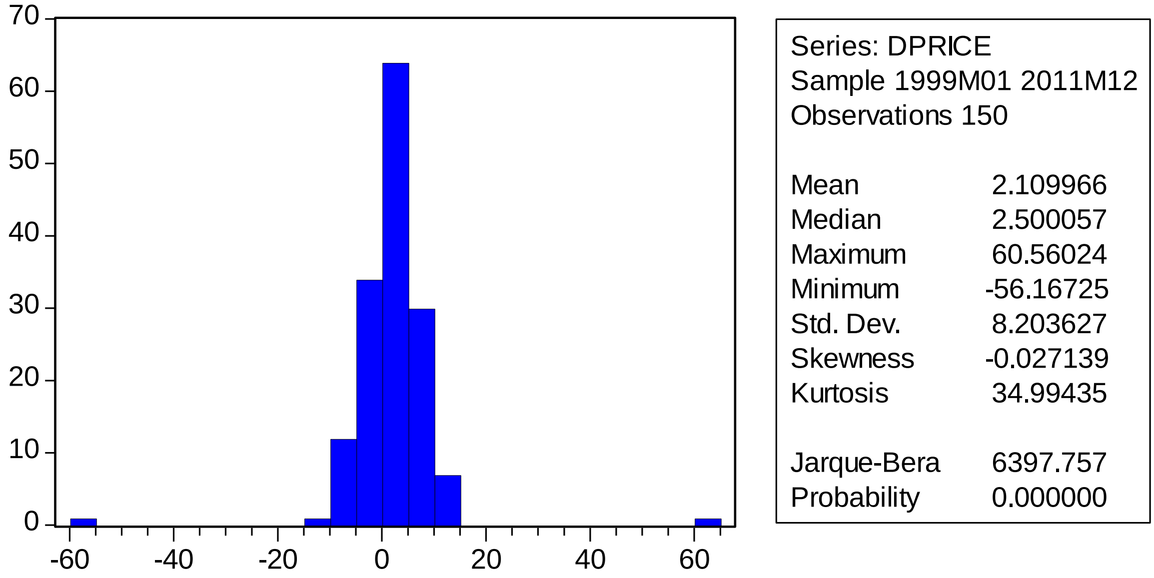


Figure 5.6(a); The percentage change in exchange rates

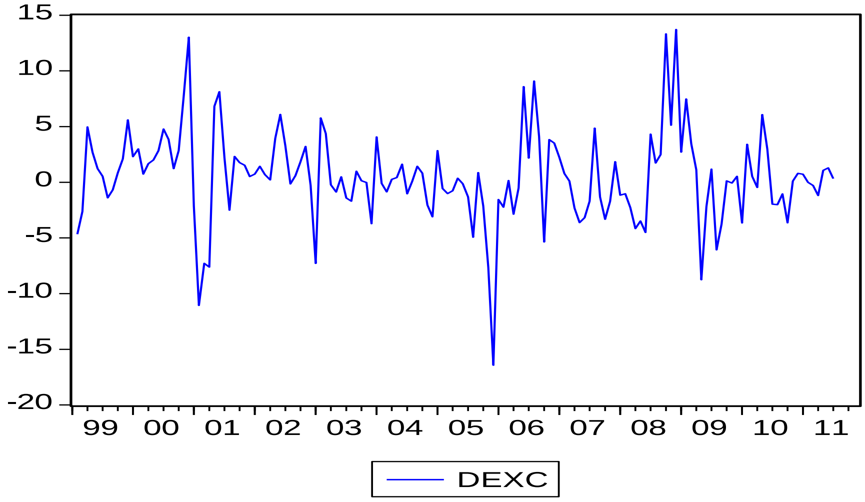


Figure 5.6(a) shows the natural log-difference, multiplied by 100, of the exchange rates which is roughly equal to the percent change of the monthly data shown in Figure 2.2.

Figure 5.6(a) displays the percent in the vertical axis and the time period in the horizontal axis. From the graphs -16.4% in December 2005 was the largest drop (appreciation of the Kwacha). 13.7% in December 2008 was the largest rise (depreciation of the Kwacha). Although there are some outliers, the percent changes seem to be distributed within a relatively small range, i.e., variance of the percent change is small. The exchange rates seem to be heteroscedastic.

Figure 5.6(b): The percentage change in stock prices.

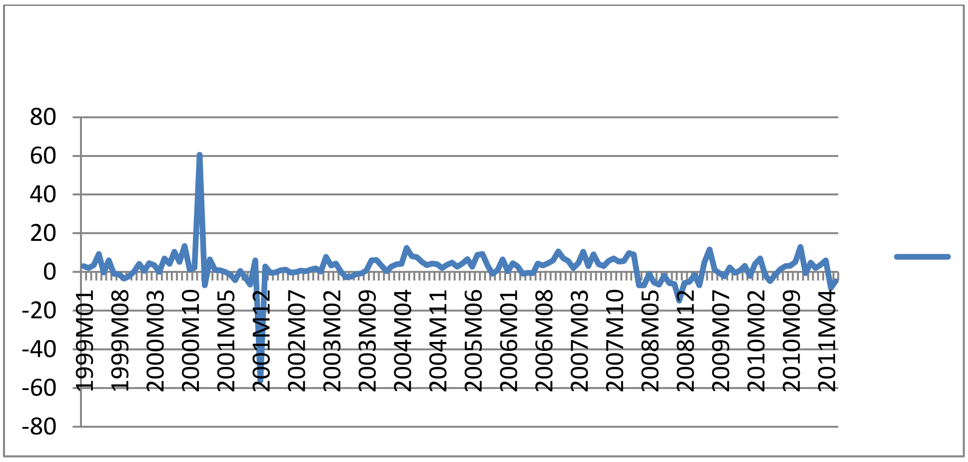


Figure 5.6(b) shows the natural log-difference, multiplied by 100, of the all share stock index which is roughly equal to the percent change of the monthly data shown in Figure 2.1.-56.2% in January 2002 is the largest drop and 60.6% in January 2001 is the largest rise in the index. There are some outliers in the data and seems to be heteroscedastic.

5.6.1 Univariate EGARCH Results

The parameter estimation for the EGARCH (1, 1) model is presented in Table 5.7. The series are tested for the presence of ARCH effects. Equation 15 is estimated and the residuals are tested for serial correlation. For stock prices as shown above when estimating GARCH (1,1) the series contain ARCH effects thus EGARCH estimation is necessary. However, the test for exchange rates shows no serial correlation (see appendix 3). From the results the null hypothesis of no serial correlation is not rejected thus estimating EGARCH for exchange rates is not necessary, therefore, the results estimated may not be valid. From the results for stock market, the asymmetry coefficient γ is positive and significant at 5%, meaning that positive shocks(good news) is more volatile than negative shocks(bad news). The positive innovations are more destabilizing in the stock market. Investors in Zambia prefer to hear good news than good news.

Table 5.7: EGARCH results

	Stock prices	Exchange rates
ω	5.282755* (10.46398)	0.000131 (0.00053)
β	-0.701473* (-4.346484)	0.824850* (6.673355)
γ	0.407668* (2.321143)	-0.037250 (-0.283133)
α	0.751535* (1.553357)	0.591796* (3.505595)

*significant at 5%, figures in parentheses are Z-statistic

Diagnostic test

ARCH-LM test F-statistic	0.680820 (0.4107)	0.015546 (0.9009)
Normality test Jarquebera	755.5679 (0.00000)	15.313 (0.000473)

Figures in parentheses are the p-value

The symmetric effect α is larger than 0.1 , so it means that the volatility is sensitive to market events in th stock. The parameter β measures the persistence in conditional volatility irrespective of anything happening in the market. According to Wu (2005), a necessary condition for the volatility persistence terms to be stable is that the value of the estimated coefficients should be less than one; and in this case the coefficients are less than one. The coefficient for stock prices is negative and significant at 5% meaning that the volatility in the variables persists. The diagnostic test illustrates that the model has been correctly specified and no extra heteroscedasticity needs to be accounted for. The non-normality of the residuals is taken care of by assuming Bollerslev-Woodrigdge heteroscedasticity consistent covariance.

5.6.2 Bivariate EGARCH Results

For a Vector Autoregression (VAR) model it is in order to select the number of lags that would be appropriate to apply to our variables; hence the lag selection test of up to 4 lags is estimated. Using the lag order selection criteria, lag 1 is selected by all criteria (see appendix 3). Again, ensuring that the lag length selected for the VAR model is free from serial correlation, the LMF test to check for serial correlation is applied up to the number of lags in the VAR model. The OLS of this equation (17) is then estimated to test for ARCH effect in the residuals using Breusch-Pagan-Godfrey test.

$$\mathrm{S_t} = \alpha + S_{t-1} + E_{t-1} + u_t \text{............................}(17)$$

The results show that there is heteroscedasticity in the residuals because we eject the null hypothesis at 10% level of significance. A bivariate extension of the EGARCH (*p, q*) model is applied in order to examine whether the volatility of stock returns affects and is affected by the volatility of exchange rates changes in the model.

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	2.749213	Prob. F(2,146)	0.0673
Obs*R-squared	5.407749	Prob. Chi-Square(2)	0.0669
Scaled explained SS	86.89115	Prob. Chi-Square(2)	0.0000

However, the logarithm breaks down when estimating the EGARCH. This is because GARCH is not found in equation 17. Therefore, an exponential ARCH is estimated, the variance equation for EARCH is specified as;

$$\ln\sigma_t^2 = \omega + \gamma\frac{u_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \alpha\left[\frac{|u_{t-1}|}{\sqrt{\sigma_{t-1}^2}} - \sqrt{\frac{2}{\pi}}\right] \text{.....................(18)}$$

Where γ is the coefficient of asymmetry in the model and α is the symmetric coefficient. The equation 18 differs from equation 16 because equation 17 does not estimate persistence since the GARCH is not included. The results of the estimation are given in table 5.8;

Table 5.8.Results of a bivariate EGARCH

LOG(GARCH) = C(4) + C(5)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(6)
*RESID(-1)/@SQRT(GARCH(-1))

	Coefficient	Std. Error	z-Statistic	Prob.
DEXC(-1)	-0.747212	0.088416	-8.451086	0.0000
DPRICE(-1)	0.428754	0.096757	4.431244	0.0000
C	0.007822	0.003411	2.293284	0.0218
Variance Equation				
C(4)	-6.346744	0.163488	-38.82087	0.0000
C(5)	1.456389	0.282933	5.147461	0.0000
C(6)	0.654200	0.134450	4.865754	0.0000

R-squared	-0.310580	Mean dependent var	0.021414
Adjusted R-squared	-0.356404	S.D. dependent var	0.085242
S.E. of regression	0.099277	Akaike info criterion	-2.298622

Sum squared resid	1.409394	Schwarz criterion	-2.177657
Log likelihood	177.2473	Hannan-Quinn criter.	-2.249476
Durbin-Watson stat	2.567327		

Heteroskedasticity Test: ARCH

F-statistic	0.228977	Prob. F(1,146)	0.6330
Obs*R-squared	0.231750	Prob. Chi-Square(1)	0.6302

From the mean equation in the output, it can be observed that the coefficient of the lagged values of exchange rates has a negative sign. This shows that past values of exchange rates negatively affect stock prices. A unit change in exchange rates cause a negative change in stock prices by 0.75%. Stock prices will fall by 0.75% for a unit rise (depreciation) in exchange rates. Moreover, past values of stock prices also affect the present value of stock prices. A unit change in past values of stock prices increase present stock by 0.43%. Both coefficients are significant at 10% and 5% level of significance.

The Variance equation in the exponential ARCH does not include volatility persistence of the shocks, however from the results γ=0.645200 is positive and is significant meaning good news generate more volatility in the model than bad news. The news can come from either stock prices or exchange rates. Moreover α=1.456389 and is also positive and significant implying that volatility is sensitive to changes in the model this.

5.7 Comparison with earlier studies

It is prudent to compare the results of this study to other studies done in developed and developing countries. However, this study differs from the other studies because of the inclusion of a volatility measure in the cointegration equation. The volatility series is included as another variable playing a role in bringing the two variables back to equilibrium. A study by Staverak (2004), Abbas (2009), Tabak (2006), and Kutty (2010) showed no cointegration between the variables, however in most countries included in their studies some cointegration were found. Abbas (2010) found no long run causality in any direction. This study is also similar to what Rahman and Uddin (2009) found; they did not find any cointegration between the variables and no variable caused the other.

On the issue of volatility, most studies used EGARCH to estimate spillover effects, however in this study does not estimate the spillover effects from one market to the other. Morales (2008) found that volatility persistence in both stock and exchange market was significant. Moreover, Doong and Lee (2005) also found persistence and asymmetry in both stock prices.

5.8 Conclusion

The chapter presented unit root tests which showed that the series are integrated of order one and are stationary in first difference. The volatility was estimated using GARCH (1,1) model, and was included in the Johansen cointegration equation as an exogenous Variable. The result shows that there is no cointegration in the long run. The variables do not move together in the long run. Granger causality test shows no causal relationship between the two variables. The estimation of the EGARCH model reveals that volatility in the stock prices and exchange rates is persistent and the coefficient of asymmetry is significant.

In relation to the objectives of the study, it is evident that there is neither long run nor short run relationship between stock prices and exchange rates in Zambia. Changes in Stock prices do not lead to changes in exchange rate neither do changes in exchange rate lead to changes in stock prices.

CHAPTER SIX

CONCLUSION, POLICY IMPLICATIONS AND RECOMMENDATIONS

6.1 Introduction

The focus of this study is examining the relationship between stock prices and exchange rates in Zambia. Therefore, this chapter concludes the study by providing a summary of the empirical findings, brief explanation on approaches used to answer the question raised and policy implications.

6.2 Summary and conclusions

There have been many studies undertaken to examine the relationship between stock prices and exchange rates. This study sets out to investigate this relationship for Zambia. The stock exchange in Zambia was opened in 1994 and there has been progressive improvement in its operation and number of companies listed and quoted. It could be said that the Zambia Kwacha follows the pattern of copper prices which is Zambia's main export commodity. However, during the 2007/8 global financial crises the exchange rates depreciated while stock prices fell, this is also reflected in the decline of the LuSE all-share index. Therefore, the study investigated whether any relationship exists between the two variables.

The theoretical literature, especially the portfolio balance and traditional approaches postulates the relationship between stock prices and exchange rates could either be negative or positive. Traditional approach explains the mechanism through demand

and balance of payment. For instance, depreciation in Kwacha would reduce the cost of products for the foreign consumers, affecting their demand for local goods. The increased demand for local goods induces producers to increase their output levels. Firm profit will increase, and ultimately leads to increase in stock price. Portfolio balance explains the mechanism through investors holding of wealth. A reduction in the prices of stock induces a decline in investors' wealth, which eventually reduce their demand for money. The result is a fall in interest rate making capital to flow out and leading to depreciation in domestic currency. Empirical studies are not conclusive on which variable causes the other; and on whether they move together in the long run. Kasman (2003), found cointegration and bidirectional causality whereas Rahman and Uddin (2009) found no cointegration and causality relationship between stock prices and exchange rates. As can be deduced from empirical studies reviewed in some countries the portfolio balance approach holds and in some cases the traditional approach holds.

This study employs Johansen cointegration to estimate the long run relationship between stock prices and exchange rates. Using monthly data from January 1999 to July 2011 for both bilateral nominal exchange rates (Kwacha/US$) and LuSE all share index. Having generated volatility series using GARCH (1,1) and incorporated into the cointegration equation, the results show that there is no long run relationship between stock prices and exchange rates and the volatility does not help in trying to bring the two variables to equilibrium. Even though literature suggest there is a relationship. Nath and Samanta (2003) in their study on India found no cointegration, Abbas (2009) too found no long run relationship in all the countries studied. For Zambia the scatter plot revealed that there is no relationship between stock prices and exchange because of the pattern they portray. There are three tiers of stock prices that give different patterns.

In the absence of cointegration, a standard Granger Causality was estimated. The results show that there is no Granger causality. Changes in stock prices don't lead to changes in exchange rate. These results neither support the traditional approach nor the portfolio balance approach. As a step further in the analysis, an exponential GARCH model is estimated. In this estimation the difference of the logarithms of stock prices and exchange rates are used. The results show that the coefficient of both asymmetry and persistent are significant for stock prices. This implies that investors on LuSE prefer to hear good news as against bad news. After adjusting for Heteroscedasticity the results show that a unit change in past values of the exchange rates has a negative impact of -0.75% on stock prices while the past values of stock prices have a positive impact of 0.43% on stock prices.

6.3 Policy implications

With the results of no cointegration and no Granger causality between stock prices and exchange rates as the analyses of this study reveals, there appears to be no predictive ability between exchange rates and stock prices in Zambia. The results may mean that investors do not have to worry about exchange rates movements when making their investment decision to hedge against their risk exposure to currency changes, and policy makers also need not worry about managing the exchange rates with a view to influencing stock prices. This can also mean that in the long-run exchange rates volatility cannot be controlled through stock market regulation. Moreover, it reveals that there is no chance of profitable speculation in the stock market or foreign exchange market, as there is no way causal relationship between stock prices and exchange rates. Participants cannot use information of one market to improve the forecast of another market.

While hedging instruments like futures, forwards and options have always been available, their relative complexities have hindered the widespread adoption by the average investor. The LuSE has to sensitise and encourage the use of these instruments and the Exchange Trade Funds (ETF) by an average investors and trading firms. Companies with branches and subsidiaries companies in different countries should centralize the exchange risk management decision to single entities than leaving it for the parent company. Furthermore, the government needs to reduce political uncertainty and improve law and order to create a conducive investment climate to attract investors.

Since the Zambian economy responds to the shocks like international copper prices, the government should develop a clear industrial policy which guides and motivates the expansion of traditional exports to other sectors so that any changes in copper prices cushions the exchange rates because of other export commodities.

6.4 Limitations of the study and recommendations for further research

One of the limitations to this study is the paucity of data. It would have been more desirable to have weekly or daily observation and for a longer period of time.

However, the only data that is available is from 1994 to 2011. This implies the need for future research after some years from now; there would be long enough data on stock prices and the exchange rates to allow for sufficient span and more rigorous analyses.

The study could not estimate the volatility spillover from one market to the other and the dynamics of how long it takes for the volatility persistence to die out, this is because estimation of volatility spillover is more tedious and require longer data span. This could have given more insight on the volatility relationship between stock prices and exchange. The inclusion of more variables would offer a better explanation of the relationship between the variables. It would be better to have more than one bilateral exchange rates(for example Kwacha/pound, Kwacha/yen) and more than one type of exchange rates (e.g. REER, NEER) used in the estimation, as this would help understand which exchange rates is a true representation of exchange rates in Zambia.

REFERENCES

Abbas, Z. (2010). Dynamics of exchange rates and stock prices: A study on emerging Asian economies. Unpublished Doctoral dissertation, Mohammad Ali Jinnah University, Pakistan. Retrieved February, 5 ,2012 from http://prr.hec.gov.pk.

Adjasi, C.K.D., Biekpe, N.B., & Osei, K.A. (2011). Stock prices and exchange rate dynamics in selected African countries: a bivariate analysis. *African Journal of Economic and Management Studies, 2*, (*2*), 143–164. Retrieved February, 5, 2012 from www.emeraldinsight.com.

Aydemir, O., & Demirhan, E. (2009). The relationship between stock prices and exchange rates. Evidence from Turkey. *International Research Journal of Finance and Economics, ISSN 1450-2887*, 23. Retrived February, 5, 2012 from www.eurojournals.com/finance.htm.

Aron, J., & Elbadawi, I. A. (1992). Parallel markets, the foreign exchange auction and exchange rates unification in Zambia. *Policy Research Working Paper WPS 909.* The World Bank.

Asteriou, D., & Hall, S.G. (2007). *Applied econometrics*; A modern approach. New York: Palgrave Macmillan.

Azman-Saini, W.N.W., Habibullah, M.S., Law, S.H., & Dayang-A_zzah, A.M. (2006). Stock prices, exchange rates and causality in Malaysia. M*unich Personal RePec Archive.* MPRA paper *656,* 0ctober 2006.

Bollerslov,T. (1986). Generalised autoregressive conditional heteroscedasticity. *Journal of Econometric, 31,* (*3*), *307*-327.

Bova, E. (2009). Is the Zambian kwacha a commodity currency? The Co-movement between Copper prices and Exchange rates. *Swiss National Centre of Competence in Research*. Working paper No 2009/11.

Branson, W.H. (1983). Macroeconomic determinants of real exchange risk, in Herring, R.J. (Ed.), *Managing Foreign Exchange Risk.* Cambridge. Herring Cambridge University Press.

Choi, D.F.S., Fang, V., & Fu, T.Y. (2009). Volatility Spillovers between Stock Market Returns and Exchange rates Changes: the New Zealand Case. *Asian Journal of Finance and Accounting*, *1*,(2).

Choudhry, T. (2005). Exchange rates volatility and the United States exports: evidence from Canada and Japan. *Journal of Japanese and International Economies, 19,* 51 – 71.

Diamandis, P.F., & Drakos, A.A. (2011). Financial liberasation, exchange rates and stock prices: exogenous shocks in four Latin American countries. *Journal of Policy Modeling, 33*, 381-394.

Dickey, D.A., & W.A. Fuller. (1981). Likelihood ratios statistics for autoregressive time series with a unit root. *Econometrica*, *49,* 1057-1072.

Dieci, R., & Westerhoff, F. (2010). Heterogeneous speculators, endogenoeus fluctuations and interacting markets: A model of stock prices and exchange rates. *Journal of Economic Dynamics and control*, *34,* 743-764.

Dimitrova, D. (2005). The relationship between exchange rates and stock prices. Studied in a multivariate model. *Issues in Political Economy*, *14, 1-25 Retrieved* February, 7, 2012 from www.emeraldinsight.com.

Dornbusch, R., & Fischer, S. (1980). Exchange rates and current account. *The American Economic Review*, *70*, (5), 960-971.

Doong, S.C., & Lee, C.H. (2011). The dynamic correlation between stock Prices and exchange rates. *Applied Financial Economics*, *21*, (11), 789-800.

Doong,S.C., & Yang, S.Y.(2004). Price and Volatility Spillovers between Stock Prices and Exchange rates: empirical evidence from the G-7 countries. *International Journal of Business and Economics*, *3*, (*2*), 139-153.

Enders, W. (2004). *Applied econometric time series*. 2nd Ed. New York: John Wiley and sons.

Enders, W. (1995). *Applied Econometric Time Series*. Iowa State University press.

Engle, R.F., & C.W. Granger. (1987). Cointegration and Error Correction: Representation, Estimating and Testing. *Econometrica, 55*, 251–76.

Frankel, J.A. (1983). Monetary and portfolio-balance models of exchange rates determination, in Bhandari, J.S. and Putnam, B.H. (Eds*), Economic Interdependence and Flexible Exchange Rates*. Cambridge: MIT Press.

Granger, C.W.J. (1988). Some recent developments in the concept of causality. *Journal of Econometrics, 39*, (*1*), 199-211.

Granger, C.W.J., Huang, B., & Yang, C. (2000). A bivariate causality between stock prices and exchange rates: evidence from recent Asian flu. *Quarterly Review of Economics and Finance, 40,* (*3*), 337-54.

Johansen, S. (1988). Statistical analysis of cointegrating vectors. .*Journal of Economic Dynamics and Control, 12,* 231-254.

Johansen, S., & Juselius, K. (1990). Maximum likelihood Estimation and Inference on cointegration, with applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, *52,* 169-210.

Kutty, G. (2010). The relationship between stock prices and exchange rates in Mexico. *North American Journal of Finance and Banking Research, 4,* (*4*), 1-12.

Kasman, Sadeet. (2003). The relationship between exchange rates and stock prices: A causality analysis. Dokuz Eylul universitesi, sosyal bilimler enstistusu dergisi. Cilt 5, Sayi 2.

Li, Y. and Huang L. (2009). On the Relationship between Stock Returns and Exchange rates: Evidence on China. Retrieved February, 6th, 2012 from http://www.ceauk.org.uk/2008-conference-papers/Yaqiong-Li.pdf.

Lin, Chien-Hsiu. (2012). The comovement between exchange rates and stock prices in the Asian emerging markets. *International review of economics and finance, 22,* 161-172.

Luo, R. and Visaltanachoti, N. (2010). Real exchange rates, Asset prices and terms of trade: A theoretical analysis. *Economic modeling*, *27,* 143-151.

Lusaka Stock Exchange (LUSE). 2008 *Factbook.* Lusaka stock exchange.

Ma, C.K. and Kao, G.W. (1990). On exchange rates changes and stock price reactions. *Journal of Business Finance and Accounting*,*17*, (*3*), 441-50.

Macdonald, R. (1988). *Floating Exchange rates: Theories and evidence.* London: Unwin Hyman Ltd.

Malmsten, H. and Teräsvirta, T. (2004). Stylized facts of time series and three popular models of volatility. *Stockholm School of Economics*. SSE/EFI working paper series in economics and finance, *563.* August 2004.

Mkenda, B. K. (2001). Long-Run and Short-Run determinants of the real exchange rates in Zambia. *Department of Economics, Goteborg University*. Working Papers in Economics. No.40.

Morales, L. (June, 2007). *The dynamic relationship between stock prices and exchange ratess: evidence from four transition economies.* Paper presented to the Asociación Española de Economía y Finanzas (AEEFI), XDécimasJornadas de Economía International. Madrid, Spain. Retrieved February, 6th, 2012 from http;//arrow.dit.ie/igi/view/content/cgi.

Morales, L.N. (2008). Volatility spillovers between equity and currency markets: Evidence from major Latin American countries. *Cuadernos De economia. 45*, 185-215.

Mungule, K.O. (2004). The Determinants of the Real Exchange rates in Zambia. *African Economic Research Consortium.* AERC Paper *146.* December 2004.

Nelson, D. (1991). Conditional heteroskedasticity in asset returns: A new approach. *Econometrica*, *59*, 347–370.

Ndulo, M., Mudenda, D., Ingombe, L., & Muchimba, L. (2009). Global Financial Crisis Discussion Series. *Overseas Development Institute*. Paper 10. May 2009.

Osinubi, T.S. (1998). *Stock market development and long-run growth in Nigeria.* Unpublished M.Sc. Economics Dissertation, University of Ibadan, Nigeria.

Pavlova, A., & Rigobon.R. (2003). Assets prices and exchange rates. MIT Sloan School of Management. Working paper 4322-03. October, 2003.

Phylaktis, K., & Ravazzolo, F. (2005). Stock prices and exchange rates dynamics. *Journal of International Money and Finance, 24,* 1031-1053.

Qayyum, A., & Kemal, A.R. (2006). Volatility spillover between the stock market and the foreign exchange market in Pakistan. *Pakistan Institute of Development Economics*. Working Paper 2006:7.

Rahman, L., & Uddin, J. (2009). Dynamic relationship between stock prices and exchange rates. *International Business Research Journal*, *2*, (2). Retrieved February, 6th, 2012 from www.ccsenet.org/journal.html.

Samantha, G.P., & Nath, G.C. (2003). Dynamic relation between Exchange rates and stock prices. A case of India. Retrieved February, 6th, 2012 from http://www.nseindia.com/content/press/feb2003c.pdf

Sarno, L., & Taylor, M.P. (2002). *The economics of exchange rates*. Cambridge: Cambridge University Press.

Saha, S. and Chakabrati, G. (2011). Financial crisis and financial market volatility spill- overs. *The international journal of applied economics and finance, 5*, (*3*), 185-199.

Senbet, L., & Otchere, I. (March,2008). *African Stock Markets.* Paper presented at the Seminar for African finance for 21st century high level. Tunisia.

Shew, A. J. (2008). Causality Relationship Between Foreign Exchange and Stock Market Close: Evidence in Singapore. *Bryant Economic Research Papers*, *1,* (*11*).

Stavarek, D. (2004). Stock prices and exchange rates in the EU and the USA. Evidence of their mutual interactions. *Munich personal RePEc Archive paper*. No 7279. Retirieved February, 6th, 2012 from http://mpra.ib.uni-muenchen.de/7272.

Tabak, B.M. (2006). The dynamic relationship between stock prices and exchange rates; evidence from Brasil. *Banco central do Brasil.* Working paper series 124. www.bcb.gov.br/pec/wps/ingl/wps124.pdf.

Tsai, J.C. (2012). The relationship between stock price index and exchange rates in Asian Markets: A quantile regression aprroach. *Journal Of International Financial Markets,Institutions and Money*, *22,* 609-621.

Walid, C., Chaker, A., & Duc, K.N. (2012). Asymmetric effects and long memory in dynamics volatility relationship between stock returns and exchange rates. *Journal of International Financial Markets, Institution and Money*, *33,* 738-757.

Walid, C., Chaker, A. M., Masood, O., & Fry, J. (2011). Stock market volatility and exchange rates in emerging countries: A markov-state switching Model. *Emerging Markets Review*, *12,* 272-292.

Weeks, J., seshamani,V., Mukungu, A.C.K., & Patel, S. (2007). Kwacha Appreciation 2005 – 2006: Implications for the Zambian Economy. *United Nations Development Programme Zambia.*

Wu, R. (2005). International Transmission Effect of Volatility between the Financial Markets during the Asian Financial Crises. *Transition Studies Review*, *15*, 19-35.

Wu, K-J., Lu, C-C., Jono, H., & Perez, I. (2012). Interrelationship between Philippines stock exchange index and USD exchange rates. Procedia-social and behavioural science, *40*, 768-782.

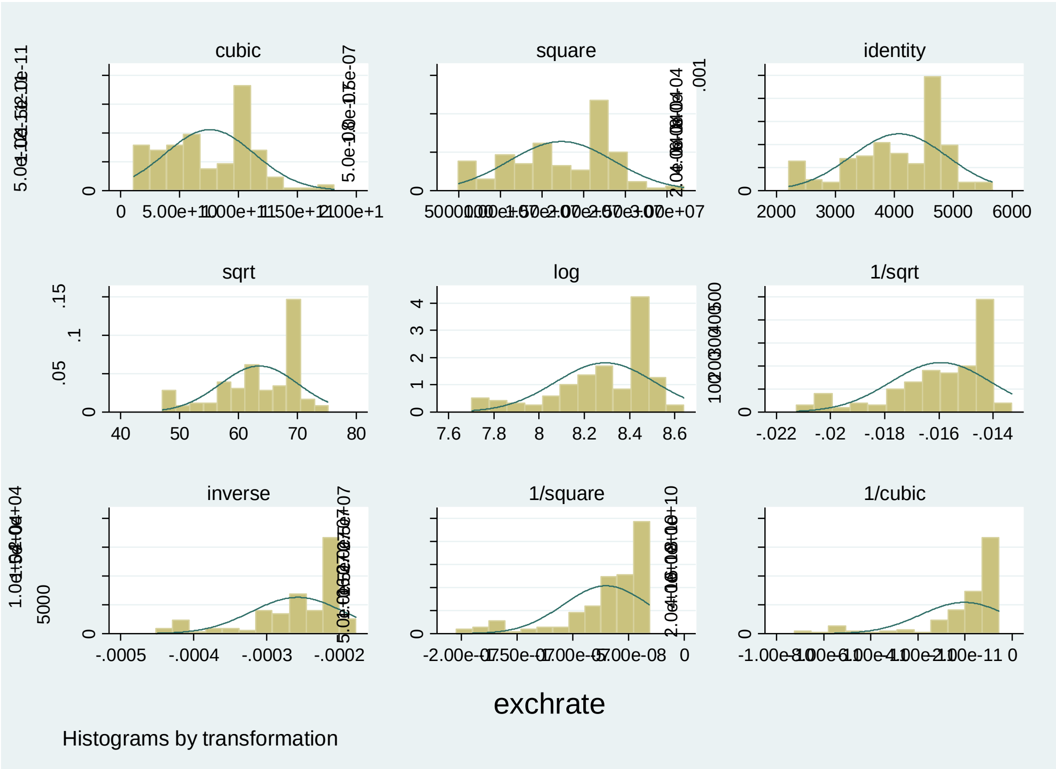
Yang, S. and Doong, S. (2004). Price and Volatility Spillovers between Stock Prices and Exchange rates: Empirical evidence from the G-7 Countries. *International Journal of Business and Economics, 3*, (*2*), 139-153.

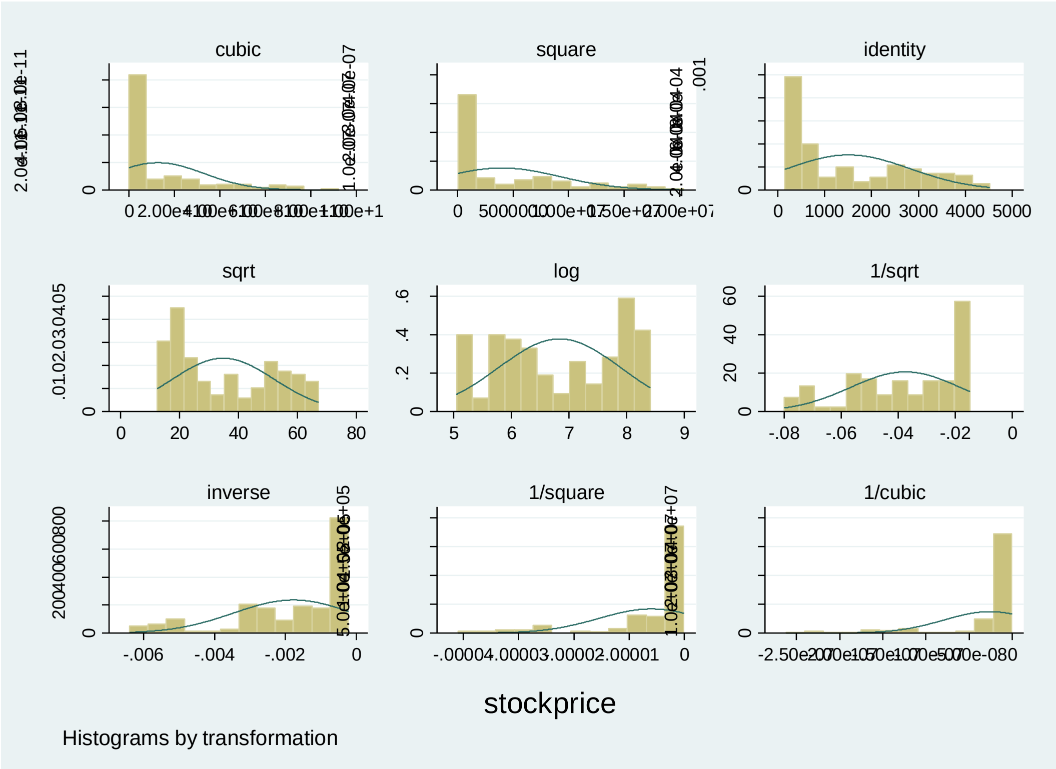
Yau, H., & Nieh, C. (2009). Testing for cointegration with threshold effect between stock prices and exchange rates in Japan and Taiwan. *Japan and the World Economy, 21*, 292-300.

Zhao, H. (2010). Dynamic relationship between exchange rates and stock price: Evidence from China. *Research in International Business and Finance. 24*, 103-112.

APPENDIX

APENDIX.1. Power ladders for both exchange rates and stock prices





APPENDIX 2. Volatility Estimation

GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

	Coefficient	Std. Error	z-Statistic	Prob.
LNPRICE(-1)	0.993486	0.010199	97.40846	0.0000
C	0.063411	0.070497	0.899490	0.3684
Variance Equation				
C	0.001325	0.000675	1.963028	0.0496
RESID(-1)^2	-0.014282	0.006597	-2.164910	0.0304
GARCH(-1)	0.832348	0.100815	8.256179	0.0000

R-squared	0.993461	Mean dependent var	6.850126
Adjusted R-squared	0.993281	S.D. dependent var	1.047748
S.E. of regression	0.085883	Akaike info criterion	-2.076059
Sum squared resid	1.069510	Schwarz criterion	-1.975705
Log likelihood	160.7044	Hannan-Quinn criter.	-2.035288
F-statistic	5507.750	Durbin-Watson stat	1.843235
Prob(F-statistic)	0.000000		

Diagnostic test.

Normality test JB =4901P-value (0.000)

Heteroskedasticity Test: ARCH

F-statistic	0.004952	Prob. F(1,147)	0.9440
Obs*R-squared	0.005019	Prob. Chi-Square(1)	0.9435

APPENDIX 3.Results of EGARCH

Serial correlation test for exchange rates

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.189783	Prob. F(1,146)	0.6637
Obs*R-squared	0.193431	Prob. Chi-Square(1)	0.6601

From the table above the p-value of 0.6637 is greater than the significant level at 10%, 5% and 1%. Therefore we fail to reject the null hypothesis of no serial correlation.

Univariate EGARCH results

Dependent variable :d(stock price)

LOG(GARCH) = C(3) + C(4)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5)
*RESID(-1)/@SQRT(GARCH(-1)) + C(6)*LOG(GARCH(-1))

	Coefficient	Std. Error	z-Statistic	Prob.
DPRICE(-1)	0.360867	0.081590	4.422953	0.0000
C	2.091702	0.393408	5.316871	0.0000
Variance Equation				
C(3)	5.282755	0.504851	10.46398	0.0000
C(4)	0.751535	0.483814	1.553357	0.1203
C(5)	0.407668	0.175632	2.321143	0.0203
C(6)	-0.701473	0.161389	-4.346484	0.0000

R-squared	-0.091879	Mean dependent var	2.103302
Adjusted R-squared	-0.130056	S.D. dependent var	8.230887
S.E. of regression	8.749771	Akaike info criterion	6.565150
Sum squared resid	10947.86	Schwarz criterion	6.686114
Log likelihood	-483.1037	Hannan-Quinn criter.	6.614296
Durbin-Watson stat	2.636238		

Dependent variable: d(exchange rate).

LOG(GARCH) = C(3) + C(4)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5) *RESID(-1)/@SQRT(GARCH(-1)) + C(6)*LOG(GARCH(-1))

	Coefficient	Std. Error	z-Statistic	Prob.
DEXC(-1)	0.434277	0.095819	4.532269	0.0000
C	0.394864	0.241951	1.631998	0.1027
		Variance Equation		
C(3)	0.000131	0.246050	0.000533	0.9996
C(4)	0.591796	0.168815	3.505595	0.0005
C(5)	-0.037250	0.131563	-0.283133	0.7771
C(6)	0.824850	0.123603	6.673355	0.0000

R-squared	0.134809	Mean dependent var	0.505977
Adjusted R-squared	0.104557	S.D. dependent var	4.069320
S.E. of regression	3.850709	Akaike info criterion	5.394388
Sum squared resid	2120.398	Schwarz criterion	5.515353
Log likelihood	-395.8819	Hannan-Quinn criter.	5.443534
F-statistic	4.456275	Durbin-Watson stat	2.086759
Prob(F-statistic)	0.000838		

VAR Lag Order Selection Criteria

Endogenous variables: DEXC DPRICE

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-904.5241	NA	1202.540	12.76795	12.80958	12.78486
1	-891.7200	25.06723*	1062.311*	12.64394*	12.76884*	12.69470*
2	-888.1562	6.876488	1068.907	12.65009	12.85824	12.73467
3	-883.8859	8.119713	1064.953	12.64628	12.93770	12.76470
4	-883.2218	1.243887	1116.386	12.69327	13.06795	12.84552
5	-881.6962	2.814841	1156.304	12.72812	13.18606	12.91421
6	-879.8112	3.424911	1191.751	12.75790	13.29911	12.97783
7	-879.4243	0.692038	1254.662	12.80879	13.43326	13.06255
8	-878.2989	1.981350	1307.450	12.84928	13.55701	13.13687

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

The lag length criteria selects lag one as a significant lag. Therefore lag one will be used in all estimations.