EFFECT OF FOREIGN EXCHANGE EXPOSURE ON VALUE OF NONFINANCIAL FIRMS LISTED AT NAIROBI SECURITIES EXCHANGE, KENYA

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Effect of Foreign Exchange Exposure on Value of Nonfinancial Firms Listed at Nairobi Securities Exchange, Kenya

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University

Signature …….. Date……...

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This Thesis has been submitted for examination with our approval as University supervisors.

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DEDICATION

My dedication for this research project goes to my wife Grace Kavosa Oguda, my sons Alex Oguda, Derrick Oguda and daughter Joy Vihenda for their support and patience, while writing this thesis, without whom, the journey would have been too longer.

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ACRONYMS / ABBREVIATIONS

ARCH	Auto-Regressive Condition Heteroscedasticity
ARIMA	Auto-Regressive Integrated Moving Averages
ARMA	Auto-Regressive Moving Averages
CPI	Consumer Price Index
FCD	Foreign Currency Deposit
FDI	Foreign Direct Investment
FEBCs	Foreign Exchange Bearer Certificates
FEER	Fundamental Equilibrium Exchange Rate
FEM	Foreign Exchange Market
GARCH	Generalized Auto-Regressive Condition Heteroscedasticity
GDP	Gross Domestic Product
GEX	Government Expenditure
GNP	Gross National Product
GPPP	Generalized Purchasing Power Parity
HAC	Heteroscedasticity and Autocorrelation
IMF	International Monetary Fund
IRD	Interest Rates Differential
IS1	Import Substitution Industrialization

ITMEER	Intermediate-Term Model-Based Equilibrium Exchange Rate
JYP	Japanese Yen
KNBS	Kenya National Bureau of Statistics
LOP	Law of One Price
MENA	Middle East and North African
MM	Money Market
MP	Monetary Policy
MRPK	Marginal Revenue Product of Capital.
NAIRU	Non-Accelerating Inflation Rate of Unemployment
NATREX	Natural Real, Exchange Rate
NBER	National Bureau of Economic Research
NEER	Nominal Effective Exchange Rate
NER	Nominal Exchange Rate
NERs	Nominal Exchange Rates
NSE	Nairobi Securities Exchange
NKFl	Net Capital and Financial Inflows
NPIs	Non-Profit Institutions
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares

OPEN	Degree of Openness of Economy Trade Liberalization
PB	Portfolio Balance
PEER	Permanent Equilibrium Exchange Rates
PG	Productivity Growth
PP	Phillip Peron
PPP	Purchasing Power Parity
PRINV	Private Investment (as Percent of GDP)
PSC	Private Sector Credit (as Percent of GDP)
PUBINV	Public Investment (as Percent of GDP)
PSC	Private Sector Credit (as Percent of GDP)
REER	Real Effective Exchange Rate
RER	Real Exchange Rate
RERM	RER Misalignment
RERs	Real Exchange Rates
TOT	Public Investment as (percent of GDP)
TP	RER Misalignment
TPPP	Trend Purchasing Power Parity
UIP	Uncovered Interest Rate Parity
UK	United Kingdom

UNDP	United Nations Development Programme
US	United States
US$	US Dollar
USA	United States of America
WPI	Wholesale Price Index

DEFINITION OF KEY TERMS

Contemporaneous Exchange Rate Changes: Refers to the current (spontaneous) changes in exchange rate (Atindehou & Gueyie, 2001).

Firm Value: An economic measure reflecting the market value of a business, it is a sum of claims by all claimants: creditors (secured and unsecured) and shareholders (preferred and common**)** (Okoye, Odum, & Odum, 2017).

Foreign Exchange Exposure: refers to the sensitivity of a firms cash flows, real domestic currency value of assets, liabilities, or operating incomes to unanticipated changes in exchange rates. The current study will adopt exchange rate exposure as the sensitivity of the value of the firm, proxied by the firm's stock return to unanticipated changes in exchange rates (Chow, Lee & Solt, 1997).

Foreign Exchange: Price for which the currency of a country can be exchanged for another country's currency (Aggarwal & Harper, 2010).

Foreign Exchange Rate: refers to the sensitivity of a firm's cash flows, real domestic currency value of assets, liabilities, or operating incomes to unanticipated changes in exchange rates (Jorion, 1990).

Lagged Exchange Rate Changes: Changes in exchange rates in the preceding period(s) (El-Masry, 2006).

Market performance: refers to how stocks fare under their respective markets given the risks and returns of the markets (Topak, 2011).

Unexpected Exchange Rate Changes: Residuals or the difference between the expected and actual exchange rates. This is the forecasting error (Bartram & Karolyi, 2006).

ABSTRACT

The study investigates the effects of exchange rate exposure on firm value for nonfinancial firms listed at Nairobi Securities Exchange-NSE for period 2001-2016. Specifically the study undertakes to determine the effect of contemporaneous exchange rate changes on firm value of nonfinancial companies, secondly, establish the effect of unexpected exchange rate movements on firm value of nonfinancial companies, thirdly examine the effect of lagged changes in exchange rates on firm value of nonfinancial companies, fourthly establish the effect of changes in exchange rate exposure on firm value as moderated by the market twenty share index of nonfinancial companies at the Nairobi Securities Exchange of the twenty one (21) firms. In line with the financial theory, any change in an exchange rate should affect the value of a firm or an industry. However, earlier research did not fully support this theory, which is surprising in view of the considerable exchange rate fluctuations over the last two decades. Therefore, the study aimed to identify the sensitivity of nonfinancial companies stock returns to exchange rate movements over these periods. An accepted way to measuring exchange rate exposure at the company level can be to exploit the information content in the stock prices. The use of one all-comprising exchange rate indicator fails to address the complexity of the extra-market exchange rate exposure of individual companies. Descriptive research design was used. The study adopted a two staged methodology. The first stage involved the determination of the foreign exchange exposure. At this point the REER is determined as the weighted average of the seven major currencies used by Kenya. The unexpected foreign exchange changes were determined using the ARIMA and GARCH model. The second stage of analysis involves a panel model where different aspects of foreign exchange exposure are regressed on firm value. The findings of the study reveal that contemporaneous exchange rate changes and unexpected exchange rate changes both have a significant negative influence on firm value. This underscores the need for hedging to protect the firm from adverse exchange rate effects. The results were however inconclusive on the effects of lagged changes in exchange rates on firm value. The 20 share index was found to moderately significantly influence the relationship between exchange rate exposure and firm value (share capital gains). The study recommends increases efforts toward exchange rate risks monitoring and mitigation, specifically the usage of derivatives in hedging. It is further recommended that the government through central bank continually monitors the exchange rate movements due to its influence on firm value, share prices and capital gains.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Exchange rate movements have been a big concern for investors, analyst, managers and shareholders since the abolishment of the fixed exchange rate system of Bretton Woods in 1971 (Afza & Alam, 2011). This system was replaced by a floating rates system in which the price of currencies is determined by supply and demand of money (El-Masry & Abdel-Salam, 2007). Given the frequent changes of supply and demand influenced by numerous external factors, this new system is responsible for currency fluctuations (Abor, 2005).

The frequent changes in foreign exchange rates is of prime concern to firms, financial analysts and economists due to its effect on firm operations, revenue and valuation. Exchange rate variability is a source of cash flow risk for firms with foreign-denominated assets and liabilities (whether exporters or importers), as well as firms with overseas operations (Salifu, Osei & Adjasi, 2007). Movements in exchange rates can have a dramatic effect on a firm's financial performance. Example, for the fiscal year ending March 31, 2009, Honda announced that exchange rate hurt the firm's profits to a larger extent than did falling sales over the same period (Greimel, 2009).

Exchange rate changes can affect an individual investor who owns a portfolio consisting of securities in different currencies; a multinational company with subsidiaries and branches in foreign locations; an exporter/importer who concentrates on international trade and even a firm that has no direct international activities (El-Masry, 2006). Furthermore, exchange rate changes, through their impact on the costs of inputs, outputs, and substitute goods, play a significant role in determining the competitive position of domestic companies with no direct international operations relative to foreign firms (Joseph, 2002).

1.1.1 Foreign Exchange Exposure

Foreign exchange rate exposure refers to the sensitivity of a firms cash flows, real domestic currency value of assets, liabilities, or operating incomes to unanticipated changes in exchange rates (Hagelin & Pramborg, 2004). Exchange rate fluctuations affect operating cash flows and firm value through translation, transaction, and economic effects of exchange rate risk exposure (Bartram, 2008). Firms dealing in multiple currencies face a risk (an unanticipated gain/loss) on account of sudden/unanticipated changes in exchange rates, quantified in terms of exposures.

The literature generally identifies four channels of foreign exchange exposure: Economic/operational exposure, translational exposure, transactional exposure, and contingency exposure (Salifu *et al.,* 2007). Economic/ operational exposure is the extent to which a firm's market value, in any particular currency, is sensitive to unexpected changes in foreign currency. Currency fluctuations affect the value of the firm's operating cash flows, income statement, and competitive position, hence market share and stock price. Currency fluctuations also affect a firm's balance sheet by changing the value of the firm's assets and liabilities, accounts payable, accounts receivables, inventory, loans in foreign currency, investments (CDs) in foreign banks; this type of economic exposure is called balance sheet exposure (Hagelin & Pramborg, 2004).

Transaction exposure is a form of short term economic exposure due to fixed price contracting in an atmosphere of exchange-rate volatility (Mello & Parsons, 2000). The most common definition of the measure of exchange-rate exposure is the sensitivity of the value of the firm, proxied by the firm's stock return, to an unanticipated change in an exchange rate. This is calculated by using the partial derivative function where the dependent variable is the firm's value and the independent variable is the exchange rate (Adler & Dumas, 2010).

Translation exposure is defined as the likely increase or decrease in the parent company's net worth caused by a change in exchange rates since last translation. This arises when an asset or liability is valued at the current rate (Hagelin & Pramborg, 2004). No exposure arises in respect of assets/liabilities valued at

historical rate, as they are not affected by exchange rate differences. Translation exposure is measured as the net of the foreign currency denominated assets and liabilities valued at current rates of exchange. If exposed assets exceed the exposed liabilities, the concern has a positive or long or asset translation exposure, and exposure is equivalent to the net value. If the exposed liabilities exceed the exposed assets and results in negative 'or short' or liabilities' translation exposure to the extent of the net difference (Mello & Parsons, 2000). In addition, translation exposure is the change in accounting income and balance sheet statements caused by changes in exchange rates (Geczy, Milton & Schrand, 1997).

Risk management might enhance the value of the firm in two ways: Free Cash Flows can become larger or the discount rate becomes lower. The rise of the amount of free cash flows can occur in several ways: more money can be led to those investments that generate the highest return. Stability in cash flows due to risk management makes it possible to keep investments in place, instead of having to abandon these in case money is needed. According to Hagelin and Pramborg (2004), management of foreign exchange risk increases shareholders value through enhanced business performance and the reduction of the firms' cost of capital. Further in the event of corporations successfully managing its foreign exchange risks the benefits received from such effective execution will have a long-term positive impact in creating value for the corporations' shareholders (Tofallis, 2009).

Modern finance and economics have been concerned with the effects of changes in exchange risk on returns and cash flows of corporations. After the collapse of the Bretton Woods System in the mid-1970s, most corporations throughout the world viewed exchange rates as significant risk factor. This is especially the case in those industries that have been subject to substantial globalization (Bartramet, 2010). The changes in exchange risk have an impact on domestic and international corporations that can be defined as the 'exposure' of the corporation to fluctuating foreign exchange rates. The exposure to foreign exchange rate fluctuations usually manifests itself as an impact on: (i) 'the value of net monetary assets with fixed nominal payoffs' and (ii) the value of real assets held by the firm' (Jorion, 1990).

Corporations are exposed to the risk of changing exchange rates through many channels. For example, if a firm relies on international or cross-border sales, the firm exposes itself to the risk of foreign exchange rate fluctuations. The change in exchange rates will have an impact on the value of international sales revenue (Abor, 2011).

Local companies, firms and corporations that do not have any international revenue or are not involved in cross-border sales may also be impacted by changing exchange rates, possibly indirectly through their competition with other importing companies (Jong *et al*., 2006). Researchers continue their efforts to understand the determinants and level of exposure to changing exchange rates for corporations because of the implications for business activity of foreign exchange risk and the difficulty in predicting fluctuations in foreign exchange markets (Salifu *et al*., 2007).

Empirical research indicates that volatile exchange rates affect the revenue and profits of both multinational and local corporations. Because of the prevalence of outsourcing activities to foreign countries, corporations incur costs in foreign currency (e.g., wages, taxes and material) and it is important for corporate financial managers to be aware of the extent of this exposure (Abor, 2011). Furthermore, corporations not involved in foreign exchange trades or outsourcing activities are also exposed to the fluctuating exchange rates through competition with multinational organizations, foreign competitors, and macroeconomic conditions. Therefore, many local and multinational organizations find their income statements and business performance affected by fluctuating exchange rates, in spite of their having only indirect financial exposure. A change in prices, the cost of final goods, the cost of raw material, labor costs or the costs of input or output and other substitute goods due to fluctuating exchange rates may have an adverse effect on the competitive position of a local or domestic firm with no international and foreign activities. Theory and empirical work in financial economics suggests that the exposure of a firm to changing exchange rates depends on the type of product and the nature of the competitive environment in which the firm operates (Bradley & Moles, 2001).

Foreign exchange risk is a major concern for investors and managers alike. One of the difficulties in managing foreign exchange risk - whether from an investor's or a manager's point of view – is measuring the extent to which companies are exposed to the risk. Fundamentally addressing the problem of measuring exchange rate operating exposure involves analyzing the competitive position of the specific company, the dynamics of that company, as well as the dynamics of the markets in which the company is involved. A shortcut to the measurement problem may be to exploit the information content in the stock prices (Afza & Alam, 2011).

1.1.2 Foreign Exchange Rate Exposure and Firm Value

As businesses are increasingly interconnected globally, foreign exchange rate movements have been perceived as one of the most important sources of uncertainty to firms' cash flows and profitability (Afza & Alam, 2011). Changes in foreign currency exchange rates can affect firm value since they directly affect a firm's current and future cash flows. Evidence also suggests that this disparity results as many firms are able to manage their foreign exposure by passing through its effects to customers or by engaging in financial or operational hedging (Carter, Pantzalis, & Simkins, 2006; Bartram, Brown, & Minton, 2010).

Overall, theory supports the existence of a relationship between the value of the firm and exchange rate movements. Economic theory suggests that changes in the exchange rate can produce a shift in stock prices, directly in the case of multinational firms, exporting and importing companies, firms which import part of their inputs and indirectly for other companies (El-Masry & Abdel-Salam, 2007). Exchange rate movements affect both the prices of imported finished goods and the costs of imported inputs, thus influencing indirectly those companies that compete with such firms (Grambovas & McLeay, 2006).

Studies on foreign exchange rate exposure and firm value was pioneered by Jorion (1990) who examined the relationship between stock returns and exchange rates, by performing an empirical analysis among US multinational companies. He presented evidence showing that the relationship between stock returns (value) and exchange rates differs systematically across multinational companies. The degree of foreign

exchange rate exposure on firm value was found to be positively related to the percentage of foreign involvement. More specifically; the empirical evidence suggests that exchange rate fluctuations do affect firm value (Gentry, 2012; Choi & Prasad, 2005). Fama (2008) has mathematically established that operative hedging through the creation of operational flexibility represents a strategic complement to any variance minimizing financial hedge. The study shows that there exists a strategic complement between financial and real option-based operative hedging. Given this, one should expect that firms use both financial and operational hedging techniques (Madura, 2009).

According to El-Masry (2006), changes in exchange rate can influence firm current and future expected cash flows and ultimately, stock prices. The direction and magnitude of changes in exchange rate on firms value are a function of a firm's corporate hedging policy which indicates whether the firm utilizes operational hedges and financial hedges to manage currency exposure and the structure of its foreign currency cash flows (Bartram, 2008). The Purchasing power parity theory which refers to rates of changes of price levels, that is, inflation rates, states that the rate of appreciation (depreciation) of a currency is equal to the difference in inflation rates between the foreign and the home country (Sarno & Taylor, 2002).

Foreign exchange risk is a major concern for investors and managers alike (Du, 2010). One of the difficulties in managing foreign exchange risk - whether from an investor's or a manager's point of view – is measuring the extent to which companies are exposed to the risk. Fundamentally addressing the problem of measuring exchange rate operating exposure involves analyzing the competitive position of the specific company, the dynamics of that company, as well as the dynamics of the markets in which the company is involved. A shortcut to the measurement problem may be to exploit the information content in the stock prices. According to Adler & Dumas (2010) exchange rate exposure can be measured by the regression coefficient (or coefficients if more than one currency) when a stock's price is regressed on exchange rate(s) (Takatoshi, 2013).

Authors have used this stock market approach to measure the extra-market exchange rate exposure of companies on an industry level (Adler & Dumas, 2010; Aggarwal, & Harper, 2010) as well as on a company level (e.g. Jorion, 2011). Most of the analyses involve US data and in spite of selection procedures (e.g. only inclusion of companies with reported foreign operations) that should favor findings of exposures, they tend to fail finding significant relations between the changes in exchange rates and the contemporaneous changes in stock prices. Using a stock market approach this study examined the exchange rate exposure of nonfinancial firm listed at NESM from January 2001 to December 2016 employing monthly frequency of the data.

1.1.3 An Overview of Kenya Exchange Rate Market

Kenya's exchange rate policy has undergone several changes over the last four decades. During the 1960's and 1970's, the Kenya government maintained a fixed exchange rate system. The Kenya shilling was pegged to the British pound until December 1971 and to the US dollar until October 1975 when in an effort to arrest the deterioration in the balance of payment and contain pressures on domestic prices, the peg was switched from the dollar to the Special Drawing Rights (SDR) and at the same time devalued by 10.8 percent. The switch to the SDR was considered more appropriate since it tended to be more stable than any other single currency unit and thereby reduced the exchange rate instability from foreign currency fluctuations (CBK, 2002).

Towards the end of 1970s and early 1980s, Kenya once again faced difficult balance of payments problems exacerbated by global recession. The economy suffered from a weak export sector and a highly restrictive import system. As part of stabilization measures advocated by both the International Monetary Fund (IMF), and World Bank, Kenya accepted the conditions of the 1980, and 1982 structural adjustment loans (SAL), which among other things, necessitated further reforms in Kenya's exchange rate regime. However, the political disturbances arising from the 1982 coup attempt made it difficult for the government to fulfill these conditions (CBK, 2002).

An active use of the exchange rate to complement other fiscal and monetary instruments began in 1983 when the fixed exchange rate regime was replaced with a crawling peg system. This adjustable crawling peg exchange rate regime meant adjusting the rate on a daily basis against a composite basket of currencies of its main trading partners based on inflation differentials with these countries. This move was considered appropriate as it was expected to maintain economic growth for Kenya as well as maintain stability of the Kenyan currency. Unfortunately, the crawling peg exchange rate remained generally overvalued and with Kenya's inflation rising faster than that of the average inflation of its trading partners, it meant that the country's economic growth continued to deteriorate (WBP, 2001). More extensive liberalization of the foreign exchange regime was therefore, undertaken in the early 1990s as a way of addressing the deterioration in Kenya's economic growth.

The Central Bank of Kenya (CBK), in December 1990, introduced shilling denominated Foreign Exchange Bearer Certificates (FEBCs). The objective was to attract foreign currency held outside the banking system by Kenyans so as to improve the then dwindling foreign exchange reserves. The source of funds was not supposed to be declared. The instrument was later discontinued due to administrative problems.

In October 1991, convertible Foreign Exchange Bearer Certificates (Foreign exchange-Cs) were introduced to tap foreign exchange in the parallel foreign exchange market. The instrument conferred a right to purchase foreign exchange up to the face value of the certificates on demand. In August 1992, Kenyan exporters were allowed to retain 50% of their export earnings in foreign currency retention accounts with local banks. This was aimed at not only encouraging economic growth, employment and poverty reduction, but also financing international trade. Although the Forex-C instrument was relatively successful as it had attractive premium on the foreign exchange market, it faced a number of administrative problems and hence had to be discontinued in 1993, a year that marked the climax of reforms in Kenya's foreign exchange market (CBK, 2002).

Between January and May 1993, The Kenya shilling exchange rate to the US dollar was devalued by about 72%. Thus, the exchange rate which traded at Kshs 36.2/US$ in January 1993 was progressively devalued such that by May 1993 it traded at Kshs 61.2/US$. The shilling was again devalued by about 6% between June, and September 1993 before finally being allowed to float in October 1993. Since then, Kenya's exchange rate system, like in many countries, has shifted from being the final target of monetary policy. The implementation of such a flexible exchange rate regime has meant that the Central Bank of Kenya (CBK) had no official obligation to defend its currency except to smoothen out any erratic movements in the exchange rate such as those caused by non-economic factors. It has also enabled monetary policy credibility to be built. This is because monetary policy is no longer confined to the defending a particular exchange rate, but more importantly, it is used to achieve price stability, a phenomena that provides the best environment for efficient resource reallocation and growth, by preventing arbitrary and unfair wealth redistributions often associated with high and variable inflation rates (CBK, 2002).

According Patnaik, Felman and Shah (2017) there is usually an exchange market pressure in African countries and the direct measures of EMP are model dependent and primarily geared towards finding the magnitude of money market disequilibrium that must be removed either through reserve or exchange rate changes under any desired exchange rate target. Patnaik, Felman and Shah (2017) further argued that Exchange market pressure indices, are designed to capture and forecast crises. Direct measures often lack consistent units, whilst indices do not have this problem and are better suited to crisis conditions.

1.2 Statement of the Problem

Multinational firms are subject to foreign exchange exposure due to inter-currency transactions they undertake. According to El-Masry (2006), movements in exchange rates can have a dramatic effect on a firm's performance. An examination of annual reports of companies listed at NSE show that a number of them have had their value eroded because of foreign exchange risk yet some have also posted losses as a result of hedging. In the year 2009 Kenya Airways (KQ) posted an annual loss of 5.6

billion after unrealized losses on jet fuel price hedge hit the bottom line sending its shares plunging 25%. In the year 2012 Kenol Kobil also posted a foreign-exchange loss of 4.6 billion shilling attributable to unfavorable forward contact hedging (NSE, 2012). This leads to the question on whether foreign exchange risk exposure affect firm value in NSE.

Despite the critical role that foreign exchange exposure plays in firm performance, there exists scanty empirical evidence on exchange rate behaviour and the value of firms listed in the NSE. Globally, a number of studies provide evidence for the relationship between foreign exchange rate exposure and changes in the value of firms (El-Masry, 2006; Lee & Suh, 2012; Mozumder, De Vita, Larkin, & Kyaw, 2015; El-Masry, 2006; Jeon, Zheng & Zhu, 2017; Glaum, 2005; Li, Lin & Hong, 2010). Locally, studies have mainly focused on explaining the determinants of exchange rate behaviour, with emphasis on the role of macroeconomic variables such as monetary policy shocks. For instance, Olweny and Omondi (2011), analyzed effects of macroeconomic factors on stock return volatility with foreign exchange rate as one of the exogenous variables, Were, Geda, Karingi, and Njuguna (2001), analyzed factors that have influenced the exchange rate movements since the foreign exchange market was liberalized in 1993.

A related study by Ndung'u (1999), assessed whether the exchange rates in Kenya were affected by monetary policy and whether these effects were permanent or transitory. The study by Kiptoo (2007) focused on the real exchange rate volatility and misalignment and its impact on the Kenya's international trade and investment. Sifunjo, (2011), focused on chaos and non-linear dynamical approaches to predicting exchange rates in Kenya. Musyoki, Pokhariayal and Pundo (2014) focused on real exchange rate volatility and misalignment on Kenyan economic growth. Even then, these studies including Ndung'u (1995); Ndung'u (2001); Kiptoo (2007); Musyoki *et al.* (2014). Olweny and Omondi (2011); Sifunjo (2011) did not deal with the impact of exchange rate exposure on the firm value of nonfinancial listed companies in Nairobi Securities Exchange (NSE).

1.3 Research Objectives

The study was guided by the general and specific objectives.

1.3.1 General Objective of the Study

To establish the effect of foreign exchange rate exposure on the value of nonfinancial firms listed at the Nairobi Securities Exchange.

1.3.2 Specific Objectives of the Study

1. To determine the effect of contemporaneous exchange rate changes on value of nonfinancial firms listed at Nairobi Securities Exchange.
2. To establish the effect of unexpected exchange rate movements on value of nonfinancial firms listed at Nairobi Securities Exchange.
3. To examine the effect of lagged changes in exchange rates on value of nonfinancial firms listed at Nairobi Securities Exchange.
4. To establish the moderating effect of market performance on the effect of foreign exchange exposure on value of nonfinancial firms listed at Nairobi Securities Exchange.

1.4 Study Hypotheses

H_{01}: Contemporaneous exchange rate has no significant effect on value of nonfinancial firms listed at Nairobi Securities Exchange.

H_{02}: Unexpected exchange rate movements do not have a significant effect on value of nonfinancial firms listed at Nairobi Securities Exchange.

H_{03}: Lagged changes in exchange rates have no significant effect on value of nonfinancial firms listed at Nairobi Securities Exchange.

H_{04}: There exists no significant moderating effect of market performance on the effect of foreign exchange exposure on value of nonfinancial firms listed at Nairobi Securities Exchange.

1.5 Significance of the Study

1.5.1 Policy Makers

Knowledge of the degree to which foreign exchange rate exposure affects value of firms is important for the design of both exchange rates and economic policies. For example, if exchange rate exposure has adverse effects on exports, trade-adjustment programmes in Kenya that have strongly emphasized the need for export expansion could be unsuccessful if exchange rates are very volatile. In addition, the intended effect of trade liberalization policy may be doomed by a variable exchange rate and could precipitate to a balance of payment crisis. This study is therefore, an important focus on the impact of foreign exchange rate exposure on the value of multinational non-financial companies listed at Nairobi Securities Exchange. The results of the study provide important information that policymakers in Kenya may use in the design of exchange rate and economic policies.

When interpreting economic outturns, it is useful to know whether an observed change in the value of exchange rate is justified by perceived shocks to the macroeconomic environment. Different shocks can have very different implications for the outlook, especially so in open economies, such as Kenya, where terms of trade effects can have significant implication for inflation outcomes. The findings from this study clearly identified the major determinants/shocks that account for the observed exchange rate movement in Kenya and these would help in determining the best policy responses.

1.5.2 Academicians

This study empirically estimated impact of foreign exchange rate exposure on value of non-financial companies in Kenya, a concept that is frequently cited in policy-related discussions of the international conjuncture, not only by policymakers but

also by academicians. Additionally, exchange rates risks form a significant part of corporate risk management and relative to longer-term measures of companies' performance. This study provides empirical evidence that can be replicated in other economies or form the basis for further studies and also for knowledge dissemination.

1.5.3 International Community

The study will be of significant importance to the international community. In the context of fixed exchange rate arrangements, in particular monetary unions, it is important to know whether a particular entry rate were costly to sustain or whether subsequently adjustment of relative inflation rates were necessary to adjust any nominal exchange rate peg. Kenya is a member of the East African Community (EAS) and the Common Market for Eastern and Southern Africa (COMESA) both of which are pursuing monetary integration programmes, whereby countries are implementing policy measures aimed at achieving macroeconomic convergence and introduction of currency convertibility before finally adopting a single currency issued by a single central bank by 2018 respectively.

1.5.4 Management of Listed Nonfinancial Firms

This study focuses on effect of foreign exchange rate exposure on the value of nonfinancial firms listed at the Nairobi Securities Exchange. The results will be important to the managers of such firms by providing empirical. Evidence on how the exposures affect the shareholder wealth. The subject of exchange rate management, which is amongst the most important concerns of the current debate on economic reform in Kenya. The management of these institutions together with the shareholders will therefore be able to lobby the policymakers backed by empirical evidence.

1.6 Scope of the Study

The current study is restricted to all nonfinancial firms with significant foreign exchange transactions that are quoted at the NSE. According to the industrial

classification of Data stream: banks, stockbrokers, fund managers, financial and property firms, insurance firms and brokers, investment trusts, investment firms, property agencies and property developers are financial firms and hence, excluded from the sample. The decision to examine only nonfinancial firms is also based on the complexity of foreign exchange rate exposure and risk management practices used by financial firms and the prescriptions of the exchange rate exposure theory, which discusses firms as producers and consumers. Additionally, non-financial firms with international trade engage in a many foreign currencies denominated transactions which subject their cash flows to foreign exchange exposures. This restriction also makes the study sample comparable to some earlier studies, which usually included only nonfinancial firms. The total firms that fit the selected criteria were 21.

The study focussed on the period 2001-2016. The period represent the time when the Kenyan government undertook substantial privatization of public corporations and major economic restructuring including enactment of various acts regulating the financial and capital market. Additionally, it is within the period when Kenya economy was liberalized and adoption of the floating exchange rate regime which commenced in July 1993. The study used only secondary data which is panel in nature. This study collected and used data on the nominal exchange rates of a basket of 7 major currencies that have been trading with Kenya over the period of study. The basket considered countries trading with Kenya both globally and regionally

1.7 Limitations of the Study

The study concentrated on non-financial companies listed at Nairobi Securities Exchange from January 2001 to December 2016. The study is subject to several limitations; first it only concentrated on multinational nonfinancial, this may limit ability to generalise the findings to non-listed nonfinancial firms and also financial firms. To mitigate on the inability to generalise, the study used a census of all listed nonfinancial firms with significant international transactions. The study recommends future studies to be carried out in order to interrogate the replicability of the findings.

Secondly, this study considered the time unit as months which could be collapsed to annual time series or panel analysis, or daily as a smaller unit of time. Both share prices and exchange rates vary on a daily basis implying that there is possibility based on availability of data to consider a smaller time unit for other studies. Finally, the study only used a basket of seven currencies generally trading with Kenya based on published reports from consecutive. It is probable that different results may be achieved if a different set or currencies was selected. Major currencies were included in the study but the study also recommends that future studies focus on other currencies to paint a complete picture on all currencies.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter is organized into five parts. The first part covers the theories relating to exchange rate determination. The second part deals with both the short and long term determinants of the exchange rate. The third part covers the determinants of firm value. The fourth part provides theoretical underpinnings of foreign exchange rate risk management and its effect on firm value. The firth part deal with comprehensive empirical literature review that informs and anchor the study.

2.2 Theoretical Framework on Exchange Rate Determination

This section reviews relevant theories in the area of exchange rate determination. A theory is a systematic explanation to an occurrence and a researcher should be conversant with those theories applicable to his area of research (Durham & Stockes 2015; Shapira, 2011). This section reviews theories related to the study and clearly documents how they inform the study.

2.2.1 The Portfolio Balance Hypothesis

The Portfolio Balance (PB) approach of exchange rate determination stems from the work on portfolio theory (Markowitz, 1952), and the demand for money (Tobin, 1958). The theory postulates that exchange rate determination occurs in the process of balancing demand and supply of financial assets in each country. Under this approach therefore, people will hold diversified portfolios of securities in all countries taking into account demand and supply conditions in those countries, implying that all markets must clear with equations setting money and bond demand equalling money and bond supplies. The PB model allows one to distinguish between short run equilibrium and the dynamic adjustment to long run equilibrium. It also allows for the full interaction between the exchange rate, the balance of payments, the level of wealth and stock equilibrium (MacDonald & Taylor, 1992).

The exchange rate is not determined primarily by the demand for foreign currency generated by trade in goods and services, but rather by decisions on how to spread wealth over different available assets including bonds (Belk, 2002). The PB approach therefore, differs from the monetary approach in that domestic and foreign bonds are assumed to be imperfect substitutes. It also postulates that exchange rates are determined in the process of equilibrating the stock or total demand of financial assets including money in each country. The model under the PB approach is based on risk averse individuals, who maximize their utility by first accumulating their wealth and then distributed them accordingly as per markets conditions (Dhanani, 2003).

The PB approach also explicitly brings trade into the analysis. Domestic and foreign residents hold both domestic and foreign securities. Thus, the approach recognizes that the exchange rate is a principal determinant of the current account of the balance of payments. A surplus in the current account, for example, represents a rise in net domestic holdings of foreign assets, which affects the level of wealth, level of asset demand and exchange rate (Copeland, 1989).

As noted by MacDonald and Taylor (1992), the PB model allows one to distinguish between short run equilibrium and the dynamic adjustment to long run equilibrium. It also allows for the full interaction between the exchange rate, the balance of payments, the level of wealth and stock equilibrium. A current account surplus leads to a redistribution of the world's wealth (a rise in net domestic holdings of foreign assets) and an appreciation of the domestic currency occurs only if domestic and foreign.

The theory informs the current study by appreciating that the foreign exchange exposure affects the firm value depending on the type of portfolio held by the firm. According to standard portfolio theory if the effect of foreign exchange risk does not vanish in well-diversified portfolios, exposure to this risk should command a risk premium in the sense that investors are willing to pay a premium to avoid this systematic risk (Chu-Sheng, 2010). El-Masry (2006) posits that exchange rate movements can affect an individual investor who owns a portfolio consisting of

securities in different currencies, multinational company (MNC) with subsidiaries and branches in foreign locations, an exporter/importer who concentrates on international trade and even a firm that has no direct international activities.

2.2.2 Purchasing Power Parity Theory

The Purchasing Power Parity (PPP) theory was first invoked, in somewhat ambiguous terms, in the period of Napoleonic wars and received its christening at the hands of Gustav (1918) during the World War I. Later, after World War II, it was restated by Hansen (1944). Purchasing power parity (PPP) is the simple proposition that prices in different countries should be equal if they are converted to the same currency (Chowdhry, Roll & Xia, 2005). The absolute version of PPP is based on the law of one price, which maintains that arbitrage should tend to equilibrate prices of the same good at different locations.

Relative purchasing power parity (PPP) holds for pure price inflations, which affect prices of all goods and services by the same proportion, while leaving relative prices unchanged (Chowdhry, Roll & Xia, 2005). It accounts for the possibility of market imperfections such as transportation costs, tariffs, and quotas (Madura, 2008). The theory assumes that the actions of importers and exporters motivated by cross-country price differences induce changes in the spot exchange rate. In another vein, PPP suggests that transactions on a country's current account affect the value of the exchange rate on the foreign exchange market.

This proposition states that the rate of appreciation (depreciation) of a currency is equal to the difference in inflation rates between the foreign and the home country (Sarno & Taylor, 2002). The economic forces behind PPP will eventually equalize the purchasing power of currencies. This can take many years, however. A time horizon of 4-10 years would be typical (Copeland, 1989). The PPP has, however, not been without criticisms. One of the strongest criticisms of the absolute version of PPP is by Samuelson (1964) who stated that PPP is a misleading pretentious doctrine, promising us what is rare in economics, detailed numerical prediction. An empirical test by Chowdhry, Roll and Xia (2005) revealed that PPP holds in the long-run.

The theory informs the current study by depicting the possibility of firms to take advantages of discrepancies of short-term currency prices to earn an arbitrage profits. Even in the long-run, due to market imperfections, more aggressive firms are able to profit from the discrepancies in prices and exchanges rates among markets. It is generally believed that the higher exchange rate movements and the unpredictability of foreign sales affect the firms' level of profitability (Afza & Alam, 2011).

2.2.3 The Elasticity Hypothesis

Marshall – Lerner Condition, named after English political economist Alfred Marshal (1842-1924) and Romanian – born economist Abba Lerner (1905-1982), advanced the elasticity hypothesis approach theory. Per this approach, the exchange rate is determined in the process of balancing the value of the nation's imports and exports. In a situation where the current account of the balance of payments is in deficit, the exchange rate will rise (this is equivalent to a depreciation of the currency under investigation in a flexible exchange rate regime) (Carbaugh, 2003). Depreciation in the currency makes a nation's imports more expensive to domestic residents and its exports cheaper to foreigners. Because of this, the nation's exports rise and its imports fall until the current account is balanced. Since the speed of adjustment depends on how responsive exports and imports are to exchange rate changes, this approach is often referred to as the elasticity approach to balance of payments. The approach stresses trade or the flow of goods in the determination of exchange rates and is therefore, more useful in explaining exchange rate behavior in the long run than in the short run (Carbaugh, 2003).

To illustrate the elasticity approach of exchange rate determination, this study considers the effects of depreciation of the exchange rate on the current account of the balance of payments. First, it assumed that prices of goods and services are fixed such that changes in the NER imply corresponding changes in the RER. In other words, the study assume that the supply elasticities for the domestic export good and foreign import good are perfectly elastic, implying changes in demand volumes have no effect on price. Thus, the current account is expressed as:

$$CA_t = NER_t * (X_t - M_t)$$

where, CA_t is the current account, NER_t is the nominal exchange rate defined as amount of foreign currency per unit of domestic currency, X_t is the value of domestic exports at time *t* and M_t is the value of domestic imports at time *t*. When the exchange rate depreciates, implying decline in the absolute value of NER_t, foreign residents find domestic goods and services less expensive, implying that X_t negatively depends on the exchange rate as shown below, which is the rate of change of X_t with respect to NER_t:

$$\left[\frac{dX_t}{dNER_t} < 0\right]$$

Thus, the price elasticity of demand for exports (η_x) is defined as the percentage change in exports over the percentage change in prices, which in this case are represented by the nominal exchange rate, that is:

$$\eta_x = -\frac{dX_t}{X_t} \Big/ \frac{dNER_t}{NER_t}$$

Similarly, when the exchange rate depreciates, domestic residents find foreign goods more expensive, implying *M* depends positively on the exchange rate, that is:

$$\left[\frac{dM_t}{dNER_t} > 0\right]$$

It follows from the above also that the price elasticity of demand (η_m) for imports is defined as the percentage change in imports over the percentage change in prices, which in this case, are also represented by the *NER*, that is:

$$\eta_m = -\frac{dM_t}{M_t} \Big/ \frac{dNER_t}{NER_t}$$

Thus, the effect of the exchange rate depreciation on the current account is expressed as follows:

$$\frac{d(CA_t)}{d(NER_t)} = X + NER_t \left[\frac{dX}{dNER_t}\right] - \left[\frac{dM}{dNER_t}\right]$$

$$\frac{d(CA_t)}{d(NER_t)} = X + NER_t \left[\frac{dX}{dNER_t}\right]\left[\left(\frac{NER_t}{X}\right)\left(\frac{X}{NER_t}\right)\right] - \left[\frac{dM}{dNER_t}\right]\left[\left(\frac{NER_t}{M}\right)\left(\frac{M}{NER_t}\right)\right]$$

$$\frac{d(CA_t)}{d(NER_t)} = X - \eta_x X - \eta_m \frac{M}{NER_t}$$

If we assume that we were initially in a balanced current account, where $M = NER * X$, then

$$\frac{d(CA_t)}{d(NER_t)} = X - \eta_x X - \eta_m X$$

Dividing by X yields the Marshall – Lerner Condition, named after English political economist Marshal (1924); Romanian (1982); Lerner (1982); Carbaugh (2003).

In its simplest form, Marshall – Lerner principle states that for a currency devaluation to have a positive impact in trade balance and hence, balance of payments the price elasticity of demand for imports and exports must be greater than unity. As devaluation (revaluation) of the exchange rate means a reduction (increase) on price of exports, demand for these will increase (decrease). At the same time, price of imports will rise (decline) and their demand diminishes (increases). The net effect on the trade balance will depend on price elasticities. If goods exported are elastic to price, their demand will increase proportionately more than the decrease in

price and total export revenue will increase. Similarly, if goods imported are elastic, total import expenditure will decrease. Both will improve the trade balance.

$$\frac{d(CA_t)}{d(NER_t)}\frac{1}{X} = (1 - \eta_x - \eta_m)$$

$$\text{Thus } \frac{d(CA_t)}{d(NER_t)} < 0 \; if \; \eta_x + \eta_m > 1$$

The Marshall-Lerner Condition states that starting from equilibrium in the current account, a depreciation of the exchange rate will improve the current account only if the sum of elasticities of exports and imports is greater than unity (Williamson, 1985). In this exchange rate elasticity model, price effects contribute to a worsening of the current account because imports become expensive. Volume effects, however, tend to contribute to improvement of current account because exports become cheaper from the foreign country's perspective whenever the exchange rate depreciates. Thus, in the short run, the Marshall-Lerner condition might not hold since export and import volumes do not substantially change, hence, price effects tend to dominate, thus leading to worsening of the current account position following exchange rate depreciation. The reverse is true in the long run.

2.2.4 The Arbitrage Pricing Theory

Arbitrage Pricing Theory (APT) was proposed by Ross (1976). It is an asset pricing theory which states that the expected return of an investment or a financial asset can be modeled as a linear relationship of various macroeconomic variables and where the degree of correlation to changes in each variable is represented by a beta coefficient. The model derived rate of return will then be used to obtain the price or value of the asset correctly. The asset value should equal the expected end of period asset value or future cash flows discounted at the rate implied by the model. If the asset value changes, arbitrage should bring it back to the line.

The theory has been used before in foreign exchange studies. Jorion (1990, 1991) uses arbitrage pricing theory to investigate the foreign exchange effect on US multinationals. He finds no evidence of a link between changes in exchange rates and firm value, concluding that US investors do not require a premium for bearing exchange risk. Jecheche (2012) uses APT in Zimbabwe using time series data from 1980 to 2005 and found no meaningful relationships between Stock Prices and Exchange Rate but considering impulse response functions the effect is significant as early as the first period.

The theory informs the current study by depicting that the firm value is as a result of many macroeconomic variables among them exchange rates. The APT rests on the hypothesis that the equity price is influenced by limited and non-correlated common factors and by a specific factor totally independent from the other factors (Jecheche, 2012). Firms are exposed to foreign exchange risk if the results of their projects depend on future exchange rates and if exchange rate changes cannot be fully anticipated (Abor, 2005).

2.3 Conceptual Framework

A concept is an abstract or general idea inferred or derived from specific instances (Kombo & Tromp, 2009), unlike a theory, a concept does not need to be discussed to be understood (Durham & Stokes, 2015). While a conceptual framework is a device that organizes empirical observations in a meaningful structure (Shapira, 2011). Childs (2010) argued that a conceptual framework to be a set of broad ideas and principles taken from relevant fields of enquiry and used to structure a subsequent presentation.

When clearly articulated, a conceptual framework has potential usefulness as a tool to assist a researcher to make meaning of subsequent findings. It forms part of the agenda to be scrutinized, tested, reviewed and reformed as a result of investigation and it explains the possible connections between the variables (Durham & Stokes, 2015).

Conceptual frameworks are pivotal to research as they clarify and integrate philosophical, methodological and pragmatic aspects of doctoral thesis while helping the profession to be seen as a research-based discipline, comfortable with the language of meta-theoretical debate (Sykes & Piper, 2015). The conceptual framework drawn below indicates contemporaneous exchange rate changes, unexpected exchange rate movement, lagged changes in exchange rates as independent variables. Firm value stock returns as dependent variable and 20 share index as moderating variable.

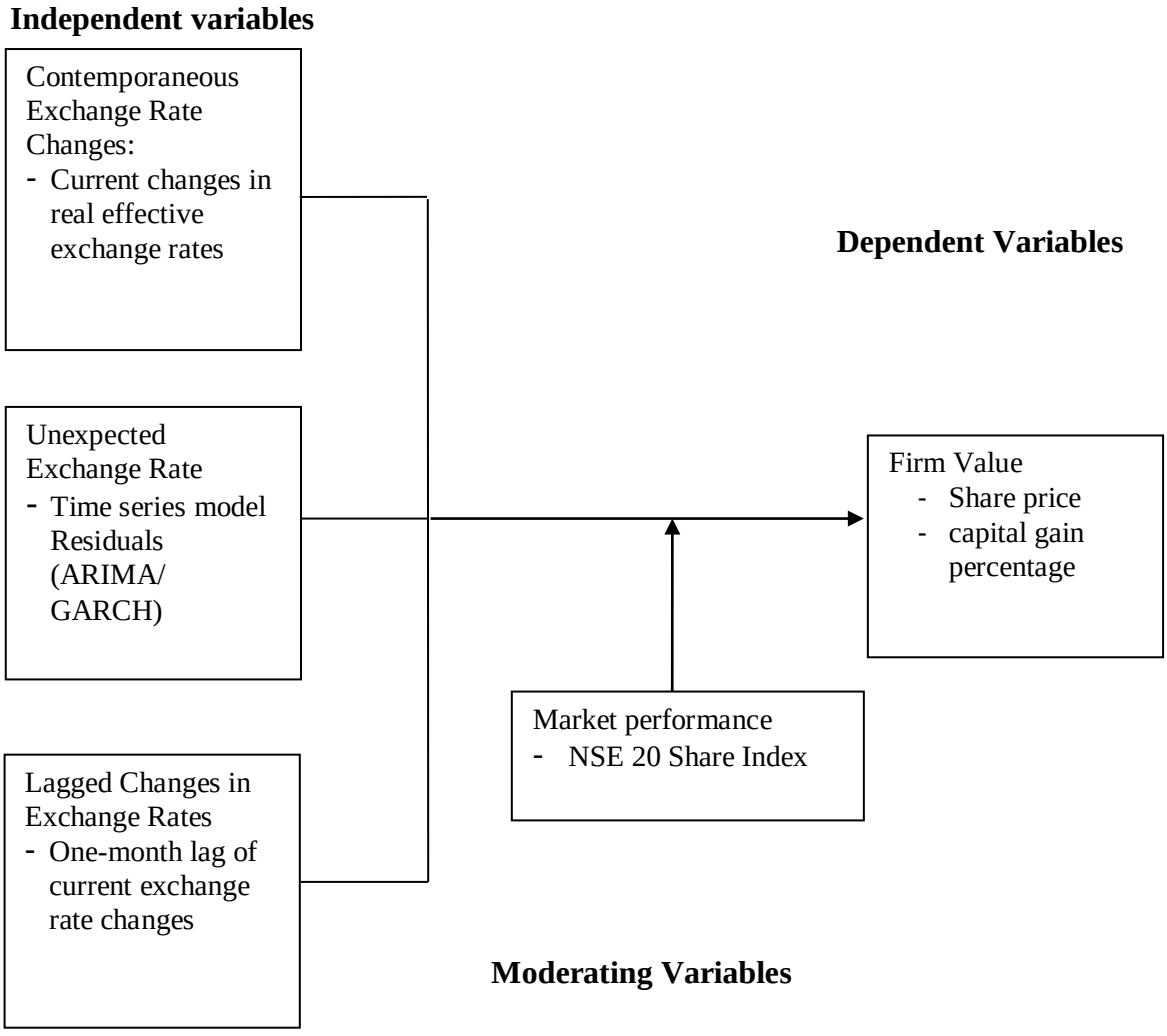

Figure 2.1: Conceptual Framework

2.3.1 Contemporaneous Exchange Rate Changes

Contemporaneous exchange rate changes **r**efers to the current (spontaneous) changes in exchange rate (Atindehou & Gueyie, 2001). The movements in foreign exchange rates can be measured in nominal and real terms (El-Masry, 2006). Atindehou and Gueyie (2001) claim that there is little difference between nominal and real exchange rates because they are highly correlated. Thus, if the changes for nominal and real exchange rates were almost perfectly correlated, then the use of either one would have similar impact on stock returns. Frait and Komareck (2001) found that contemporaneous movements in nominal and real foreign exchange rates are almost perfectly correlated for the seven countries used in his study. This study uses the real effective exchange rate as generated to determine the contemporaneous changes across the periods.

2.3.2 Unexpected Exchange Rate

The basic understanding of exchange rate exposure is the sensitivity of a firm's market value to a change in exchange rate. An unexpected change in exchange rate might have an impact on firm's value. The impact could arise due to influence of exchange rate on firm's cash flow, foreign sales, foreign competition and so on (Williamson, 2001; Bartram & Karolyi, 2006). Accordingly, a change in exchange rate could create gain or loss and make a change in firm's value. Adler and Dumas (1984) develop a measure of exchange rate risk exposure. They point out that the concept of exposure is arbitrary in sense that stock prices and exchange rates are determined jointly. Consequently, the unexpected changes in the exchange rate can be calculated as the difference between the actual and anticipated changes in exchange rates using the time series model; ARIMA and/or GARCH (Tai, 2005; Bartram, 2008).

2.3.3 Lagged Changes in Exchange Rates

Economic theory suggests that firms are subject to foreign exchange exposure as their cash flows are driven, directly or indirectly, by changes in exchange rates (Agyei-Ampomah, Mazouz, & Yin, 2013). However, this effect is not immediate

and there is likely to be a lag. El-Masry (2006) argues that existence of some market inefficiencies in incorporating exchange rate changes into the returns of firms and industries gives rises to lagged responses. The study thus examined the effect of lagged changes in exchange rates on firm value of nonfinancial firms listed at Nairobi Securities Exchange. The study uses a one month lag of contemporaneous exchange rate changes as a proxy for lagged changes in exchange rates.

2.3.4 Market Performance

Economic theory predicts that exchange rate changes are associated with stock market performance. This is known as the "flow-oriented" exchange rate model (Dornbusch & Fischer, 1980; Phylaktis & Ravazzolo, 2005), which suggests that changes in exchange rates have a significant impact on international competitiveness and trade balance and, accordingly, affect real income and output. Stock prices respond to exchange rate changes since the current value of firms' future cash flows are expressed and incorporated into stock prices. The general market performance is therefore hypothesised to moderate the relationship between foreign exchange exposures and firm value.

The linkage between these stock market and foreign exchange market can be established through the instruments of wealth, demand for money, interest rates, etc. (Mishra, 2004). There are two approaches to explain the theoretical linkage between these two markets. One is traditional approach which states that movements in exchange rates lead those of stock prices. The other is portfolio balance approach which states that exchange rates are determined by market mechanism, i.e. changes in stock prices might have impact on exchange rate movements (Granger, Huang, & Yang, 2000; Caporale, Pittis & Spagnolo, 2002; Stava´rek, 2005; Pan, Fok & Liu 2007).

The portfolio balance approach states that stock price is expected to have negative correlation with exchange rates. A decrease in stock prices reduces domestic wealth which leads to lower domestic money demand and interest rates. Also foreign investors trim their investment in domestic assets and currencies. That means domestic assets and currencies are in low demand to both domestic and foreign

investors. These shifts in demand and supply of currencies cause capital outflows and the depreciation of domestic currency, or increase in exchange rate, when expressed as the price of foreign currency in units of local currency. On the other hand, when stock prices rise, foreign investors become willing to invest in a country's equity securities. Thus, they will get benefit from international diversification. This situation will lead to capital inflows and a currency appreciation (Granger et al., 2000; Caporale et al., 2002; Stava´rek, 2005; Pan et al., 2007).

2.3.5 Firm Value

Firm value is the investor's perception toward the value of the success of firm related to its stock price (Sujoko & Soebiantoro, 2007). The firm value is very important, as higher firm's value will increase the welfare of the stockholder (Bringham & Gapensi, 2006). The welfare of the shareholder and value of the firm are commonly represented on the stock price, which implicitly represent the investment decision, financing and asset management (Hermuningsih, 2013). The increase of stock price will also increase the value of the firm and as such, this study uses stock returns as a proxy of firm value. There are other studies that has used stock returns as a proxy of firm value (Li, Lin & Hong, 2010; Mozumder, De Vita, Larkin & Kyaw, 2015).

Foreign exchange risk is a major concern for both investors and corporate managers because exchange rate (ER) movements can directly or indirectly affect cash flows and the market value of firms (Mozumder, De Vita, Larkin & Kyaw, 2015). Doukas *et al.* (2003) argue that the effect of ER fluctuations on the market value of firms depends upon the ER exposure of the firm. ER exposure can directly affect firms that are involved in international trade. Domestic firms can also be affected indirectly, through a mechanism whereby ER exposure affects aggregate demand and industry competitiveness and concentration. According to Li, Lin and Hong (2010), the basic understanding of exchange rate exposure is the sensitivity of a firm's market value to a change in exchange rate. An unexpected change in exchange rate might have impacts on firm's value. The impacts include firm's cash flow, foreign sales, foreign competition and so on (Williamson, 2001; Bartram & Karolyi, 2006). Accordingly, a change in exchange rate could create gain or loss and make a change in firm's value.

2.4 Empirical Literature Review.

2.4.1 Contemporaneous Exchange Rate Changes and Firm Value

Several empirical studies have examined how firms deal with foreign exchange risk and the effect on their financial performance. Belk (2010), confirmed the existence of a positive and significant relation between the use of currency derivatives and firm value for a sample of UK firms. Similar result was found by Carter *et al*. (2006), where the study showed that hedging with relation to oil prices in the airlines industry is positively related to firm value and the hedging premium reaches over 5%. The authors showed evidence that the greatest benefit of hedging in this sector would be the reduction in underinvestment costs because the fuel price is highly correlated to the investment opportunities in the sector. Du (2010) in his study on exchange rate matters and asset pricing, concluded that whether firms need to hedge the currency risk depends on whether currency exposure is positive or negative. He argued that firms with positive exposure should hedge the risk to reduce the cost of capital, while firms with negative exposure should not.

Takatoshi (2013) investigated the effect of exchange rate risk management on the exchange rate exposure of Japanese firms. They noted that firms with larger dependency on foreign markets have larger foreign exchange exposure and that the higher the U.S. dollar invoicing share, the larger the foreign exchange exposure. In addition, they found out that local currency (Yen) invoicing itself reduces the foreign exchange exposure. Their findings indicated that Japanese firms utilized operational and financial hedging strategies and price revision policy depending on their choice of invoicing currency.

El-Masry (2006) studied the foreign exchange rate exposure of UK nonfinancial companies (364) at the industry level over the period 1981-2001. The study considered the impact of the changes (actual and unexpected) in exchange rates on firms' or industries' stock returns employing OLS model. The findings indicated that a higher percentage of UK industries were exposed to contemporaneous exchange rate changes than those reported in previous studies. The study provides important

insight thought it would important to determine whether similar results would be found in case of developing financial markets like Kenya.

Lee and Suh (2012) used a sample of 261 US multinationals over the period 1984–2002 to examine the relation between exchange rate changes and the profitability of foreign operations. The study found that the impact of exchange rate changes on foreign operations' profitability is not statistically significant in the majority of industries. Furthermore, exchange rate changes explained less than 2% of the variation in foreign operations' profitability for most industries. The study also found that the impact of exchange rate changes on foreign operations' profitability is generally weak for non-US multinationals from Australia, Canada, Japan and the UK. The study used trade-weighted exchange rates as opposed to the contemporaneous exchange rate changes. A replication of the study using contemporaneous exchange rate changes would reveal the dynamic relations between exchange rates and firm performance.

Mozumder, De Vita, Larkin, and Kyaw (2015), investigated the sensitivity of firm value to exchange rate (ER) movements, and the determinants of such exposure for 100 European blue chip companies over 2001-2012. The study unveiled a positive relationship between ER movements and the market value of firms, indicating that a depreciation of ERs (indirect quotation) is likely to have a positive impact on the market value of European firms. The relationship between exposure and firm-specific characteristics was found to be weak, though smaller-sized firms were found to be slightly more exposed to ER movements than larger ones. The shortcoming of the study was overreliance on Eurozone countries with the UK as the only non-Eurozone country included in the analysis.

Ndung'u (2001) studied liberalization of the foreign exchange market in Kenya and the short-term capital flows problem. The study used Vector Autoregressive model (VEM). The results confirmed that domestic as well external shocks influence the movements of real exchange rate and real interest rate differential, thereby directly affecting or triggering capital flow. Kiptoo (2007) on the other hand focused on the real exchange rate volatility and misalignment and its impact on the Kenya's

international trade and investment. The studies focused on the macroeconomic effect with no particular reference to the stock market.

Musyoki, Pokhariyal, and Pundo (2014) carried out a study on the impact of real exchange rate volatility on economic growth in Kenya. The study used Generalized Autoregressive Condition of Heteroscedasticity (GARCH) and computation of the unconditional standard deviation of the changes to measure volatility and Generalized Method Moments (GMM) to assess the impact of the real exchange rate volatility on economic growth for the period January 1993 to December 2009. The study revealed that the RER Volatility had a negative effect of the economy. The study was restricted to the whole economy and not the stock market performance.

2.4.2 Unexpected Exchange Rate Movements and Firm Value

Doukas, Hall and Lang (2003) examined the relation between Japanese stock returns and unanticipated exchange-rate changes for 1,079 firms traded on the Tokyo stock exchange over the 1975–1995 period. Second, they investigated whether exchange-rate risk is priced in the Japanese equity market using both unconditional and conditional multifactor asset pricing testing procedures. The study found a significant relation between contemporaneous stock returns and unanticipated yen fluctuations. The exposure effect on multinationals and high-exporting firms, however, was found to be greater in comparison to low-exporting and domestic firms. This, further justify the focus of this study on multinational nonfinancial firms listed in the NSE.

Glaum (2005) carried out an empirical analysis on foreign exchange risk management in German non-financial corporations and found interesting discrepancies between the positions of the academic literature and corporate practice. He found that numerous firms are concerned about their accounting exposure and some firms are actively managing it. Of the three definitions of exposure offered by financial literature, namely translation, transaction and economic exposure, only economic exposure is considered to be consistent with financial theory (Bartram, Dufey & Frenkel, 2005). However, Glaum (2005) found out that although economic exposure is favoured by the academic literature, it is of little importance in practice.

Li, Lin and Hong (2010) studied the impacts of unexpected changes in exchange rate on firms' value in Taiwan. The study examined the exposure of firms to exchange rate fluctuations by both employing the Generalized Autoregressive Conditional Heteroskedasticity Model (GARCH) and the Classical Linear Regression Model (CLRM). Panel regression analysis was used to find the determinants of exchange rate exposure, such as firm size, export ratio, quick ratio and long-term debt ratio. The empirical findings in the present study were summarized as follows: It was positive and significant exposure of foreign exchange risk. Firms with a larger size, a higher quick ratio or a higher long-term debt ratio were inclined to have a lower exposure in exchange rate. However, the export ratio of a firm had little impacts on the firm's exchange rate exposure.

Kiptui and Kipyegon (2008) studied external shocks and real exchange rate movements in Kenya. The primary focus was the how external shocks results to unexpected changes in exchange. Error correction model (ECM) was used to capture the long-run and short-run dynamics of the impact of external shocks on the real exchange rate together with terms of trade, net foreign exchange flows and openness using monthly data for1996 to 2007. The results showed that the fluctuations in exchange rate was partly due to external shocks that may often lead to unexpected exchange rate movements. The study did not however focus on how the unexpected exchange rate movements influences firm value.

2.4.3 Lagged Changes in Exchange Rates and Firm Value

The relationship between exchange rate changes and industry portfolio returns for Canada, Japan and the United States over the period from January 1979 to December 1988 is examined by Bodnar and Gentry (1993). Less than half of the industries display significant exchange rate exposure at the 10% level in the countries mentioned. The exchange rate is an important factor for explaining industry returns at the economy-wide level in those countries. They also specified exchange rate exposure as a function of industry characteristics.

Doukas, Hall and Lang (2003) in a study between Japanese stock returns and unanticipated exchange-rate changes for 1,079 firms traded on the Tokyo stock

exchange over the 1975–1995 period found that Lagged-exchange rate changes on firm were statistically insignificant. This they argued implied that investors are able to assess the impact of exchange-rate changes on firm value with no significant delay. Similary, Krishnamoorthy (2001), found all the exposure coefficients, obtained from regressing industries' stock prices on lagged exchange rate changes, are insignificant at conventional levels. The findings in these studies tend to indicate that the exchange rates changes are immediately integrated in stock prices which is questionable in the light of market imperfections.

El-Masry (2006) investigated the lagged impacts of exchange rate changes on the monthly stock returns of UK industries from January 1981 to December 2001. The study employed OLS model to estimate foreign exchange rate exposure of 364 UK nonfinancial companies over the period 1981-2001. The findings showed that there was evidence of significant lagged exchange rate exposure. This lagged exchange rate exposure, he argued were consistent earlier studies that there may exist some market inefficiencies in incorporating exchange rate changes into the returns of firms and industries. This logical given the market imperfections that exists in capital markets.

Tang (2015) investigated the exchange rate exposure of Chinese firms at the industry and firm level based on the conventional capital asset pricing model (CAPM) framework. At the industry level, the dynamic conditional correlation MGARCH (DCC MGARCH) estimated demonstrated that the market model and three- factor model are appropriate for exposure measurements, and industry returns are more likely to be exposed to unanticipated changes in the real exchange rate and the trade-weighted effective exchange rate, particularly for manufacturing industries. The result showed that lagged exchange rate changes have significant exposure effects on firm returns. This study however failed short of simultaneously evaluation the effects of the contemporaneous changes and lagged changes.

Jeon, Zheng, and Zhu (2017) examined impact of changes in the foreign exchange rate on firms' stock returns in global markets. Using daily firm-level data for 14 international markets from January 2000 to December 2011, they found evidence

that changes in the trade-weighted multilateral exchange rate systematically impact individual firms' stock returns for all seven emerging markets and some advanced economies.

2.4.4 Market Performance and Firm Value

From the economic viewpoint, movement in stock prices and stock indices depend on different factors. Kurihara (2006) points out that enterprise performance, dividends, stock prices of other countries, gross domestic product, exchange rates, interest rates, current account, money supply, employment, their information, etc. may have an impact on daily stock prices. In particular, the continuing process of market integration has made the exchange rates as one of the main determinants of business profitability and equity prices (Kim, 2003). This study hypothesizes that market performance moderates the effect of foreign exchange exposure on firm value of nonfinancial firms listed at Nairobi Securities Exchange. Past studies reinforced this hypothesis.

Smyth and Nandha (2003) examined the relationship between stock prices and exchange rates in four South-Asian countries of Bangladesh, India, Pakistan and Sri Lanka using daily data from 1995 to 2001. Using Engle-Granger as well as Johansen's cointegration techniques, they were unable to find any long-run equilibrium relationship between the two variables in any of the four countries. Using Granger causality test they also concluded that exchange rates Granger cause stock prices in India and Sri Lanka but for Bangladesh and Pakistan they found no evidence of causality running in either direction.

Phylaktis and Ravazzolo (2005) used monthly data from 1980 to 1998 for Hong Kong, Indonesia, Malaysia, the Philippines, Singapore and Thailand. They analyzed the short- and long-run relationships between exchange rates and stock prices and the avenues through which exogenous shocks affect these two variables. They found that exchange rates and stock prices are positively related using the method of cointegration and Granger causality tests. US stock price is the causing variable which acts as a channel that links the exchange rates of the five countries to their stock market indices.

By using weekly data from 1999 to 2010 for the countries of Australia, New Zealand, Japan, Switzerland, USA, UK and Euro Zone, Katechos (2011) examined the relationship between stock markets and exchange rates in the light of the global equity market returns. The method of maximum likelihood regression with GARCH was applied and results showed that there is a link between the exchange rates and the global stock market returns but the characteristics of the currencies determine the sign of the relationship. The value of currencies with higher rates of interest is positively related to global equity returns and the value of currencies with lower rates of interest is negatively related to global equity returns. Larger is the interest rate differential more is the explanatory power of the model.

Jiranyakul (2012) undertook a study on the linkages between Thai stock and foreign exchange markets. The study used monthly data of stock market index or stock prices from the Stock Exchange of Thailand and the nominal bilateral exchange rate in terms of baht per US dollar from the Bank of Thailand for the period covers July 1997 to June 2010. The results indicated that there exists positive unidirectional causality running from stock market return to exchange rate return. The exchange rate risk causes stock return to fall as expected. Moreover, there are bidirectional causal relations between stock market risk and exchange rate risk, but in different directions.

Yang et al. (2014) used daily data from 1997 to 2010 for India, Indonesia, Japan, Korea, Malaysia, the Philippines, Singapore, Taiwan and Thailand to study the relationship between stock returns and exchange rates. They applied Granger causality test in quantiles and they found that during the Asian financial crisis, all the countries except for Thailand there are feedback relations between exchange rates and stock prices and in Thailand, stock returns lead exchange rates. The causal effects are heterogeneous across different quantiles and different periods and most of the stock and foreign exchange markets are negatively correlated.

Olweny and Omondi (2011) carried out a study on the effect of macro-economic factors on stock returns volatility in the Nairobi Stock Exchange in Kenya. The study employed Exponential Generalized Autoregressive Conditional Heteroscedasticity

(EGARCH) and Threshold Generalized Conditional Heteroscedasticity (TGARCH). The study found out foreign exchange rate, Interest rate and Inflation rate, affect stock return volatility. The study did however did not evaluate the effect of the macroeconomic factors on firm value but rather the volatility of the market.

2.5 Critique of Literature

There has been growing wealth of literature foreign exchange rate exposure and stock returns in different countries since the pioneer work by Aggarwal (1981) and later advanced by Jorion (1990) who developed a two-factor model which combines market's rates of returns and exchange rates. Of the three definitions of exposure offered by financial literature, namely translation, transaction and economic exposure, only economic exposure is considered to be consistent with financial theory (Bartram, Dufey & Frenkel, 2005). Based on the point of impact, empirical studies provide evidence of contemporaneous exchange rate changes (El-Masry, 2006; Lee & Suh, 201; Mozumder, De Vita, Larkin, & Kyaw, 2015), lagged exchange rate changes and firm value El-Masry (2006; Jeon, Zheng, and Zhu (2017) and unexpected (Glaum, 2005; Li, Lin & Hong, 2010) and firm value. These studies however failed short of simultaneously evaluation the effects of the contemporaneous changes, lagged changes and unexpected changes on foreign exchange exposures on the firm value.

In empirical studies, some show significant effects of exchange rate exposure on firm value and competition (Mozumder, De Vita, Larkin, & Kyaw, 2015; Doukas, Hall & Lang, 2003). Other empirical studies present weak relationships between exchange rate changes and stock returns (Griffin & Stulz, 2001; Dominguez & Tesar, 2006). On the other hand, Bartram, Brown and Minton (2010); Bartram and Bodnar (2007) present a phenomenon of foreign exchange exposure puzzle. That is, there exists the discrepancy between theoretical predictions and observed levels of exchange rate exposure Besides, Bartram and Bodnar (2009) show evidence of the significant return impact on firm-level currency exposure when "conditioning" on the exchange rate change. Accordingly, we might anticipate that exchange rate exposure matter the firm's value.

2.6 Research Gaps

A number of studies provide evidence for the relationship between foreign exchange rate exposure and changes in the value of firms in other parts of the world particularly in the developed countries (El-Masry, 2006; Lee & Suh, 201; Mozumder, De Vita, Larkin, & Kyaw, 2015; El-Masry, 2006; Jeon, Zheng, & Zhu, 2017; Glaum, 2005; Li, Lin & Hong, 2010). Nonetheless, the empirical evidence on the impact of exchange rates exposure on firm value is not conclusive and has generated mixed results. Furthermore, the majority of the studies in the area focus on the valuation consequences of exposure to exchange rate changes. Such studies focus on the USA and other developed countries. For instance, a number of empirical studies in the UK have examined the approach of corporate treasurers in managing foreign exchange rate exposure (Marshall, 2000; Bradley & Moles, 2001; Belk, 2002; Bradley & Moles, 2002; Faff & Marshall, 2002; Dhanani, 2003; El-Masry, 2006; Katechos, 2011). These studies however failed short of simultaneously evaluation the effects of the contemporaneous changes, lagged changes and unexpected changes on foreign exchange exposures on the firm value.

In the Kenyan context, there exists scanty empirical evidence on the relationship between foreign exchange exposures and firm value. The existing studied focused on explaining the determinants of exchange rate behavior, with emphasis on the role of macroeconomic variables such as monetary policy shocks (Ndung'u, 1999; Kiptoo, 2007; Sifunjo, 2011; Musyoki, Pokhariayal & Pundo, 2014; Olweny & Omondi, 2011). Therefore, the current study seeks to join the debate by filling the stated gaps and shed more light by providing empirical evidence on actual, contemporaneous and lagged impacts of foreign exchange rate exposure on the monthly stock returns of Kenya nonfinancial listed companies' from January 2001 to December 2016.

2.7 Summary

In general, the empirical evidence that show there are ambiguities on effect of foreign exchange exposure on trade and investment depending on circumstances. Past studies depicts negative, positive, or an inconclusive relationship between exchange rate volatility and the volume of trade. The overall evidence is best

characterized as mixed, since the results are sensitive to the choices of sample period, model specification, volatility measures and countries considered (developed versus developing).

Specifically, the empirical evidence on the effect of foreign exchange exposure on the on value of listed nonfinancial firms is inconclusive. The empirical evidence adduced provides mixed results across developed and developing economies. In the case of developing economies, the empirical results offer unequivocal support for the view that volatility of exchange rates has significant negative effect on the volume of trade and negative investment hence affect firm value, while the relationship is found to be ambiguous among developed countries.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methodology used in the study. The research philosophy and design, target population, sample size, sampling scheme followed and the type of instrument used to collect data have been adequately described. Data collection procedures and data analysis techniques used are also introduced and discussed.

3.2 Research Philosophy

The ultimate goal of any research is to generate new knowledge. The research question determines the philosophical assumptions underpinning the research. Saunders, Lewis and Thornhill (2009), define research philosophy as the process of developing knowledge from research as well as the nature of that knowledge. There are many research philosophical perspectives widely discussed in literature such as positivism and postpositivism, constructivism, interpretivesm, transformative, critical, pragmatism and deconstructivism (Bryman, 2012; Creswell, 2014; Saunders et al., 2009). Positivism and interpretivism are the two major philosophical views commonly applied in business research (Bryman, 2012). According to Saunders *et al*. (2009), positivism advocates for observation of social phenomena by the researcher from which data is generated to formulate hypothesis while interpretivists seek to understand differences among humans as actors in social setups.

The research philosophy adopted in this study was positivism. According to Creswell (2014), positivism implies that the researcher seeks to gather facts to determine causes of social phenomena. Wahyuni (2012), points out that positivists apply a scientific approach to develop numeric measures to generate acceptable knowledge. Positivists believe that there exists universal generalisation that can be applied across contexts while interpretivists rely on the principles of idealism, and explore the understanding of social phenomena (Bryman, 2012). This study adopted the positivist approach because it sought to examine the relationship between exchange

rate exposure risk and firm value. Consequently, the hypotheses were derived first and then data was collected and analysed to confirm or negate the propositions arising from the hypotheses.

3.3 Research Design

A research design is a blueprint for conducting a study with maximum control over factors that may interfere with the validity of the findings (Cooper & Schindler, 2008). Polit, Beck, and Owen (2003) describes a research design as the overall plan for obtaining answers to the questions being studied and for handling some of the difficulties encountered during the research process. The choice of research strategy according to (Saunders *et al.*, 2009), is guided by the research question(s), objective(s), the extent of existing knowledge, amount of time and resources available as well as the philosophical underpinning. There are a variety of research designs to choose from; action research, causal, cohort cross-sectional, descriptive, experimental, quasi-experimental & longitudinal (Cooper & Schindler, 2008; Kothari, 2004; Saunders *et al.*, 2009).

This study adopted a descriptive research design. The design was appropriate since the study seeks to describe the effects of foreign exchange rate exposure on the firm value of nonfinancial firms listed at the Nairobi Securities Exchange. According to Saunders *et al.* (2009), a descriptive research design is appropriate since it involves collecting and analyzing study units data at a point in time in order to assess strength of relationships among variables. It also describes the characteristics or behaviour of a given population in a systematic and accurate version (Sekaran, 2010). The study will provide a description of how contemporaneous, unexpected and lagged changes exchange rate movements affect the firm value.

3.4 Study Population

A research population is a well-defined collection of individuals or objects known to have similar characteristics or trait that the researcher wishes to study (Kumar, 2005). Saunders *et al.* (2009) defined a population as the entire group of individuals, events or objects having a common observable characteristic. The population for the

current study constituted the 21 nonfinancial firms listed at the Nairobi Securities Exchange as per Appendix 1. These are firms that engage in a many foreign currencies denominated transactions which subject their cash flows to foreign exchange exposures. According to Bartram (2008), firms with foreign currency-based activities, such as imports and exports, corporate cash flows and thus firm value are a function of exchange rates, rendering the management of foreign exchange rate risk an important corporate objective and activity.

3.5 Sampling and Sampling Technique

The study adopted a census of all the 21 nonfinancial firms listed at the Nairobi Securities Exchange. Census is the study of whole population and as such, it enhances validity of the data and results by including all information for all the elements in the study (Saunders *et al.*, 2009). According to Kothari (2004), census method involves an exhaustive enumeration of the units constituting the target population.

3.6 Data and Data Collection

Miles, Huberman and Jonny (2014), defined data collection in research as the process of gathering and measuring information on targeted variables in established systematic fashion. From the conceptual framework, the study has three independent variables, one moderating variable and one dependent variable. The study used secondary data with two data sets. The study is therefore a quantitative study. Data on monthly share prices was sourced from NSE monthly reports whereas the average monthly exchange rates were sourced from Central Bank of Kenya. Secondary data analysis is an empirical exercise that applies the same basic research principles as studies utilizing primary data and has steps to be followed just as any research method (Arain, Campbell, Cooper, & Lancaster, 2010; Melisa, 2014).

Various studies have relied on secondary data to collect data especially where quantitative data is required, Olweny and Themba (2011), examined the effects of banking sectorial factors on the profitability of commercial banks in Kenya and adopted an explanatory approach by using panel data research designed for collecting

secondary data from 38 Kenyan banks from 2002 to 2008. Ongore (2013), explanatory study that was based on secondary data obtained from published statements of accounts for ten years and thereby ignoring the use of primary data.

The data collection covered 16 year period from 2001 to 2016, this period was selected for the study in order to base the analysis on as recent data as possible. This could also be important since several regulations for various institutions had been put in place. Kosikoh (2014) argued a period of more than five years could help in the computation of various ratios of both the independent and dependent variables for several years for better analysis. In addition Exchange rates in Kenya have witnessed significant volatility since liberalization in October, 1993 (Maana *et al.*, 2010). According to (Kisaka & Mwasaru, 2012) the Kenya government changed its foreign exchange policy from a fixed exchange rate regime to a floating exchange rate regime in 1993. At the same time, the government embarked on a mission to develop the Nairobi Securities Exchange (NSE) to international standards.

3.7 Data Processing and Analysis

3.7.1 Operationalization of Study Variables

Operationalization is the process of strictly defining variables into measurable factors. The process defines fuzzy concepts and allows them to be measured, empirically and quantitatively (Ardelt, 2004). The study consists of three independent variables, one moderating variable and one dependent variable to be operationalized as follows; Contemporaneous exchange rates were computed for every month in the period of study as the current changes in the real effective exchange rates. The real effective exchange rate (REER) is computed as weighted average of the different real exchange rates (RER) from the basket of currencies where the weights are determined on importance of the country based on the terms of trade between the countries.

Seven major currencies were selected to constitute the basket from which the foreign currency exchange rates are determined. This includes; US Dollar, Euro, Sterling Pound, Japanese Yen, South African Rand, Tanzanian Shillings and Ugandan

Shillings. The currencies were selected since they constitute Kenya's largest foreign exchange volumes. The formula used for the computation of the real exchange rates (RER) from the NER in the study is given by;

$$RER = NER \times \frac{p^*}{p} \quad \text{.....} \quad (3.1)$$

Where p^* is the price levels of the foreign currency p the price level of the domestic currency and NER the nominal exchange rate. Further the study adopted the formula constructed by Broeck and Slok (2001) for real exchange rates from relative prices and nominal exchange rates by the real exchange rate decomposition;

$$q_t = s_t - p_t^* + p_t \quad \text{.....} \quad (3.2)$$

Where q_t is the real exchange rate, s_t the nominal exchange rate, p_t^* the foreign country's price levels p_t the domestic country's price levels all in natural logarithms.

With the natural logarithms of the individual from the individual decomposed RERs, the resulting equation adopted to compute the REER that was adopted was an arithmetic weighted average of the individual logged RERs of a basket of currencies.

$$REER = \sum_{i=1}^{m} W_i \times rer_i \quad \text{.....} \quad (3.3)$$

Where $rer_i = log_e RER_i$ is the natural log of the real effective exchange rate of currency i

W_i is the weight given to the currency i which is determined by trading volumes.

The second independent variable for the study was unexpected changes in exchange. To identify the unexpected changes in exchange rates the study fitted a time series model for the REER using the Autoregressive Integrated Moving Average (ARIMA) According to El-Masry (2006), ARIMA models are used to extract unexpected changes in exchange rates from the series of exchange rate (or interest rates) movements. However, ARIMA models as first modelled for the data are not characterised as robust for the volatility that is attributed with conditional heteroscedasticity and autocorrelation of the disturbance term. Consequently the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) models is used. The fitted values of the model correspond to the expected changes in exchange rate risk factor. The residuals are then defined as the unanticipated changes in exchange rates.

The third independent variable for the study was lagged exchange rate exposure of industries. El-Masry (2006) argues that existence of some market inefficiencies in incorporating exchange rate changes into the returns of firms and industries gives rises to lagged responses. The study uses a one month lag of contemporaneous exchange rate changes as a proxy for lagged changes in exchange rates.

The dependent variable for the study is firm value. This study similar to El-Masry (2006) considers the impact of the changes in exchange rates on firms' or industries' stock returns. The stock prices are corrected for dividends and capital changes. The stock prices are end of month observations. The stock returns that are used as dependent variables in the subsequent equations are continuously compounded monthly returns (ln (stock $price_t$)-ln(stock $price_{t-1}$)). The estimated exchange rate coefficient provided a measure of the effect of the exchange rate changes on the stock returns given its relation to the market return index (Bodnar & Wong, 2003).

Table 3.1: Operationalization of Study Variables

Variable	Abreviation	Measure	Empirical Support
Firm Value	FIRMV	Capital Gain	Li, Lin and Hong (201); Mozumder, De Vita, Larkin and Kyaw (2015)
Contemporaneous Exchange Rate Changes	CEX	Current changes in real effective exchange rates	El-Masry (2006); Takatoshi (2013); Lee and Suh, (2012)
Unexpected Exchange Rate Movements	UEX	Time series model Residuals (ARIMA/ GARCH)	Tai (2005; Bartram (2008)
Lagged Changes in Exchange Rates	LEX	One-month lag of current exchange rate	Jeon, Zheng and Zhu (2017)
Market performance	MKTP	NSE 20 Share Index	Caporale, Pittis and Spagnolo (2002); Stava´rek, (2005); Pan, Fok and Liu (2007)

3.7.2 Data Processing

The secondary data was collected from Nairobi securities exchange and Central bank of Kenya. Data on the dependent variable; firm value was based on the share prices of the firms being studied as kept by Nairobi securities exchange. The historical data on the monthly share prices of each firm was therefore collected from Nairobi stock exchange from the year 2001 to the year 2016. Also collected from NSE was the data on the 20 Share index which was used as a measure of the moderating variable market performance.

Considering the aim of the study to assess the effect of foreign exchange rate exposure on the value of nonfinancial companies listed at the Nairobi Securities Exchange, the independent variable measurements were based on the historical foreign exchange rates of Kenyan shillings against foreign currencies. The data on

foreign exchange rate exposure was therefore collected from central bank of Kenya. The historical exchange rates of Kenyan currency to foreign currencies were collected and used for analysis to measure the independent variable. Before the objective data analysis, the data was processed and analysed for completeness and missing data.

According to Blumberg, Donald and Schindler (2014), data processing involves editing coding, classification, tabulation and graphical presentation. The study yielded data containing quantitative details from institutions in NSE, the panel data to collect was analysed quantitatively through a mathematical and regression equations and this was solved using a statistical tool. According to Polit and Beck (2006), the amount of data collected in a research study cannot be analysed and answered by use of simple numeric information, the data collected need to be processed and analyzed in an orderly manner, quantitative information is usually analyzed through statistical procedures, this procedures cover broad range of techniques, however some methods are computationally formidable, the underlying logic of statistical tests are important and basically computers are used to make the analysis become friendly rather than use of complex mathematical and detailed operations in analysis (Polit & Beck, 2006).

3.7.3 Missing Data Analysis and Data Cleaning

The secondary data was processed and analysed for completeness and missing data using Microsoft Excel. The data collected was longitudinal that is cross-sectional data collected over a period of time. The data from central bank on exchange rates was complete for all the 192 months observed. The data on 20 share index that was used as the moderating variable was also complete for all the 192 months. The data from Nairobi security exchange on share value for the targeted 21 firms was however incomplete with gaps of missing data. This was therefore processed and analysed for missing data. Table 4.1 presents the missing data analysis on the share prices for 21 firms across the 21 years. The panel data has both cross sectional and the time series component thus missing data analysis was done considering both aspects of the panels.

The analysis of missing data was aimed at determining the proportion of missing data in the panels. According to Cohen, West and Aiken (2003), less 10% of missing data is not large and does not constitutes a large amount of missing data. This study considered those panels that had more than 10% missing observations of the total observations as candidates for deletion. 17 entities observed across 190 months within the period of study had 0% missing data out of the 3,230 observations collected from the panels and thus were all retained. These formed 80% of the total 4,032 targeted observations. Another (9%) 380 observations from 2 entities observed across 190 months were also retained being that they had only up to 6% of missing data. The 2 observations had period missing data totalling to 11 months each across the period and were thus cleaned using the neighbourhood approach. The total proportion of retained observations was 89% that is equivalent to 89% response rate. The remaining 11% of the targeted 4,032 observations were dropped where more than 10% of the data within the panels were missing. 2 entities were dropped that had 22% and 26% missing data respectively while data from 2 of the 192 targeted months were also missing. The two last months of the period of study were therefore dropped leaving panel data consisting of 19 entities observed across 190 months with a total of 3,610 observations. Further analysis after data processing was done using the STATA statistics software version 13.

Table 3.2: Missing Data Analysis

Count: Missing months	**Count: Missing Entities**	**Observed Entities**	**Observed Months**	**% of missing data**	**Total Obs**	**% of Obs**	**Cumulate %**	**Status**
0	0	17	190	0%	3230	80%	80%	Retained
11		2	190	6%	380	9%	89%	Retained
43		1	192	22%	192	5%	94%	Dropped
50		1	192	26%	192	5%	99%	Dropped
	19	19	2	100%	38	1%	100%	Dropped

3.7.4 Data Analysis

The study adopted a two staged methodology. The first stage involved the determination of the foreign exchange exposure. At this point the REER is determined as the weighted average of the seven major currencies used by Kenya the unexpected foreign exchange changes were determined using the ARIMA and GARCH model. The appropriate diagnostic tests are carried out to determine the best model to fit the data.

The second stage of analysis involves a panel model where different aspects of foreign exchange exposure are regressed on firm value. The study analysed data though the use of descriptive statistics and multiple linear regression analysis between dependent variables and independent variables. This was done with the help of data analysis and statistical software (STATA).

Olweny (2012) argued that multiple regression techniques give both quantitative and qualitative results that are conclusive and robust as well. The results were presented using tables, charts and graphs for easy understanding. According to Ambrosius (2007), multi-linear regression model is a statistical tool used to describe the simultaneous associations of several variables with one continuous outcome. The following model was fitted

$$R_{it} = \beta_{0i} + \beta_{1i} ER_{-1} + \ldots + \beta_{ki} ER_{t-k} + \beta_{k+1i} RM_t + \varepsilon_{it},\ t = 1,\ldots,t \qquad (3.4)$$

where R_{it} is the return on the ith firm in month t. ER_{t-1} is the lagged exchange rate changes (each lag is one month), R_{mt} is the return on the stock market and ε_{it}, is the random error term.

Study variables and model specifications requires that changes in foreign exchange rates can be measured in nominal and real terms, the choice between nominal and real exchange rate variations is discussed below. Most previous studies on the relation between stock returns and changes in exchange rates have used nominal exchange rates. Lee and Suh (2012), argues that if the changes in exchange rates are measured in real terms, then all variables in the regression equations must also be

adjusted for inflation for consistency purposes. El-Masry (2006) posit that the contemporaneous movements in nominal and real foreign exchange rates are almost perfectly correlated for the seven countries used in his study. In an effort to find additional empirical support for the arguments put forward by previous studies, the real and nominal foreign exchange rate exposure of nonfinancial firms in NSE was estimated in this study. Both nominal and real exchange rate changes were employed to determine if there is any significant difference in their impact on stock returns.

This view is shared also by the assertion of Atindéhou and Gueyie (2001), that there is little difference between nominal and real exchange rates based on the assertion that these are highly correlated. Hence, if the changes for nominal and real exchange rates were almost perfectly correlated, then the use of either of them would have a similar impact on stock returns. Katechos (2011) and El-Masry (2006) have examined the impact of the changes in both nominal and real exchange rates. For financial markets to be efficient, the use of unexpected changes in exchange rates are preferable to actual changes since the expected values of the relevant variables should have been reflected in asset prices and only the unexpected changes should affect asset returns (Adler & Dumas, 2010).

Previous studies on measuring foreign exchange rate exposure imply that the important decision for measuring exchange rate exposure is the type of proxy to use for the exchange rate risk factor, to represent unexpected (or actual) exchange rate changes in the exchange rate. Those studies use the rate of actual change in the exchange rate as a proxy of the unexpected changes in the exchange rate (Jorion, 2011; Bodnar & Wong, 2003; Adler & Dumas, 2010; Takatoshi, 2013; Williamson, 2001). However, some empirical studies use unexpected changes in exchange rates as a proxy for the exchange rate risk factor (Lee & Suh, 2012; Tang, 2015).

3.7.5 Diagnostic Tests

The study used both time series and panel data analysis. The time series model is used in an attempt to isolate the unexpected foreign exchange rate changes using either ARIMA and/or GARCH models. Necessary tests to identify the best time series model were carried out. The non-random behavior of the time series data could

undermine the usefulness of the standard econometrics methods if it was applied directly without considering time series properties of the data (Russel & Mackinon, 1993; Gujarati, 2012). Stationarity tests, cointegration tests and error correction mechanism are therefore carried out.

Generalized Autoregressive Conditional Heteroskedasticity (GARCH) was also modelled. Financial returns data often exhibit volatility clustering, where large changes in returns are followed by further large changes (Du, 2010). As such the magnitude of residuals often seems to be related to the magnitude of recent residuals - heteroskedasticity. By modeling the variance of residuals it may be possible to obtain more efficient estimators. Autoregressive Conditional Heteroskedasticity (ARCH) models (Engle, 1982), and Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models (Bollerslev, 1986), are designed to model and forecast conditional variances. As such, it seems obvious to test if modeling the variance can improve the ability to detect extra-market exchange rate exposures of individual companies.

Using a GARCH (1, 1) approach - and thus modeling the mean as well as the variance – the proportion of companies that exhibited a significant extra-market exchange rate exposure. This finding suggests that failing to model the variance of residuals reduces the ability to detect extra- market exchange rate exposure.

The pattern or non-stationarity in macroeconomic time series data can readily be revealed using standard tests for presence of unit root. According to Gujarati (2012), a series which is stationary after being differentiated once is said to be integrated of order 1 and is denoted by *1(1)*, meaning first (1^{st}) difference. In general, a series, which is stationary after being differentiated *d* times is said to be integrated of order *d*, denoted *I (d)*. Thus, a series which is stationary at levels, implying without differentiating, is said to be *1(O)*. Other variables may prove stationary *I (O)* or trend-stationery i.e. *1(0)* after removing a deterministic trend component through differentiating twice.

There are at least three stationarity tests available in literature and which this study employed. These are (i) eye ball test for stationarity using graphs (ii) the correlogram

method and (iii) unit root method. In the eyeball test for stationarity using graphs, the series or data are graphed in levels (or levels), first differences and second differences i.e. *y, Dy* and *D (D(y)*. Judgment is then made whether the graphs suggest nonstationarity in the mean and or variance in the data series (Agung, 2009).

The correlogram method is rather pictorial and gives the autocorrelation coefficients at various lags of the series. Generally, the maximum length of the lag is up-to one third of the sample size. A non-stationary time series starts with a very high coefficient and the coefficients taper off very slowly. A non-stationary time series has also very high Ljung-Box Q statistics with low p-values. That means that a stationary time series must have almost zero autocorrelation and partial autocorrelation coefficients at all lags and all Q statistics should also be not significant with high p-values. It has however, been argued in literature that the correlogram test is not a formal test but rather involves subjective judgment applied to the time series graph of the series (Johnston & DiNardo, 2007).

The other stationary method is the unit root test. It is the most widely used formal statistical tests. There are several ways of testing for a unit root. These include Dickey-fuller (DFE), Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) unit root tests. The simplest form of the ADF tests (and PP tests) amounts to estimating:

$$y_t = \rho_a + u_t \ldots\ldots \quad (3.5)$$

or in an equivalent regression expression:

$$\Delta y_t = u_a + (\rho_a + 1) y_{t-1} + \varepsilon_t \ldots\ldots \quad (3.6)$$

where, $u_t - IID(o, \sigma^2)$. *u* and *y* are parameters and *ε* is assumed to be white noise. Here the null hypothesis is $H_0 : \rho_a = 1$ against the alternative hypothesis. $H_1 : \rho_a < 1$.

The variable *y* is considered a stationary series if $-1<p<1$ while it is considered a non-stationary series (that is, random walk with drift) if $\rho=1$. While the ADF test corrects for higher order serial correlation by adding lagged differenced terms on the

right-hand side, the PP test makes a correction to the t-statistic of the coefficient from the Autogressive of order one that is, AR (1) regression to account for the serial correlation in ε. Both ADF and PP unit root tests was used in this study (Thapa, 2002).

Various studies measure unexpected changes in the exchange rate measures by using an autoregressive integrated moving average, ARIMA models. ARIMA models are used to extract unexpected changes in exchange rates from the series of exchange rate movements. By using ARIMA models, Fang and Loo (2004) examine the effect of current and unexpected exchange rate changes on US bank common stock returns. ARIMA residuals are used as a proxy of unexpected changes in exchange rates. They find that the unexpected changes in the exchange rates have a significant cross-sectional effect on common stock returns. To extract unexpected changes in interest rates, Bae (2010); Dinenis and Staikouras (2008) examine the effect of unexpected changes in interest rates on the common stock returns of portfolios of financial institutions in the US and the UK, respectively. They find a significant negative relationship between the common stock returns and the current and unexpected changes in interest rates.

In order to identify the unexpected changes in exchange rates this study followed a two-step procedure. The first step consists of finding an ARIMA (p,d,q) model. Autocorrelation and partial correlation structures seem to suggest ARIMA (1,1,1) for exchange rate factors. The fitted values of this model correspond to the expected changes in exchange rate risk factor. The residuals are then defined as the unanticipated changes in exchange rates. The second step involves the substitution of these residuals for the exchange rate variables in regression models. The current study views foreign exchange rate exposure as the impact of unexpected or actual rate of change in exchange rates on stock returns, since the exchange rate changes equal the expected exchange rate changes plus the unexpected exchange rate changes.

In terms of previous studies, such as Jorion (1990), a firm's or an industry's exchange rate exposure coefficient can be obtained using a time-series OLS equation as follows:

$$R_{it} = \beta_{0i} + \beta_{1i} ER_t + e_{it}, \quad (3.7)$$

where R_{it} is the return of the ith stock over time period t, ER_t is the percentage contemporaneous change in exchange rates over time period t, and β_{0i} and $i\varepsilon$ are respectively the intercept and random error term. In this study, the exchange rate sensitivity of 21 nonfinancial companies is estimated over the period from July 2001 to December 2016. Most studies use an alternate specification to Equation (3.1). This specification has the additional feature of explicitly controlling for movements in the stock market. The reason being that specific financial risk is only one part of the total risks that determine the variance in stock returns. Hence, the alternate specification is as follows:

$$B_{it} = \beta_{0i} + \beta_{1i} ER_t + \beta_{2i} RM_t + e_{it}, \quad t = 1, \ldots, T \quad (3.8)$$

This equation, R_{mt} is the rate of return on the NSE 20 market share index, which reflects important economy-wide factors e_{it} is unique to stock i. It is assumed to be uncorrelated with the common factors ER_t and R_{mt}. The two factors ER_t and RM_t are assumed to capture all risk, which systematically affects stock returns. In practice, the coefficients of exchange rate exposure, β_{1i}, estimated by equations (3.4) and (3.5) are highly correlated (Jorion, 2011). Such a model asserts the fact that returns are a function of contemporaneous changes in exchange rate and a market index with firm specific intercept and slope coefficients. The error term is the disturbance term assumed to be normally and independently distributed with mean zero and constant variance. The market variable is intended to capture the time serial influence of the general market on individual stock returns. The estimated exchange rate coefficient provided a measure of the effect of exchange rate changes on the stock returns given its relation to the market return index (Bodnar & Wong, 2003).

However, a change in exchange rates is likely to affect future expected flows and hence, the impact of changes in exchange rates on industries' stock returns may extend over a number of months. To allow for this possibility, several lags of the exchange rate variables should be included in the regression to explore whether there are important lags in the price adjustment process that must be recognized in the estimation (Agung, 2009). In this study the, lagged changes in exchange rate variables are included as explanatory variables to examine whether a lagged relation between exchange rate movements and stock returns is present in the sample firms.

The second stage of analyses involved the regression of different types of foreign exchange exposure on firm value of 21 multinational manufacturing firms listed in the NSE. A following panel data model was therefore employed.

$$\mathrm{FIRMV}_{it} = \alpha_0 + \beta_1 \mathrm{CEX}_{1it} + \beta_2 \mathrm{UEX}_{it} + \beta_3 \mathrm{LEX}_{it} + \varepsilon_{it} \quad \text{..... (3.9)}$$

Where i = 1,2, …,135, and t = 1,2,3,4

In the model i stand for the i^{th} cross-sectional unit and t for the t^{th} time period. The dependent variable is the firm value (FIRMV) which is hypothesized to depends on

contemporaneous exchange rate changes (CEX), unexpected exchange rate changes (UEX) and lagged exchange rate changes (LEX), each firm (i) on the sample over the 2001-2016 period (t) of analysis. Market performance (MKTP) was used used as the moderating variable. To test the moderating effect, the following model will be used.

$$\mathrm{FIRMV}_{it} = \alpha_0 + \beta_1 \mathrm{CEX}_{1it} + \beta_2 \mathrm{UEX}_{it} + \beta_3 \mathrm{LEX}_{it} + \beta_4 MKTP_{it} + MKTP\ (\beta_5 \mathrm{CEX}_{1it} + \beta_6 \mathrm{UEX}_{it} + \beta_7 \mathrm{LEX}_{it}) + \varepsilon_{it} \quad (3.10)$$

Necessary diagnostic tests were used to identify the best panel model for the study. The study used Hausman test to determine whether to use fixed effect equation or random effect equation. The fixed effects model allows the intercept to vary across the individuals but each individual's intercept does not vary over time (Gujarati &

Sangeetha, 2007). This recognises the fact that each cross-sectional unit may have some unique characteristics. According to Gujarati and Sangeetha (2007), one of the limitations of fixed effects is that it consumes a lot of degrees of freedom when the number of cross-sectional units is very large. This approach has been adopted by prior studies in the firm value- debate such as Gompers *et al*. (2003); Henry, (2008); Krafft *et al*. (2013). Panel data models are very useful in examining fixed and/or random effects of individual or time (Myoung, 2011). It also showed changes in exchange rate exposures practices among the firms during the study period.

On the other hand, the random effects model explores differences in error variance components across individual or time period (Myoung, 2011). It assumes that the intercept of a unit in the cross section is random drawing from a large population with a constant mean value (Gujarati & Sangeetha, 2007). According to Myoung (2011), "the random effects model assumes that individual effect (heterogeneity) is not correlated with any regression and then estimates error variance specific to groups (or times)". This model would be appropriate if differences across NSE listed firms have some influence on the firm value. According to Gujarati and Sangeetha (2007), it is advantageous to use random effects as it is economical with degrees of freedom. In order to choose which model is appropriate the study used Hausman's specification test. The model specification for panel data is the same as equation 3.1 above under OLS.

Normality was also tested since panel regression analysis requires that all variables to conform to normality. Cameron (2005), points out that testing data for normality ensures that the study hypothesis tests are at the correct significance levels. In this study, the Jarque-Bera test commonly used in literature (Agung, 2014; Brooks, 2008) was applied. Further, skewness and kurtosis levels was used to assess the normality of this study's data (Cameron, 2005).

Tests for Heteroscedasticity and Autocorrelation were also carried out. One of the assumptions of panel regressions is homoscedasticity, which implies that the error terms along the regression line are equal. The absence of homoscedasticity gives rise to heteroscedasticity. In line with prior studies (Monda & Giorgino, 2013; Topak,

2011), this study used Modified Wald test to test for heteroscedasticity. Another important assumption of the panel regression model is that there is zero covariance between the error terms over time (Brooks, 2008; Wooldridge, 2012). The errors are autocorrelated or serially correlated if this assumption is violated. First order serial correlation of the residuals was tested using the Wooldridge test panel models in line with Ntim (2013).

Based on model pre-estimation specification test, the study identified the best model for the study. A multivariate analysis was adopted and the study hypotheses tested. Two models were estimated, one without the moderating variable and another one with the moderating variable.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

Chapter four presents the analyses of the data collected and the interpretation of the results and findings from the analyses. The aim of this study was to assess the effect of foreign exchange rate exposure on the value of nonfinancial companies listed at the Nairobi Securities Exchange from January 2001 to December 2016. This chapter describes the data processing, data analysis of the study variables objectives and presentation of the analysis results. The chapter also presents hypotheses testing conclusions drawn on the objectives of the study.

4.2 Descriptive Analysis

Univariate analyses were done on each study variable with descriptive statistics outputs. The univariate analysis was done based on the measurement scale of the study variable. The study considered contemporaneous, unexpected and lagged exchange rate changes as independent variables, firm value as the dependent variable and market performance as a moderating variable. The analysis was based on the observed indicators used to measure each variable.

4.2.1 Foreign Exchange Exposure

The independent variables were all based on the changes on the foreign exchange rates of the country over time. The changes used as independent variables were measurements based on the actual exchange rates of the Kenyan shillings over time. To measure the changes, data on historical exchange rates were collected from Central bank of Kenya and used of determine the various changes. Mark (1990) computed contemporaneous movements in nominal and real foreign exchange rates which he found to be almost perfectly correlated for the seven countries used in his study. This study collected and used data on the nominal exchange rates of a basket of 7 major currencies that have been trading with Kenya over the period of study. The basket considered countries trading with Kenya both globally and regionally.

The nominal exchange rate is the number of units of the domestic currency that can purchase a unit of a given foreign currency calculated and measured as domestic currency per unit of foreign exchange (Jabara, 2009). Rodriguez-Lopez (2010) also used nominal exchange rate, measured as the home-currency price of the foreign currency in his study on the prices and exchange rates.

The study aimed at assessing the effect of foreign exchange rate exposure on the value of nonfinancial companies listed at the Nairobi Securities Exchange from January 2001 to December 2016. The specific objectives were formulated with independent variables on movements of exchange rate exposure. The measurements of the independent variables were based on the changes on the rates which can be measured in nominal or real terms. For nominal exchange rates the data was used as collected to measure the units of Kenya shillings that could purchase each of the foreign currencies considered in the basket of currencies at the different time periods.

The Nominal exchange rates were then used considering the consumer price indices of the countries in the basket on currencies to generate the real exchange rates (RER). The formula used for the computation of the real exchange rates RER from the NER is given by;

$$RER = NER \times \frac{p^*}{p} \quad \text{.....} \quad (4.1)$$

Where p^* is the price levels of the foreign currency p the price level of the domestic currency and NER the nominal exchange rate.

Schweigert (2002) defines real exchange rate R, as R = EP* / P, where the nominal exchange rate, E, is the domestic currency price of foreign currency (pesos per dollar), P* is a measure of the foreign (U.S.) price level, and P is a measure of the domestic (Guatemalan) price level. He further goes on to refer to depreciation as a decrease in R and appreciation of the foreign currency against the domestic currency as an increase in R. The study used the above formula to generate the RERs with the collected nominal exchange rates of the basket of currencies and consumer price

indices CPI^* and CPI as the price levels for the foreign and domestic currencies respectively. The consumer price indices data was from World Bank data base with 2010 set to 100 for all countries and regions.

Figure 4.1 shows a graphical presentation of the nominal and real exchange rates of Euros to Kenya shillings. The euro Nominal Exchange Rate (NER) against the Kenyan shilling was pictured to have an overall increase with time as shown by the lowess fit curve of NER against time. The actual values however showed that over time, the nominal rate was characterised by periodic fluctuations regardless of the overall increase in the long run. The NER lowess fit show a constant increase across the period but flattens in the latter time periods to imply stability of the Euro NER against the Kenyan shilling above 100 towards the end of the period.

The Euro to Kenya shillings RER on the other hand show and overall decreasing function as portrayed by the lowess fit of the RER against time. The RER begins high above the NER sees a constant decrease with time to values below the NER in the latter periods. The graph also shows that the RER of the Euro to Kenya shillings also has short term fluctuations over the period. There is an intersection between the NER and RER in the year 2010 when the World Bank data set used consumer price indices to 100 for all countries. This means that the price ratio for the two countries equals to 1 and the resulting RER would equal to the NER.

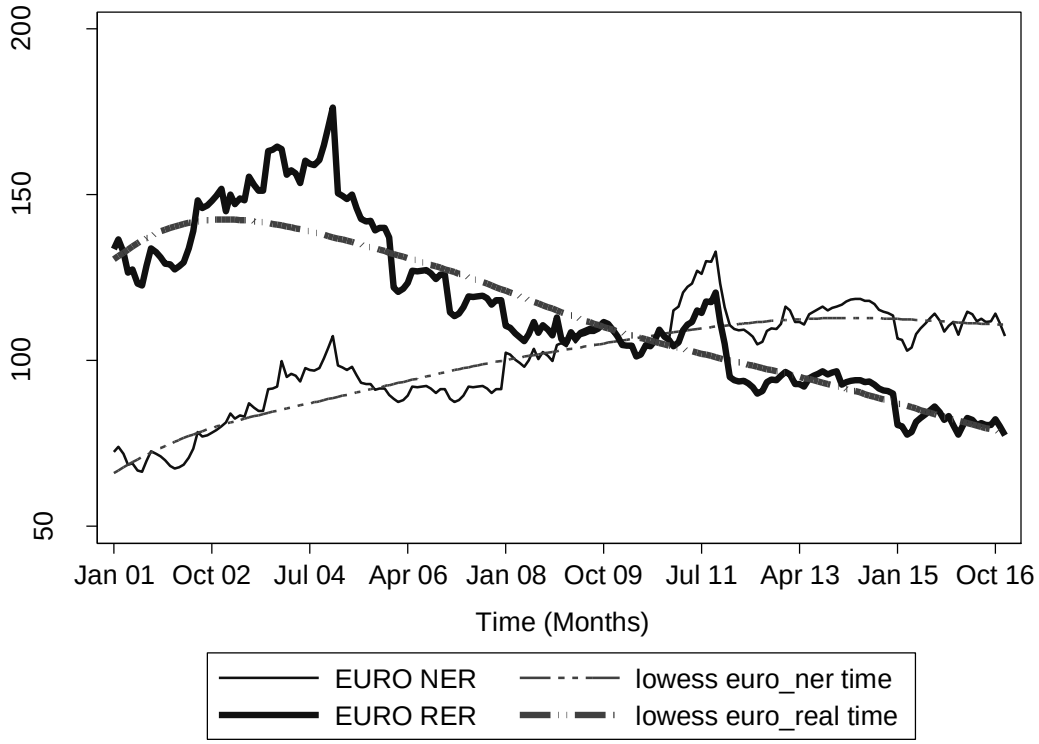

Figure 4.1: Euro NER and RER Over Time With Lowess Smoothening

The US dollar nominal exchange rate to Kenyan shillings also showed a general increase with time as shown in the lowess smoothened curve in figure 4.2. The curve shows that the dollar to shillings nominal rate was stable just below 80 in at the beginning of the period followed by some drop and finally an overall constant increase to the end of the period. The actual NER of the dollar to shillings rate shows that the dollar has periodic fluctuations over time.

The US dollar to Kenya shillings RER begins high at the beginning of the period and sees a constant steep drop as shown by the smoothened lowess fit of the US dollar real exchange rate to Kenyan shillings. The RER drops below the NER amidst short term fluctuations but in the latter months of the period the rate of drop decreases as implied by the flattening lowess curve.

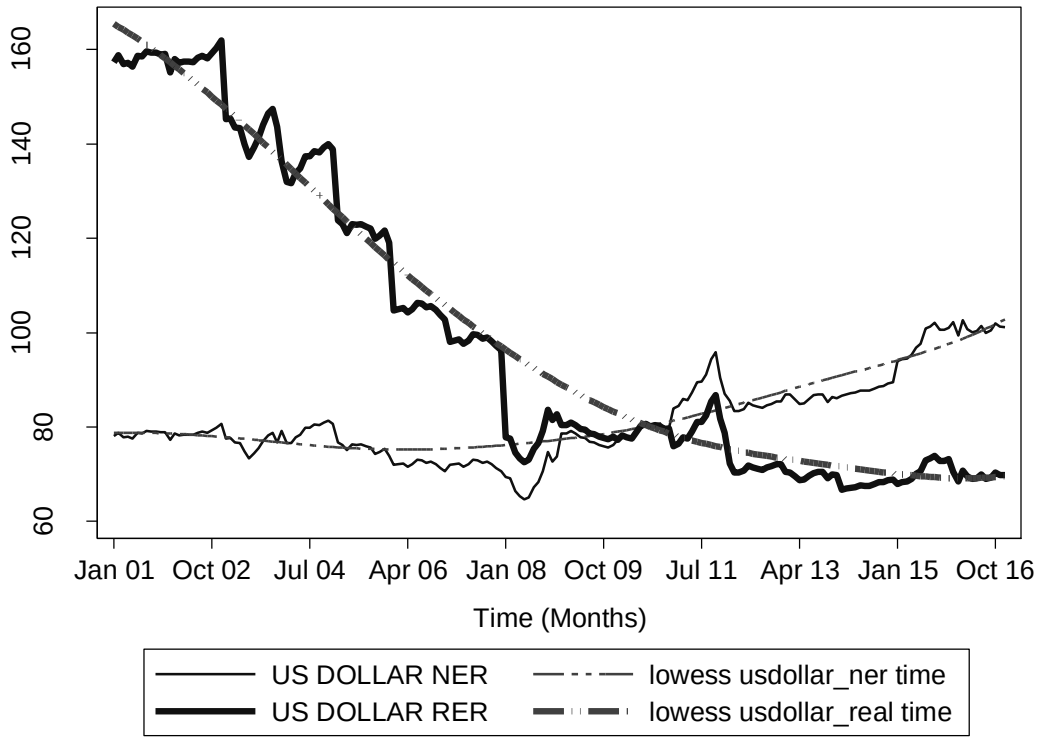

Figure 4.2: Dollar NER and RER over time with lowess smoothening

Based on the graphical presentation of the Sterling Pound nominal rates against the Kenyan shillings, the pound kept high rates above 100 for the entire period. At the beginning of the study period, the Sterling pound nominal rate to Kenyan shillings is seen to have a steeper increase compared to the rest of the period as shown by the NER lowess smoothened curve in figure 4.3. The rates curve tends to flatten in the mid period keeping very slow increase for the entire period amidst periodic short-term fluctuations.

The actual plots of the RER show fluctuations in the monthly real exchange rate of Kenyan shillings against the Sterling pound. The RER against the pound starts high above 200 with slight stability very early in the period portrayed by the flat start of the lowess fitness curve. The RER however sees a sudden steep drop to even below the NER towards the end of the period.

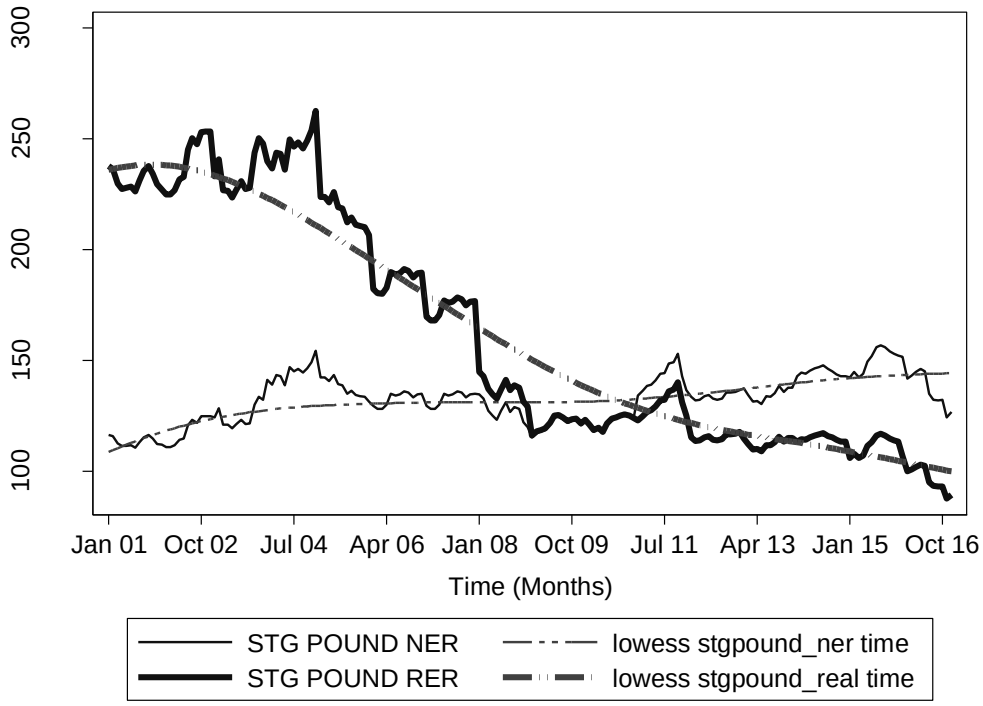

Figure 4.3: Sterling Pound NER and RER over time with lowess smoothening

The Japanese Yen nominal and real exchange rate curves are shown in figure 4.4. There is virtual implication of short-term fluctuations in the in both the nominal and real exchange rates. As portrayed in the presentation for the other currencies in the basket, the RER and the NER for the Japanese yen against the Kenyan shillings in the long-run move in the opposite directions.

Amidst fluctuations, the RER is seen to start high above 150 but have a decrease with time and even drops below the NER. The decrease is almost constant throughout the year as portrayed by the RER lowess curve. The NER lowess fit curve is on the other shows a low start which is flat for the first months in the period the characterised by a slow increase in the middle of the period and a slight drop at the end of the period. All through the period both the NET and RER show fluctuating up and down movements in short term.

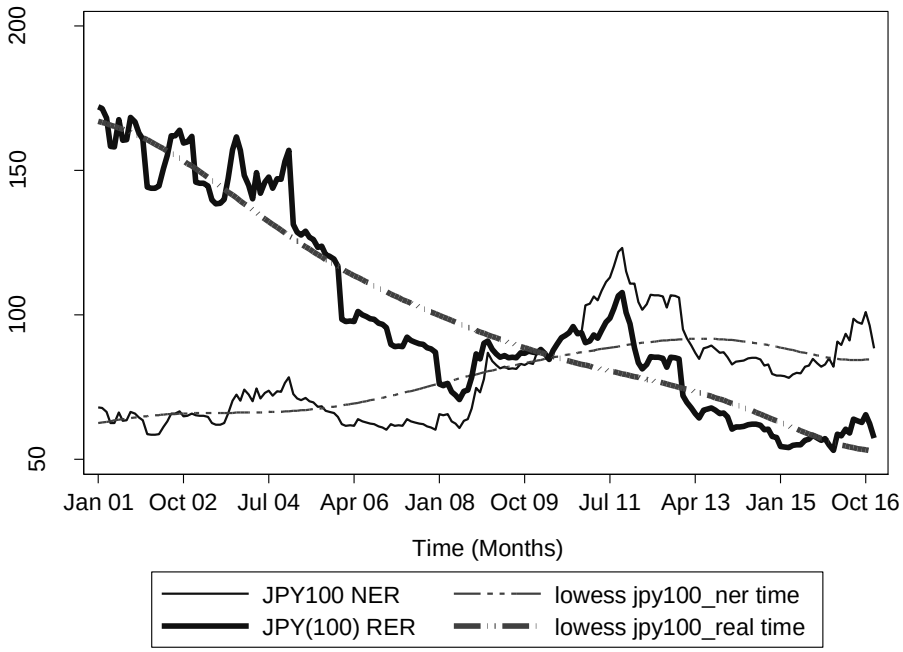

Figure 4.4: Japanese Yen NER and RER over time with lowess smoothening

The other currency studied in the basket of nominal exchange rates was the South African rand. This is a regional country trading with Kenya in the African region. As portrayed in the presentation for the other currencies in the basket, figure 4.5 shows that the real exchange rates of the SA rand to Kenya shillings started higher than the nominal exchange rates but is characterised by a general decrease to values slightly below the nominal exchange rates.

Further analysis of the lowess curve fit of both rates show that they both start begin with a general increase after which the RER changes course to a gradual decrease up to the end of the period. The NER lowess curve on the other hand flattens in mid period and starts to drop slowly towards the end of the period. Considering actual RERs and NER values, they both portray short term fluctuations with an acute high rise and immediate fall at one point in time. It was also noted that while all the other global currencies trading with Kenya exchanged with Kenyan currencies at high rates above 50, 80 and 100, the rand a regional currency was trading at much lower rates below 25 both in real and nominal terms.

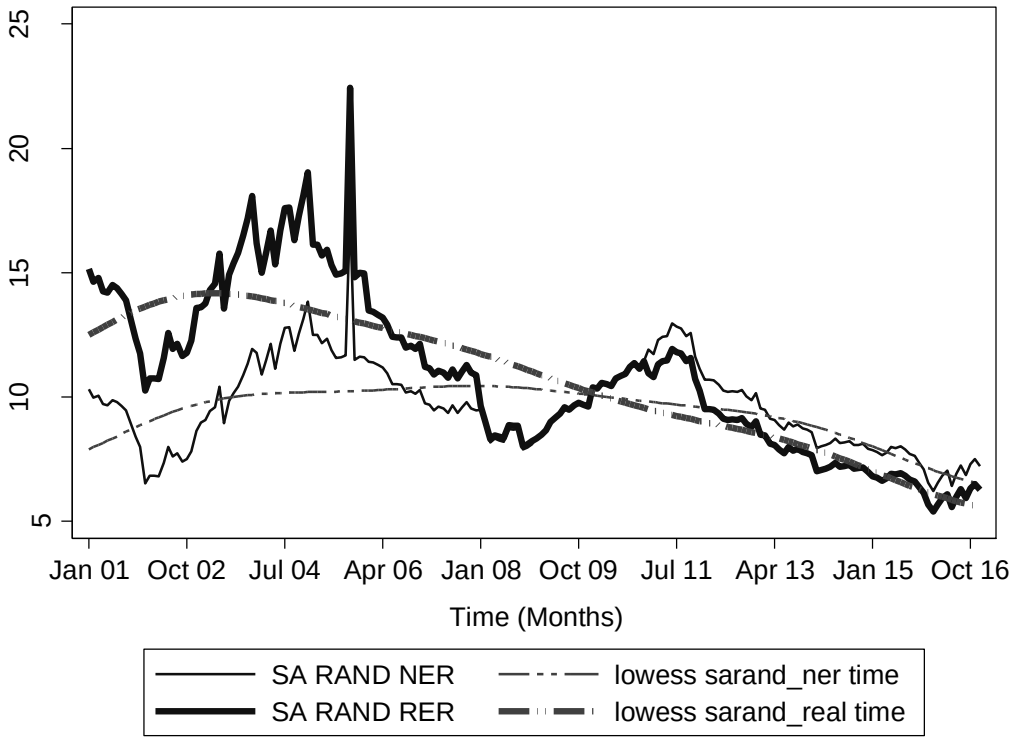

Figure 4.5: SA rand NER and RER over time with lowess smoothening

The Tanzanian shilling was another regional currency considered in the basket of currencies. This currency was considered important being that Tanzania is a neighbouring country and therefore has much trade with Kenya in the Est African region. Based on the graphical presentation of the Tanzanian shilling (Tshs) nominal rates against the Kenyan shillings, the Tshs compared to the other currencies in the basket traded with the Kenyan shilling at low rates below 1 both in nominal and real terms throughout the period. The rate below 1 implies that the Kenyan shillings is much stronger that the Tshs as the reciprocal would be greater than one implying that it would require more Tshs to buy a Kenyan shilling.

Both exchange rates in terms of Tsh. to Kenyan shillings were all below 0.15 throughout the period as shown in figure 4.6. At the beginning, the Tshs started high both in nominal terms and real terms which both saw sudden drops and virtual general stability towards the end of the period amidst short-term fluctuations. This

can be seen by the lowess smoothen fit curves for both NER and RER that have sudden drops later flattens. Unlike other currencies in the basket, the RER of the Tshs was seen to remain higher than the NER throughout the period. The results are in agreement with Atindehou and Gueyie (2001) who claim that there is little difference between nominal and real exchange rates because they are highly correlated.

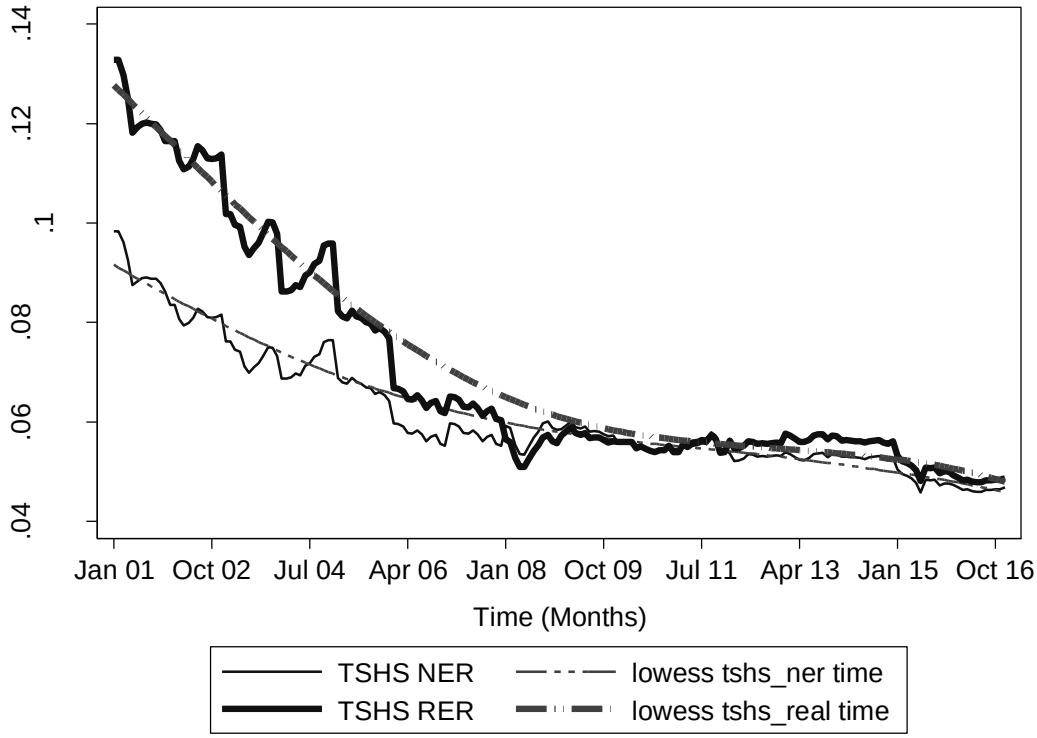

Figure 4.6: Tanzanian shillings NER and RER over time with lowess smoothening

Another regional currency that was considered in the basket was the Ugandan shillings (Ugx). Uganda is also an East African regional neighbour to Kenya. Like the other regional currencies, the Ugx traded at low rates against the Kenyan shilling both in nominal and real terms. More similarly to the Tshs, the Ugx exchange rates in terms of Kenya shillings per Ugx were also all less than 1 implying a stronger Kenya shilling.

As shown in figure 4.7, both the real and nominal rates of Ugx to Kenya shillings were on a decreasing trend over the period as implied by the lowess curve fits amidst short-term fluctuating variations. The NER seemed to have a constant decrease while the RER had a steep decrease from the beginning flowed by a slower rate of decrease in the latter years. The figure also shows that the real rates were always greater than the nominal exchange rates of the Ugx to the Kenyan shillings.

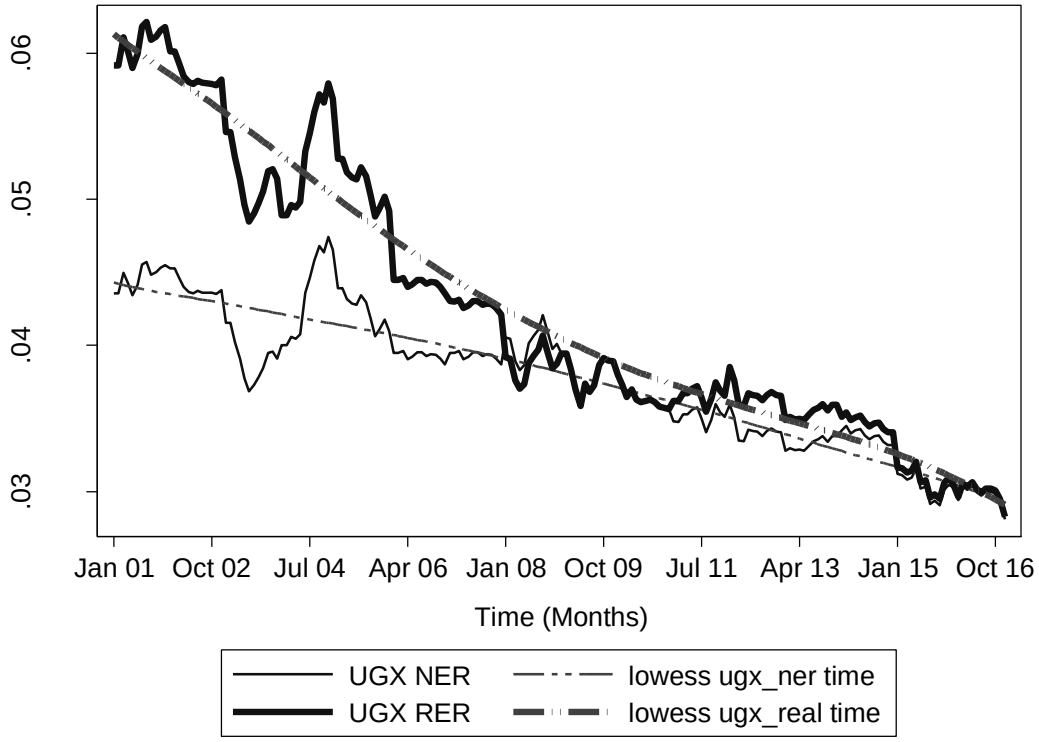

Figure 4.7: Ugandan shillings NER and RER over time with lowess smoothening

Table 4.1 presents the descriptive statistics of the individual exchange rates for each currency for the entire period combined. The results show very varying figures on the mean nominal exchange rates between Kenya shillings and each of the currencies. This shows that Kenya trades highly with countries with both strong currencies and weak currencies. Five of the currencies considered in the basket were all stronger than the Kenya shilling, the Sterling Poundbeing the strongest that had a mean NER of 132.460. The other two currencies in the basket that were on the other

hand found to be on average weaker than the Kenya shilling were the Tanzanian shillings and the Ugandan shillings with mean NERs of 0.061 and 0.038 respectively.

The strong currencies in the basket that were trading with Kenya are globally strong and very marketable currencies globally such as the dollar that had a mean NER of 81.566 against the Kenya shilling over the 190 months combined. The weaker currencies on the other had were regional currencies that trade with Kenya by virtue of regional trade and being neighbouring countries to Kenya. The coefficient of variations indicated that Japanese Yen and Tanzanian shillings had the highest spread (20%) over the study period with Sterling pound depicting the lowest spread (8%) indicating that it is the most stable of the selected currencies. Madura (2011) argues that foreign exchange rate movements tend to be larger for longer time horizons thus the longer the time horizon the higher the spread.

Table 4.1: Nominal Exchange Rates Summary Statistics

Currency	Mean	Std Deviation	Min	Maximum	C.V
Euro	100.133	14.896	66.458	132.94	15%
US Dollar	81.566	8.929	64.631	102.606	11%
Sterling Pound	132.46	11.087	110.742	156.914	8%
Japanese Yen	78.964	15.621	58.529	123.189	20%
SA Rand	9.664	1.788	6.226	17.396	19%
Tanzanian Shillings	0.061	0.012	0.046	0.098	20%
Ugandan Shillings	0.038	0.005	0.028	0.047	13%

A further analysis of the nominal exchange rates (NER) shows that the NER is very heterogeneous across the different currencies. As shown on the spaghetti plot in figure 4.8 of the different currencies in one graph, some of the currencies have high NERs like the Sterling Pound that is constantly above the others and above 100 while the others like the Ugandan shilling and the Tanzanian shilling are barely above 0 throughout the period.

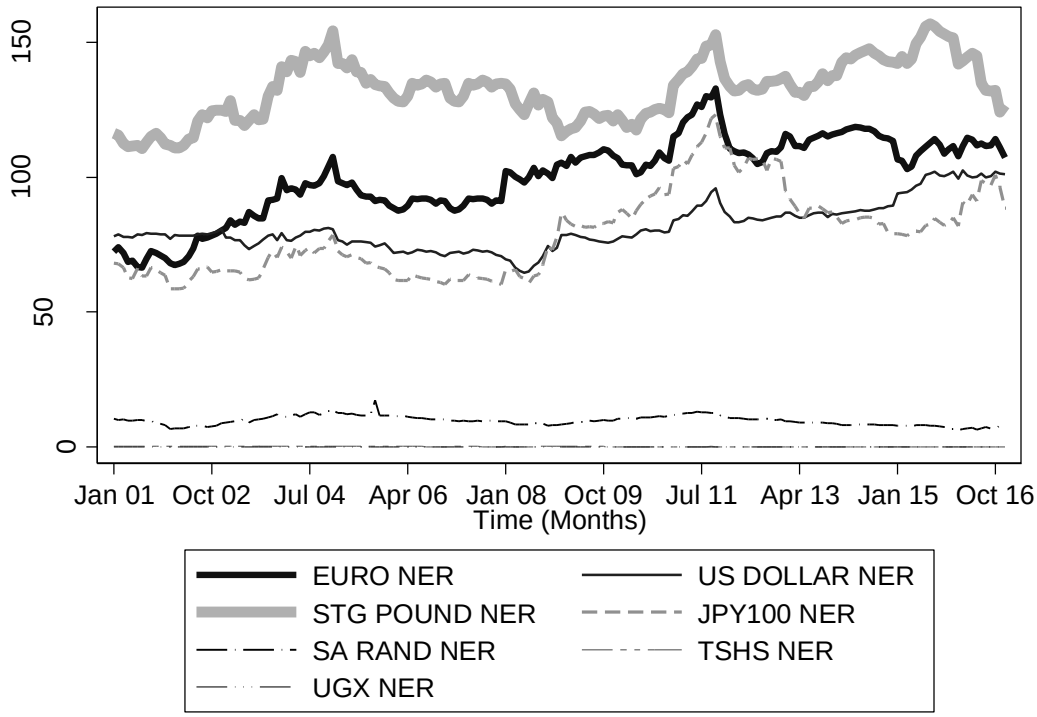

Figure 4.8: NER Spaghetti plot

To further examine the level of heterogeneity of the shows the level of heterogeneity of the NER an analysis of the overall mean NER with the variations within groups and between the groups of currencies was done. Table 4.2 shows that the mean overall NER for all the currencies and all the months in the period combines was 57.555. The overall standard deviation which is a measure of dispersion is 50.776. The overall standard deviation is very high but it is ac contribution from the variation between and variation within groups. The variation within groups of currencies was only 9.744 while the variation between the groups was 53.799. This confirms that the variation of NER between currencies is very high.

Table 4.2: Overall Nominal Exchange Rate (NER)

Variable		Mean	Std. Dev.	Min	Max	Observations
Nominal exchange rate	overall	57.555	50.776	0.028	156.914	N=1344
	between		53.799	0.038	132.460	n=7
	within		9.774	23.880	101.781	T=192

The summary statistics of the individual real exchange rates for each currency for the entire period combined are shown in table 4.3. The tables show very varying figures on the mean real exchange rates between Kenya shillings and each of the currencies. Five of the currencies considered in the basket were all stronger than the Kenya shilling, the Sterling Pound being the strongest that had a mean RER of 162.040. There are other two currencies Tshs and Ugx in the basket that were found to be on average weaker than the Kenya shilling with mean RERs of 0.070 and 0.042 respectively. The US dollar a strong and very marketable currency globally had a mean RER of 99.180 against the Kenya shilling over the 190 months combined. The coefficient of variations result indicates an almost equal spread in the RERs of the selected currencies.

Table 4.3: Real Exchange Rates Summary Statistics

Year	Mean	Std Deviation	Min	Maximum	C.V
Euro	115.616	24.431	77.428	176.304	21%
US Dollar	99.18	32.524	66.736	161.926	33%
Sterling Pound	162.04	53.562	87.605	262.699	33%
Japanese Yen	100.402	35.203	53.17	172.114	35%
SA Rand	10.886	3.35	5.396	22.44	31%
Tanzanian Shillings	0.07	0.023	0.048	0.133	33%
Ugandan Shillings	0.042	0.009	0.028	0.062	21%

Figure 4.9 shows of the spaghetti plot of the RERs of the 7 currencies being studied. Unlike the NER, the figure shows that in real terms, most of the currencies are virtually depreciated against the shilling over time. The Sterling Poundstill remained the stronger currency throughout the period.

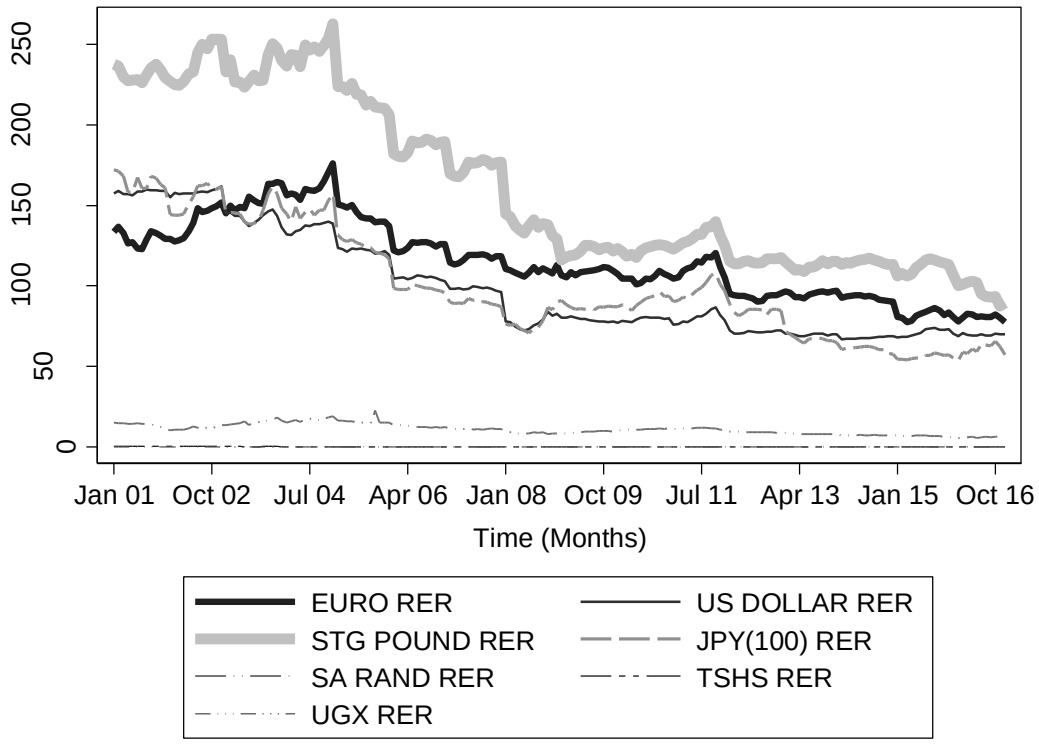

Figure 4.9: RER Spaghetti Plot

The level of homogeneity portrayed by the NER across the currencies was still persistent with the exchange rates in real terms. The overall RER for all the currencies and all the months in the period combines was 69.748. The overall standard deviation is 66.947 which show high heterogeneity in RER. Table 4.4 shows that there was high variation between groups of the different currencies with a standard deviation of 65.328 compared to the lower variation within groups of currencies with a standard deviation of 28.656. This implies most of the variation is due to differences between the currencies than the variation due to changes in the real exchange rates over time.

Table 4.4: NER Summary Statistics

Variable		Mean	Std. Dev.	Min	Max	Observations
Real exchange rate	overall	69.748	66.947	0.028	262.699	N=1344
	between		65.328	0.042	162.040	n=7
	within		28.656	-4.686	170.407	T=192

Considering the high heterogeneity of both the NER and the RER across the different currencies, the scale range of the measurements of the same variable differ with different currencies which would be detrimental for computation of combined composite exchange rates for the 7 currencies in the basket. According to Rogoff (1996,), in the long run, the real exchange rate tends toward purchasing power parity, but at an extremely slow speed of convergence. Real exchange rates are non-stationary therefore it is not advisable to assess RER in the point of view of the PPI (Frait, 2001). Mark De Broeck and Torsten Slok (2001) constructed real exchange rates of from relative prices and nominal exchange rates by the real exchange rate decomposition;

$$q_t = s_t - p_t^* + p_t \text{.....} \quad (4.2)$$

Where q_t is the real exchange rate, s_t the nominal exchange rate, p_t^* the foreign country's price levels p_t the domestic country's price levels all in natural logarithms?

Chinn (2006) described this equation with natural logarithms of real and nominal rates as the standard decomposition of real exchange rates while Schweigert (2002) describes the decomposition as a result of rearrangement of the formula $Q = S \times \left({}^{P^*}/_{P}\right)$ following the introduction of natural logarithm of real exchange rates on the equation. In this, Q is the real rate, S the nominal rate, P* the foreign country's price levels and P the domestic country's price levels.

The data collected for the study were therefore further transformed by getting the natural logarithms of the RER data for further analysis which also normalised the scale of measurements of the RERs across the different currencies. This took care of the heterogeneity and skewedness exhibited by both the NER and the RER as observed. Table 4.5 shows the summary statistics of the natural logged RER. The scale after normalising show that the highest mean is 4.883 as the natural logarithm for the NER of the Sterling Pound and the Ugandan shilling value as the minimum mean. The standard deviations were also greatly reduced with the highest variation being in the Japanese Yen with a standard deviation of 0.324. The coefficient of variation indicated that the South African Rand had the highest spread (13%) over the period of the study.

Table 4.5: Logged RER Summary Statistics

Year	Mean	Std Deviation	Min	Maximum	C.V
Euro	4.728	0.21	4.349	5.172	4%
US Dollar	4.548	0.308	4.201	5.087	7%
Sterling Pound	5.035	0.324	4.473	5.571	6%
Japanese Yen	4.549	0.345	3.973	5.148	8%
SA Rand	2.34	0.31	1.686	3.111	13%
Tanzanian Shillings	-2.703	0.291	-3.04	-2.019	11%
Ugandan Shillings	-3.183	0.215	-3.565	-2.779	7%

Upon generating the logarithms, the heterogeneity between groups' pf currencies was generally reduced. As shown in table 4.6, overall mean logged RER was found to be 2.188 with a standard deviation of 3.362. Much of the variation is also explained by the differences in the real exchange rates with the difference currencies as shown by the much larger standard deviation between groups of 3,16 compared to the standard deviation within groups which was 0,290.

Table 4.6: RER Summary Statistics

Variable		Mean	Std. Dev.	Min	Max	Observations
Real exchange rate	overall	2.188	3.362	-3.565	5.571	N=1344
	between		3.617	-3.183	5.035	n=7
	within		0.290	1.533	2.959	T=192

Effective Exchange Rates

The generated exchange rates logarithms were used to determine the composite exchange rates from the basket. Using the real exchange rates from all the 7 countries in the basket of currencies considered, real effective rates were generated for each month in the period and used for further analysis. The real effective exchange rate (REER) is computed as weighted average of the different real exchange rates (RER) from the basket of currencies where the weights are determined on importance of the country based on the terms of trade between the countries. The composite REER can be calculated as a weighted average directly from the RERs arithmetically or geometrically though the geometric technique is typically used due to the symmetric and consistency properties that are not attributed to the arithmetic weighted average technique (Hinkle, 2000). Hinkle defined the real effective exchange rate as the relation to the average of the country's main trading partners given by the geometric equation;

$$REER = \prod_{i=1}^{m} RER_i^{w_i} \quad \text{.....} \quad (4.3)$$

Where REER is the real effective exchange rate

RER_i is the real effective exchange rate of currency i in the basket of currencies

w_i is the appropriate weight given to currency i from the basket

m is the total number of currencies in the basket.

According to Betliy (2002), the geometric average is also more advantageous in using, since getting the logarithm transformation of the geometric average gives an average that the arithmetic average of the logs of different RERs for the currencies in the basket. The study therefore adopted the geometric technique to get the REER as geometric weighted averages of the RERs of the 7 currencies in the basket. Having generated the natural logarithms of the individual RERs, the resulting equation adopted to compute the REER was an arithmetic weighted average of the individual logged RERs given below.

$$REER = \sum_{i=1}^{m} W_i \times rer_i \quad \text{.....} \quad (4.4)$$

Where $rer_i = log_e RER_i$ is the natural log of the real effective exchange rate of currency i

W_i is the weight given to the currency i.

The log RER that had been generated was therefore used to compute the REER as the composite measure of exchange rate exposure for the basket of currencies combined. Similarly the nominal effective exchange rate (NEER) can be computed as a weighted average from logged NER of the currencies in the basket.

Figure 4.10 shows the plots of the computed real effective exchange rate (REER) over the 190 months period and the nominal effective exchange rate both generated using the respective logged RERs and NERs. As shown in the figure, both the NEER and the REER start as increasing functions based on the lowess smoothened fits but soon after, the NEER develops a slow increase while the REER flattens. The REER at the beginning of the period is higher than the NEER but along the period, the NEER surpasses the REER. Both rates are also seen to be exhibited by fluctuations along the period.

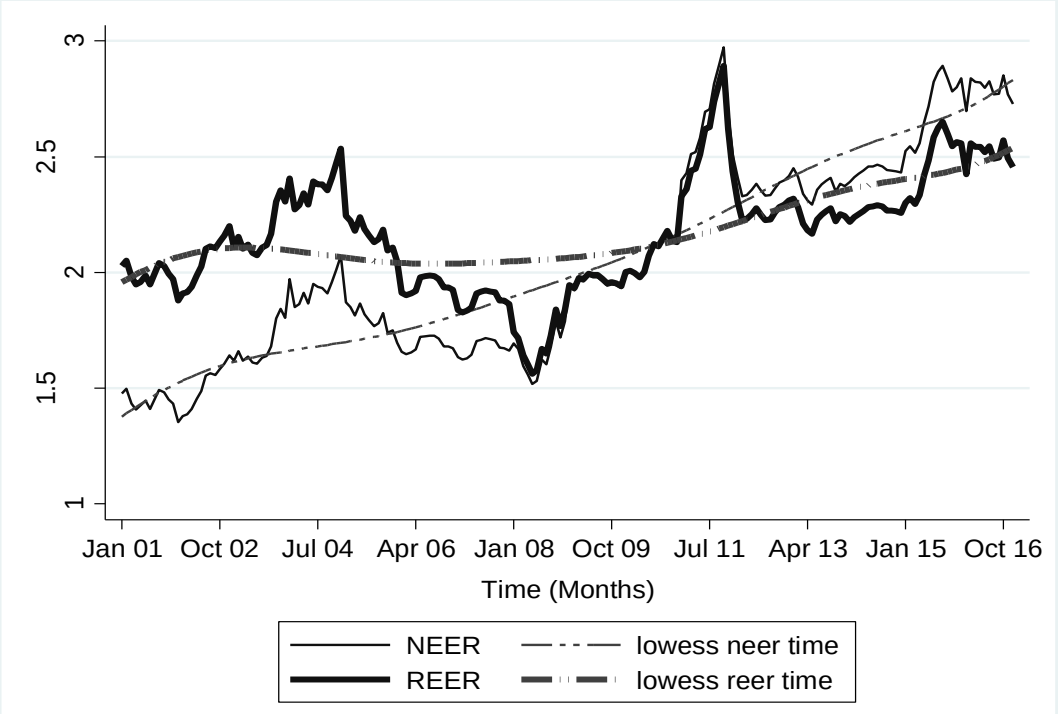

Figure 4.10: NEER and REER over Time with Lowess Smoothening

Upon the generation of the real effective exchange rate (REER) from the log RER as the exchange rate exposure measure, the study used these effective exchange rates to calculate the changes in the exchange rate exposures as the independent variables in the study. Each independent variable of the study was based on the changes on the exchange rate exposure as a measure of the changes in the computed composite REERs from the seven currencies.

4.2.2 Contemporaneous Changes

The first objective of the study sought to determine the effect of contemporaneous exchange rate changes on firm value of nonfinancial companies at Nairobi Securities Exchange. The independent variable based on this objective was the contemporaneous changes exchange rate movement measured as current changes in exchange rates. Contemporaneous exchange rates were computed for every month in the period of study as the current changes in the effective exchange rate measures.

The real effective exchange rate as generated was used to determine the contemporaneous changes across the periods as used in the study. Table 4.7 shows the summary statistics of the contemporaneous changes in the exchange rates. The mean movement based on the contemporaneous changes was found to be -0.002 with a standard deviation of 0.016. This shows that evidence of fluctuating changes both negative and positive.

Table 4.7: Summary Statistics for Contemporaneous Changes in Exchange Rates

	Mean	Std Deviation	Min	Maximum
Contemporaneous movements	-0.002	0.061	-0.199	0.291

Figure 4.11 shows the graphical presentation of the calculated changes in the exchange rates with time. The plot shows that the changes were fluctuating about zero across the period both in the negative and positive directions.

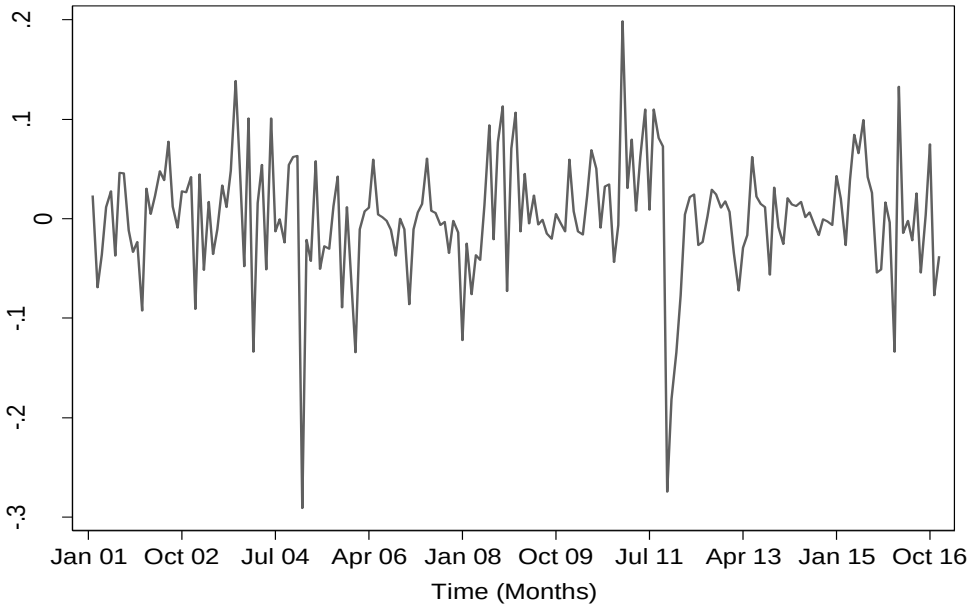

Figure 4.11: Contemporaneous Changes in Exchange Rates with Time

Considering that the objective was to determine the effect of contemporaneous exchange rate changes on firm value of nonfinancial companies at Nairobi Securities Exchange, the contemporaneous changes were included in the panel dataset of the 19 companies of NSE. Table 4.8 shows the overall summary statistics of the contemporaneous changes in the panel dataset. The overall mean was found to be -0.002 with an overall standard deviation of 0.061. The overall variation is however equal to the variation within the groups of NSE listed companies as shown by the equal standard deviations. There is no variation between the firms themselves as implied by the standard deviation of 0 between the groups. The 0 variation between the firms can be attributed to the fact that foreign exchange rate is an exogenous variable index that is not pegged to each firm but is based on currency measurements that are similarly used by all the firms and the entire country collectively. This means that the level of effect and influence of the changes could vary across firms but the value of currency changes and currency exchange rate change measurements do not vary but are similar to all firms.

Table 4.8: Contemporaneous Changes Panel Analysis Statistics Summary.

Variable		Mean	Std. Dev.	Min	Max	Observations
Contemporaneous movements	overall	-0.002	0.061	-0.199	0.291	N=3591
	between		0.000	0.021	0.021	n=19
	within		0.061	-0.199	0.291	T=189

4.2.3 Exchange Rate Prediction

The next objective of the study required the measurement of unexpected changes on the exchange rates. The unexpected changes in exchange rate can be calculated as the difference between the actual and anticipated changes in exchange rates. This involves and requires an appropriate proxy for calculating the anticipated exchange rates by estimation from the available historical information. Harris, Marr and Spivey (1991) use the forward rate premium/discount as an appropriate exchange rate risk factor that reflects investor expectations, whereas Choi and Prasad (1995) use the forward rate or the lagged spot rate as a proxy for expected exchange rate.

The researcher had to develop or adopt a technique to predict the expected or anticipated exchange rates from which the unexpected exchange rate changes were extracted. Being a time series dataset, the study adopted time series techniques to predict the anticipate the effective exchange rate in order to extract the unexpected exchange rate changes as the residuals of the adopted time series model. By using ARIMA models, Fang and Loo (2004) examine the effect of current and unexpected exchange rate changes on US bank common stock returns. ARIMA residuals are used as a proxy of unexpected changes in exchange rates.

To adopt ARIMA as the model of choice, tests were done to confirm possibilities of using ARIMA otherwise other time series modelling such as a simple random walk or trend estimation would suffice for prediction. From figure 4.12 above it was seen through lowess smoothening, that the exchange rates exhibit some trend but probably not stationary while the actual rates show timely fluctuations long time.

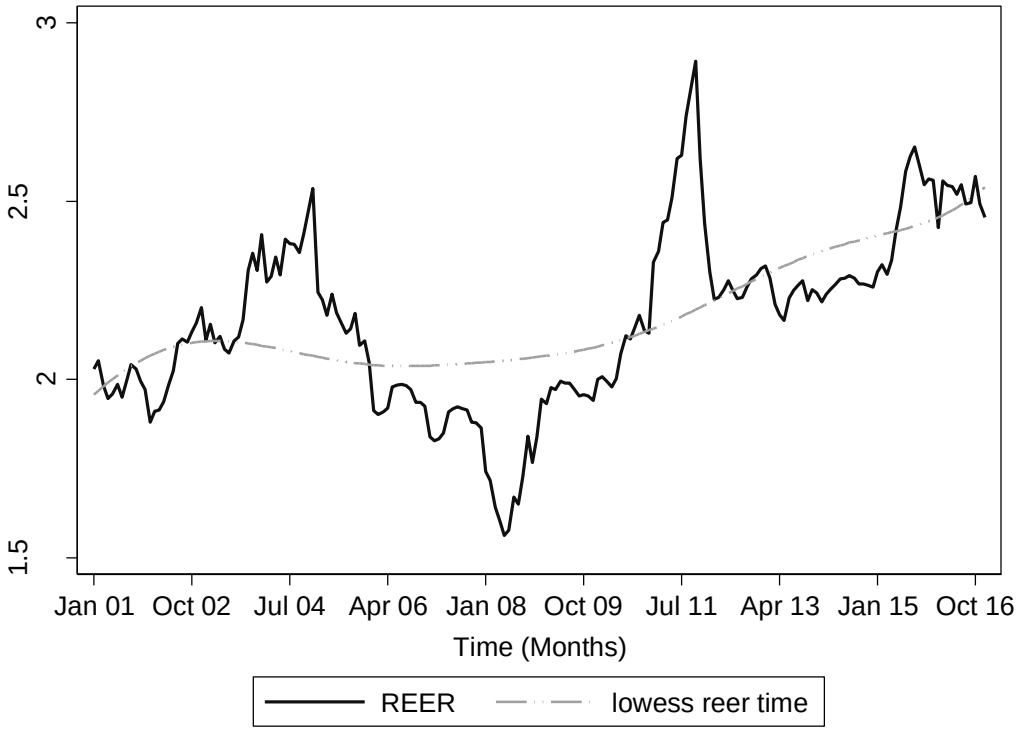

Figure 4.12: Effective Exchange Rate

To assess possible model underlying the effective exchange rates that could be adopted to predict the expected rates an autocorrelation function (acf) plot of the exchange rates was fitted. Figure 4.13 presents the acf plot from the effective exchange rates. Based on the slow decay of the autocorrelation plots that alternate positively and negatively but with no definite decay to zero, the dataset is most probably not stationary and may require differencing to achieve stationarity. It is also noted that the autocorrelation plots are alternating with both negative and positive spikes giving a possibility of both autoregressive (AR) and moving average (MA) components in the underlying models. This implies possibility of ARMA models but due to the possible non-stationarity, a differencing to achieve stationarity would further imply based on the order of differencing an inclusion of the integrated (I) component to the ARMA yielding a full ARIMA model for the effective exchange rates prediction.

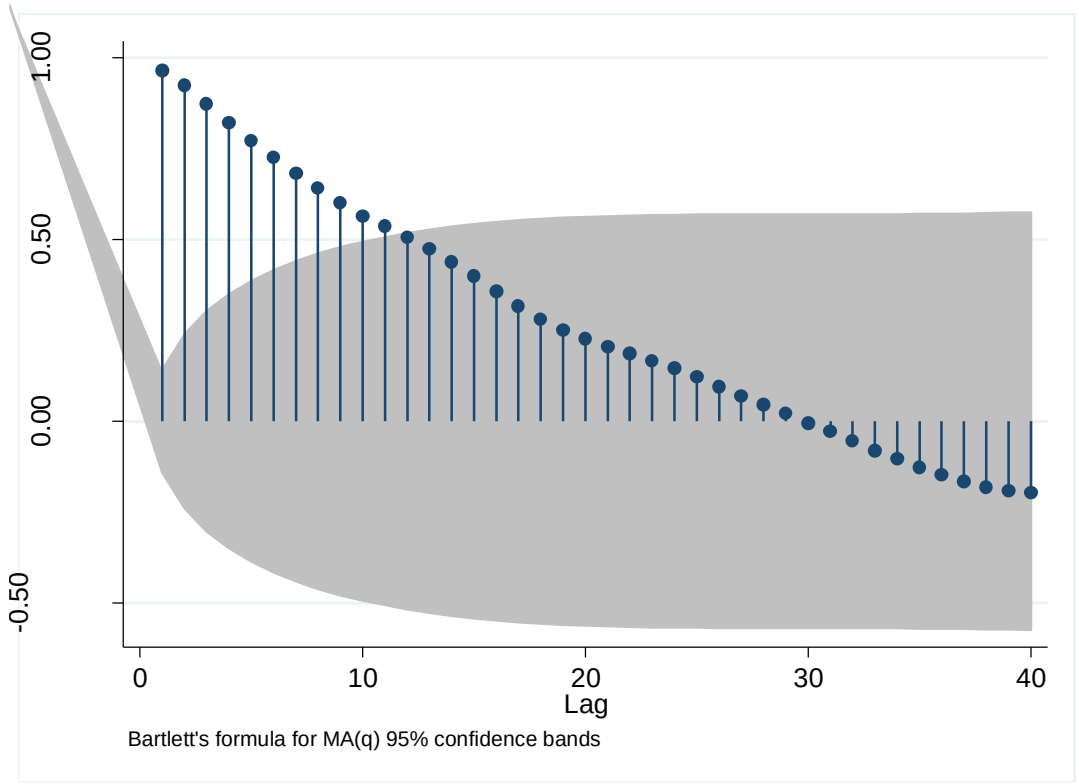

Figure 4.13: Autocorrelation Function (ACF) Plot

Having known the possibility of all the three components of the ARIMA model underlying the data, the partial autocorrelation function (pacf) was also plotted for the exchange rates data yielding the figure 4.14 below. The PACF plot confirms the possibility of the autoregressive component of the model underlying the data. Further to the confirmation, the acf plot only implies possibility of the AR component of at least order 1 while the pacf also helps confirm existence of AR(1) or if there is possibility of higher order AR. The pacf plots show an evident departure from zero implying possibility of a higher order AR component as opposed to and AR(1) characterised by partial autocorrelation plots that do not depart from zero.

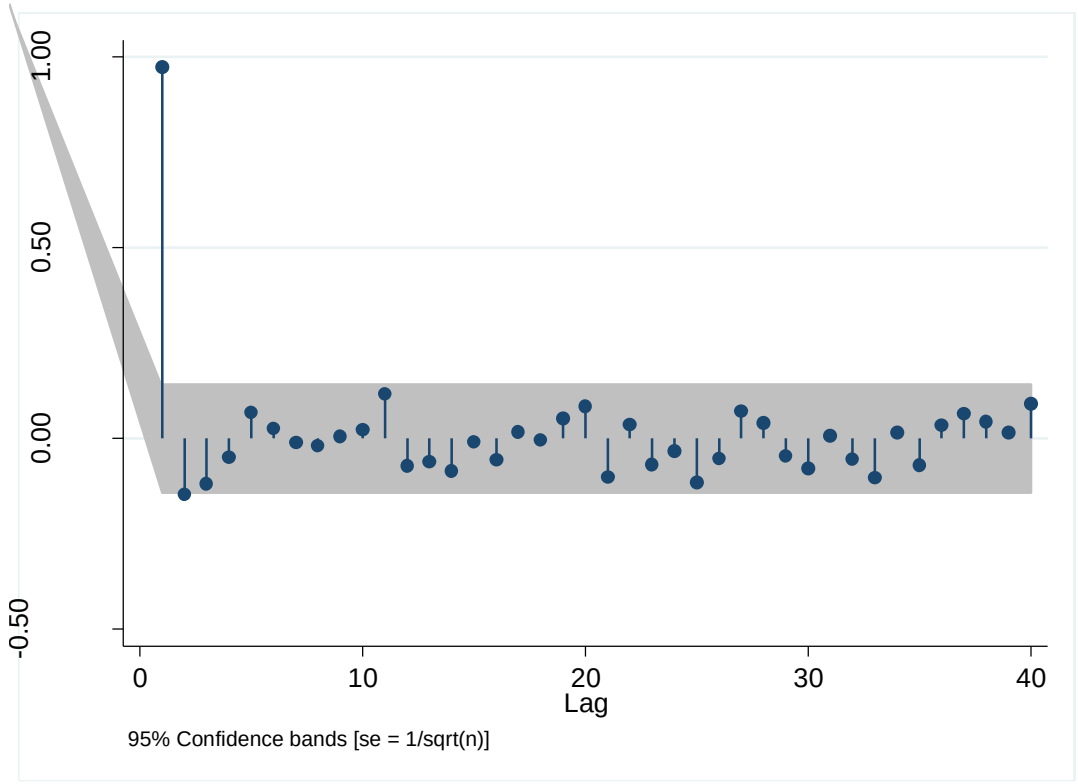

Figure 4.14: Partial Autocorrelation Function (PACF) Plot

To continue with the time series model estimation, the non-stationarity required confirmation to allow for differencing befire fitting the ARMA components of the ARIMA. The correlogram method which is rather pictorial technique which gives the autocorrelation coefficients at various lags of the series have been used to test for

stationarity. It has however, also been argued in literature that the correlogram test is not a formal test but rather involves subjective judgment applied to the time series graph of the series (Johnston & Di Nardo, 2007). To confirm stationary for the time series data in this study, the researcher performed an augmented Dickey-Fuller unit root test for time series stationarity. Non stationary data implies a trend which would require differencing before fitting any ARIMA model. The test Dickey-Fuller z(t) test statistic -1.523 is greater than all the critical values at 1%, 5% and 10% levels of significance which implies that at 5% level of significance, confirming a unit root and thus non-stationarity. The p-value for the z(t) statistic 0.522 is greater than 0.05 which confirms a unit root hence non-stationarity.

Further to the confirmation of significant non-stationarity, the augmented Dickey-Fuller with generalised least squares (DF-GLS) test also performs the test on the number of possible lags from which the optimal lag for differencing is determined (Stock & Watson, 2011). The results show that the optimal differencing order required to detrend the data is one based on the optimal lag of 1 which was found to have the minimum root mean square error estimate (RMSE) of 0.0610026. This implied that the ARIMA model estimation required first order differencing further implying and ARIMA model of first order integrated component denoted ARIMA(p,1,q) where p and q are the orders of the AR and the MA components respectively.

Table 4.9: Augmented Dickey-Fuller Test

	Test Statistic	0.01 Critical Value	0.05 Critical Value	0.1 Critical Value
Z(t)	-1.523	-3.480	-2.884	-2.574

MacKinnon approximate p-value for z(t) = 0.5220

Opt Lag (Ng-Perron seq t) = 1 with RMSE 0.0610026

Min SC = -5.535189 at lag 1 with RMSE 0.0610026

Min MAIC = -5.556364 at lag 1 with RMSE 0.0610026

The ARIMA Model

Upon determination of the first order differencing requirement for the data, the study sought to determine the optimal orders of the AR and MA components. The AICs and BICs were computed for the different possible ARIMA models for comparison to determine the optimal model. Akanke's information criterion (AIC) and Bayesian information criterion (BIC) are comparative indices that use the log likelihood estimates that can help in determining the optimal model. A better model would have the minimum AIC or BIC. Table 4.10 shows a summary of the comparative model indices for the possible ARIMA models to predict the exchange rates. The ARIMA (2,1,2) has both the minimum AIC and minimum BIC statistics that makes it the optimal possible ARIMA model.

Table 4.10: ARIMA Model Comparative Indices

Model	Obs	ll(model)	df	AIC	BIC
ARIMA(2,0,2)	192	269.327	6	-526.655	-507.110
ARIMA(2,1,2)	191	267.898	5	-525.797	-509.535
ARIMA(3,1,3)	191	268.182	7	-522.365	-499.599
ARIMA(3,1,2)	191	268.025	6	-524.050	-504.537
ARIMA(1,1,3)	191	267.241	5	-524.482	-508.221
ARIMA(2,1,3)	191	268.024	6	-524.047	-504.534

Table 4.11 shows the results of the ARIMA (2,1,2) model which was determined to be the optimal ARIMA model. An ARIMA(2,1,2) implied that the model would have first order integrated component I(1) which meant getting the first differences of the data, an AR(1/2) which meant including the first and second lags of the autoregressive component and an MA(1/2) which meant also including first and second lags of the moving average component.

Based on the ARIMA(2,1,2) results, the Wald chi-square statistic was found to be 49.33 with a p-value of 0.000 which is less than 0.05 implying general significance

of the ARIMA model at 5% level of significance. The model is of D.reer implying the ARMA predicts differenced real effective exchange rates. Further all the estimates of the model had z-statistics all with p-values less than 0.000 implying significance of all the AR lags and MA lags in the model. The constant to the model was found to be insignificant and was thus dropped and suppressed to yield a no constant model given by the equation;

$$y_t = 0.786y_{t-1} - 0.676y_{t-2} - 0.693\varepsilon_{t-1} + 0.735\varepsilon_{t-1} + \mu_t \quad \ldots \qquad (4.5)$$

$y_t = D.reer_t$ is the differenced real effective exchange rate at time t

y_{t-i} is the ith lag of the autoregressive component of the model

ε_{t-i} is the ith lag of the moving average component of the model

μ_t is the error term at time t

Table 4.11: ARIMA (2,1,2)

Sample: Jan 2001 - Dec 2016					**Number of obs**	=	**191**
					Wald chi2(2)	=	49.33
Log likelihood = 267.898					Prob > chi2	=	0.000
	D.reer	**Estimate**	**Std. Error**	**z**	**Pr(>|z|)**	**[95% Conf.**	**interval]**
ARMA	ar						
	L1.	0.786	0.258	3.050	0.002	0.281	1.291
	L2.	-0.676	0.246	-2.740	0.006	-1.159	-0.193
	ma						
	L1.	-0.693	0.251	-2.760	0.006	-1.185	-0.201
	L2.	0.735	0.206	3.570	0.000	0.331	1.139
	/sigma	0.059	0.002	28.760	0.000	0.055	0.064

GARCH Model

The study also assessed and analysed the data in terms of a generalised autoregressive and conditional heteroscedastic process (GARCH). ARIMA models as first modelled for the data are not characterised as robust for the volatility that is attributed with conditional heteroscedasticity and autocorrelation of the disturbance term. Autoregressive Conditional Heteroscedasticity (ARCH) models (Engle, 1982), and Generalized Autoregressive Conditional Heteroscedasticity (GARCH) models (Bollerslev, 1986), are on the other hand designed to model and forecast conditional variances In linear time series shocks are assumed to be uncorrelated but not necessarily identically independent distributed. A standard linear model assumes constant variance for the residuals but in cases where the residuals do not exhibit homoscedasticity the GARCH could be adopted where the residuals are conditionally heteroscedastic. To extend the robustness of the ARIMA model previously fitted with robust auto correlated and conditionally heteroscedastic residuals, the GARCH model was fitted. The GARCH(p,q) process is superior to the ARCH(1) model due to the inability of the ARCH process to model shocks in case the process has shocks. The GARCH process models the conditional volatility of the residuals terms that are conditionally heteroscedastic and auto correlated.

An arch(p) process we estimate the parameter of the lagged residuals and the simple arch(1) is given by;

$$\sigma_t^2 = \alpha_0 + \alpha_1 a_{t-1} \quad (4.6)$$

Where

σ_t^2 is the conditional volatility of the residual at time t

a_{t-1} is the lagged residual

α_1 is the coefficient of the lagged residual

α_0 is the constant of the arch equation

In a simple arch process the variance (volatility) of the next periods only depend on the past residuals. In the garch(p,q) process, the variance (volatility) depends on both the past residuals and the past variances or past volatiliies. In a garch process, coefficients of the past residuals and of the past volatilities are estimated.

A simple garch(1,1) process is given by the equation;

$$\sigma_t^2 = \alpha_0 + \alpha_1 a_{t-1} + \sigma_{t-1}^2 \quad \text{.....} \qquad (4.7)$$

Where

σ_t^2 is the conditional volatility at time t

a_{t-1} is the lagged residual

α_1 is the coefficient of the lagged residual

α_0 is the constant of the arch equation

σ_{t-1}^2 is the past conditional volatility at time t-1

An ARCH effect was first tested on the residuals for the estimated ARIMA model. This helped determine whether there was need to fit an ARCH or a GARCH process model. The ARCH-LM test was used to test for presence of any variation in the conditional volatilities in the proposed data. Table 4.12 shows the results for the ARCH effect test that was conducted for up to 20 lags. The p-value for the Chi-square test for the LM statistic was less than 0.05 implying that the variable exhibits an arch effect. This is an implication that at least an ARCH process of order one was necessary in modelling the expected exchange rates.

Table 4.12: ARCH Lagrange Multiplier test

lags(p)	chi2	df	Prob>chi2
1	145.062	1	0.000

A GARCH model of the residuals from the ARIMA model was fitted without considering the mean ARIMA model various possible GARCH or ARCH orders were and the appropriate unbiased model chosen based on the Bayesian information criterion (BIC) measures. The distribution for the proposed GARCH model was assumed to be normal having tested the distribution of the disturbance term from the mean ARIMA model to be normally distributed. AS shown in table 4.13, the data showed non-existence of a GARCH process but the ARCH (1) process was found to be the optimal model for the ARIMA residuals of the real exchange rates. The ARCH (1) process was found to have an AIC of -142.371 and BIC of -132.559 which are the minimum AIC and BIC values respectively amongst all the possible GARCH models tested.

Table 4.13: GARCH Model Comparative Indices

Model	Obs	ll(model)	df	AIC	BIC
arch(1)	192	74.185	3.000	-142.371	-132.599
Garch(1,1)	192	74.540	4.000	-141.080	-128.050
Garch(2,1)	192	60.275	4.000	-112.551	-99.521
arch(1/2)	191	74.306	4.000	-140.612	-127.582

Having determined that the ARCH (1) process was the appropriate ARCH model exhibited, the study proceeded to fit the ARCH process for the data assuming normal distribution of the residuals and assuming no volatility to be modelled. Table 4.14 shows the results of the ARCH (1) process modelled. Th chi-square of the model was found to be 2986.070 with a p-value of 0.000 implying a general significance of

the arch (1) process modelled. Also shown in the process results, the lag in the ARCH (1) process is 1.129 with a z statistic of 4.170and p-value of 0.000. That implies significance in the estimated first lag of the computations.

The Arch equation generated for the residuals is given by the equation

$$\sigma_t^2 = 0.001 + 1.129a_{t-1} \ldots\ldots\ldots\ldots\ldots\ldots \quad (4.8)$$

Table 4.14: ARCH(1) model

Sample: Jan 2001 - Dec 2016					**Number of obs**	=	**192.000**
Distribution: Gaussian					Wald chi2(2)	=	2986.070
Log likelihood = 197.92					Prob > chi2	=	0.000
	reer	**Estimate**	**Std. Error**	**z**	**Pr(>|z|)**	**[95% Conf. interval]**	
	Constant	-10.394	1.727	-6.020	0.000	-13.779	-7.009
ARCH							
	arch						
	L1.	1.129	0.271	4.170	0.000	0.598	1.660
	_cons	0.001	0.000	2.040	0.042	0.000	0.002

In the case where the mean one may want to combine the models for the σ_t^2, whether

ARCH, GARCH, or other variations of GARCH with a model for the mean, the ARCH-M model can be used as was first suggested by Engle, Lillien and Roberts (1987). The ARCH-M (ARCH in mean) model provides an explicit link between the risk (conditional volatility) and the best forecast of a time series. The ARCH (1)-M model based on an ARMA(2,1,2) mean model for the real effective exchange rates is specified as;

$$y_t = \phi_0 + \phi_1 y_{t-1} + \phi_2 y_{t-2} + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \sigma_t \epsilon_t + \lambda \sigma_t^2 \ldots. \quad (4.9)$$

and

$$\sigma_t^2 = \alpha_0 + \alpha_1 a_{t-1} + \sigma_{t-1}^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4.10)$$

$\mathrm{y}_t = \mathrm{D.reer}_t$ is the differenced real effective exchange rate at time t

y_{t-i} is the ith lag of the autoregressive component of the mean ARIMA model

ε_{t-i} is the ith lag of the moving average component of the mean ARIMA model

λ is the coefficient of the ARCH volatility affecting the mean ARIMA equation

σ_t^2 is the conditional volatility of the residual at time t (ARCH model)

a_{t-1} is the lagged residual (ARCH model)

α_1 is the coefficient of the lagged residual (ARCH model)

α_0 is the constant of the arch equation (ARCH model)

Having fitted an ARCH(1) model for the residuals, a GARCH-M was fitted as it allows for inclusion of the ARCH terms if existing to the mean model into the equation. Earlier it had been determined that an ARIMA (2,1,2) was the appropriate mean model and was thus used as the mean model in the GARCH-M model. The combination of the ARCH process with the ARIMA (2,1,2) as the ARCH(1)-M model results are presented in table 4.15. The results show a generally significant model at 5% level of significant with the Wald Chi-square statistic of 148.62 and a p-value of the statistic as 0.000 which is less than 0.05. All the coefficient estimates of the model were also found to be significant at 5% level of significance with p-values of the z statistics all less than 0.05. The generated ARCH (1)-M mean model equation was;

$$y_t = 0.092\mathrm{y}_{t-1} - 0.789\mathrm{y}_{t-2} - 0.192\varepsilon_{t-1} + 0.853\varepsilon_{t-2} + \sigma_t\epsilon_t + \lambda\sigma_t^2 \ldots \quad (4.11)$$

Where σ_t is given by the ARCH (1) equation;

$$\sigma_t^2 = 0.002 + 0.689a_{t-1}$$

y_t = D.reer that is to imply the model was fitted on differenced effective exchange rates as per the integrated component of the ARIMA (2,1,2).

Table 4.15: ARCH(1)-M Model With ARIMA(2,1,2) Mean Equation

Sample: Jan 2001 - Dec 2016					**Number of obs**	=	**191**
Distribution: Gaussian					Wald chi2(2)	=	148.62
Log likelihood = 277.552					Prob > chi2	=	0.000

	D.reer	**Estimate**	**Std. Error**	**z**	**Pr(>|z|)**	**[95% Conf. interval]**	
ARMA							
	ar						
	L1.	0.092	0.129	0.710	0.477	-0.162	0.346
	L2.	-0.789	0.124	-6.350	0.000	-1.032	-0.545
	ma						
	L1.	-0.192	0.105	-1.820	0.068	-0.398	0.014
	L2.	0.853	0.111	7.690	0.000	0.636	1.070
ARCH							
	arch						
	L1.	0.689	0.173	3.980	0.000	0.350	1.028
	_cons	0.002	0.000	8.500	0.000	0.001	0.002

4.2.4 Unexpected Changes

Having fitted a model that could predict the real effective exchange rates, predictions based on the ARCH (1)-M model with ARIMA (2,1,2) as the mean model was used to predict the effective exchange rates. The residuals from the model were then extracted as the unexpected changes in the effective exchange rates. The process is in

line with Fang and Loo (2004) who also used ARIMA models to examine the effect of current and unexpected exchange rate changes on US bank common stock returns. Table 4.16 shows the summary statistics of the unexpected changes in exchange rates. The mean of the unexpected changes is 0.002 with a standard deviation of 0.047. This implies that the unexpected changes exhibit periodic fluctuations about 0.

Table 4.16: Summary Statistics for Unexpected Changes in Exchange Rates

	Mean	**Std Deviation**	**Min**	**Maximum**
Unexpected movements	0.002	0.047	-0.293	0.186

Figure 4.15 shows the graphical presentation of the plot of the generated unexpected changes in the effective exchange rates against time. The plot is actually a residuals plot of the ARCH-M with ARIMA mean model used to fit the exchange rates prediction. The residuals are the difference in the expected and anticipated rates from the actual rates that gives the definition of the unexpected exchange rates. The plot shows that the changes were fluctuating about zero across the period both in the negative and positive directions.

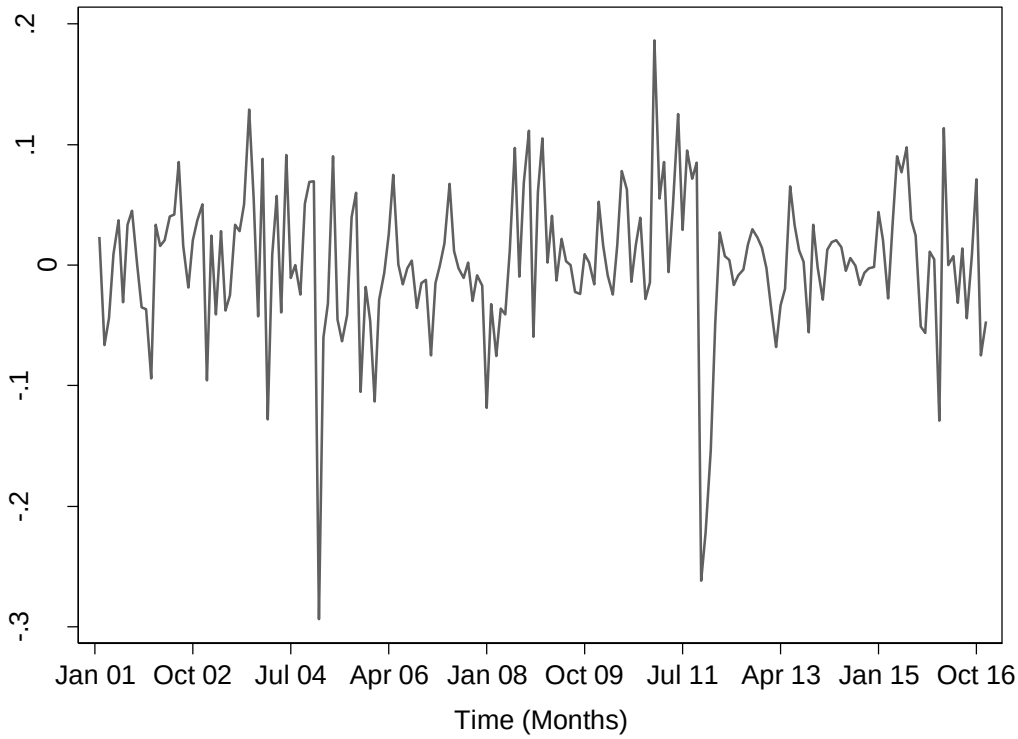

Figure 4.15: Unexpected Changes in Exchange Rates with Time

The second objective of the study was to determine the effect of unexpected exchange rate movements on firm value of nonfinancial companies at Nairobi Securities Exchange. The resulting data of the unexpected returns was therefore used as a variable in the panel data consisting of the 19 firms over a period of 190 days. The overall mean was found to be 0.002 with an overall standard deviation of 0.047. The overall variation is however equal to the variation within the groups of NSE listed companies as shown by the equal standard deviations. There is no variation between the firms themselves as implied by the standard deviation of 0 between the groups.

Table 4.17: Unexpected Changes Panel Analysis Statistics Summary.

Variable		Mean	Std. Dev.	Min	Max	Observations
Unexpected movements	overall	0.002	0.047	-0.293	0.186	N=3591
	between		0.000	-0.001	-0.001	n=19
	within		0.047	-0.293	0.186	T=188

4.2.5 Lagged Changes in Exchange Rates

The study also sought to determine the effect of lagged changes in exchange rates on firm value of nonfinancial companies at Nairobi Securities Exchange. Bartov and Bodnar (1994), suggest that lagged changes in the value of the home currency are more meaningful for establishing a pricing relationship than contemporaneous changes. In their view the exchange risk is priced in equity markets, but the market is not fully efficient with respect to exchange rate changes and so the market takes time to incorporate all the implications of foreign exchange rate movements. Lagged exchange rates changes were measured considering one month lags of the exchange rate changes. Table 4.18 shows the summary statistics of the lagged changes in exchange rates. The analysis found mean of the unexpected changes to be 0.002 with a standard deviation of 0.047.

Table 4.18: Summary Statistics for Lagged Changes in Exchange Rates

	Mean	Std Deviation	Min	Maximum
Lagged changes	-0.002	0.061	-0.199	0.291

Figure 4.16 is a graphical plot of the lagged changes in the effective exchange rates against time. These are plots of one month lags of exchange rate changes. The figure shows that the lagged changes in exchange rates were fluctuating about zero across the period both negatively and positively.

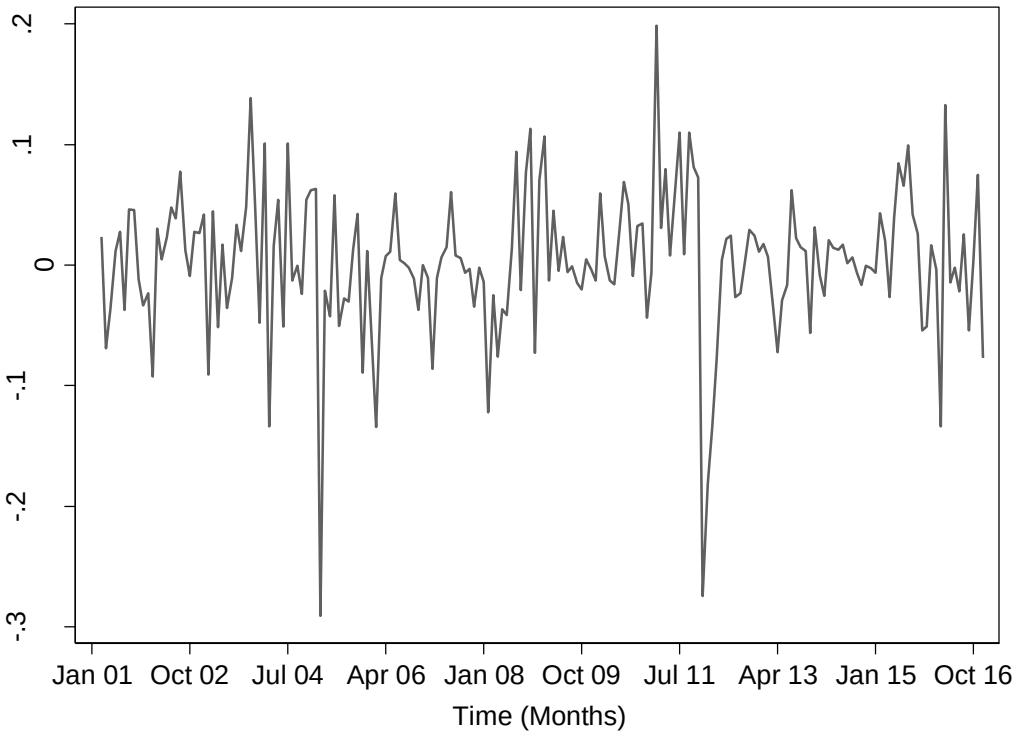

Figure 4.16: Lagged Changes in Exchange Rates with Time

The objective was on the assessment of the effect of the lagged changes in exchange rates on firm value of nonfinancial companies at Nairobi Securities Exchange. The data on the lagged changes was used as an independent variable in the panel data consisting of the 19 firms over a period of 190 days. The overall mean was found to be -0.002 with an overall standard deviation of 0.061. The overall variation is however equal to the variation within the groups of the NSE listed companies as shown by the equal standard deviations. This implies that there is no variation between the firms themselves as implied by the standard deviation of 0 between the groups but the cause of variation is across the time period within each entity.

Table 4.19: Lagged Changes Panel Analysis Statistics Summary

Variable		Mean	Std. Dev.	Min	Max	Observations
Lagged movements	overall	-0.002	0.061	-0.199	0.291	N=3572
	between		0.000	0.020	0.020	n=19
	within		0.061	-0.199	0.291	T=188

4.2.6 Firm Value

Firm value was the dependent variable of the study in all the objectives. The general objective of the study was about exploring the effect that foreign exchange rate exposure has on the value of nonfinancial companies listed at the Nairobi Securities Exchange from January 2001 to December 2016. The data on the firm value of the nonfinancial companies listed at the Nairobi Securities Exchange was collected and processed for analysis. The data collected measured the dependent variable firm value in terms of the share prices from which the capital gains percentage was also derived.

Share Price

The measurement of firm value in term of the share prices was deduced directly from the data as collected from NSE. The share price measurements were collected as end of the month observations of stock prices corrected for dividends and were measured on a continuous scale. The summary statistics for annual averages of share prices were also analyses of using the mean as the measure of central tendency and standard deviation as a measure of dispersion.

As shown in table 4.20, the mean share prices seem to be generally increasing over the years share prices for the 19 firms with the lowest annual mean as 27.583 in 2002 and the highest being 162.323 in 2014. The annual standard deviations show the variation of share prices across the firms within the given year. The analysis show that the high standard deviations each year which also seem to increase over the

years implying existence of variations across time as well. The highest variation across the firms was noted to have been in 2016 that had a standard deviation of 198.819 and the lowest in 2001 with a standard deviation of 23.969. The overall mean share price was found to be 102.332 with a standard deviation of 115.276. The panel unit of analysis being monthly, the summary statistics of average share prices per month is shown in appendix IV.

Table 4.20: Summary Statistics for Share Prices

	Mean	Std. Dev.	Min	Max	C.V
year = 2001	29.446	23.969	2.738	82.275	81%
year = 2002	27.583	25.651	2.403	115.037	93%
year = 2003	68.065	70.763	5.564	436.263	104%
year = 2004	106.872	107.165	8.828	509.837	100%
year = 2005	93.341	67.749	9.225	255.634	73%
year = 2006	121.813	80.622	15.096	515.87	66%
year = 2007	110.106	78.094	13.751	306.647	71%
year = 2008	89.249	61.24	9.295	199.421	69%
year = 2009	80.69	58.037	7.093	202.524	72%
year = 2010	102.822	75.897	9.108	285.409	74%
year = 2011	102.515	80.019	9.202	277.087	78%
year = 2012	104.404	98.293	9.033	474.445	94%
year = 2013	141.292	143.92	12.798	585.722	102%
year = 2014	162.323	177.961	13.5	971.636	110%
year = 2015	161.185	197.094	12.543	900.571	122%
year = 2016	142.272	198.819	6.683	855.5	140%
Overall	102.332	115.276	2.403	971.636	113%

The analysis of the summary statistics of share prices within and between groups is presented in table 4.21. The overall mean of share price across all the firms and for all the years was found to be 102.332 with an overall standard deviation of 115.276. The standard deviation between panels is 79.379 which is slightly lower than the standard deviation within which was 85.542. This means that the variation of share prices is both due to differences across the firms as well as the variation caused by changes along time. There is however more variation on share prices due to changes with time than the variation across the entities.

Table 4.21: Share Price Panel Analysis Statistics Summary.

Variable		Mean	Std. Dev.	Min	Max	Observations	
Share price	overall	102.332	115.276	2.403	971.636	N =	3610
	between		79.379	16.550	313.382	n =	19
	within		85.542	-165.499	760.587	T =	190

Figure 4.17 is a spaghetti plot of share prices with time. The line graphs are of each of the entity security over time. The figure gives an indication of high variation of share prices between the securities as well as high variation across time within each entity. There is a virtual indication of some level of homogeneity between the entities in the earlier years which that had low variation of share prices. With time the share prices increase and decrease at different levels causing heterogeneity with higher variations between the entities securities. The graph shows sharp acute drops in share prices in the year 2007. This was due to approval by NSE for splitting of shares of companies whose share prices were very high. The companies applied for splitting to lower their share values in order to increase marketability of the shares.

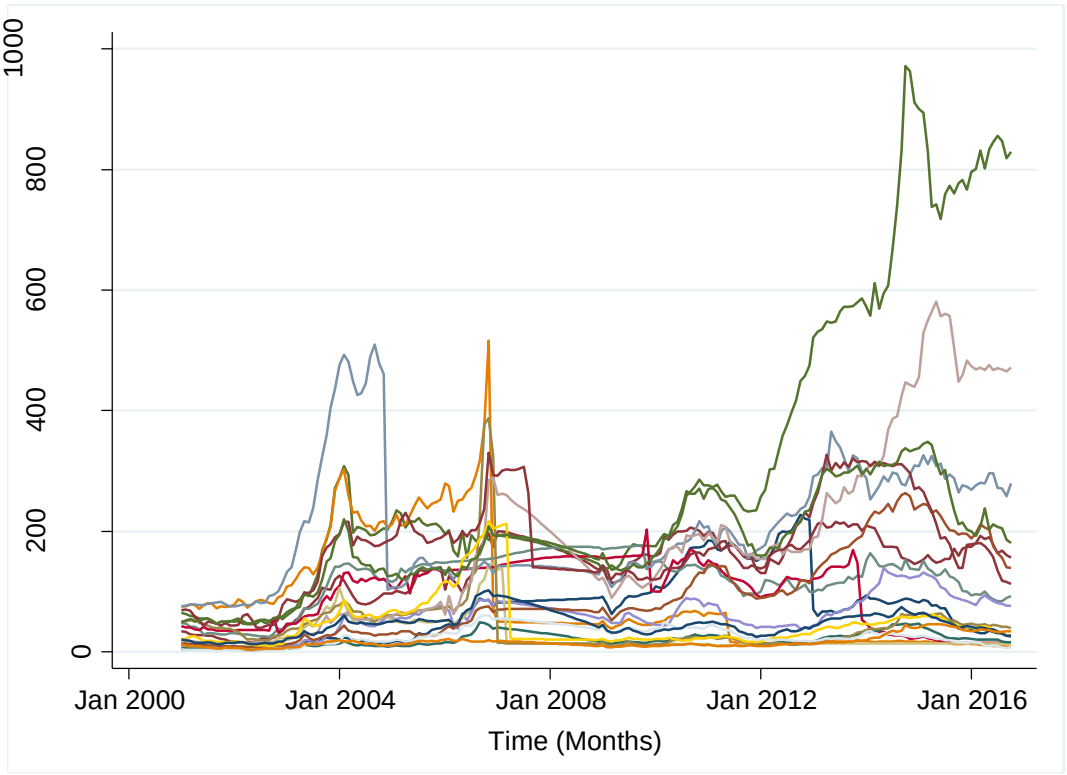

Figure 4.17: Share Price Spaghetti Plot

Figure 4.18 below shows the virtual presentation of a scatter plot of the share prices of each security against time for the period in months for the 16 years. The distribution of the share prices in this plot also virtually shows low variability across the entities in the earlier years which increases with time. Plotting the mean share price for each month, the line shows fluctuations in the mean share price with time. This implies variation of share prices with time. Regardless of the fluctuations, the mean plot also shows a general slow but increasing trend of the mean share price with time.

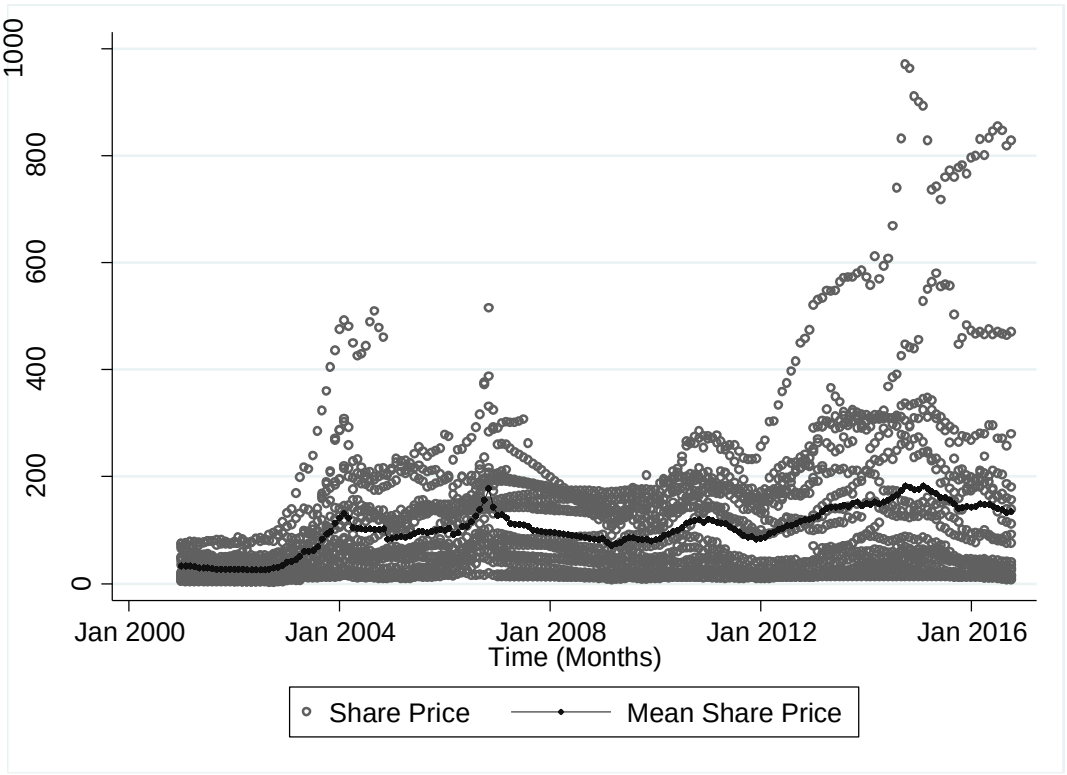

Figure 4.18: Scatter Plot on the Share Prices against Time with Mean Plots

A scatter plot of the share prices against the 19 securities for each month is shown in figure 4.19. The plot also shows a mean share price plot for each entity security which is an average of the share prices over the years for each entity. The mean plots firm show very possible difference in mean share prices across the 19 firms. The variation of share prices over time is shown within each entity where some entities have all plots clustered together implying no variation over time while other have plots spread with both very high and very low prices implying high variation within. The plot also virtually confirms high variation between the firms by the mean share price plot. The mean share price plot show distinct fluctuation implying a difference in mean share prices across the entities.

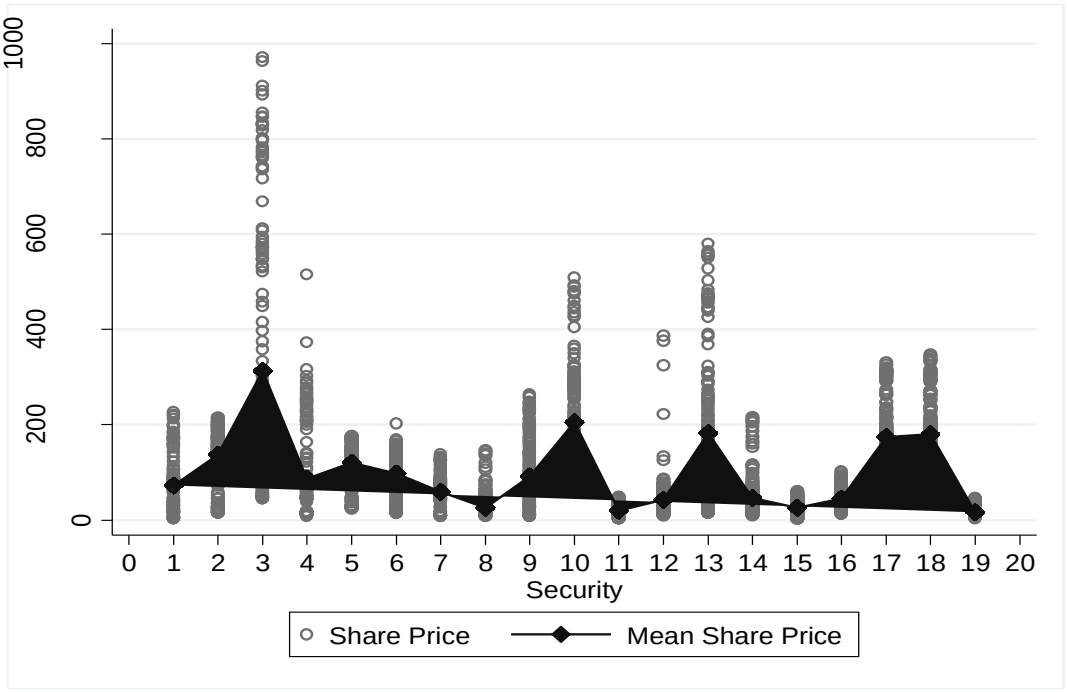

Figure 4.19: Scatter plot on the share prices against entity security with mean plots

Capital Gains

Further to the share prices, the study considered the capital gains as a measure of firm value. The capital gains percentage was to be considered as the coefficient measure of firm value in the study model. As shown in table 4.22, the mean capital gains seem to generally have no increasing over time but exhibit alternating increases and decreases with both negative and positive gains. The lowest annual mean capital gains percentage was found to be -2.980 in 2011 and the highest being 11.872 in 2003. The annual standard deviations show the variation of capital gains percentage across the firms within each given year. Its notable that over the years, the mean is less that the standard deviation depicting a significance spread of capital gains across the firms.

The analysis show that the standard deviations each year which seem to decrease over the years implying possible existence of variations across time. The highest variation across the firms was noted to have been in 2004 where the coefficient of variation was 2153% and the lowest in 2003 with a coefficient of variation of 149%.

The overall mean share price was found to be 1.132 with a standard deviation of 10.492. An analysis of the statistics on average capital gains percentage per month for the period is in appendix IV.

Table 4.22: Summary Statistics for Capital Gain Percentages

	Mean	Std. Dev.	Min	Max	C.V
year = 2001	-2.169	7.721	-23.73	42.239	356%
year = 2002	2.087	12.136	-41.038	58.005	582%
year = 2003	11.872	17.661	-20.612	107.575	149%
year = 2004	-0.554	11.925	-77.764	61.46	2153%
year = 2005	2.547	7.58	-22.61	46.801	298%
year = 2006	4.929	16.364	-86.345	69.769	332%
year = 2007	-2.019	11.198	-95.584	15.671	555%
year = 2008	-1.601	1.768	-7.2	1.025	110%
year = 2009	0.118	9.97	-50.253	32.472	8449%
year = 2010	3.076	6.734	-11.627	29.098	219%
year = 2011	-2.98	7.993	-73.33	15.761	268%
year = 2012	2.318	5.469	-13.604	20.519	236%
year = 2013	2.725	8.751	-67.98	25.173	321%
year = 2014	1.144	6.643	-15.733	28.666	581%
year = 2015	-2.17	5.893	-20.532	28.001	272%
year = 2016	-2.017	5.87	-33.22	15.286	291%
Overall	1.132	10.492	-95.584	107.575	927%

The analysis of the summary statistics of capital gains within and between groups is presented in table 4.23. The overall mean of capital gains percentage across all the firms and for all the years was found to be 1.132 with an overall standard deviation of 10.492. The standard deviation between panels is 0.573 which is much lower than the standard deviation within which was 10.478. This means that the variation of capital gains is almost entirely due to variation caused by changes along time and not from variations due to differences across the entities. This shows that capital gains is probably homogeneous across entities and there are probably no significant differences in capital gains across the entities. The firms probably register the same amount of capital gains.

Table 4.23: Capital Gains Panel Analysis Statistics Summary.

Variable		Mean	Std. Dev.	Min	Max	Observations
Capital gains	overall	1.132	10.492	-95.584	107.575	N = 3591
	between		0.573	0.000	2.232	n = 19
	within		10.478	-96.069	107.278	T = 189

A scatter plot of the capital gains percentages for the 19 securities for each month is shown in figure 4.20. The figure also has a plot of the mean capital gains for each entity security which is an average of the capital gains over the period for each entity. The mean plots seem equal to 0 across all the entities virtually showing no difference in mean capital gains across the companies but rather a constant mean capital gains across the companies.

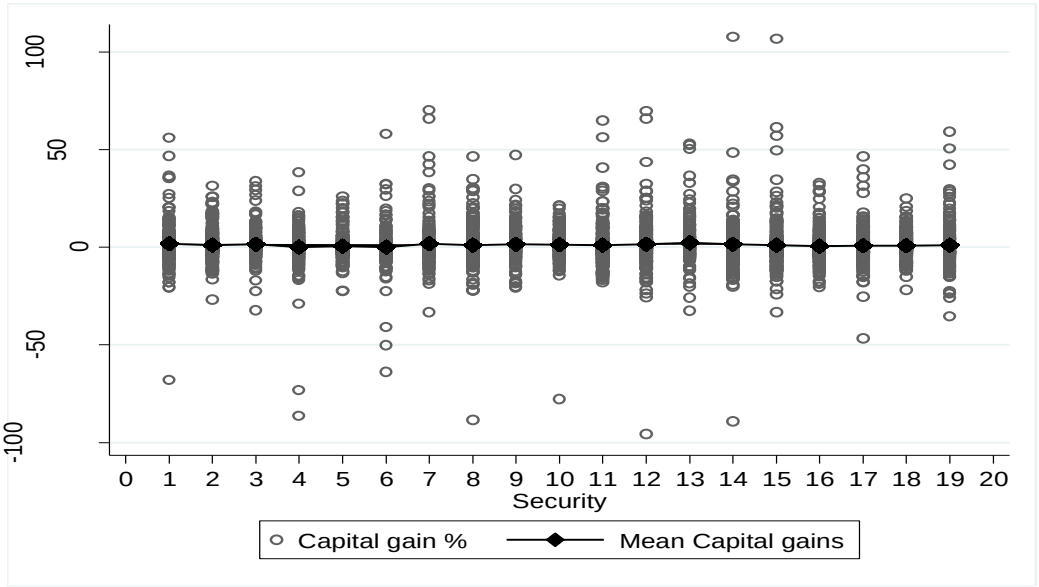

Figure 4.20: Scatter Plot on the Capital Gains against Entity Security with Mean Plots

Figure 4.21 below is a virtual presentation of a scatter plot of the capital gains of each security against time for the entire time period in months. The distribution of

the capital gains in this plot also virtually shows low variability across the entities in throughout the period as the plots are mainly clustered along 0. The plots also virtually show that the capital gains percentage is stationary with no possible increasing or decreasing functions. Plotting the mean capital gains for each month, the line shows fluctuations in the mean capital gains with time evidence of mean difference in capital gains in different time periods. This implies presence of variation of capital gains with time.

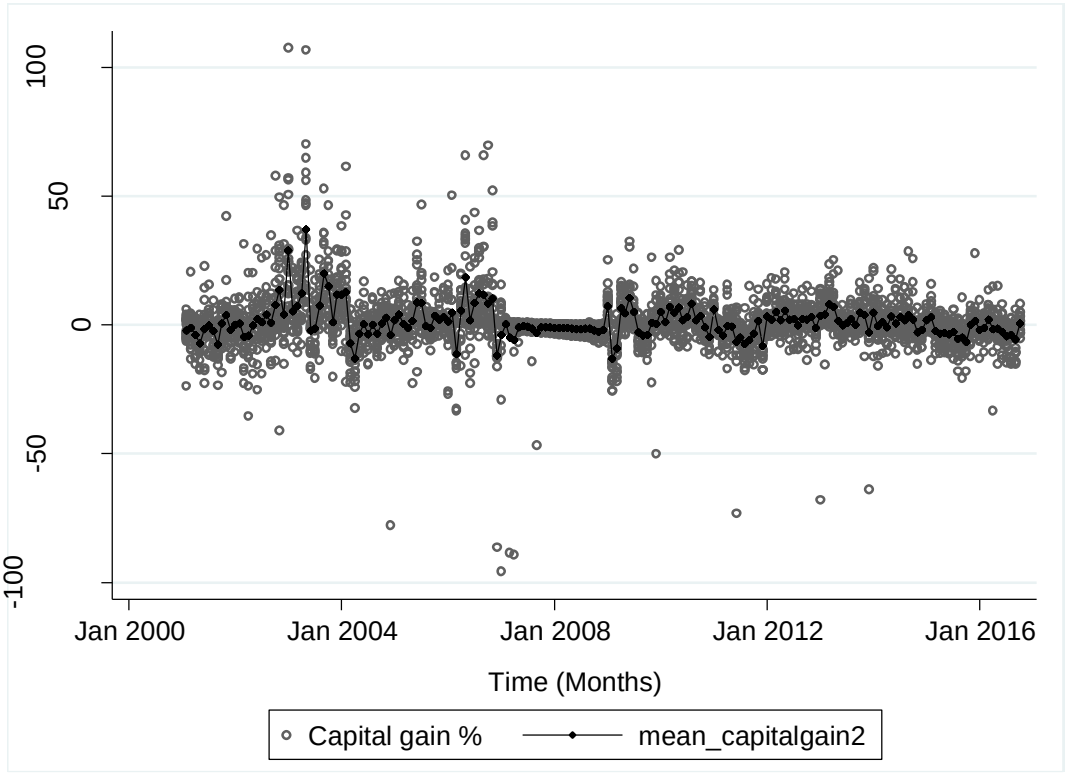

Figure 4.21: Scatter Plot on the Capital Gains against Time with Mean Plots

Figure 4.22 is a spaghetti plot of capital gains with time. The line graphs represent the movement of capital gains for each entity security over time. The figure gives an indication of low variation of capital gains between the entity securities as the lines seem to be fused and moving together rather than spaced. There is an indication of very fluctuating but none increasing capital gains over time and implication of high across time within each entity. There is a virtual indication of high levels of homogeneity between the entities in the throughout the period.

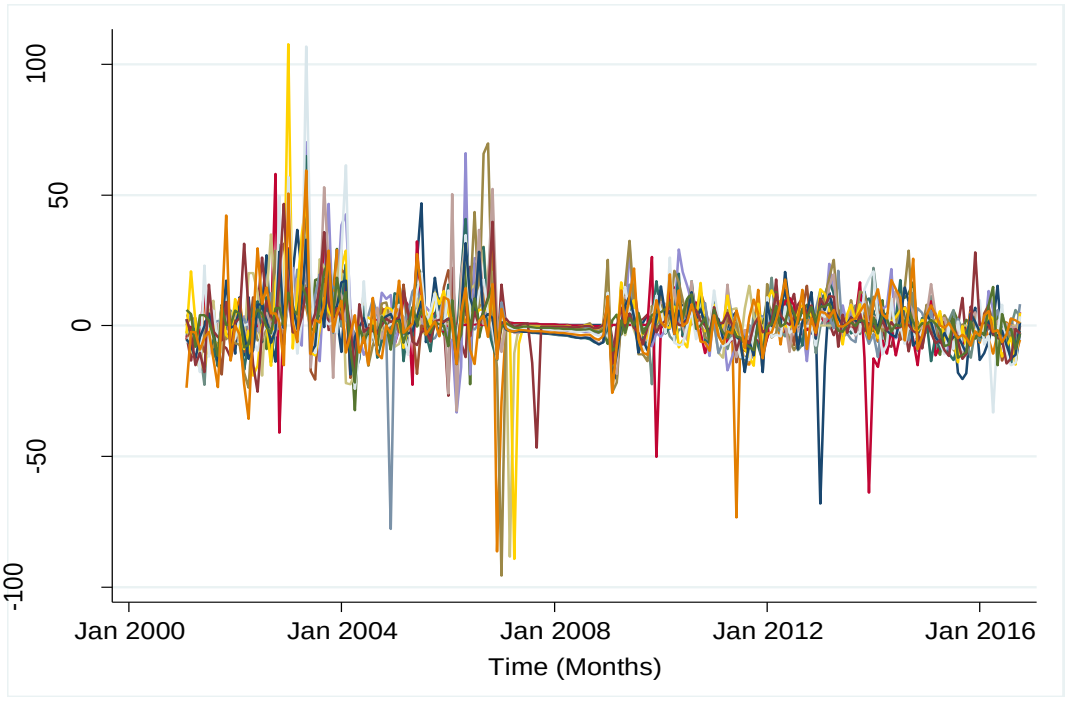

Figure 4.22: Capital Gains Spaghetti Plot

Stationarity Test

To assess possibility of a stationarity, an Augmented Dickey-Fuller (ADF) Test of the averaged capital gains was carried out. The ADF test is used to test for stationarity in time series data. The capital gained were averaged across the entities for each time period which resulted into a time series dataset used for the ADF stationarity test. Table 4.23 presents the ADF stationarity test for the time series data of the averaged capital gains

Table 4.23: Augmented Dickey-Fuller Test Capital gains

	Test Statistic	0.01 Critical Value	0.05 Critical Value	0.1 Critical Value
Z(t)	-7.415	-4.011	-3.438	-3.138

MacKinnon approximate p-value for Z(t) = 0.0000

To confirm panel data stationarity of the dependent variable, a unit root test was done to confirm stationarity or none stationarity with statistical significance. The IPS (Im-Pesaran-Shin) test was used being an extension of the augmented Dickey-Fuller

(ADF) for panel data. The IPS test takes an approach that bases the test as a combination of independent Dickey-Fuller tests. It views the panel data regression as a system of N individual regressions for the N regressions of the N panels thus a panel data unit root test is carried out as a combination of N independent ADF tests where N=19 panels in this study. The results are presented in table 4.24. The p-value of the $Z_{\tilde{t}-bar}$ statistic was found to be 0.000 so we reject the null hypothesis of a unit-root and favour the alternative that panels are stationary.

Table 4.24: Im-Pesaran-Shin unit-root (Stationarity) test

Ho: All panels contain unit roots			Number of panels =		19
Ha: Some panels are stationary			Number of periods =		189
AR parameter:		Panel-specific	Asymptotics:		T,N->Infinity
Panel means:		Included			Sequentially
Time trend:		Not included			
ADF regressions:		No lags included			
			Fixed-N exact critical values		
	Statistic	**p-value**	**1%**	**5%**	**10%**
t-bar	-11.4266		-1.97	-1.84	-1.77
t-tilde-bar	-8.7459				
Z-t-tilde-bar	-38.0406	0.000			

4.2.7 Market performance

Another objective of the study was to assess and determine the moderating effect of market performance on the effect of foreign exchange exposure on firm value of nonfinancial companies at Nairobi Securities Exchange. The market performance of the listed firms was thus hypothesised to be a moderating variable that influences the relationship between exchange rates exposure and firm value. To measure market performance the study collected data on the Nairobi stock exchange 20 Share Index of its listed firms. This data was also collected from NSE in months for the period 2001 to 2016.

Table 4.25 shows the summary statistics of the 20 share index in the panel dataset for 19 listed companies across 190 months. The overall mean was found to be 3658.121 with an overall standard deviation of 1253.481. The overall variation is however also equal to the variation within the groups of the NSE listed companies as shown by the equal standard deviations. There is no variation in the 20share index between the firms themselves as implied by the standard deviation of 0 between groups. The 0 variation between the firms can be attributed to the fact that the 20 share index is variable index that is measured per firm but is an index that equally cuts across all the 19 companies. This means that the level of effect and influence of the changes could vary across firms but the measurement index does not vary for each firm.

Table 4.25: Share Index Analysis Statistics Summary

Variable		Mean	Std. Dev.	Min	Max	Observations
Share index	Overall	3658.121	1253.481	1027.650	5987.370	N = 3610
	Between		0.000	3658.121	3658.121	n = 19
	Within		1253.481	1027.650	5987.370	T = 190

Figure 4.23 shows the graphical presentation of the plot of the NSE 20 share index over time. The graph shows a virtual increasing trend as shown by the lowess curve. The curve starts at about 1000 with a steady increase in the market 20 share index but in the mid period, the actual fluctuations cause the fit to flatten out above 4000 for the remaining time with a drop towards the end of the period.

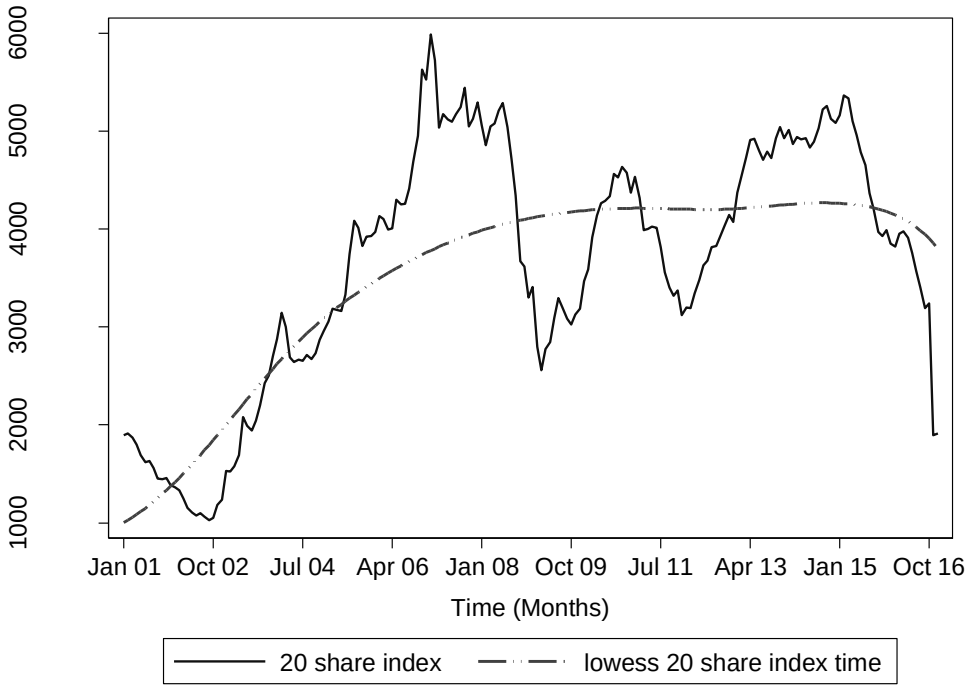

Figure 4.23: 20 Share Index over Time with Lowess Smoothened Curve

Considering that the objective was to assess the moderating effect of market performance 20 share index on the influence of exchange rate exposure on firm value, the scales of measurements of the 20 share index was much larger than the measurement of the capital gains percentage used to measure firm value and the changes in real exchange rates used as the independent variables. The collected data on 20 share index was logged to normalise the scale.

Table 4.26 shows the summary statistics of the panel data of log 20 share index. The overall mean was found to be 8.125 with an overall standard deviation of 0.435. The standard deviation is low implying no much variation in the logged 20 share index. Further analysis show that overall standard deviation is in fact equal to the standard deviation within implying that the entire variation is due to the index changes over time and that there is no variation in the logged 20 share index between firms.

Table 4.26: Log Share Index panel analysis statistics summary.

Variable		Mean	Std. Dev.	Min	Max	Observations	
Log Share Index	overall	8.125	0.435	6.935	8.697	N =	3610
	between		0.000	8.125	8.125	n =	19
	within		0.435	6.935	8.697	T =	190

Figure 4.24 is a graphical presentation of the plot of the logged 20 share index over time. The lowess curve shows a virtual increasing trend. The curve starts with a steady increase in the market 20 share index from 7 but flattens out in the mid period amidst the actual fluctuations. The curve remains flat for the remaining time with a drop towards the end of the period. The scale of measurements of the logged 20 share index is unitary and low compared to the larger scale of the direct measurements of the 20 share index.

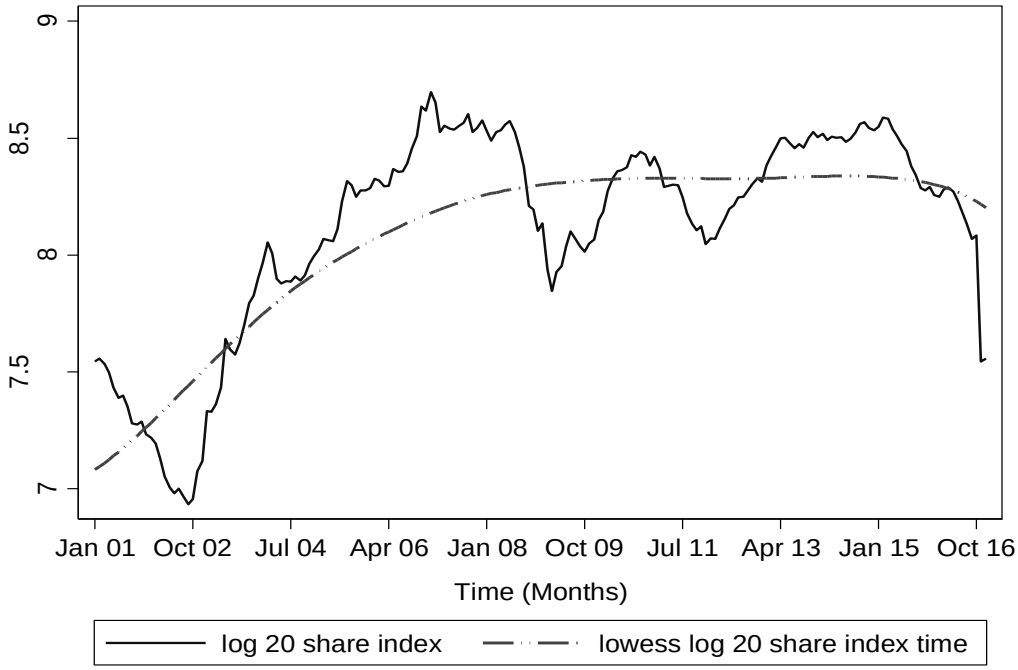

Figure 4.24: Log 20 Share Index over Time with Lowess Smoothened Curve

4.3 Statistical Modelling

The conclusions on the study objectives were based on the results of the statistical modelling analysis upon which the hypotheses of the study were also tested. The study purposed to determine the effect of foreign exchange rate exposure on the value of nonfinancial companies listed at the Nairobi Securities Exchange from January 2001 to December 2016. The study adopted statistical modelling techniques to analyse the relationships between the variables measured as described in the descriptive analysis. To determine the effect of foreign exchange on firm value, the study fitted statistical models to estimate the influence that the independent variables contemporaneous changes, unexpected changes and lagged changes in exchange rates had on firm value.

The secondary data collected and processed and cleaned yielded a panel dataset which combine both time series and cross sections in the data. The final data set was noted to contain cross sections consisting of 19 entities and a relatively large time period of 190 months across a 16years. This yielded a total of 3610 observations in panes of 19 firms and 190 months. The processed and cleaned dataset was also noted to have yielded balanced panels where each entity in the data set was observed over the same number of time periods which was 190 months.

The analytical model can take on a random effect or a fixed effect structure though the random effects model can be consistently estimated by both the random effect estimator and the fixed effect estimator. The random effect is therefore preferred if there can be surety that the individual-specific effect really is an unrelated effect. The random effect model therefore does not include the entity-specific effect for entity (ε_i). For this study, all the independent variables are time varying and therefore all the 3 independent variables in the study are included in the X'_{it} K-dimensional row vector of time-varying independent variables where K=3. There are no time invariant independent variables Z'_{it} included in this study as the independent variables

contemporaneous, unexpected and lagged changes in the exchange rates are all time varying.

A fixed effect model assume homogeneity of estimates across entities and that the independent variable that influence firm value vary over time but have a fixed effect across the entities. A random effect model on the other hand implies that the variation across entities is random. An alternative to the two is a pooled model that assumes that there is no panel effect in the data thus a pooled model of the observations from the panel is fitted based on simple linear regression. The study fitted a pooled model, tested for panel effect and then fitted both the fixed and random effect models basing on ordinary least squares and further used Hausman test to determine the appropriate model to be adopted.

4.3.1 Pooled Model

First the researcher fitted a pooled OLS model to explore the joint effect of foreign exchange rate exposure on firm value. The model included all the 3 independent variables (contemporaneous, unexpected and lagged changes in exchange rates) measurement under foreign exchange exposure as joint predictors in the model.

The results of the pooled OLS regression model considering the joint effect are presented in table 4.27. The results show that the R-square is 0.017 implying 1.7% of the variation in firm value is explained by the variations of 3 predictors in the model. The Model generally significant at 5% significance level as implied by the p-value of the anova F-statistic which was found to be 0.000, which is less than 0.05. This is an implication that at least one of the predictors in the model is significantly not equal to 0. The coefficient estimates of contemporaneous changes and unexpected changes in the multiple pooled OLS regression model were both found to be significant. The P-values of the t-statistics to these two estimated coefficients were both equal to 0.00 which is less than 0.05 confirming significance at 5% level of significance. The coefficient estimate of lagged changes was however not found to be significant as shown by the p-value of 0.316 which is less than 0.05 to imply that lagged changes have no significant influence on firm value of nonfinancial companies listed at the Nairobi Securities Exchange.

Table 4.27: Pooled Model for the Joint Effect of Foreign Exchange Exposure

		Number of obs	**=**	**3572**
		F(3, 3568)	=	20.27
		Prob > F	=	0.000
		R-squared	=	0.017
		Adj R-squared	=	0.016
	Estimate	**Std. Error**	**t value**	**Pr(>|t|)**
Contemporaneous Changes	-5.763	1.442	-4.000	0.000
Unexpected Changes	-30.547	3.926	-7.780	0.000
Lagged Changes	1.231	1.227	1.000	0.316
_Cons	1.214	0.178	6.830	0.000

The Breusch Pagan Lagrange Multiplier test was also done as a model specification test for the multiple joint influences of the independent variables on firm value. This was to specify whether there was a random panel effect on the relationship due to the panel structure of the data collected for analysis. The results of the Breusch Pagan LM test as shown in Table 4.28 which gives a p value of 1 for the BP chi-square statistic which is greater than 0.05. This indicates that there are no significant differences on firm value cross the entity securities and therefore the random effects model is expected yield the same results as the pooled OLS model.

Table 4.28: Multiple Regression Lagrange Multiplier Test - (Breusch-Pagan)

Estimated results:	**Var**	**sd=sqrt(Var)**
Firm value	110.414	10.508
e	110.889	10.435
u	0.000	0.000

Test: Var(u) = 0

chibar2(01) = 0.000

Prob > chibar2 = 1

The Hausman specification test was then used to determine the appropriate and more viable model of the random effect and the fixed effect. The test is based on testing orthogonally of the common effects and the regressors. As shown in table 4.29, the test requires computation of the beta coefficients of both the fixed effect (b) and of the random effect (B) and determining the differences and further a covariance matrix of the difference vector. A chi-square Wald statistic is then computed and used to conclude on the model specification. The table footer shows that the Wald ch-square statistic computed was 0.00 with a p-value of 1. This p-value is greater than 0.05 implying that the random effect is the more viable model for the joint effect of foreign exchange exposure on firm value.

Table 4.29: Hausman Test for Multiple Regression

	(b) Fixed	**(B) Random**	**(b-B) Difference**	**sqrt(diag(V_b-V_B)) S.E.**
Contemporaneous Changes	-5.763	-5.763	0.000	0.067
Unexpected Changes	-30.547	-30.547	0.000	0.182
Lagged Changes	1.231	1.231	0.000	0.057

Chi2 (3) = (b-B)'[(V_b-V_B) ^ (-1)] (b-B) = 0.000, Prob>chi2 = 1

4.3.2 Random Effect Model

Based on the results of the Hausman model specification test results that favoured the random effect model, Table 4.30 presents the summary statistics for the random effect model of the joint effect on firm value. The total number of observations is 3572 with 19 groups of entities. The minimum number of observations per groups is equal to the average and also to the maximum number of observations which was 188 implying a balanced panel. The R^2, the variation of the dependent variable firm value explained by the variation of unexpected changes in the model was found to be 0.017 as the overall R^2, 0.000 as the R^2 within and the R^2 between also 0.000. The R^2

within groups and between groups being 0 imply possibility of no variation caused by differences across panes and within panels. The R^2 within gives you the goodness of fit measure for the individual mean de-trended data which disregards all the between information in the data. The Wald statistics here analyses the general significance of the model which shows that the p-value of the Chi-square statistic is 0.000. The p-value is less than 0.05 implying that at least one of the estimated parameters in the model is not equal to zero meaning that foreign exchange rates exposure has an influence on firm value.

Table 4.30: RE Model Summary Statistics for Multiple Regression

	Model Statistics			**Panel Observations**			
R-sq:	Within	=	0.000	Number of Obs		=	3572
	Between	=	0.000	Number of groups		=	19
	Overall	=	0.017				
Wald	chi2(3)	=	60.81	Obs per group:	Min	=	188
	Prob > chi2	=	0.000		Avg	=	188
	corr(u_i,Xb)	=	0.000		Max	=	188

The random effect multiple regression model confirms that the estimated coefficients of contemporaneous and unexpected changes in exchange rates are significantly not equal to zero as shown in table 4.31. The estimated beta coefficients of contemporaneous and unexpected changes in the joint random effect model were found to be -5.763 and -30.547 respectively with a z-statistic of -4 and -7.780 respectively and a p-values both equal to 0. Both P-values are less than 0.05 implying that at 0.05 level of significance, both the contemporaneous changes and unexpected changes in exchange rates significantly influence the firm value of nonfinancial companies at Nairobi Securities Exchange.

The lagged changes were however found not to have significant influence on firm value at 5% significance level as shown by the p-value of 0.316 which is greater than 0.05. Sigma_u which was found to be 0.000 is the standard deviation of residuals within groups while Sigma_e that was equal to 10.435 the standard deviation of the overall error term. Rho is calculated from sigma_u and sigma_e and gives the intra-class correlation. Form the table, the intra-class correlation is 0.000 implying that 0% of the variance is due to the differences across panels.

Table 4.31: RE Model Coefficients Table for the Joint Effect

	Coefficients.	**Std. Err.**	**z**	**P>|z|**
Contemporaneous changes	-5.763	1.442	-4.000	0.000
Unexpected changes	-30.547	3.926	-7.780	0.000
Lagged changes	1.231	1.227	1.000	0.316
Constant	1.214	0.178	6.830	0.000
sigma_u	0.000			
sigma_e	10.435			
Rho	0.000	(fraction of variance due to u_i)		

The study also tested if the fitted random effect multivariate model was consisted with the classical assumptions of linear maximum likelihood estimation (MLE). To test hypotheses and draw conclusions basing on the random effect model, other tests of assumptions on the estimated model were deemed necessary. The researcher thus performed other post estimation diagnostic tests basing on the various classical assumptions of the fitted random effect model.

4.3.3 Serial Correlation Post Estimation Diagnostic

Fitting an MLE model for panel data assumes that the error term does not exhibit serial correlation. This was assessed for the joint effect model fitted using the Wooldrige test for the existence of first order autocorrelation of the error term. This test uses the F-statistic to test the null hypothesis that there is no existence of first order autocorrelation. As shown in table 4.32, the p-value of the f-statistic was found to be 0.0007 which is less than 0.05 implying the existence of first order autocorrelation of the error term. This is an implication that the fitted model violated the assumption of non-autocorrelation of the error term.

Table 4.32: Serial Correlation Test

Breusch-Godfrey/Wooldridge test for serial correlation in panel models	
F(1, 18) Estimate	**p-vlalue**
16.494	0.0007

4.3.4 Heteroscedasticity Post Estimation Diagnostic

Maximum likelihood estimation also assumes that the error term for panel analysis exhibit group wise homoscedasticity in the panels. Homoscedasticity is implied if the disturbance term has constant variance where violation of the assumption is termed heteroscedasticity. Group wise heteroscedasticity implies that variance of the eror terms of the model at the different time periods vary and are significantly larger in some time periods more than the other (Wooldridge, 2002).. A Wald test of homoscedasticity was to test for group wise heteroscedasticity using a chi-square statistic. This tested the null hypothesis that the variances of the error term were equal for all time periods. The results are presented in table 4.33. The p-value of the Wald chi-square statistic were found to be 0.000 thus the hypothesis rejected at 0.05 level of significance denoting presence of heteroscedasticity and violation of group wise homoscedastic error terms (Gujarati, 2012).

Table 4.33: Heteroscedasticity Test

Wald Test			
	Wald Chi-square	Df	p-vlalue
	2532.8467	19	0.000

4.3.5 Normality Post Estimation Diagnostic

The normality of the error term was also tested to as assumed by MLE regression fitting that the error term follows a Gaussian distribution. Unlike cross-sectional analysis, it was key that the researcher tested normality for panel data based on the both components that could cause it. The researcher therefore tested normality on u which is the normality on the entity specific errors within groups and normality one that is the normality of the remainder or overall error term. The normality test used the Jacque Bera approach for normality test which is based on the consideration that a Gaussian distribution of the eror terms should have a mean of 0.000, a skewness of 0.000 and a kurtosis of 3 (Wooldridge, 2002). The Jacque Bera approach tests the deviation of the skewness from 0.000 and Kurtosis from 3 using a ch-square statistic. The p-values of the chi-square statistics for both u and e were found to be less than 0.05 (p=0.000) implying that the error terms do not follow a normal distribution.

Table 4.34: Normality Test

	Observed	Bootstrap				Normal-based
	Coef.	**Std. Error**	**Z**	**P>|z|**	**[95%**	**Conf. Interval]**
Skewness_e	578.320	699.995	0.830	0.409	-793.645	1950.285
Kurtosis_e	225841.800	54503.810	4.140	0.000	119016.300	332667.300
Skewness_u	-0.064	0.065	-0.980	0.326	-0.191	0.063
Kurtosis_u	0.353	0.059	5.980	0.000	0.237	0.469

Joint test for Normality one: chi2(2) = 17.48 Prob > chi2 = 0.0001

Joint test for Normality onu: chi2(2) = 50.86 Prob > chi2 = 0.0000

4.3.6 Cross Sectional Dependence Post Estimation Diagnostic

Model estimation for panel data also assumes that there is cross-sectional independence of the disturbance term. A violation of cross sectional independence of the disturbance term imply that that the model was not correctly specified as the predictors (X_{it}) of the model are not strongly exogenous as assumed in OLS regression that X_{it} is strongly exogenous if the error term is independent of its past present and future (Sarafidis & Wansbeek, 2010). As shown in table 4.35, the multivariate model fitted for this study was found to exhibit cross-sectional dependence thus violating the assumption of cross-sectional independence. This was tested using the Breusch-Pagan Lagrangian multiplier test for cross-sectional independence that uses a chi-square statistic. The p-value of the chi-square is 0.000 which is less than 0.05 implying presence of cross-sectional dependence.

Table 4.35: Cross Sectional Dependence Test

Pesaran Friedman test	
Pesaran's Z statistic Estimate	**p-value**
57.715	0.000

4.3.7 Feasible Generalised Least Squares Model

The random effect model fitted violated all the classical assumptions tested of cross sectional independence, non-serial correlation, normality and panel homoscedasticity of the residuals. A panel GLS model that allows for auto correlated and heteroscedastic errors and cross sectional dependence was then fitted to ensure the model fitted was heteroscedastic robust and allowed for serial correlation and correctional dependence. Bootstrapping is used when assumption on which the parametric model is based on are in doubt. Bootstrapping is used on the calculation of standard errors that follow a normal distribution in the event that normality is violated (Varian, 2005). Bootstrapped standard errors were used on the FGLS model due to the violation of normality in the random effect model fitted.

Table 4.36 presents the results of the FGLS model fitted. The model was fitted for 3572 observations with 19 groups of entities for 188 time periods. The model fitted allowed for heteroscedastic residuals and cross sectional dependence which were violated considering the fixed effect model. The GLS model was also bootstrapped to correct the violation of normality and also allowed for autocorrelation of the residuals to order 1 as tested from the fixed effect model. To allow for autocorrelation of order 1, the autoregressive first lag coefficient was computed and found to be -0.1706 which was used on fitting GLS estimated with first order auto-correlated residuals. To test the significance of the model, the Wald Chi-square statistic was computed as 41.29 which had a p-value of 0.000 that is less than 0.05. This indicates that the GLS model fitted is generally significant and that estimated coefficients of the predictors are not jointly equal to zero to imply that exchange rates exposure significantly influence the value of nonfinancial companies listed at the Nairobi Securities Exchange.

The robust FGLS model after correction of violations of classical assumptions confirms that the estimated coefficients of contemporaneous changes and unexpected changes in exchange rates are both significantly not equal to zero. The estimated beta coefficients of contemporaneous and unexpected changes in the joint random effect model were found to be -4.912 and -22.526 respectively with a z-statistic of -3.760 and -6.350 respectively and p-values both equal to 0. Both P-values are less than 0.05 implying that at 0.05 level of significance, both the contemporaneous changes and unexpected changes in exchange rates significantly influence the firm value of nonfinancial companies at Nairobi Securities Exchange.

The lagged changes were however found not to have significant influence on firm value at 5% significance level as shown by the p-value of 0.168 which is greater than 0.05. The equation generated from the model fitted is given by the equation below.

$$Y_{it} = 1.138 - 4.912X^{J}{}_{it} - 22.526X^{K}{}_{it}$$

Table 4.36: Generalised Least Squares Model

Coefficients: generalized least squares				
Panels: heteroskedastic with cross-sectional correlation				
Correlation: common AR(1) coefficient for all panels (0.1706)				
Estimated covariances	= 190	Number of Obs	=	3572
Estimated autocorrelations	= 1	Number of groups	=	19
Estimated coefficients	= 4	Time periods	=	188
		Wald chi2(3)	=	41.29
		Prob > chi2	=	0.00
	Coefficients.	**Bootstrap Std. Err.**	**z**	**P>|z|**
Contemporaneous changes	-4.912	1.306	-3.760	0.000
Unexpected changes	-22.526	3.546	-6.350	0.000
Lagged changes	1.513	1.096	1.380	0.168
Constant	1.138	0.190	5.980	0.000

4.4 Hypothesis Testing

Following the pre estimation model specification test that indicates violation of classical linear regression assumption, the study tested the hypotheses based on the feasible generalized least squares (FGLS). This method guarantees the efficiency and consistency of the estimators for valid significance tests (Wooldridge, 2002).

4.4.1 Contemporaneous Exchange Rate Changes and Firm Value

The first objective of the study was to determine the effect of contemporaneous exchange rate changes on firm value of nonfinancial firms listed at Nairobi Securities Exchange. To achieve the objective the following hypothesis was tested;

H_{01}: There is no significant effect of contemporaneous exchange rate changes on firm value of nonfinancial firms listed at Nairobi Securities Exchange.

From the GLS model fitted, the p-value of the z-statistic for the estimated coefficient of contemporaneous exchange rate changes is 0.000 which is less than 0.05. The null hypothesis was rejected at 0.05 level of significance and a conclusion drawn that contemporaneous exchange rate changes has a significant negative influence on firm value of nonfinancial firms listed at Nairobi Securities Exchange. The results depict that that the higher the contemporaneous exchange rate changes, the lower the firms value in the market. This depicts that contemporaneous exchange rate changes erodes shareholders' funds and gives a solid ground for hedging.

The results are consistent to earlier studies. Doukas, Hall and Lang (2003) found a significant relation between contemporaneous stock returns and unanticipated yen fluctuations. Williamson (2001) shows that firms have a higher foreign exchange rate exposure if they have higher levels of foreign sales. Bartram and Karolyi (2006) find that the foreign exchange rate exposure of firms is systematically related to the fraction of firm's foreign sales. It therefore follows that, unless hedging is used to counter the exchange rate exposures, firms with high foreign sales will have their value eroded.

4.4.2 Unexpected Exchange Rate Movements and Firm Value

The second objective of the study was to establish the effect of unexpected exchange rate movements on firm value of nonfinancial firms listed at Nairobi Securities Exchange. To achieve this objective, the following hypothesis was tested;

H_{02}: There is no significant effect of unexpected exchange rate movements on firm value of nonfinancial companies at Nairobi Securities Exchange.

Considering the fitted GLS model, the p-value of the t-statistic for the estimated coefficient of unexpected exchange rate movements is 0.000 which is less than 0.05. The null hypothesis was rejected at 0.05 level of significance and a conclusion drawn that unexpected exchange rate movements has a negative significant influence on firm value of nonfinancial companies at Nairobi Securities Exchange. This depicts an inverse relationship between unexpected exchange rate movements and firm value. It

implies that unexpected exchange rate movements may lead to depletion of firms' value and further justifies the need for hedging.

The findings of the study concur with those of earlier studies (Li, Lin & Hong, 2010; Doukas, Hall & Lang, 2003). Li, Lin and Hong (2010) studied the impacts of unexpected changes in exchange rate on firms' value in Taiwan and found a positive and significant exposure of foreign exchange risk. Doukas, Hall and Lang (2003) examined the relation between Japanese stock returns and unanticipated exchange-rate changes for 1,079 firms traded on the Tokyo stock exchange over the 1975–1995 period.

Firms are exposed to foreign exchange risk if the results of their projects depend on future exchange rates and if exchange rate changes cannot be fully anticipated. Abor (2005) posits that foreign exchange risk is commonly defined as the additional variability experienced by a multinational corporation in its worldwide consolidated earnings that results from unexpected currency fluctuations. Generally, companies are exposed to three types of foreign exchange risk: transaction (commitment) exposure, economic (operational, competitive or cash flow) exposure and translation (accounting) exposure. Economic risk relates to adverse impact on equity/income for both domestic and foreign operations because of sharp, unexpected change in exchange rate (Madura, 2003).

4.4.3 Lagged Changes in Exchange Rates and Firm Value

The third objective of the study was to examine the effect of lagged changes in exchange rates on firm value of nonfinancial firms listed at Nairobi Securities Exchange. To achieve this objective, the following hypothesis was tested;

H_{03}: There is no significant effect of lagged changes in exchange rates on firm value of nonfinancial firms at Nairobi Securities Exchange.

It was found according to the fitted GLS model, the p-value of the t-statistic for the estimated coefficient of lagged changes in exchange rates is 0.168 which is greater than 0.05. The null hypothesis was accepted at 0.05 level of significance and a

conclusion drawn that lagged changes in exchange rates has no significant influence on firm value of nonfinancial firms at Nairobi Securities Exchange. The findings concur with earlier studies; Doukas, Hall and Lang (2003) who found that Lagged-exchange rate changes on firm were statistically insignificant implying that investors are able to assess the impact of exchange-rate changes on firm value with no significant delay.

The findings however contradicts other earlier studies; El-Masry (2006) finds evidence of significant lagged exchange rate exposure which depicts existence of some market inefficiencies in incorporating exchange rate changes into the returns of firms and industries. Similarly, Tang (2015) shows that lagged exchange rate changes have significant exposure effects on firm returns. This result is consistent with the view that currency exposure as measured by the trade weighted currency index may fail to capture the true extent of a firm's foreign exchange rate exposure (Aggarwal & Harper, 2010; Rees & Unni, 2005).

4.4.4 The Moderating Effect of Market Performance

The last objective of the study was to determine the moderating effect of market performance on the influence of exchange rate exposure and firm value of nonfinancial companies at Nairobi Securities Exchange. Market performance was measured in terms of logged 20 share index of the NSE market. To introduce the effect of the moderator, interaction terms between the independent variables and the moderating variable share index were first determined. The researcher fitted a panel data model that assessed the moderating effect. The moderating variable and the interaction variables were then added to the multivariate model and the effect of the addition assessed. Since the comparison of the new model was to be made with the first model without the interactions, a similar model estimation technique was adopted. The researcher thus fitted a GLS model including the moderator and the interaction terms in the model to assess this effect as the random effect model had been tested and violated the classical assumptions of estimation.

To make statistical comparison between the models and draw conclusions on the significance of the moderating effect, the study adopted the use of Likelihood ratio test (LR chi-square test).

The test considers whether there is significant contribution of additional predictors in a nested model. Considering the contribution of the variables in each step to the LR chi-square statistics, the first steps includes 4 predictors contemporaneous exchange rate changes, unexpected exchange rate changes, lagged exchange rate changes and the moderating variable market performance. The second step adds 3 predictors as the interactions between the moderating variable and the three independent variables. The LR test assesses whether there is significant contribution to the model by addition of the 3 interaction terms. As shown in table 4.37, the addition of the interaction terms between the independent variables and the moderator has a significant additional influence on firm value. The additional change in the change in LR statistic due to the addition is 56.360 and the p-value of the change due to the addition of the interaction terms is 0.000 implying that the interaction terms significantly change the LR of the model. This shows that there is a moderating influence of market performance on the influence that exchange rate exposure has on firm value.

Table 4.37: Likelihood Ratio Test

Likelihood-ratio test				**LR chi2(3)**	**=**	**56.360**
Model 1 nested in Model 2				Prob > chi2	=	0.000
Model	**Observations**	**Log likelihood**	**Df**	**AIC**		**BIC**
1	3572	-13268.940	24	26585.880		26734.220
2	3572	-13240.760	27	26535.520		26702.410

The GLS model of test the moderating effect was also fitted for 3572 observations with 19 groups of entities for 188 time periods. As shown in table 4.38, the moderated model was also fitted to allow for heteroscedastic residuals and cross sectional dependence which were violated considering the fixed effect model. This GLS model also allowed for autocorrelation of the residuals to order 1 as tested from the fixed effect model which involved the estimation of the autoregressive first lag coefficient found to be 0.1531 that was used on fitting GLS estimated with first order auto-correlated residuals. The introduction of the interaction variables to the model yielded a statistically significant model as shown by the Wald Chi-square statistical analysis. The Wald chi-square statistic for this model was found to be 100.73 with a p-value of the 0.000. The p-value being less than 0.05 implied that at 0.05 level of significance, the estimated GLS model was generally significant and the coefficient estimates of the model were at least not jointly equal to zero.

The introduced interaction variables between market performance and each independent variable were all found to have significant influence on the firm value of nonfinancial companies at Nairobi Securities Exchange. The results of the coefficients of the moderating effect are shown in table 4.39. The interaction variables of market performance and contemporaneous changes, unexpected changes, interest rate risks and operational risks had coefficient estimates of 16.793, 50.671, 0.273 and -13.462 respectively that all had p-values equal to 0.000 which is less than 0.05. This confirms that market performance significantly moderate the relationship between firm value and exchange rate exposure.

Table 4.38: Moderating Effect Model

Coefficients: generalized least squares						
Panels: heteroskedastic with cross-sectional correlation						
Correlation: common AR(1) coefficient for all panels (0.1531)						
Estimated covariances	=	190		Number of Obs	=	3572
Estimated autocorrelations	=	1		Number of groups	=	19
Estimated coefficients	=	8		Time periods	=	188
				Wald chi2(7)	=	100.73
				Prob > chi2	=	0.000
		Coefficients	**Bootstrap Std. Err.**	**z**		**P>|z|**
Contemporaneous changes (X_1)		-140.484	33.848	-4.150		0.000
Unexpected changes (X_2)		-430.528	72.084	-5.970		0.000
Lagged changes (X_3)		110.402	27.229	4.050		0.000
Market performance (Z)		-1.556	0.462	-3.370		0.001
X_1Interaction Z		16.793	4.176	4.020		0.000
X_2 Interaction Z		50.671	8.929	5.670		0.000
X_3 Interaction Z		-13.462	3.354	-4.010		0.000
Constant		13.681	3.764	3.630		0.000

H_{04}: There is no significant moderating effect of market performance on the effect of foreign exchange exposure on firm value of nonfinancial companies at Nairobi Securities Exchange.

The additional change in the change in LR statistic due to the addition of the interaction variables had a p-value of 0.000 implying that the interaction terms significantly change the LR of the model. The null hypothesis was rejected and a conclusion drawn that market performance has a significant moderating effect on the

effect of foreign exchange exposure on firm value of nonfinancial companies at Nairobi Securities Exchange. The results are consistent with those if earlier studies. Kanas (2006) finds that spillover from stock markets to foreign exchange markets is significant for five out of six developed countries, but spillover from foreign exchange markets to stock markets is not significant for all countries. Chen et al. (2004) find a lagged stock market reaction to exchange rate fluctuation in New Zealand.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The chapter gives a summary of the findings as presented in chapter four. The chapter also presents the relevant discussions, conclusions related to the analysis results. Further recommendations are made and suggestion also made on areas for further research. The conclusions drawn are based on findings related to the specific objectives of the study and recommendations are based on the conclusions drawn from the study. The study sought to assess the effect of foreign exchange rate exposure on the value of nonfinancial companies listed at the Nairobi Securities Exchange from January 2001 to December 2016.

5.2 Summary of the Findings

To assess the effect of foreign exchange rate exposure on the value of nonfinancial companies listed at the Nairobi Securities Exchange from January 2001 to December 2016, analyses was done on the data collected and results found guided by the specific objectives. The study targeted 21 firms listed at the Nairobi Securities Exchange for 192 months for the years 2001 to 2016. This resulted to a target of 4,032 observations. Due to missing data, 11% of the targeted observations leaving 3610 observations of panel data consisting of 19 entities observed across 190 months.

The results on the exchange rates exposure were based on the changes in Real Effective Exchanges (REER). The data collected was on nominal exchange rates from a basket of 7 currencies which were used to calculate the real effective exchange rates used. The results on the firm value were based on the capital gains that were computed from the share values of the firms. The overall mean of share price across all the firms and for all the years was found to be 102.332 with an overall standard deviation of 115.276. This was observed to have high variation both across the firms and over the period with standard deviations of 79.379 between

groups and 85.542 within groups. The capital gains was however found to have high variation over time and very low variation across the firms as portrayed by the overall mean capital gains of 1.132 overall standard deviation of 10.492, standard deviation between groups of 0.573 and standard deviation within groups of 10.478. The moderating variable market performance was based on the Nairobi stock exchange 20 Share Index. The 20 share index had a mean of 3658.121 and standard deviation of 1253.481. The 20 share index has no variation across firms.

5.2.1 Contemporaneous Changes in Exchange Rates and Firm value

The first objective of the study was to determine the effects of contemporaneous changes in exchange rates on firm value of companies listed at the Nairobi Securities Exchange. The contemporaneous changes in exchange rate movement were measured as current changes in the REER. The mean movement based on the contemporaneous changes was found to be -0.002 with a standard deviation of 0.016. On the final generalised least squares multiple regression model, the coefficient of contemporaneous changes was found to be significant at 0.05 level of significance with a p-value of 0.000 which is less than 0.05. The same relationship was maintained in the moderated model. This confirmed the significant effects of contemporaneous changes on firm value of contemporaneous.

5.2.2 Firm Value and Unexpected Changes in Exchange Rates

The second objective of the study was to determine the effects of unexpected changes in exchange rates on firm value of companies listed at the Nairobi Securities Exchange. For this objective the independent variable was unexpected changes in exchange rates movement that was measured based on the REER of the basket of currencies. To measure the unexpected exchange rate movements the study first modelled the data for predicted exchange anticipated exchange rates. The model resulted to an ARCH (1)-M model with ARIMA (2, 1, 2) as the mean model. The fitted model was used to get predictions of exchange rates that were then used to measure the unexpected changes in exchange rates as difference between the actual changes in exchange rates and the predicted/ anticipated exchange rates.

The mean movement based on the contemporaneous changes was found to be -0.002 with a standard deviation of 0.047. The results of inferential statistics showed that unexpected changes have a negative significant effects (β = -22.526, z = -6.350, p-value= 0.000) on firm value of nonfinancial firms listed at Nairobi Securities Exchange. A similar negative significance relationship was revealed by the full model that incorporates the moderating variable.

5.2.3 Firm Value and Lagged Changes in Exchange Rates

Lagged changes in exchange rates were also used as an independent variable in the study as a factor influencing the firm value of companies listed at the Nairobi Securities Exchange. The lagged changes were also gotten from the changes in exchange rates as the 1 month lags of the real effective exchange rates as described on descriptive analysis.

The mean movement based on the contemporaneous changes was found to be -0.002 with a standard deviation of 0.061. The inferential statistics results showed that showed that lagged changes in exchange rates have no significant effects on firm value (β = -1.705, z = -0.590, p-value= 0.557). However, upon introducing the moderator, the relationships becomes a significant positive (β = 110.402, z = 4.050, p-value= 0.000).

5.2.4 Moderating Effect of Market Performance

The study also assessed the moderating effect on the influence that foreign exchange exposure on firm value of companies listed at the Nairobi Securities Exchange. The moderating effect was assessed using market performance as the moderating variable which was measured using the 20 share index of NSE listed companies. The mean was found to be 3,658.121 with a standard deviation of 1,253.481. The 20 share index had no variation across the firms but only varied over time. The log share index which was used was found to have a mean of 8.125 with a standard deviation of 0.435.

To determine the moderating effect, a hierarchical multiple regression model was fitted with the first step as a model including the independent variables and the second model including interaction variables between the moderator and the independent variables. The study found that market performance has a moderating effect. The likelihood ratio test determined that the addition of the 3 interaction terms between the independent variables and the moderator had a significant additional influence on firm value. The LR statistic due to the addition 56.360 had a p-value of 0.000 implying a significant moderating influence of market performance on the influence of exchange rate exposure on firm value of companies listed at the Nairobi Securities Exchange.

5.3 Conclusions

The conclusions of the study were also based on the specific objectives and their respective hypotheses. The main objective of this study is to establish the effect of foreign exchange rate exposure on the value of nonfinancial companies listed at the Nairobi Securities Exchange from January 2001 to December 2016. The study therefore on the specific objectives sought to determine the influence of the foreign exchange rate exposure measures (contemporaneous changes, unexpected changes, and lagged changes) on the value of nonfinancial companies listed at the Nairobi Securities Exchange. The analyses of the study deduced that the contemporaneous changes and unexpected changes on foreign exchange rates have significant negative influences on firm value of nonfinancial companies listed at the Nairobi Securities Exchange while the lagged changes have no significant influence on the same.

The conclusion drawn on the first objective was based on the hypothesis that contemporaneous exchange rate changes have no significant influence on the value of nonfinancial companies listed at the Nairobi Securities Exchange. The study analysis deduced that contemporaneous changes have a significant influence on firm value and rejected the null hypothesis at 0.05 level of significance. The study therefore concluded that contemporaneous exchange rate changes have a negative significant influence on the value of nonfinancial companies listed at the Nairobi Securities Exchange.

The study also concluded that unexpected exchange rate changes have a negative significant influence on the value of nonfinancial companies listed at the Nairobi Securities Exchange. This conclusion was reached at after rejecting the null hypothesis of the study that unexpected exchange rate changes have no significant influence on the value of nonfinancial companies listed at the Nairobi Securities Exchange. The study analysis deduced the significance of coefficient estimate of unexpected exchange rate changes at 0.05 level of significance. This resulted to rejection of the null hypothesis and a conclusion that that unexpected exchange rate changes have a negative significant influence on the value of nonfinancial companies listed at the Nairobi Securities Exchange.

The third objective of the study was to examine the effect of lagged changes in exchange rates on the value of nonfinancial companies at Nairobi Securities Exchange. To draw conclusions on this objective, the study used the null hypothesis that lagged changes in exchange rates have no significant influence on the value of nonfinancial companies listed at the Nairobi Securities Exchange. Analyses of the study data collected revealed non-significance of the estimated coefficient of lagged changes in exchange rates at 0.05 level of significance that resulted to rejection of the null hypothesis. The study therefore drew a conclusion that lagged changes in exchange rates do not significantly influence the value of nonfinancial companies at Nairobi Securities Exchange.

The fourth and the last objective was to establish the moderating effect of market performance on the effect of foreign exchange exposure on firm value of nonfinancial companies at Nairobi Securities Exchange. The analysis for this involved determination of interaction variables between the moderator and each of the three independent variables which were used in a stepwise hieratical model. All the three interaction variables were found to have significant coefficient estimates in the model at 0.05 level of significance. This implied that market performance moderated the influence of all the independent variables on firm value.

To draw conclusion on the fourth objective the null hypothesis was tested that there is no significant effect of market firm value on the effect of foreign exchange exposure on firm value of nonfinancial companies at Nairobi Securities Exchange. The LR test on the addition of the interaction variables revealed significant additional influence which resulted to a rejection of the null hypothesis at 0.05 significance level. The study thus drew a conclusion that market performance has a significant influence on effect of foreign exchange exposure on firm value of nonfinancial companies at Nairobi Securities Exchange.

5.4 Contribution of the Thesis

5.4.1 Managerial Decision

The study provides an empirical basis for managerial decision. It concludes that there exists an inverse relationship between contemporaneous and unexpected exchange rate changes and firm value. This provided a solid basis for hedging especially for firms with internationally oriented operations. Secondly, management of listed firms should consider exchange rate exposure when making decisions involving share prices for floatation of shares and valuation reporting. The market timing hypothesis would thus be applicable in the sense that during the time of volatile exchange rate, firms should hold back the issuance of additional equity. Specifically, firms should upscale their foreign exchange forecasting and adopt mitigation measures to reduce unexpected forex exposures.

1.5.2 Investors

Investors in equity shares of listed companies in Nairobi stock exchange should consider factors of exchange rates exposure as relevant information to make informed decisions on the stocks to invest in. The investors should take into consideration the following: First, contemporaneous changes in exchange rates should not be ignored. Contemporaneous changes are measures of current changes in foreign exchange rate changes. These have been found to have a significant negative influence on capital gains on share prices. Contemporaneous increases in real exchange rates of Kenyan shillings against the basket of currencies considered is

expected to result into a fall in capital gains which would be important for informed decisions in the stocks to invest in.

Secondly, Consideration of unexpected changes when making investment decision in stock markets is key. The study deduced that unexpected changes in exchange rates have significant negative influence on capital gains and share prices. The joint effect model found that of the three factors considered, unexpected exchange rate changes was the most influential with influence about twice as much as that of contemporaneous changes. This shows how important it is to consider the unexpected changes to determine expectations on share prices for investment in NSE stock market. Unexpected exchange rate changes are deduced from prediction of anticipated exchange rates. It is therefore recommended that investors take keen interest in proper time series estimation modelling for expected changes in foreign exchange rates for informed investment decisions in stock markets.

Lastly, the 20 share index that is the overall market performance of the stock market should not be overlooked when considering investment in the share prices of non-financial companies listed at Nairobi stock exchange. The 20 share index was found to moderate significantly influence the relationship between exchange rate exposure and firm value (share capital gains). Overlooking market performance would result into misestimating of expected income from the stocks invested in.

1.5.3 Macroeconomic Policy Maker

Considering the results from analysis that shows that exchange rates exposure have significant negative influences on firm values of listed companies in Nairobi stock exchange, it is recommended that the government through central bank considers control of stability of the Kenyan shilling as it has influence on firm value, share prices and capital gains that are in turn influence the performance of both investors and the non-financial companies listed. This would also have an effect on the sectors production. The study further recommends increases efforts toward exchange rate risks monitoring and mitigation, specifically the usage of derivatives in hedging. The central bank should continue with its policy on managed foreign exchange regime but narrow the allowed margin of fluctuations.

5.5 Areas of Further Research

The study concentrated on non-financial companies listed at Nairobi Securities Exchange from January 2001 to December 2016. Another research can be carried out to explore the influence of exchange rate changes on the firm value of the financial firms listed with NSE over the same period. This will aid in providing comprehensive policy recommendations for both financial and non-financial firms.

Other studies can also be carried out for influence of foreign exchange rates exposure on firm value using smaller time units. This study considered the time unit as months which could be collapsed to annual time series or panel analysis, or daily as a smaller unit of time. Both share prices and exchange rates vary on a daily basis implying that there is possibility based on availability of data to consider a smaller time unit for other studies. This will provide a clear empirical evidence on more frequent fluctuations in exchange rates on the firm value. It provide a need to mitigate even the short-term fluctuations.

This Study concentrated on a basket of currencies generally trading with Kenya based on published reports from consecutive Central bank reports over the years. Researches can be performed considering other baskets of currencies to determine the influence of exchange rates exposure of baskets that do not generally trade much with the Kenyan shilling. This will provide empirical evidence on all currencies and how the firm values are influenced by their exposures to all the currencies.

The study considered a panel dataset therefore exploring a general effect that interest rates exposure has on firm value of non-financial companies listed with Nairobi stock exchange. The general influence based on the panel data analysis might not be the case for individual firms. It therefore possible to carry out case study researches to consider the influence exchange rate exposure on individual companies. This would be time series analyses that would consider, ARIMAX, SARIMAX models or GARCH-M models with SARIMAX as mean models of individual firms. Considering individual firms may require considering a basket of currencies that relate most with the company in question rather than the same basket that affects all trades in the country. The influence of foreign exchange rates could be due to

exchange rates with currencies of countries that are related to the particular firm due to specific trade relations to global partners of the firm such as EABL with Diageo operating countries and BAT with BAT global firms which could be left out by the central bank basket of currencies.

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APPENDICES

Appendix I: Multinational Nonfinancial Firms Listed at NSE

		LISITING
	AGRICULTURAL	**CODE**
1	Williamson Tea Kenya Ltd Ord 5.00***AIMS***	KE0000000505
	AUTOMOBILES & ACCESSORIES	
2	Marshalls (E.A.) Ltd Ord 5.00	KE0000000364
3	Sameer Africa Ltd Ord 5.00	KE0000000232
	COMMERCIAL AND SERVICES	
4	Atlas African Industries Ltd ***GEMS***	KE4000004095
5	Deacons (East Africa) Plc Ord 2.50***AIMS***	KE5000005438
6	Kenya Airways Ltd Ord 5.00	KE0000000307
7	Nation Media Group Ltd Ord. 2.50	KE0000000380
8	TPS Eastern Africa Ltd Ord 1.00	KE0000000539
9	Uchumi Supermarket Ltd Ord 5.00	KE0000000489
10	WPP Scangroup Ltd Ord 1.00	KE0000000562
	CONSTRUCTION & ALLIED	
11	Bamburi Cement Ltd Ord 5.00	KE0000000059
12	Crown Paints Kenya Ltd Ord 5.00	KE0000000141
13	E.A.Cables Ltd Ord 0.50	KE0000000174
14	E.A.Portland Cement Co. Ltd Ord 5.00	KE0000000190
	ENERGY & PETROLEUM	
15	Kenol/Kobil Ltd Ord 0.05	KE0000000323
16	Total Kenya Ltd Ord 5.00	KE0000000463
17	Umeme Ltd Ord 0.50	KE2000005815
	INSURANCE	
18	Britam Holdings Ltd Ord 0.10	KE2000002192
19	Jubilee Holdings Ltd Ord 5.00	KE0000000273
20	Pan Africa Insurance Holdings Ltd Ord 5.00	KE0000000414
	INVESTMENT	
21	Trans-Century Ltd Ord 0.50***AIMS***	KE2000002184

Source,

Nairobi Securities exchange publication on August 11, 2016

Appendix II: Data Collection Sheet

Name of the Institution…….

Date of Licensed /Registered……..……..……

DATA Set I: Exchange Rates

	Average Exchange rate (Direct Quote)						
Month	**US DOLLAR**	**EURO**	**JPY(100)**	**SA RAND**	**STG POUND**	**STG POUND**	**UGSH**
Jan-01							
Feb-01							
Mar-01							
Apr-01							
May-01							
Jun-01							
Jul-01							
Aug-01							
Sep-01							
Oct-01							
Nov-01							
Dec-01							
Jan-02							
Feb-02							
Mar-02							
Apr-02							
May-02							
Jun-02							
Jul-02							
Aug-02							
Sep-02							
Oct-02							
Upto Dec 2016							

DATA Set I: Stock Prices and 20 Share Index

Firm.....

Month	**avg_shareprice**
Jan-01	
Feb-01	
Mar-01	
Apr-01	
May-01	
Jun-01	
Jul-01	
Aug-01	
Sep-01	
Oct-01	
Nov-01	
Dec-01	
Jan-02	
Feb-02	
Mar-02	
Apr-02	
May-02	
Jun-02	
Jul-02	
Aug-02	
Sep-02	
Oct-02	
Upto Dec 2016	

Appendix III: Summary Statistics for Share Prices per Month

Time	Mean	Std. Dev.	Min	Max
Jan 2001	33.194	25.147	3.874	75.395
Feb 2001	32.894	25.536	3.624	76.308
Mar 2001	32.644	25.812	3.493	79.003
Apr 2001	31.286	24.856	3.327	78.234
May 2001	29.466	23.759	2.738	77.857
Jun 2001	28.890	24.265	3.368	77.572
Jul 2001	29.197	24.956	2.968	80.249
Aug 2001	28.373	24.410	3.138	80.175
Sep 2001	26.661	23.441	2.950	81.568
Oct 2001	26.987	24.207	3.159	82.275
Nov 2001	27.122	23.630	3.325	78.692
Dec 2001	26.633	23.217	3.084	75.095
Jan 2002	26.911	23.792	2.928	79.031
Feb 2002	27.429	25.138	3.028	87.194
Mar 2002	26.930	25.393	3.031	83.203
Apr 2002	25.712	24.286	3.050	77.188
May 2002	25.549	24.374	2.874	78.929
Jun 2002	25.741	25.242	2.598	83.923
Jul 2002	26.027	25.426	2.531	85.771
Aug 2002	26.234	25.032	2.532	83.437
Sep 2002	26.691	26.010	2.442	92.240
Oct 2002	28.918	27.101	2.403	94.929
Nov 2002	31.157	28.698	3.595	100.194
Dec 2002	33.693	32.464	3.550	115.037
Jan 2003	40.239	36.576	5.564	132.908
Feb 2003	41.714	37.808	6.276	139.937
Mar 2003	45.368	43.312	5.600	169.856
Apr 2003	50.730	49.136	5.688	198.967
May 2003	61.147	52.067	11.756	216.952
Jun 2003	60.106	51.597	10.719	214.038
Jul 2003	61.513	56.536	9.707	238.698

Aug 2003	68.595	67.174	9.968	285.749
Sep 2003	82.711	78.695	11.149	323.534
Oct 2003	93.367	87.599	13.098	359.662
Nov 2003	98.169	98.851	12.727	405.031
Dec 2003	113.115	113.121	12.593	436.263
Jan 2004	122.533	120.807	13.569	475.960
Feb 2004	131.385	125.749	16.749	492.833
Mar 2004	123.147	120.565	14.589	481.217
Apr 2004	105.394	106.077	11.943	449.348
May 2004	103.719	103.543	10.424	425.367
Jun 2004	102.694	102.576	11.199	428.763
Jul 2004	101.238	105.293	10.587	445.095
Aug 2004	102.843	113.128	11.059	489.282
Sep 2004	101.860	116.608	9.704	509.837
Oct 2004	101.588	111.285	9.141	478.015
Nov 2004	102.783	108.120	9.289	460.771
Dec 2004	83.285	62.615	8.828	206.251
Jan 2005	84.184	64.584	9.917	215.279
Feb 2005	87.272	68.922	11.088	234.672
Mar 2005	88.191	69.519	9.572	229.821
Apr 2005	87.492	68.861	9.594	230.438
May 2005	88.899	70.087	9.225	225.756
Jun 2005	93.655	71.065	11.395	242.084
Jul 2005	98.099	72.469	13.595	255.634
Aug 2005	97.609	70.707	13.171	247.137
Sep 2005	95.781	67.842	11.878	237.513
Oct 2005	98.114	68.558	12.333	244.916
Nov 2005	99.647	69.235	13.617	248.925
Dec 2005	101.144	68.459	13.640	253.186
Jan 2006	99.764	70.003	15.795	279.000
Feb 2006	103.479	70.072	16.186	275.000
Mar 2006	91.901	62.478	15.096	232.192
Apr 2006	95.068	63.702	18.100	250.105
May 2006	106.700	65.430	21.236	252.619

Jun 2006	107.317	63.592	19.298	265.455
Jul 2006	115.819	66.245	16.445	271.900
Aug 2006	125.809	66.082	16.761	292.636
Sep 2006	138.608	71.843	17.419	316.571
Oct 2006	155.842	97.082	16.658	377.211
Nov 2006	178.030	126.936	19.298	515.870
Dec 2006	143.417	89.364	16.847	324.945
Jan 2007	127.757	81.073	14.349	292.019
Feb 2007	128.779	82.513	14.293	300.015
Mar 2007	122.290	86.786	14.237	302.811
Apr 2007	111.469	86.001	14.182	301.324
May 2007	110.709	85.381	14.127	301.267
Jun 2007	110.284	85.256	14.071	303.558
Jul 2007	109.930	85.344	14.017	306.647
Aug 2007	106.885	79.629	13.963	263.000
Sep 2007	99.625	69.981	13.908	224.750
Oct 2007	98.751	69.205	13.852	218.350
Nov 2007	97.866	68.471	13.799	212.275
Dec 2007	96.924	67.708	13.751	205.962
Jan 2008	95.920	66.924	13.697	199.421
Feb 2008	94.863	66.132	13.607	192.756
Mar 2008	93.768	65.338	13.217	186.026
Apr 2008	92.683	64.552	12.834	179.313
May 2008	91.465	63.746	12.414	173.757
Jun 2008	90.134	62.913	11.976	173.967
Jul 2008	88.803	62.096	11.545	174.094
Aug 2008	87.604	61.327	11.151	174.070
Sep 2008	86.463	60.605	10.760	173.880
Oct 2008	84.819	59.791	10.239	173.694
Nov 2008	82.910	58.938	9.682	173.535
Dec 2008	81.561	58.224	9.295	173.186
Jan 2009	84.851	58.507	10.355	170.368
Feb 2009	77.279	56.975	7.685	171.034
Mar 2009	71.412	55.680	7.093	171.702

Apr 2009	74.492	55.962	8.058	172.373
May 2009	76.768	56.192	8.140	173.047
Jun 2009	82.944	58.460	9.055	173.723
Jul 2009	86.210	60.173	11.030	174.401
Aug 2009	85.587	61.778	10.453	178.700
Sep 2009	83.504	61.650	9.376	175.767
Oct 2009	82.520	62.548	8.329	176.454
Nov 2009	83.332	64.502	8.226	202.524
Dec 2009	79.376	58.556	9.036	175.091
Jan 2010	82.268	59.699	9.155	175.650
Feb 2010	84.261	62.565	9.108	187.100
Mar 2010	90.151	67.242	10.909	195.565
Apr 2010	93.217	68.395	10.565	192.250
May 2010	98.267	71.649	12.000	210.000
Jun 2010	100.373	73.350	11.971	215.571
Jul 2010	104.627	77.109	12.111	237.727
Aug 2010	113.263	84.147	12.938	266.050
Sep 2010	115.777	85.979	12.925	265.409
Oct 2010	118.409	86.826	12.628	274.450
Nov 2010	119.135	89.597	11.827	285.409
Dec 2010	114.118	85.998	10.680	275.773
Jan 2011	119.870	88.672	11.121	276.286
Feb 2011	117.890	87.135	10.690	272.900
Mar 2011	114.010	85.266	9.741	277.087
Apr 2011	113.512	85.587	9.726	266.000
May 2011	112.609	85.169	9.440	256.429
Jun 2011	105.769	84.634	9.981	259.191
Jul 2011	101.837	82.542	10.055	258.762
Aug 2011	95.959	78.974	9.202	247.000
Sep 2011	90.519	75.132	9.489	235.455
Oct 2011	87.135	72.139	10.443	232.400
Nov 2011	87.849	72.808	10.934	233.273
Dec 2011	83.220	71.146	9.575	234.200
Jan 2012	84.975	73.747	9.281	257.333

Feb 2012	87.240	75.895	9.033	268.143
Mar 2012	94.504	85.139	9.232	302.773
Apr 2012	96.062	86.551	10.029	303.790
May 2012	100.680	92.132	11.811	333.591
Jun 2012	103.810	96.572	12.588	358.250
Jul 2012	107.880	101.193	12.277	375.500
Aug 2012	108.964	104.896	11.939	397.136
Sep 2012	112.153	109.711	12.068	416.400
Oct 2012	116.501	116.809	12.341	449.652
Nov 2012	119.768	119.626	12.359	458.182
Dec 2012	120.315	123.227	12.467	474.445
Jan 2013	122.414	134.065	12.798	521.546
Feb 2013	126.774	138.139	13.500	531.400
Mar 2013	134.223	142.355	13.500	535.158
Apr 2013	141.334	147.527	13.500	548.250
May 2013	143.611	149.322	13.500	546.318
Jun 2013	143.310	148.549	13.500	547.700
Jul 2013	144.078	149.965	13.500	564.522
Aug 2013	146.286	151.280	13.500	572.095
Sep 2013	144.739	148.750	13.500	572.524
Oct 2013	150.206	151.398	13.500	573.238
Nov 2013	152.557	152.251	13.500	580.000
Dec 2013	145.969	152.359	13.500	585.722
Jan 2014	149.747	150.707	13.500	572.818
Feb 2014	147.670	146.814	13.500	558.050
Mar 2014	152.167	156.911	13.500	612.143
Apr 2014	149.213	150.347	13.500	568.900
May 2014	153.240	155.390	13.500	594.667
Jun 2014	155.778	160.294	13.500	607.400
Jul 2014	160.832	171.131	13.500	669.136
Aug 2014	166.194	183.772	13.500	740.333
Sep 2014	173.970	202.163	13.500	832.591
Oct 2014	183.211	229.363	13.500	971.636
Nov 2014	180.576	228.179	13.500	963.350

Dec 2014	175.279	217.935	13.500	911.400
Jan 2015	176.734	216.886	13.500	900.571
Feb 2015	183.065	221.930	13.500	894.350
Mar 2015	178.010	212.281	13.500	829.455
Apr 2015	171.450	199.110	13.500	737.550
May 2015	167.903	200.175	13.500	742.650
Jun 2015	161.374	192.890	13.500	717.571
Jul 2015	161.676	199.858	13.500	759.478
Aug 2015	156.746	201.900	13.500	773.429
Sep 2015	149.376	193.691	12.995	760.591
Oct 2015	141.182	190.708	12.543	777.714
Nov 2015	142.444	193.417	13.228	782.250
Dec 2015	144.255	192.692	13.252	766.727
Jan 2016	143.632	197.311	12.393	796.950
Feb 2016	143.872	198.111	12.605	800.333
Mar 2016	148.725	204.652	11.960	831.095
Apr 2016	147.946	199.297	9.855	801.429
May 2016	147.765	206.200	9.655	834.000
Jun 2016	144.967	207.668	9.874	845.857
Jul 2016	140.689	209.022	9.168	855.500
Aug 2016	138.141	207.589	7.789	847.261
Sep 2016	132.734	201.501	6.683	818.762
Oct 2016	134.244	204.785	6.923	829.364

Appendix IV: Summary Statistics for Capital Gains per Month

Time	Mean	Std. Dev.	Min	Max
Jan 2001				
Feb 2001	-2.084	6.435	-23.730	5.917
Mar 2001	-1.159	7.441	-13.367	20.750
Apr 2001	-3.880	5.091	-15.155	2.985
May 2001	-7.126	5.603	-17.696	4.091
Jun 2001	-1.715	10.707	-22.616	23.007
Jul 2001	-0.147	6.212	-11.881	15.704
Aug 2001	-2.420	5.466	-12.741	9.531
Sep 2001	-7.717	6.347	-23.438	1.738
Oct 2001	0.542	6.934	-18.587	8.024
Nov 2001	3.854	11.000	-8.461	42.239
Dec 2001	-2.011	5.389	-13.363	5.725
Jan 2002	0.135	4.886	-10.707	10.315
Feb 2002	0.611	5.034	-7.161	10.818
Mar 2002	-4.649	11.253	-22.444	31.303
Apr 2002	-4.142	11.816	-35.609	20.084
May 2002	-0.275	8.890	-19.011	20.190
Jun 2002	2.182	11.453	-25.348	29.622
Jul 2002	1.134	9.212	-19.068	25.989
Aug 2002	4.093	8.022	-8.855	27.064
Sep 2002	0.686	10.815	-15.346	34.915
Oct 2002	7.849	15.588	-13.842	58.005
Nov 2002	13.432	18.563	-41.038	49.633
Dec 2002	3.991	13.964	-15.037	46.565
Jan 2003	28.872	24.160	7.255	107.575
Feb 2003	5.289	7.784	-8.713	22.069
Mar 2003	7.209	11.428	-10.767	36.637
Apr 2003	12.136	10.072	-7.748	34.638
May 2003	37.200	26.244	6.855	106.672
Jun 2003	-2.237	9.826	-17.327	21.410
Jul 2003	-1.357	9.409	-20.612	17.545

Aug 2003	7.564	8.747	-13.598	25.386
Sep 2003	19.908	12.874	-0.577	52.963
Oct 2003	14.988	11.480	-1.646	46.510
Nov 2003	1.102	8.189	-19.995	14.847
Dec 2003	11.795	8.719	-2.883	29.368
Jan 2004	11.630	11.721	-10.026	38.320
Feb 2004	12.728	18.660	-21.975	61.460
Mar 2004	-7.247	8.291	-22.326	6.110
Apr 2004	-13.118	8.567	-32.345	4.001
May 2004	-3.361	5.448	-12.713	8.195
Jun 2004	0.388	6.814	-11.199	17.028
Jul 2004	-3.736	5.242	-15.410	3.809
Aug 2004	0.102	4.658	-7.405	10.658
Sep 2004	-3.482	5.882	-12.253	6.971
Oct 2004	0.589	6.259	-12.454	12.677
Nov 2004	2.753	3.496	-3.607	10.191
Dec 2004	-3.897	18.530	-77.764	11.731
Jan 2005	1.715	5.183	-8.190	12.332
Feb 2005	4.158	5.856	-7.029	17.310
Mar 2005	0.186	8.256	-13.672	15.692
Apr 2005	-1.260	4.707	-11.193	7.759
May 2005	1.605	7.251	-22.610	13.144
Jun 2005	8.642	12.586	-18.423	32.317
Jul 2005	8.423	11.774	-3.099	46.801
Aug 2005	-0.376	3.246	-6.259	7.064
Sep 2005	-1.118	4.045	-9.813	5.339
Oct 2005	3.589	5.379	-4.815	18.357
Nov 2005	1.924	3.491	-4.094	10.411
Dec 2005	3.072	5.396	-3.363	14.548
Jan 2006	1.260	12.357	-26.867	21.158
Feb 2006	4.742	12.718	-5.507	50.299
Mar 2006	-11.436	8.903	-33.136	0.625
Apr 2006	5.460	9.127	-15.750	19.898
May 2006	18.520	19.242	-11.981	66.028

Jun 2006	1.866	10.605	-22.467	22.614
Jul 2006	8.436	12.358	-14.783	43.610
Aug 2006	12.274	12.557	-4.610	36.635
Sep 2006	11.621	15.887	0.354	65.814
Oct 2006	8.235	16.093	-4.370	69.769
Nov 2006	10.138	16.658	-7.518	52.228
Dec 2006	-11.963	18.898	-86.345	1.854
Jan 2007	-3.838	24.090	-95.584	15.671
Feb 2007	0.353	1.170	-1.446	2.738
Mar 2007	-4.987	20.232	-88.432	1.113
Apr 2007	-5.902	20.339	-89.272	1.034
May 2007	-0.966	1.794	-6.909	0.958
Jun 2007	-0.564	1.016	-2.306	0.884
Jul 2007	-0.573	1.009	-2.431	1.018
Aug 2007	-1.551	3.248	-14.234	0.744
Sep 2007	-3.301	10.537	-46.578	0.676
Oct 2007	-0.919	1.130	-2.931	0.609
Nov 2007	-0.956	1.143	-3.048	0.544
Dec 2007	-1.022	1.195	-3.213	0.479
Jan 2008	-1.103	1.245	-3.385	0.416
Feb 2008	-1.185	1.294	-3.567	0.398
Mar 2008	-1.240	1.354	-3.753	0.392
Apr 2008	-1.215	1.431	-3.916	0.388
May 2008	-1.452	1.483	-4.249	0.390
Jun 2008	-1.634	1.572	-4.543	0.392
Jul 2008	-1.651	1.680	-4.779	0.391
Aug 2008	-1.434	1.781	-4.864	0.390
Sep 2008	-1.382	1.883	-5.172	1.025
Oct 2008	-2.306	2.027	-6.221	0.391
Nov 2008	-2.791	2.334	-7.200	0.391
Dec 2008	-1.823	2.376	-6.333	0.561
Jan 2009	7.150	7.267	-7.079	25.259
Feb 2009	-13.184	8.329	-25.783	1.962
Mar 2009	-9.242	7.537	-21.824	4.321

Apr 2009	6.602	6.105	-3.480	16.692
May 2009	4.419	5.605	-3.663	14.995
Jun 2009	10.379	8.695	0.391	32.472
Jul 2009	5.051	5.849	-1.709	21.819
Aug 2009	-2.894	4.762	-10.852	4.851
Sep 2009	-4.093	3.842	-10.869	2.549
Oct 2009	-3.880	4.960	-13.686	4.340
Nov 2009	0.785	8.777	-22.413	26.255
Dec 2009	0.328	13.382	-50.253	17.082
Jan 2010	4.935	4.967	-4.357	15.066
Feb 2010	1.026	3.259	-3.072	8.244
Mar 2010	6.924	7.823	-4.134	26.057
Apr 2010	4.698	7.660	-6.623	21.114
May 2010	6.725	9.285	-8.305	29.098
Jun 2010	1.667	6.327	-7.123	20.544
Jul 2010	3.092	5.882	-8.318	15.356
Aug 2010	8.265	5.469	0.510	17.040
Sep 2010	1.692	3.342	-5.286	8.817
Oct 2010	3.451	5.602	-5.988	16.480
Nov 2010	-0.959	4.629	-10.519	8.639
Dec 2010	-4.598	3.061	-11.627	0.891
Jan 2011	5.899	3.428	0.186	13.572
Feb 2011	-1.898	3.617	-10.449	2.406
Mar 2011	-4.106	3.562	-12.221	1.534
Apr 2011	-0.343	8.323	-17.030	15.761
May 2011	-0.757	4.068	-12.145	6.346
Jun 2011	-6.758	17.095	-73.330	6.725
Jul 2011	-4.837	3.583	-12.014	0.740
Aug 2011	-7.387	5.841	-17.750	6.550
Sep 2011	-5.818	6.864	-14.837	15.189
Oct 2011	-3.340	6.149	-15.412	10.053
Nov 2011	1.619	4.702	-7.893	13.821
Dec 2011	-8.029	6.374	-17.683	3.593
Jan 2012	3.320	5.588	-4.588	15.950

Feb 2012	2.054	5.510	-4.495	18.296
Mar 2012	5.143	6.053	-3.376	17.771
Apr 2012	1.858	4.646	-7.262	9.605
May 2012	5.425	6.546	-4.032	20.519
Jun 2012	1.986	5.135	-9.992	10.721
Jul 2012	2.190	5.249	-9.365	12.142
Aug 2012	-0.164	4.712	-9.336	7.985
Sep 2012	2.191	5.436	-7.744	13.740
Oct 2012	2.068	6.216	-13.604	15.322
Nov 2012	2.929	3.683	-2.932	12.926
Dec 2012	-1.190	4.080	-10.482	6.343
Jan 2013	3.587	17.825	-67.980	13.901
Feb 2013	4.119	6.033	-15.286	12.188
Mar 2013	8.120	7.069	-0.970	23.721
Apr 2013	6.968	7.076	-3.692	25.173
May 2013	1.551	5.770	-8.103	21.057
Jun 2013	-0.109	3.804	-7.114	7.744
Jul 2013	0.762	2.052	-3.061	4.544
Aug 2013	2.222	3.865	-5.238	9.792
Sep 2013	-0.062	3.205	-6.344	7.702
Oct 2013	4.651	4.952	-3.191	16.524
Nov 2013	3.822	6.510	-12.302	13.945
Dec 2013	-2.934	15.924	-63.923	17.924
Jan 2014	4.661	8.055	-12.472	22.177
Feb 2014	-0.473	7.161	-15.733	13.928
Mar 2014	1.065	4.977	-11.029	9.693
Apr 2014	-1.012	5.013	-10.693	7.643
May 2014	3.400	7.155	-8.178	21.709
Jun 2014	0.542	5.951	-11.448	13.932
Jul 2014	2.947	5.578	-5.332	17.599
Aug 2014	1.855	6.378	-6.887	14.693
Sep 2014	3.674	8.008	-9.787	28.666
Oct 2014	2.007	8.094	-7.608	25.577
Nov 2014	-3.006	4.677	-15.125	6.666

Dec 2014	-1.928	3.800	-8.765	5.012
Jan 2015	1.671	2.789	-2.561	8.081
Feb 2015	3.040	6.190	-13.547	15.964
Mar 2015	-2.436	4.481	-11.290	4.786
Apr 2015	-3.388	4.798	-11.080	5.561
May 2015	-3.278	4.349	-10.862	3.964
Jun 2015	-3.663	4.561	-11.497	2.025
Jul 2015	-2.637	5.235	-13.247	5.982
Aug 2015	-5.325	5.796	-18.056	2.635
Sep 2015	-4.902	6.534	-20.532	10.744
Oct 2015	-6.637	4.676	-18.143	2.251
Nov 2015	0.058	4.946	-12.261	7.454
Dec 2015	1.454	7.125	-5.056	28.001
Jan 2016	-1.834	4.564	-13.212	9.834
Feb 2016	-1.301	4.132	-10.554	4.600
Mar 2016	2.159	4.766	-5.960	13.381
Apr 2016	-1.593	9.198	-33.220	14.936
May 2016	-1.539	6.205	-15.074	15.286
Jun 2016	-2.711	5.390	-13.368	8.015
Jul 2016	-4.392	4.581	-14.576	1.140
Aug 2016	-3.858	5.612	-15.035	2.769
Sep 2016	-5.544	5.948	-15.010	5.953
Oct 2016	0.442	3.493	-5.360	8.181