UNIVERSITY OF GHANA

IMPACT OF CENTRAL BANK INTERVENTION ON EXCHANGE RATES

BY

ENOCH OFORI KWARTENG

(10703897)

THIS LONG ESSAY IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON, IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF AN MASTER OF SCIENCE IN DEVELOPMENT FINANCE

JULY, 2019

DECLARATION

I do hereby declare that this work is the result of my own research and has not been presented by anyone for any academic award in this or any other university. All references and other sources used in the work have been fully acknowledged.

…… ……..

ENOCH OFORI KWARTENG **DATE**

(10703897)

CERTIFICATION

I confirm that the work reported in this thesis was carried out by the candidate under my supervision as University supervisor.

…… ……

SAINT KUTTU (PhD) **DATE**

(SUPERVISOR)

DEDICATION

This work is dedicated to my parents, Victoria Osei Tutu and Kwabena Kwarteng, for their encouragement and constant support. It has been their heart's desire for me to pursue this program.

To my beloved wife and life partner, Joyce Amu Kwarteng, I am very grateful for her support all through this period. To my son, Kofi Animonyam Kwarteng and my unborn daughter, Animpa Kwarteng, I am grateful to the Lord for giving me such a wonderful family, one that has been there through thick and thin.

ACKNOWLEDGMENT

I would first like to thank the Lord Almighty for making this possible, I have only come this far by grace.

Next, I would like to thank my supervisor, Dr Saint Kuttu, for his unwavering support, his guidance and supervision. Dr Kuttu's doors were always open and whenever I encountered any difficulty, he was there to offer me his expert guidance. This work would have been far more difficult, had it not been his help.

I would also like to thank the entire teaching staff of MSc Development Finance (weekend option). These group of experts taught me a lot over the past year, making it easier to go through this work. Staff at the one year programmes office are also not left out.

Lastly, I would like to express my gratitude to all who have in diverse ways have supported my work and education. To my lovely wife who has been my backbone over the years, my parents and siblings, my pastor and entire congregation at Church of Pentecost Russia Worship Centre, Mr Robbert Abbey and the late Mr Bernard Quaye. Thank you Precious Doe for coming through for me when I needed you.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Concerns about currency fluctuations are becoming increasingly prominent in both advanced and emerging countries, including Ghana because they affect imports and exports directly.

The main aim of the study is to assess the impact of the Central Bank intervention on Exchange rates in Ghana, using Société Générale Ghana as a case study.

This study used secondary data mainly drawn from the Bank of Ghana Data base. The study covers a time period of 4 years (2014-2018) which captures period in which the Bank of Ghana initiated new rules to augment and support the free fall of the cedi. To interpret and analyze the data in relation to the variables under study, Descriptive Statistics, Unit root test such as the Augmented Dicky Fuller Test was run. Models for the study were the Stock Watson (DOLS) test and the Granger Causality test. Eviews10 was used in the data analysis.

The results indicate that the data was stationary using the Augmented Dickey Fuller test

The correlation analysis indicates that there exist a positive correlation between interbank rate and Central Bank Intervention with a correlation coeffiecient of .073. A regression analysis was run to establish the effect of the central bank intervention on the exchange rate. The coefficient of the dependent variable at zero level of the explanatory variable was .073 indicating a positive relationship exist between central bank intervention and the interbank exchange rate despite the fact that the constant has no significant meaning in the model than reflecting the value of interbank exchange rate when central bank intervention is held constant. The R2 which is the determinant of the coefficient measures the proportion of the variance in the dependent variable that can be

explained by the independent variable. The coefficient of 0.005 explains only 5 percent of the variability of the dependent variable.

The F-ratio in the ANOVA table indicates whether the overall regression model is a good fit for the data. The table indicates that the independent variables do not statistically justify the model to be a good fit (1,58)=0.308, p>.005. The Null Hypothesis of the Granger Causality states that Intervention does not Granger Cause Interbank rate. The rule of thumb indicates that the probability of the F-statistics must be less than 5 percent to show causal relationship. The probabilities of the causal variables of intervention was 0.712 and interbank rate was 0.111. per the results obtained, the null hypothesis is rejected and a conclusion drawn that no relationship exists between central bank intervention and the exchange rate. Conclusions were drawn based on the findings and recommendations made for policy makers and future research directions.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

As a currency strategy, Ghana aims for price stabilization, amongst others, and this includes maintaining growth within the goal range, as the government's annual growth objective of 8%+/-2% highlights. As a net importer, import costs could make the attainment of the inflation goal more difficult. Thus, nations with a higher price pass (higher imports) may be more susceptible to exchange rate fluctuations (Ebeke & Azangue, 2015).

The volatility of the exchange rate, identified as continuing exchange rate changes, has dominated latest global financial literature due to their impact on developing countries. Concerns about currency fluctuations are becoming increasingly prominent in both advanced and emerging countries, including Ghana because they affect imports and exports directly (Alagidede & Ibrahim, 2017).

Ghana has introduced important financial-sector reforms including the rejection of the fixed exchange rates to promote the floating regime as a result of its advent of FINSAP, part of the Economic Recovery Program (ERP). Ghana's currency policies included retention of a fixed exchange rate system with occasional devaluation and currency rationing before the introduction of the 1983 economic recovery program (IMF). Since 1988 however, the country's flexible currency system was introduced as a result of the continuous instability and depreciation of the local currency. In this context, the problem of exchange rate stabilization, as illustrated by consecutive budget and strategy reports, has proved to be a significant problem in Ghana's political sphere over the last few years. Nevertheless, the maintenance of a stable value for the cedi in

relation to significant international currencies remained a task for decision makers (Mumuni & Owusu -Afriyie, 2004).

1.2 Problem Statement

Pursuant to its mandate under the Foreign Exchange Act 2006(Act 723), the Bank of Ghana in February, 2014 reviewed the Foreign Exchange measures to curb the continuous decline of the Ghana Cedis (BOG, 2014).

According to the BOG (2014), no bank is to grant foreign currency denominated loan or foreign currency linked facility to a customer who is a resident. The central Bank equally prohibited offshore deals by resident companies which include exporters. This measures according to the (BOG, 2014) was introduced to halt the free fall of the cedi.

Furtherance to the policies, the central bank also intervenes on the foreign exchange market by selling funds to (or even buying from) commercial banks to meet customer demand and keep exchange rates in check.

Although the central bank's regular tool employed for managing exchange rate fluctuation is its intervention on the foreign market, one would wonder the extent to which such interventions affect exchange rates.

Aimed at helping to stabilize the cedi, the central bank usually adopts a reactionary posture, and because it is difficult to disentangle the effects to central bank interventions, it becomes difficult to assess the extent to which the foreign exchange market is affected, and how well the market reacts to such interventions. Also, there is a need for more literature on examining these effects in emerging economies. This dissertation is unique in that while it seeks to fill this gap, it will also

examine the impact of the Central bank's policy rate changes on exchange rate fluctuations in Ghana.

1.3 Aim and Objectives of the Study

The main aim of the study is to assess the impact of the Central Bank intervention on Exchange rate in Ghana. In line with the above aim, the following are the specific objectives of the study.

1. To establish a relationship between the Central Bank's intervention and the movement of the exchange rate on the interbank market in Ghana.

2. To identify the factors which contributes to the exchange rate fluctuations on the interbank market in Ghana.

1.4 Research Question

1. What is the relationship between the Central Bank's Intervention and the movement of the exchange rate on the interbank market in Ghana?

2. Which factors contributes to the exchange rate fluctuations on the interbank market in Ghana?

1.5 Significance of the Study

This research focuses on an area with virtually non-existent empirical research findings. While it is generally accepted among bankers on the foreign exchange market that the central bank's intervention does not significantly influence exchange rates, the central bank continues to use it in a bid to influence exchange rate fluctuation, specifically the cedi's depreciation against the dollar. This research will therefore provide a basis on which research can be done on the area.

This research can also serve as a guide to the central bank on future interventions. With its findings, the central bank may either explore other alternatives that may prove more efficient in curbing the

cedi's depreciation or if proven to affect exchange rates, the central bank can continue and improve upon its interventions so as to keep exchange rate fluctuations in check.

1.6 Limitation of the Study

This research will be limited in a number of ways. First, the interbank exchange rates (also known as the revaluation rates) do not represent the actual rates at which customers transact with their banks, however since there is no official documentation of such rates, the interbank rates will be adopted and assumed as the prevailing exchange rates for the period specified.

Again, the currencies covered in this research will be limited to the US dollar Ghana cedi pair (USDGHS). This is because the central bank only trades in these currencies on the market. It is assumed that all the other currencies are derived from the USD at the prevailing offshore cross-currency rates.

Data will be limited to interbank transactions only. Although there are other markets, such as forex bureau and black market, whose activities have an effect on exchange rates, they are not covered in this research due to the unavailability of data on activities in those markets.

1.7 Structure of the Study

This thesis is organized into six chapters.

Chapter one comprises the background to the study, the statement of the problem, aim and objectives of the study, significance of the study, limitations of the study and the organization of the study.

Chapter two is divided into two sections. The first section presents the overview of the Central Bank of Ghana whilst the second section deals with the overview of exchange rate in Ghana.

Chapter three provides a review of related and relevant literature. This is decomposed into review of the theoretical literature and empirical literature.

Chapter four spells out the methodology of the study. It includes: the research design, data and data sources, model specification, justification of the model, estimation techniques, pre-estimation diagnostics, Granger causality test, post estimation techniques among others.

Chapter five deals with the interpretation and discussion of the results of the study and

Chapter six presents the summary, main contributions of the study, conclusions, recommendations of the study and direction for future research

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This chapter reviewed related literature in line with the aim and objectives of the current study. The literature review is in two folds, the theoretical and empirical review.

2.1 The History of Central Banks

Good-heart (2010) discusses the history in his study on the changing roles of Central banks. He noted that over the years, central banks have three core aims or functions. "These have been:

i) To maintain price stability, subject to the monetary regime in current operation, for example the gold standard, a pegged exchange rate or an inflation target,

ii) To maintain financial stability, and to foster financial development more broadly,

iii) To support the State's financing needs in times of crisis, but at most times to constrain misuse of the State's financial powers. In the past this meant preventing debasement and misuse of the inflation tax. Prospectively it may in future also involve preventing misuse of the bank tax."

The main tenets of these three objectives however have evolved as individual states and their respective central banks had to become prominent financers during the war times. These included states such as England and France. But, in current times where major wars have been non-existent, the Central Bank's major concern has been to draft plans on finance (stable prices) and check against financial instability in the countries where they operate (Goodheart, 2010). Subsequently, Goodheart (2010) identified three main periods of history where he distinguished the evolving

functions of central banks and the inter-dependencies that existed among these periods. These three periods are "the Victorian era (between the 1840s-1914), the decades of government control (between 1930s-1960s), and the triumph of the markets (1980s-2007)". He also discusses a current period where central banks have evolved into and are working in and how the specific objectives of this period are changing the financial market, today.

The Victorian era was characterized by the reconciliation of adherence to the Gold Standard with the safeguarding against financial instability, especially in moments of difficulties, as documented by notable writers Henry Thornton and Walter Bagehot. One major principle that characterized this era was that concerning 'Real Bills'. Goodheart (2010) asserted that in this respect 'Real' does not mean 'adjusted for expected inflation' as now, but it meant 'real' in the sense of being based on actualities. "Since 'real bills' were based on real output and trade, monetising them via Central Bank discounts could not create inflation, so the argument went, since output and money would rise hand in hand." (Goodheart, 2010). Similarly, since they were based on trade/output, they would become quasi-automatically self-financing when the goods were eventually sold.

The assumption of Real bills existed till the Great Depression when it collapsed, paving way for other objectives of the Central banks, where governments began to extensively control financial markets and put central banks in great check, thereby compromising their autonomy- almost leading to the extinction of the roles of central banks. The Great Depression and the subsequent disintegration of the Gold Standard represented a huge Central Bank failure. Their goal, their systems and their structure totally collapsed. Moreover, the Socialist perspective that would be under the control of government was another system that was being worked on to be adapted, a perspective which was given a massive support by the need to fund the intricacies and the demands of World War II.

This is not to say that Central Banks in these more subservient countries had no influence on the conduct of monetary policies. They were treated by the relevant Minister(s) as expert advisors, alongside the civil servants in the Ministry of Finance or Treasury as in the case of England. Central Banks, on the other hand, increased their knowledge of market behaviour. (Goodheart, 2010). This led to central banks being more stringent on their policies especially of lending and outsourcing capital into the financial market, thereby constraining private sector expansion and only satisfying the demands of customers that had big businesses. However, the system encouraged banks and financial institutions to take on more risks to maximise profits thereby extensively calling for the regulation of these banks by the Central Banks.

According to Goodheart (2010) the Central Banks during this era then had only three main functions; "advice on policy, administration of the system of controls and management of markets", (Goodheart, 2010). The latter role was what Central Banks did often as their first two roles were still being majorly controlled by the government via the Ministry of Finance. Today, central banks have put together all these roles and have secured some autonomy so they can function to stabilize financial markets in the countries where they operate, with one major function of such central banks serving as regulatory bodies for the other banks that surface in any country's economy.

2.1.2 The Central Bank of Ghana (The Bank of Ghana, BoG)

The Central Bank of Ghana traces its roots to the Bank of the Gold Coast, which was under the jurisdiction of the British government and was established on the 4th of March, 1957, as a mark of political independence for the country Ghana, under the Bank of Ghana Ordinance (No. 34) of

1957 passed by the British Parliament. The principal objective of the Bank of Ghana then was "to issue bank notes and coins: to keep and use reserves and to influence the credit situation with a view to maintaining monetary stability in Ghana and the external value of the Ghana pound; and to act as a banker and the financial adviser to the Government." Over the years, the Bank of Ghana has undergone several legislative changes. The Bank of Ghana Ordinance (No.34) of 1957 was replaced by the Bank of Ghana Act (1963), Act 182, which was then changed by the Bank of Ghana (Amendment Act), 1965, (Act 282). The Bank of Ghana Law, 1992 PNDCL 291 also subsequently replaced Acts 182 and 282. Currently, the Bank of Ghana operates under the Bank of Ghana Act, 2002 (Act 612) and now has its statutory obligations as follows;

i. Formulate and implement monetary policy aimed at achieving the objects of the Bank.
ii. Promote by monetary measure, the stabilisation of the value of the currency within and outside Ghana
iii. Institute measures which are likely to have a favourable effect on the balance of payments, the state of public finances and the general development of the national economy.
iv. Regulate, supervise and direct the banking and credit system and ensure the smooth operation of the financial sector.
v. Promote, regulate and supervise payment and settlement systems.
vi. Issue and redeem the currency notes and coins.
vii. Ensure effective maintenance and management of Ghana's external financial services.
viii. License, regulate, promote and supervise non-banking financial institutions.
ix. Act as a banker and financial adviser to the Government.

x. Promote and maintain relations with international banking and financial institutions and subject to the Constitution or any other relevant enactment, implement international monetary agreements to which Ghana is party; and

xi. Do all other things that are incidental or conducive to the efficient performance of its functions under this Act and any other enactment."

(Source: The Bank of Ghana Website, bog.gov.gh, Accessed December 26, 2018)

The Bank of Ghana, from all its functions, and under the current governorship of Dr. Ernest Addison and deputy governorship of Dr. Johnson P. Asiama and Dr. Maxwell Opoku-Afari, is chiefly a regulatory body for financial institutions in the country and this study seeks to assess its regulatory functions on financial institutions in the country.

The regulatory function of the Bank of Ghana is enshrined in Act 612 and 673 (2002) of the Ghanaian Constitution and the Bank of Ghana functions to make sure that;

i. "Depositors' funds are safe

ii. The solvency, good quality and assets, adequate liquidity and profitability of banks are maintained.

iii. Adherence to statutory and regulatory requirements is enforced.

iv. Fair competition exists among banks.

v. An efficient payment system is maintained." (Source: The Bank of Ghana, bog.gov.gh, Accessed December 26, 2017)

The Bank of Ghana then issues licensing and regulatory mechanisms for financial institutions that include banks (Class I and II Banks, representative offices of foreign banks and rural banks),

savings and loans or financial houses, non-bank financial institutions, credit reporting bureaus, micro-finance institutions and foreign exchange bureaus.

2.1.3 The Exchange Rate Regime in Ghana

After independence, Ghana's trading record started with currency switching from the British pound to the Cedi. The fixed exchange rate was typically applied before the 1980s and subsequently, Ghana decided to use the flexible exchange rate. Since its independence, these levels have been prone to the management of the different political administrations. The Bretton Wood Agreement established a fixed exchange rate system in Ghana between 1957 and 1982. The cedi was fixed by a decree on the British Pound until 1966, and on the American Dollar until 1982. Economic liberalization in 1983, and the exchange rate in this respect, took a long and slow course until the inter banking of the currencies in 1992. Ghana presently practices a management of the float currency regime, where demand and supply powers can determine the exchange rate but with some monetary authority intervention. This smooth and step-by-step release of currency and the development of Forex Bureaux began with a scheme of export rewards and import surcharges and then the Auctioning System and, lastly, registration of private forex bureau offices. The Cedi has thus been devalued to a significant extent, bringing its importance nearer to parallel market standards. The exchange-rate method culminated in the 1992 interbank exchange market working in conjunction with the forex bureaus. It was established that the central bank performed a main part in the industry, beginning with a system of export incentives and import surcharges, followed by an auction system and finally by the licensing of private foreign exchange bureaus. The Purchasing Power Parity (PPP) was subsequently implemented to the actual foreign exchange costs. Consequently, adjusting exchange rates on a weekly basis was essential in line with the country's major trading members ' relative growth prices. Based on the overvaluation of the

exchange rate, the Government of Ghana decided in December 1984 on a strategy of continuous foreign-exchange devaluations to substitute the annual adjustment. Thus, from 1984 until the interbank scheme was introduced in 1992, the cedi was specifically devalued by the state consecutively. Statistics indicate that, from € 2.75/US$ 1.00 in 1983, the cedi depreciated to € 390.00/US$ 1.00 in January 1992. The cedi have depreciated from the dollar since then. The strategy was rolled out in July 2007 after centuries of elevated inflation weakened the value of the cedi. This was then replaced by the Ghana cedi (GHs) at an internal exchange rate of 1 Ghana cedi to 10,000 cedis. During the period, cedi were traded at 9700 = 1.00 dollars, which means that the Ghana cedi exchange rate was from GHC.97 to 1.00 dollars. This was obtained by reducing the real cedi price by four numbers. This made Ghana's cedi more worth than the US dollar.

It is noted that the cedi has continuously downsized since the adoption of a flexible exchange rate system in 1983, with only brief exchange-rate stability. In 2015 cedi showed significant volatility, from 3.24 in January to 3.47 in February to 3.75 in March to 3.85 in April to 4.33 in June and 4.05 in August, respectively.

Simply put, the continued depreciation of the cedi is owing to comparatively elevated national unemployment that erodes domestic and external values.

This indicates that between 2013 and 2015, Ghana cedi cumulatively depreciated by over 50%. Consequently, the formal rate was GHc4 = US$ 1, rendering the currency overestimated (1/4=US$0.25).

An amount of macroeconomic factors have affected this volatility pattern. These include sustainability of inflation debt, interest rates, fiscal stabilization and internal disequilibrium. We

can see export rates rise in national currency in conditions of depreciation and therefore customers must settle more for the products they purchase.

Another frequently asked question with regard to the currency is whether and how Ghana's exchange rate fell short of its long-term equilibrium. This is crucial because keeping a misalignment of the currency or equilibrium generates a large welfare-cost condition. It gives the economic agents inaccurate messages and thus contributes to financial disturbance. In a study carried out by Amarquaye et al. (2016), it was found that the Ghanaian economy suffered the following since 1983, when the Ghana currency was overvalued to an official rate between 2.75 and 1 USD;

• A 30% decrease in per capita income

• Import volumes fell to one third of their previous level

• 52% decline in real export earnings and exports fell from 21% of GDP to 4%

• Fall in domestic savings rate from 12% to about 3%

• 80% decline in real wages and

• A fall in rate of investment from 14% to 2% of GDP

Two things to do in order to correct such situation or ensure alignment of the exchange rate with its long term equilibrium point are to;

1) Allow the exchange rate itself to normalize or come back to the equilibrium point or
2) Remove inconsistencies between macro-economic policies and exchange rates

Since none of these mechanisms easily settles the exchange rate, any effort aimed at keeping the exchange rate as close as possible to the long term equilibrium in the long. It has been proven by evidence in other countries that nominal devaluation can produce real depreciation and improve a country' position externally if it is accompanied by appropriate macro-economic policies (Sebastian, 2009).

2.2 Theoretical Review

To fully understand the relationship between the banking intervention and foreign exchange rates, below are used as underpinning theories.

2.2.1 Information Hypothesis

This hypothesis is proposed by Marquez (2002) and postulates that competition has a harmful effect on cost efficiency of banks. In accordance with the banking literature, most studies (Bikker and Haaf, 2002; Weill, 2004; Carbo et al., 2009) have discovered that the banking market has a structure of imperfect competition and this specific characteristic distinguishes it from the others. The theoretical literature in banking proposes that the imperfect market structure could be the consequence of the inability of banks to get adequate information about their clients before granting loans which results in adverse selection and moral hazard problems. Therefore, to reduce the effects of moral hazard and adverse selection, banks have to devise some mechanisms such as customer relationship building and screening (Leon, 2014; Fungacova, Pessarosi & Weill, 2013; Pruteanu-Podpiera, Weill & Schobert, 2013; Petersen & Rajan 1995; Mayer, 1988). These mechanisms, if well implemented, can lessen the issue of information asymmetry which leads to adverse selection and moral hazard problems.

Nonetheless, heightened competition may deteriorate the length of relationship the bank has established with the borrower and as a result increases costs to the bank. Therefore, increased

competition worsens cost efficiency. On the contrary, the studies on relationship banking (e.g. Petersen and Rajan 1995) indicate that banks that have more market power enjoy lower costs of monitoring and dealings with borrowers. Furthermore, market power allows banks to enjoy greater profits, which may create incentives to behave prudently, this behaviour leads to the selection of less risky activities with lower monitoring costs. By implication, banks with market power are under less pressure to increase the quality of banking services, as a result reducing the operational costs. In such situations, a direct relationship between cost efficiency and market power occurs. This is further supported by proponents of scale economies on bank efficiency (such as Martin 1992; Bertoletti and Poletti 1996) that the presence of scale economies in a market implies that the rise of the number of competitors leads to greater average costs for every incumbent bank.

2.2.2 The Economics of Exchange Rates

Taylor (2015) states that the management of the exchange rate was one of the most active and difficult fields of financial studies between the 1970s and 1990s. Academic stake in the effectiveness of external exchange markets can be explained by statements regarding the financial market price information content and its social efficiency consequences. The efficient market hypothesis from Taylor (2015) could easily be restricted to a common assumption that respondents in the foreign currency exchange industry (in an aggregate context) are reasonable and risk neutral. If the risk-neutral theory for effective economies maintains, the anticipated monetary benefit (anticipated shift in transaction rates) must be balanced by the opportunity cost of keeping money instead of the other monetary (interest price difference). But prices are also expected to completely reflect information available to money on an efficient speculative market and excess returns on speculation cannot be made by a dealer.

2.2.3 Foreign Exchange Market Efficiency

Early efficiency studies tested for the randomness of exchange rate changes for example Poole (1967). However, only if the nominal interest rate differential is identically equal to a constant, and expectations are rational, then (1) implies that a random walk in the exchange rate (with drift if the constant is non-zero). Generally, the random walk model is inconsistent with the uncovered interest rate parity condition. Taylor's (1995) Quoting demonstrates that another technique of market efficiency evaluation is a technique of assessing the profitability of filter regulations (Dooley & Jeffrey Shafer, 2016; Levich & Lee Thomas, 2015). A basic principle of the j-percent system includes the purchase of a currency whenever it j% higher than its latest station and the sale of it when it j% lower than its latest maximum. If the industry is effective and uncovered, the exchange price cost of such a policy should eliminate on average any gain. An amount of research show that easy filter controls are affordable, although it is not generally evident that the ideal filter line size could have been selected ex ante and that significant risk aspects are often present in that significant sub-period failures. Early efficiency experiments with easy discrete spot rate trials have therefore been supplanted with the fundamental linear regression analysis of exposed parity of concern. The tests were replaced by a sophisticated use of rational estimators that enables the sample to be used more finely than the contract time of Taylor (2015).

2.2.4 Channels of Influence

The huge foreign exchange intervention literature is focused on three major influential pathways: modelling, capital balance and market microstructure. Intervention by means of a sound stream can be efficient if it is considered to be a reliable indicator of monetary policy's potential standing (Guimarãeset al. 2014).

2.2.4.1 The Monetary Channel

Economists acknowledged at least as Hume Price Species Flow (the price-species stream system is a logical argument of David Hume against the Merkantilist (1700-1776), a country that should strive for a favourable equilibrium between money growth and currency change (or currency equilibrium of foreign currencies). The reasoning looks at the impact in a gold standard of global operations. He asserted that if a nation had a good equilibrium of trade with a gold standard, the quantity of gold in that nation exceeded that of imports would spill into that nation. On the other hand, if the nation had adverse trade equilibrium, money would come from the nation as much as the import price increases the export price). Although international economists may not agree on the time frame and relative relevance of money in currency models, only a few would oppose the inclusion of money among the exchange rate characteristics, Taylor (2015) for theoretical reasons.

2.2.4.2 The Exchange Rate Channel

This is yet another currency-based, GDP-intensive platform, sometimes modeled under the IS-LM model, through swap rate effect, the currency distribution channels (Akila, 2005). The fundamental concept is to lower short-term nominal interest rates and therefore also lower the actual short-term interest rates when the bank raises money supply. Lower actual interest levels indicate a lower appeal to local currencies than overseas investments which lead to lower supply for that exchange. Due to the resulting dollar depreciation, internal growth is less than external growth and net exports are growing Romer (2006). This can be especially significant route of communication for tiny accessible countries with versatile exchange rates. The reason that certain small, open economies choose to adopt fixed exchange levels can also be understood by this equation: if the exchange level cannot alter, national interest rates have to be equivalent to the global interest rate, Weerapana (2005).

2.2.4.3 The Portfolio-Adjustment Channel

The closed-economy, portfolio-equilibrium property supply systems, first created by Tobin (1969), have been expanded to the open-economy situation. In an asset request model, risk-averse property owners, who are faced with unclear levels of exchange of an asset set, diversify their asset portfolios rather than hold only the asset with the lowest yield price presently in place. Taylor (2015) offers a strong incentive for property owners to diversify their portfolios across currencies when exclusive danger and political risk are brought into the model. Government bonds are the property pertinent to the fund equilibrium model.

2.2.4.4 Signaling Channel

Market respondents may modify their perceptions of exchange rates by signaling a shift in potential monetary policy by perception, under signage or the anticipation channels, of Taylor (2015), Guimarães et al. (2004) and Ishii et al. (2016). In either path, it can affect the exchange rate level. The impact arises, for example, from the purchases by the central bank of foreign currency, not as the action shifts the fundamentally supply and demand terms on the economy, but as a result of continued lower currency stress, a contradiction of financial strategy (e.g. greater exchange prices) in advance. As action constitutes a strategy tool, strategy measures that warrant action can be taken by the central bank to preserve its legitimacy and prevent economic failures. The finest instance is that if its national currency stays under downward stress the central bank has to push narrow monetary policies.

2.2.4.5 Portfolio Balance Channel

Bond assets denominated in fund equilibrium channels, domestic and international currencies are incomplete supplements (the "riskier" debt therefore pays a threat price) and action can be efficient by changing its currency structure. The microstructure strategy emphasizes the impacts on the

overseas currency sector of order stream, industry members, asymmetry of data and value identification. Central bank trades are supposed to send data to industry, modifying currency demands and triggering a flurry of foreign currency purchases that are partly enhanced by trend-setting Lyons traders, (2001).

2.2.5 Market Microstructure Intervention

This branch of intervention examines what happens when purchasing or selling orders are not always balanced during the selected period. It focuses on cost shift in order stream influences. The action or command of the central bank can have transient and continuous impacts in the framework of this action pattern. The literature on micro structuring addresses the issue of how asymmetrical data affect rates, which may lead to distinct inflation amongst business traders. As Dominguez (2003) postulates, educated traders can readily conceal their businesses during heavy-duty trading. Dominguez (2003) nevertheless showed that the response of exchange rates and yields to interference media is probable to alter based on how the weather affects traders ' predictions of potential monetary movement. Once intervention information is completely disclosed (and all confusion is fixed), volatility (and volumes) are expected to return to original rates. On the other hand, the financial concept indicates the three feasible routes above through which interference by the stock sector could change currency prices. The currency stream enables action by modifying the comparative development prices in money stocks of countries to affect exchange rates. Hurnpage (2016) argues that little debate exists on the power of such an action; indeed, by changing their money stock relatively, central banks can retain set exchange rates. The level to which these systems work in reality, however, stays accessible to the public as empirical proof on the efficacy and even its routes remain.

2.2.5.1 Official Intervention

Official interference in foreign exchange economies happens when governments purchase or sell international exchange in attempt to influence the return price, usually against their own currencies. Sterilized intervention is carried out when authorities take action at the same time or at a very brief lag to compensate or "sterilize" the impacts on the national financial basis of the consequent shift in the ownership of formal overseas assets. Some literary discussions have discussed the impacts of the intervention's exchange rate – particularly sterilized intervention.

2.3 Empirical Review

2.3.1 Exchange Stability and Central Banks Intervention

Intervention is a critical strategy instrument that key funds are using to address short-term currency defaults and to control unnecessary short-term swap volatility and other disturbing business circumstances. However, if badly embraced, it could jeopardize the credibility of companies and the limited overseas exchange reserves. Without quick modifications the exchange rate represents the stabilization of the exchange rate. This also happens if within a given threshold it fluctuates. For its stabilization, exchange rate is based on: foreign exchange supply and request; in theory the form of exchange rate scheme; adequacy and adequacy of supplementary financial and fiscal policy. The stabilization of the exchange rate shows that level changes between periods are low and there is a tiny discrepancy between them (Olisadebe, 2015). In order to monitor the transaction level and to ensure more flexibility, the central bank officials interfere in the foreign exchange market. The Exchange Stabilization Fund established in the 1930s is the only cause of action. The Fund shall be enforced by enabling the supervisory power to operate in the foreign exchange market as an autonomous trader. In order to comply with the supply and requirement timetable as

well as exchange rate, the supervisory agency functions as a broker and vendor in the exchange rate market.

Many emerging countries act through their own currencies in the exchange-rate economy. This technique is related to as "dread of flying," as proposed by Calvo and Reinhart (2000). Developed countries also have the dread of flying. Emerging countries are afraid to float when their currencies are below the goal, and are best known as ' depreciation fears. '

Two key theoretical instruments for foreign-exchange intervention are the portfolio equilibrium strategy and signal to market players in the potential monetary policy of the central bank. The sterilized action occurs when an associated sale or buy of national government debt offsets the acquisition or exchange of foreign currency in order to avoid the national monetary demand consequences (Calvo & Reinhart 2000). Clearly unsterilized action is more probable to influence exchange rates and is tantamount to monetary policy. In the case of an agent with their terminal riches consisting of national and foreign currencies and bonding, the fund equilibrium scheme is generally regarded as optimizing yield differences. (Calvo & Reinhart 2000). Relative national and foreign bond amounts will be modified by sterilized action. Policymakers do not only fear how much the exchange rate level may deviate from the balance, but also how fast it is. Intervention often seeks to speed down the pace of shift without stopping pattern shifts, a strategy recognized as wind pulling (Calvo & Reinhart 2000). While this type of interference usually happens when the exchange rate level moves away from balance, it can sometimes happen when the exchange rate frequency moves back to balance, yet "too fast." Slowing the exchange rate changes can prevent the behavior of the herd by serving as a disruptor. This sort of action can help the growth of the foreign exchange market and increase the accessibility of hedge tools by plunging in uncertainty (Calvo & Reinhart 2000).

2.3.2 Effect of Central Bank Interventions

In the most developing countries there is no well-defined guidelines for regulating currency measures in the currency market that contrast advanced economies which, in the event of action, obey the values of the International Monetary Fund (IMF). Interventions by the Central Bank on the exchange price sector have their effects and orientation on how procedures affect the factors of volatility (Mark & Sul, 2001). The action is primarily influenced by business requirements and speculative behavior. The two ways in which the measures can decrease return volatility are to remove ambiguity about potential financial strategy, and secondly to decrease the potential for a beneficial impact on the bandwagon and therefore to decrease exchange-rate volatility. CBN interference is widely thought to happen when speculative powers dominate. Speculators do not wish to bring rapid intervention because of the belief. The volatility of exchange rates is probable to raise if the action increases concerns on currency policy in regards to presence, extent and duration of interference of the carriers. In the existence of interference, this could contribute to unexpected and more unstable exchange rates. In other words, uncertainty regarding the involvement of currency authorities is possibly a major cause of volatility (Mark & Sul, 2001). This may lead to increased volatility in the exchange rate. Uncertainty over the action strategy may therefore contribute to the volatility of the exchange rate. Volatility, for instance, would rise if business providers rely on the financial authority as being unable to avoid economic powers from controlling interest price movements. Indecision on action can therefore lead to uncertainty, causing cost shifts and the volatility of exchange rates to be higher than in any such action. In addition, the impacts differ over moment owing to modifications in action strategy legitimacy. This calls for empirical evidence to examine the exchange rate impacts of action and the capacity of action to reach secure currency prices.

2.3.3 Exchange Volatility and Economic growth – A review

Meese and Rogoff (1983), using designs which depend on economically significant factors, predict exchange rates in their seminal job, have for a lengthy time been an interested problem in global literature, although empirical research is still unclear. Even if some surveys (Mark & Sul, 2001) have shown that currencies co-exist with macroeconomic fundamentals, contemporary literature in global funding states that currencies are volatile, particularly on short horizons (Corte, Sarno & Tsiakas, 2009). Studies in developing countries have concluded theoretically that unexpected currency changes substantially control the overall supply through exports, imports and request for local currency, according to Kandil and Mirzaie's (2008) disintegration of exchange rate changes into expected and unexpected motions. Nevertheless, unforeseen changes in currencies influence overall production via the costs of imports. Instead it has a restricted impact on production development and prices due to expected increases in the exchange rate on the distribution chain. It has been shown that the real exchange rate of emerging nations is unstable in terms of elevated vulnerability to crises, both real and nominal, because of changes to the sensitivity to impacts of actual exchange rates (Hausmann, Panizza and Rigobon 2005). This is the most recent example of this. As regards the impact of volatility in exchange rates on development in a sample of 95 developing countries, Dollar (1992) has established a adverse link between development and exchange rate volatility.

In a sample of 22 developing countries, Kandil (2004) notes the impacts of changes in swap prices on real output development and cost development. They contend that depending on the level of openness, volatility of exchange rates and depreciation, financial efficiency is especially damaged through operating development and inflation. Over the long term, expected changes in the exchange rates will considerably boost and reduce inflation and growth. Alagidede and Ibrahim

(2007) have demonstrated that short-term output is the principal cause of exchange rate changes in Ghana by manipulating methods from time-series literature. In the long term, however, the volatility of exchange rates has a significant impact on development in government spending, the shortage of cash, trading shock conditions, FDI transfers and fluctuations of national output. Holland et al. (2011) examined the effect on long-term financial development for developed and developing countries from 1970 to 2009 of true currency volatility, discussing the fact that high currency volatility has a positive influence on true GDP growth, as small exchange-rate volatility has a negative effect on true GDP growth. Adjustment of exchange rate volatility in a system with exchange rate and currency errors however makes factors irrelevant indicating that the stabilization of exchange rates is more important in stimulating long-term development than the misalignment of exchange rates. Gadanecz and Mehrotra's (2013) however revealed, in their latest research, non-linearity between real exchange rate volatility and output volatility in the emerging markets, while discovering no important connection between exchange rate vulnerability and long-term economic development. Their finding suggests that real currency volatility helps to absorb the pressure and reduce the volatility of outputs, but too much exchange rate volatility also reduces the volatility of output.

It describes that keeping an adequate and consistent volatility in exchange rates allows nations to investigate their development and growth capabilities. Excess volatility in currency was recognized by the creation of indecision, competitiveness, a reduction in efficiency and profit and an increase in national rates to lower the level of financial development. This has obvious social consequences and should be a political issue. Real changes in the exchange rate must take place with the fundamental alignment of the exchange rate. This in turn ensures internal stabilization and internal competitiveness.

Most papers on this subject analyse the efficacy of measures either in light of their impact on the place stage or their impact on exchange rate return volatility. The theoretical and empirical research has since the advent of the floating exchange-rate scheme has been focused on central bank action and its exchange-rate effect. A large cross chapter of developing business countries has been covered by only a few empirical research of external currency interference. Most trials suggested that the action did not have a statistically permanently-influent effect on the exchange rate (Aguilar and Nydahi, 2008) and (Neely, 2001). Many issues on the efficacy of foreign exchange intervention were discussed directly to the central banks. In this context, Dominguez and Frankel (2013) have provided some evidence to support this.

Empirical studies, and statements by central banks, propose that central banks intervene in foreign exchange markets to slow or correct excessive tendencies in the exchange rate, i.e. they "lean against the wind", and to calm disorderly markets Lewis (2005b) and (Baillie and Osterberg, 2017). Neely (2001), in his study "The Practice of Central Bank Intervention, looking under the Hood" suggests the factors that continue to drive the decision to intervene. He offers evidence from 22 responses to a survey on intervention practices sent to monetary authorities in order to explore intervention mechanics and summaries the factors that determine the efficacy as instruments, counterparties, timing and amounts as well as related issues like secret intervention, motivation, and the apparent efficacy of such transactions.

His inquiry into the interference procedures of monetary authorities revealed that some monetary authorities were intervening in the (mostly spot) economies of foreign exchange. The willingness to monitor or right short-term misalignments often leads to interference while the magnitude of the action is often dependent on business response to original transactions. Although interference is typically carried out during company hours, most financial officials will also intervene outside

these hours, if required and while there is widespread consensus that interference has an impact on interest prices, there is considerable debate as to how this impact affects its whole potential. Hisali, (2008) surveys the effectiveness of the action by the Central Bank to shape the reality that action generally focuses not on the exchange rate but on the smooth movement. In order to achieve peak assessments of potential variables for changing from one Exchange Rate State to another, the author uses conditional probabilities produced by a homogeneous Markov two-state system. Can the central bank action be among those variables? In other terms, if for some purpose the place swap price system is characterized by big and disruptive motions, how likely will main government action return it to a more peaceful system? On the other hand, what would happen if the bank intervened for some reason when the currency was in a quiet regime? As a result, procedures have also been discovered to cause an interference-incoherent exchange rate movement. Hung (1997) claims that if central banks wish to reverse patterns in exchange rates used by traders of the noise to purchase or distribute signal, they should take action to increase exchange rate volatility. The writer concludes that the measures in mid-1980 continued to reduce volatility. The measures made following the Louvre meeting were designed to strengthen the dollar. Interventions driven primarily by the objective of stabilizing prices in the post-Louvre agreement, instead, have discovered that exchanges have increased.

The Swedish Central Bank's effect on rate and volatility for the Krona / USA are analysed by Aguilar and Nydahl (2000). The currency exchange rate (SEK / USD) and the Krona / German mark (SEK / DEM). The writers have established a multivariate GARCH structure that models the effect of operations on the levels of SEK / USD and SEK / DEM and their relative volatility within a coherent structure. The results gained from the evaluation of this system and the findings of additional drills using alternatives that imply volatility to track the effects of key fund measures

on expected exchange-rate volatility show only a rather small impact on exchange-rate volatility. In estimating the template for certain sub-periods, intervention was discovered in 1995 to tend to dampen (raise) the volatility of the SEK / USD. Furthermore, poor empirical evidence is discovered for the year 1994 to show the destabilizing effects of measures on SEK / DEM spot price volatility.

Domac and Mendoza (2002) argue that central bank foreign currency transactions (but not acquisitions) were extremely efficient in affecting exchange rates and decreasing volatility in the two nations in their empirical analysis of Mexico and Turkey interventions. The effectiveness of interference, particularly in developing countries, is increasingly pessimistic (Schwartz, 2000). In emerging nations, certain writers have asserted that the action is more efficient with respect to the multitude of laws that interfere with business size, the Central Bank's data benefit and the reality that action amounts are greater compared with overall business quantities. Furthermore, in some nations, key companies are the principal source of international monetary exchanges since the state is one of the primary beneficiaries of external cash transfers (Kxiljenko, Karacadag & Guimaraes, 2003). Because of these distinctions, it has been hard to agree on modalities and the efficiency of the action between advanced and emerging nations (Rigobon, 2002). This is certainly partly linked to the disparate goals, strategies and processes in which distinct key institutions operate. However, these difficulties continue to be a significant political goal for central banks, action to reduce currency volatility caused by momentary crises. Rigobon (2002) describes the incorrectly-signed exchange rate impact of central bank measures, which appear to improve their short-term volatility. Our findings also indicate generally that GARCH's traditional estimates appear to underestimate volatility impacts (Sarno & Taylor, 2001). This involves the long-term unsustainable action that pushes against the wind. The currency crisis in Mexico in 1994, Thailand in 1997, and Brazil in

1999 emphasize action boundaries where the main bank's action operations nearly drained the foreign-exchange resources of those nations, because they were intervening. The BIS supported study into the impacts of overseas currency activities in Latin America in 2012, according to Miyajima and Montoro (2013), with involved key companies from Brazil, Chile, Colombia, Mexico and Peru. The project's aim was to know the exchange rate effect of these key banks ' foreign currency measures. The inputs to the conference have resulted in several important results. Moreno et al (2013) concluded, though the effect could be transitory, that overseas currency action can influence exchange rates and volatility. In Echavararía et al (2013), the exchange rate in Colombia reacts differently in accordance with preannounced regulations to discretionary action and interference. In Peru, Lahura and Vega (2013) note that exchange sales by the main bank have a greater effect than acquisitions on the exchange rate. Kohlscheen (2013) claims that overseas currency interference in Brazil decreases the exchange rate earnings effect of order transfers. In Chile interventions had a significant (but temporary) effect on inflation expectancies according to Pincheira (2013), but no longer. In the cases of Mexico, García-Verdú and Zerecero (2013) discover that the effect on market liquidity and circumstances of the foreign exchange auctions is dependent on the auction process. Menkhoff (2012) and Ostry et al (2012) indicate that the intervention of central banks sometimes has a deliberate effect on interest price shift, while in some instances volatility can be reduced. Responding to monetary policies tends to be more efficient (Amato et al (2005), and Kamil (2008)). Thus the results vary and may depend on the type of intervention and instrument (Miyajima & Montoro, 2013).

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter highlights the research methodology adopted for the current study. It discusses the statistical methods and necessary diagnostic tests within time series analysis to analyze the effect of Central Bank intervention on Exchange Rate.

3.1 Data Source and Scope

This study uses secondary data mainly drawn from the Bank of Ghana website, Refinitiv (formerly Reuters) trading platform and Société Générale daily rates. The study covers a time period of 4 years (2014-2018) which captures period in which the Bank of Ghana initiated new rules to augment and support the free fall of the study.

3.2 Data Analysis Tool

To interpret and analyze the data in relation to the variables under study, Descriptive Statistics, Unit root test that is the Augmented Dicky Fuller Test was run. Models for the study were the Stock Watson (DOLS) test and the Granger Causality test. Eviews10 was used in the data analysis.

3.3 Model Specification

The main aim of this thesis is to assess the effect of Central Bank intervention on Exchange rate. However, in order to prevent spurious regression, the time series properties of the study are determined before the estimation procedure is chosen.

The ADF Unit root test involves estimating regression (1) for each series and then testing for the null hypothesis of a unit root H_0: $\alpha=0$, versus the alternative of a stationary process H_1:$\alpha<0$. The test is based on the typical t-ratio for α-fuller (1976). The t-statistic does not follow the t-

distribution under the null; thus, critical values are simulated for each regression specification and sample size Mackinnon (1996)

$$\Delta y_t = \alpha y_{t-1} + x_t' \delta + \sum_{p=1}^{p} \Delta y_{t-p} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1$$

Where x_t is the exogeneous regressors that may include a constant term only, a constant and a trend or none.

Δy_{t-p} terms included to correct for higher-order correlations.

The PP unit root test involves estimating a non-augmented version of regression (1); i.e., without the lagged difference terms. PP unit root test uses a non-parametric method to control for serial correlation under the null hypothesis. H0 and H1 are the same as in the ADF test; however, PP unit root test is based on its own statistic and corresponding distribution –Phillips (1987), Phillips and Perron (1988).

The KPSS test, in contrast to ADF and PP tests, assumes that the series is stationary under the null. KPSS tests the OLS residuals obtained from equation (2) –where xt is defined as in equation (2) based on a LM statistic.

$$y_{.t} = x_t' \delta + \varepsilon_t$$

Provided all series are I(1) –as they are in this case–, then DOLS procedure is employed to estimate the single cointegrating vector that characterizes the long-run relationship among the variables

Stock-Watson DOLS model is specified as follows:

$$Y_t = \beta_0 + \beta X + \sum_{j=-q}^{p} d_j \Delta X_{t-j} + u_t$$

$$Y_t = \beta_0 + \beta X + \sum_{j=-q}^{p} d_j \Delta X_{t-j} + u_t$$

Yt dependent variable (Inter bank Exchange Rate)

X matrix of explanatory variables (Central Bank Intervention)

β cointegrating vector; i.e., represent the long-run cumulative multipliers or, alternatively, the long-run effect of a change in X on Y

p lag length

q lead length

Lag and lead terms included in DOLS regression have the purpose of making its stochastic error term independent of all past innovations in stochastic regressors. Finally, unit root tests are performed on the residuals of the estimated DOLS regression, in order to test whether it is a spurious regression. "In the unit-root literature, a regression is technically called a spurious regression when its stochastic error is unit-root nonstationary." (Choi et. al., 2008) Unit root tests and DOLS estimation were performed using EViews 10.

3.3.1 Granger Causality test

Granger (1969) proposed a time series data based approach in order to determine causality. In the Granger-sense x is a cause of y, if it is useful in forecasting y. In this study, useful means that x is able to increase the accuracy of the prediction of y with respect to a forecast, considering only past values of y. the empirical results presented in this research are calculated within a simple Granger-

causality test in order to test whether Central bank Intervention granger cause exchange rate and vice versa.

CHAPTER FOUR

PRESENTATION OF RESULTS

4.1 Overview

The findings of the analysis on the effects of the Central Bank Intervention is presented in this chapter. The analysis was carried out with Eviews10. Both descriptive and econometric tests were run on the secondary data obtained from the Bank of Ghana.

The Descriptive Statistics used in the analysis were the mean, Standard Deviation, Skewness, Kurtosis, the minimum and maximum values of the variables under study.

From table 1 below, the mean of the interbank exchange rate over the period was 3.892 USD, with a standard deviation of .621, a maximum value of 4.82 and a minimum value of 2.32. The skewness of the data was -702 with a kurtosis of -174. In terms of the intervention from the Central Bank, the minimum and maximum values were 500,000 and 214,500,000 respectively. The mean value of the intervention from the analysis was 22,424,725.544 USD, this means that over the period of the study, the Central bank pumps on average 22,424,725 dollars to sustain the free fall of the local currency, with a deviation from the mean being 50,164,360.770.

Table 4.1: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
INTERBANK_RATE	60	2.32	4.82	3.892	.6214	-.702	-.174
INTERVENTION_USD	60	500000.00	214500000.00	22424725.544	50164360.770	2.971	8.069

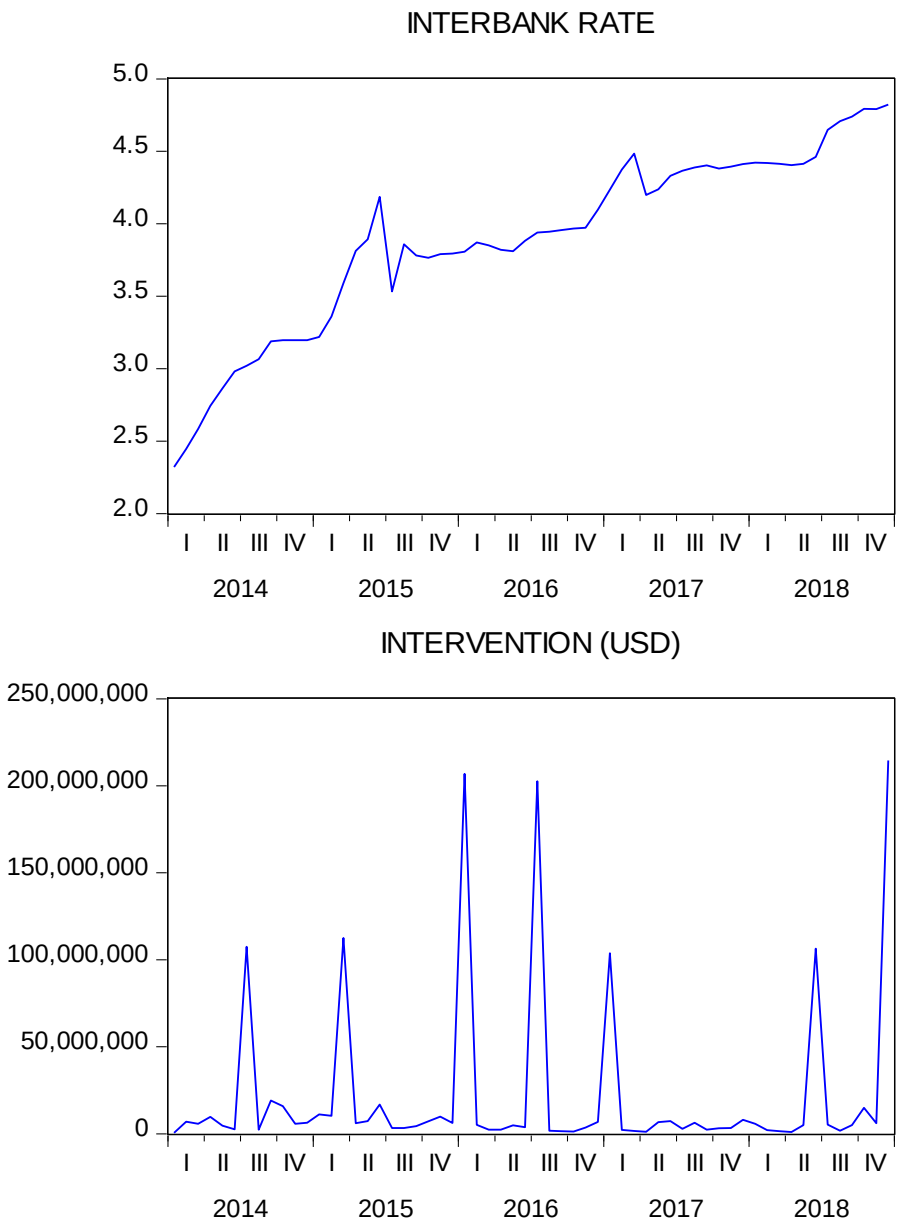

Figure 4.1: Graph of Variables.

Source: Researcher

4.2 Diagnostic Test

The first assumption is that the series are stationary. This implies that the series are normally distributed and the mean and variance are constant over a long period of time. To test the stationarity, the Augmented Dickey Fuller was run.

Table 4.2: Augmented Dickey Fuller Test

		t-statistic	Prob
Augmented Dickey Fuller test Statistic		-2.746	0.227
Test Critical Values	1% level	-4.356	
	5% level	-3.595	
	10% level	-3.233	

Source: Researcher

From the table above, the ADF statistics indicates the result is -2.746 indicating that the time series is stationary.

Table 4.3: Correlations

		INTERBANK_RATE	INTERVENTION_USD
INTERBANK_RATE	Pearson Correlation	1	.073
	Sig. (2-tailed)		.581
	N	60	60

The correlation analysis indicates that there exist a positive correlation between interbank rate and Central Bank Intervention with a correlation coeffiecient of .073

4.2.1 Multiple Regression Analysis

Table 4.4: Summary of Model

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.073[a]	0.005	-0.012	0.62507

a. Predictors: (Constant), INTERVENTION_USD

A regression analysis was run to establish the effect of the central bank intervention on the exchange rate. The coefficient of the dependent variable at zero level of the explanatory variable was .073 indicating a positive relationship exist between central bank intervention and the interbank exchange rate despite the fact that the constant has no significant meaning in the model than reflecting the value of interbank exchange rate when central bank intervention is held constant. The R2 which is the determinant of the coefficient measures the proportion of the variance in the dependent variable that can be explained by the independent variable. The coefficient of 0.005 explains only 5 percent of the variability of the dependent variable.

Table 4.5: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.12	1	0.12	0.308	.581[b]
	Residual	22.661	58	0.391		
	Total	22.782	59			

a. Dependent Variable: INTERBANK_RATE
b. Predictors: (Constant), INTERVENTION_USD

The F-ratio in the ANOVA table indicates whether the overall regression model is a good fit for the data. The table indicates that the independent variables do not statistically justify the model to be a good fit (1, 58) =0.308, p>.005.

Table 4.6: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.872	0.089		43.746	0
	INTERVENTION_USD	9.01E-10	0	0.073	0.555	0.581

a. Dependent Variable: INTERBANK_RATE

4.2.2 Johansen Co-integration test

According to Odundipe and Amaghionyeodiwe (2013) the co-integration test is run to check for long run relationship between the dependent and the independent variables, using the Eview10 software package, the test was carried out. Given the generated results, co-integration is rejected at the 5 percent level. Hence it is concluded that a long run relationship exist.

Table 4.7: Co-integration

unrestricted cointegration rank test (trace)				
hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 critical value	Prob**
None*	0.396	34.021	15.494	0
Atmost 1*	0.077	4.69	3.841	0.0303

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

*denotes rejection of the hypothesis at the 0.05 level

**Mackinnon-Haug-Michelis (1999) p-values

unrestricted cointegration rank test (maximum Eigenvalue)				
hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 critical value	Prob**
None*	0.396	29.33	14.264	0.001
Atmost 1*	0.077	4.69	3.841	0.0303

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

*denotes rejection of the hypothesis at the 0.05 level

**Mackinnon-Haug-Michelis (1999) p-values

4.2.3 Granger Causality Test

The main of the study was to establish the effect of central bank intervention on the exchange rate. The Null Hypothesis of the Granger Causality states that Intervention does not Granger Cause Interbank rate. The rule of thumb indicates that the probability of the F-statistics must be less than 5 percent to show causal relationship. The probabilities of the causal variables of intervention was 0.712 and interbank rate was 0.111. Per the results obtained, the null hypothesis is rejected and a conclusion drawn that no relationship exists between central bank intervention and the exchange rate.

Table 4.8: Granger Causality Tests

Null Hypothesis	obs	F-Statistic	Prob
Intervention does not granger cause interbank rate	58	0.712	0.495
Interbank rate does not Granger cause Intervention		0.111	0.894

Discussion of Results

The Descriptive Statistics used in the analysis were the mean, Standard Deviation, Skewness, Kurtosis, the minimum and maximum values of the variables under study.

From table 1 below, the mean of the interbank exchange rate over the period was 3.892 USD, with a standard deviation of .621, a maximum value of 4.82 and a minimum value of 2.32. The skewness of the data was -702 with a kurtosis of -174. In terms of the intervention from the Central Bank, the minimum and maximum values were 500000 and 214500000 respectively. The mean value of the intervention from the analysis was 22424725.544 USD, this means that over the period of the

study, the Central bank pumps on average 22424725 dollars to sustain the free fall of the local currency, with a deviation from the mean being 50164360.770.

The correlation analysis indicates that there exists a positive correlation between interbank rate and Central Bank Intervention with a correlation coeffiecient of .073. The results from Mongkol (2011) backed this finding. He used a descriptive study to examine the efficacy of Thailand's intervention. He found that the intervention of the Central Bank is not effective and weak because the monetary regulator assumes that the currency is determined via the market mechanism.

A regression analysis was run to establish the effect of the central bank intervention on the exchange rate. The coefficient of the dependent variable at zero level of the explanatory variable was .073 indicating a positive relationship exist between central bank intervention and the inter bank exchange rate despite the fact that the constant has no significant meaning in the model than reflecting the value of interbank exchange rate when central bank intervention is held constant. The R^2 which is the determinant of the coeffiecient measures the proportion of the variance in the dependent variable that can be explained by the independent variable. The coefficient of 0.005 explains only 0.5 percent of the variability of the dependent variable. The findings of the research is supported by the findings of Simwaka and Mkwandawire (2006). They carried out a research with the help of GARCH (1 1) model and found that official intervention in the FEM by Reserve Bank of Malawi (RBM) had an impact on Kwacha, thou very negligible, but, still significant in reducing the undesired volatility of their currency. They concluded that net sales of dollars by RBM depreciated rather than appreciate the value of Kwacha. Lahura and Marco (2013) investigated the relationship between undisclosed intra-daily data; inter-bank exchange rate and the amount of dollar purchased and sold using structural vector autoregressive (VAR) Model. They found that foreign exchange intervention in Peru was significant and effective in influencing

exchange rate in the right direction, but sales interventions were found to be more effective than purchase interventions.

The findings of the research is supported by the findings of Simwaka and Mkwandawire (2006). Using the GARCH (1 1) model, they concluded that the intervention of the Malawian Central Bank had an effect on Kwacha even though the effect is insignificant in controlling the free fall of the local currency. Their findings concluded that the Net sale of dollars rather depreciated the Kwacha instead of appreciating it. The interbank exchange rate, and the quantity of the dollar bought and sold by using the spatial autoregressive matrix (VAR) model, were studied by Lahura and Marco (2013). They discovered that interference in the foreign currency in Peru was significant and efficient in affecting exchange rates in the right direction but sales interventions were more efficient than buying interventions.

The impact of foreign-exchange measures on exchange rate expectancy in chosen developing markets (Brazil, Peru, Korea and Malaysia) was evaluated empirically by Miyajima and Montoro (2013). The estimates of the fixed effect panel model using monthly information from June 2004 to August 2012 stated that sterilized Central Bank external interference had a very poor systematic effect in tune with the central bank's expected objective on the short-term nominal exchange rate requirements.

Mbarek et al. (2011) examined the impact that the Central Bank's exchange rate action in Tunisia has had on regular data between April 1999-June 2006 using the simultaneous system model and the VAR model. The findings indicated that interventions had a significant effect on the return yield and a strong inclination to continue fluctuating the exchange rate. For a sampled period of January 1999-31 March 2011, Chen et al. (2011) used the Signal Channel for the purpose of

investigating the link between currency intervention and exchange rate in Japan. They found that the interventions shaped perceptions of the exchange rate.

According to Odundipe and Amaghionyeodiwe (2013) the co-integration test is run to check for long run relationship between the dependent and the independent variables, using the Eviews software package, the test was carried out. Given the generated results, co-integration is rejected at the 5 percent level. Hence it is concluded that a long run relationship exist. The findings are not supported by Omojolaibi and Gbadebo (2014). They studied the impact of FEM interference on naira exchange price stabilization. The ARDL technique was applied to four annual time series from 1970 to 2006. The figures include the provision of cash, the total international assets, the total overseas private inflow, the actual total domestic product and structural break. The findings confirmed that the balance between central bank interference in the FEM and monetary production factors has been maintained for a long time. The CBN intervention is therefore considered non-sterilized. Although this research is one of Nigeria's oldest empirical works (second to Adebiyi, 2007), the scholars neglected to incorporate the varying exchange rates that is primarily the goal of foreign foreign exchange intervention. In fact, when it comes to estimating an equation with the large amount of regressors, the technique they used (i.e. ARDL) is mocked for having poor degree of freedom. ARDL can therefore not demonstrate more than one equilibrium in a model (Mehdi, 2011).

The main of the study was to establish the effect of central bank intervention on the exchange rate. The Null Hypothesis of the Granger Causality states that Intervention does not Granger Cause Interbank rate. The rule of thumb indicates that the probability of the F-statistics must be less than 5 percent to show causal relationship. The probabilities of the causal variables of intervention was

0.712 and interbank rate was 0.111. per the results obtained, the null hypothesis is rejected and a conclusion drawn that no relationship exists between central bank intervention and the exchange rate.

The findings are in sharp contrast to the findings of Baillie and Osterberg (1997a) who found out that, between 1985 and 1990, spot exchange rate volatility Granger causes intervention in the yen/dollar market, while the forward premium's conditional volatility does not. They conclude that intervention is motivated by increases in spot rather than forward market volatility.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND MANAGERIAL IMPLICATIONS

5.1 Overview

This chapter summarizes the thesis, draw conclusions and make recommendations based on the findings for future research as well as for policy makers.

As a currency strategy, Ghana aims for price stabilization, amongst others, and this includes maintaining growth within the goal range, as the government's annual growth objective of 8%+/-2% highlights. As a net importer, import costs could make the attainment of the inflation goal more difficult. Thus, nations with a higher price pass (higher imports) may be more susceptible to exchange rate fluctuations (Ebeke & Azangue, 2015).

The volatility of the exchange rate, identified as continuing exchange rate changes, has dominated latest global financial literature due to their impact on developing countries. Concerns about currency fluctuations are becoming increasingly prominent in both advanced and emerging countries, including Ghana because they affect imports and exports directly (Alagidede & Ibrahim, 2017).

The main aim of the study is to assess the impact of the Central Bank intervention on Exchange rate in Ghana. In line with the above aim, the following are the specific objectives of the study.

1. To establish a relationship between the Central Bank's intervention and the movement of the exchange rate on the interbank market in Ghana.
2. To identify the factors which contributes to the exchange rate fluctuations on the interbank market in Ghana.

This study used secondary data mainly drawn from the Bank of Ghana Data base. The study covers a time period of 4 years (2014-2018) which captures period in which the Bank of Ghana initiated new rules to augment and support the free fall of the study. To interpret and analyze the data in relation to the variables under study, Descriptive Statistics, Unit root test such as the Augmented Dicky Fuller Test was run. Models for the study were the Stock Watson (DOLS) test and the Granger Causality test. Eviews10 was used in the data analysis.

The Descriptive Statistics used in the analysis were the mean, Standard Deviation, Skewness, Kurtosis, the minimum and maximum values of the variables under study.

From the analysis, the mean of the interbank exchange rate over the period was 3.892 USD, with a standard deviation of .621, a maximum value of 4.82 and a minimum value of 2.32. The skewness of the data was -702 with a kurtosis of -174. In terms of the intervention from the Central Bank, the minimum and maximum values were 500,000 and 214,500,000 respectively. The mean value of the intervention from the analysis was 22,424,725.544 USD, this means that over the period of the study, the Central bank pumps on average 22,424,725 dollars to sustain the free fall of the local currency, with a deviation from the mean being 50,164,360.770.

The augmented Dickey Fuller Test was run to determine the stationarity of the data, the results indicate that the data was stationary.

The correlation analysis indicates that there exists a positive correlation between interbank rate and Central Bank Intervention with a correlation coefficient of .073.

A regression analysis was run to establish the effect of the central bank intervention on the exchange rate. The coefficient of the dependent variable at zero level of the explanatory variable was .073 indicating a positive relationship exist between central bank intervention and the interbank exchange rate despite the fact that the constant has no significant meaning in the model

than reflecting the value of interbank exchange rate when central bank intervention is held constant. The R2 which is the determinant of the coefficient measures the proportion of the variance in the dependent variable that can be explained by the independent variable. The coefficient of 0.005 explains only 0.5 percent of the variability of the dependent variable.

The F-ratio in the ANOVA table indicates whether the overall regression model is a good fit for the data. The table indicates that the independent variables do not statistically justify the model to be a good fit (1,58)=0.308, p>.005.

According to Odundipe and Amaghionyeodiwe (2013) the co-integration test is run to check for long run relationship between the dependent and the independent variables, using the Eviews software package, the test was carried out. Given the generated results, co-integration is rejected at the 5 percent level. Hence it is concluded that a long run relationship exist.

The main aim of the study was to establish the effect of central bank intervention on the exchange rate. The Null Hypothesis of the Granger Causality states that Intervention does not Granger Cause Interbank rate. The rule of thumb indicates that the probability of the F-statistics must be less than 5 percent to show causal relationship. The probabilities of the causal variables of intervention was 0.712 and interbank rate was 0.111. Per the results obtained, the null hypothesis is rejected and a conclusion drawn that no relationship exists between central bank intervention and the exchange rate.

5.2 Recommendations

Based on the results of this study, the following recommendations are critical when it comes to ensuring a stability of exchange rates: the reduction of the intervention rate and market operation mechanisms; incentives to attract other foreign exchange suppliers; a greater emphasis on the indirect causes of the exchange rate. The decrease in consumption imports is very important for

the stabilization of the exchange rate and the consistency of the exchange rates is very essential for achieving a stable exchange rate because it empirically demonstrates that modifications and decision reversals contribute to market uncertainty or speculation.

Second, the industry should be able to create hedge tools, including the central bank, the banking sector and the business industries, to minimize the economic trends on the foreign exchange market and to make the central bank's intervention necessary to alleviate the widespread exchange rate changes. This reduces the misalignment in currencies from their basic levels, due to uncertainty and interference by the central banks, and this could be complemented by the growth of the internal liquidity-reducing securities market, which would increase industry sensitivity to changes in the policy prices of the central bank. The Central Bank of Ghana's policies are tools relying on the domestic money market and the surplus liquidity of the financial system is a fragile factor in influencing the foreign exchange market. Such strategy levels ought ideally to have an effect on the rate of return. This is feasible only if the scheme eliminates surplus liquidity and the domestic demand for securities develops through secondary trade outside the central bank of Ghana.

In maintaining and restoring Ghana's external industry, the need to reduce misalignment in the exchange rate is important. The exchange rate could compromise the viability of the external sector in Ghana to the point that market players recognized Speculation and ongoing central bank involvement in the foreign exchange market as a move back from its fundamental level. On the other side, the exchange rate direction is affected by the distribution of the donor resources and IMF program announcements. This calls on the government of Ghana to build trust in the donor community in order to disburse budget support funds. A violation of this criterion might lead to the depreciation, which is consistent with the fundamental changes in the exchange rate.

5.3 Recommendation for Future Research

Volatility of exchange rate affects various firms that do transaction in foreign currencies. These firms could include those which do imports and exports. It is therefore important to study conclusively the impact of foreign exchange rate volatility on performance of these firms in Ghana. Minimal usage of foreign exchange management techniques by the firms that are directly impacted by the volatility of exchange rate. It should be noted that that several factors act in unison or severally to determine the prevailing exchange rate level. The concerned firms do not have control on these factors yet their impact may have sudden and catastrophic repercussion on their financial health. A need for a shield against such impacts goes without say. Thus, the reason why the affected firms have not implemented the use of such hedges should be investigated.

REFERENCES

Adler, G. and Tovar, C.E. (2011). Foreign Exchange Intervention: A Shield against Appreciation Winds? IMF working paper [Online] 11 (16) p.1-6, 12. Available from: http://wwwimf.org [Accessed 19/03/2012]

Ahuja, H.L. (ed) (2011). Modern Economics: New Delhi: S. Chand

Bollerslve,T. (1986). Generalised Autoregressive Conditional Heteroskedasticity. Journal of Econometrics. [Online] 31 p.307–327. Available from: http://en.wikipedia.org [Accessed 15/03/2012]

Bank of Tanzania. (2003). Payment Systems in the Southern African Development Community—Tanzania chapter 2003.Dar es Salaam. (p.12)

Canales-Kriljenko, J.I. (2003). Foreign Exchange Intervention in Developing and Transition Economies Result of a Survey. IMF working paper. [Online] 03/95 p.5-8. Available from: www.imf.org [Accessed 20/03/2012].

Davidson, R. and Mackinnon, J.G (eds) (2004). Econometrics Theory and Methods. Oxford: Oxford University.

Domac, I. and Mendoza, A. (2002). Is there Room for Forex Interventions under Inflation Targeting Framework? Evidence from Mexico and Turkey. The World Bank, Policy Research Working Paper Series. [Online] 3288p. 6,10 and 26-28. Available from: elibrary.worldbank.org [Accessed 19/03/2012]

Dominguez, K.M. (1998). Central Bank Intervention and Exchange Rate Volatility., Journal of International Money and Finance School of Public Policy, University of Michigan[Online] 17 (1998). Available from: http://www-personal.umich.edu [Accessed 1/03/2012]

Dominguez, K.M.E. (2003). The Market Microstructure of Central Bank Intervention Journal of International Economics[Online]59 p.25–45, p.31-32, p.187-188. Available from: http://faculty.haas.berkeley.edu [Accessed 27/02/2012]

Dominguez, K.M.E. and Frankel, J.A. (1993). Does Foreign-Exchange Intervention Matter? The Portfolio Effect American Economic Review[Online] 83 (5) p.1361-1365. Available from: http://www.hks.harvard.edu [Accessed 2/02/2012]

Edison, H.J., Cashin, P. and Liang, H. (2003). Foreign Exchange Intervention and the Australian Dollar. IMF Asia and Pacific Dept working paper [Online] 3 (99). Available from: http://wwwimf.org [Accessed 15/03/2012]

Elinaza, A. (2011). Shilling's free-fall traced to illegal forex trading. The Daily News 29th October.

Elinaza, A. (2012). Short Term Bonds Make High Yield. The Daily News 24thMay.

Fatum, R and Hutchison, M.M. (2005). Foreign Exchange Intervention and Monetary Policy in Japan 2003-04.International Economics and Economic Policy [Online] 2 (2005) p.249-250. Available from: http://people.ucsc.edu [Accessed 2/04/2012]

Fatum, R. (2000). On the Effectiveness of Sterilized Foreign Exchange Intervention. ECB Working Paper [Online] 10 p.5-6, 18. Available from: www.tcmb.gov.tr [Accessible 31/03/2012]

Fisher,S. (2001). Exchange Rate Regime: Is the Bipolar View Correct? IMF Distinguished Lecture on Economics in Government 2001: The American Economic Association and the Society of Government Economists—New Orleans. Available from: www.imf.org

Ghosh, A.R, Gulde, A., Ostry,J.D. and Wolf,H. (1997). Does the Exchange Rate Regime Matter for Inflation and Growth? IMF Economic Issue.[Online] 2p.10. Available from:www.worldbank.org [Accessed 23/03/2012]

Greene, W.H.(ed.) (2008). Econometric Analysis: London: Pearson Education

Guimarães, R.F. and Karacadag, C. (2004). The Empirics of Foreign Exchange Intervention in Emerging Markets Countries: the Case of Mexico and Turkey IMF working paper. [Online]04 (123) p.4-6, 40. Available from: www.imf.org [Accessed 2/2/2012]

Gujarati, D.N. and Porter, D.C. (eds) (2009). Basic Econometric. Boston: McGraw-Hill

Harvey, A. (ed) (1990). The Econometric Analysis of Time Series. Cambridge: MIT Press

Hurnpage, O.F. (1986). Exchange-Market Intervention: The Channels of Influence, Economic Review [Online] p.8-10. Available from: http://clevelandfed.org. [Accessed 19/03/2012].

Hutchison, M.M. (2002). The Role of Sterilized Intervention in Exchange Rate Stabilization Policy. Department of Economics University of California, USA [Online]. Available from: http://www.blackwellpublishing.com [Accessed 20/03/2012]

Igogo, T. (2010). Real Exchange Volatility and International Trade Fluctuation in Tanzania. A Dissertation Submitted in partial fulfilment of the Requirement of University of Dar es Salaam for the Mater of Arts. Economics: University of Dar es Salaam.

Ishii, S., Jorge Iván Canales-Kriljenko,J.I., Guimarães, R. and Karacadag, C. (2006). Official Foreign Exchange Intervention, IMF Occasional Paper [Online] 249 p.1, 32. Available from: www.imf.org [Accessed 19/03/2012]

James Dean Brown (1997). Shiken: JALT Testing & Evaluation: University of Hawai'i SIG Newsletter. [Online] 1 (2)p. 18-21. Available from: www.jalt.org [Accessed 30/09/2012]

Martin, G. (2011). Determinants of Commercial Banks' Profitability in Tanzania. A Dissertation Submitted in partial fulfilment of the Requirement of University of Dar es Salaam for the Master of Arts. Economics: University of Dar es Salaam

Paul, C. (2007). Exchange Rate Volatility and Tradition Exports in Tanzania. A Dissertation Submitted in partial fulfilment of the Requirement of University of Dar es Salaam for the Mater of Arts. Economics: University of Dar es Salaam

Poole, William (1967). Speculative Prices as Random Walks: An Analysis of Ten Time Series of Flexible Exchange Rates, Southern Econ. J. Apr. 1967, 33(2), p468–478.http://connection.ebscohost.com

Richard, L. (2001). The Microstructure Approach to Exchange Rates Cambridge MIT Press, Chapter 5 Empirical Frameworks and Chapter 6 Exchange Rate Models: Macro to Micro foundations.

Romer, D. (ed) (2006). Advanced Macroeconomics: Boston: McGraw-Hill

Saatcioglu, C. (2006). An Analysis Of Central Bank Interventions: Evidence From Turkey. University of Istanbul, International Business & Economics Research Journal [Online] 6 (4) p.83. Available from: journals.cluteonline.com [Accessed 19/03/2012]

Sarno, L and Taylor, M.P (2002). The Economics of Exchange Rates Cambridge University Press Statistics Corner Questions and answers about language testing statistics: Reliability off surveys.

Tapia, M. and Tokman, A. (2004). Effects of Foreign Exchange Intervention Under Public Information: the Chilean Case. Working Papers Central Bank of Chile [Online] 255 p.25,26. Available from: connection.ebscohost.com [Accessed 19/03/2012].

Tobin, J. A. (1969). General Equilibrium Approach To Monetary Theory. Journal of Money, Credit and Banking [Online] 1 (1), p.15-29. Available from: http://www.deu.edu.tr [Accessible 19/03/2012].

APPENDICES

Raw Data

YEAR	MONTH	INTERBANK RATE	INTERVENTION (USD)
2014	Jan	2.3209	500,000.00
2014	Feb	2.4463	7,000,000.00
2014	Mar	2.5843	5,754,992.70
2014	Apr	2.7434	9,700,000.00
2014	May	2.8631	4,718,756.33
2014	Jun	2.982	2,500,000.00
2014	Jul	3.0192	107,470,115.70
2014	Aug	3.065	2,350,000.00
2014	Sep	3.1884	19,000,000.00
2014	Oct	3.1964	15,850,000.00
2014	Nov	3.197	5,689,594.12
2014	Dec	3.1974	6,400,000.00
2015	Jan	3.2182	11,157,900.10
2015	Feb	3.3609	10,278,124.91
2015	Mar	3.5909	112,588,276.93
2015	Apr	3.8122	5,988,276.93
2015	May	3.8932	7,273,156.26
2015	Jun	4.1865	16,700,000.00
2015	Jul	3.5322	3,350,000.00
2015	Aug	3.8588	3,256,843.74
2015	Sep	3.7815	4,400,000.00
2015	Oct	3.764	7,050,000.00

2015	Nov	3.7898	9,950,000.00
2015	Dec	3.7948	6,150,000.00
2016	Jan	3.8063	206,850,000.00
2016	Feb	3.8714	5,200,000.00
2016	Mar	3.851	2,300,000.00
2016	Apr	3.8199	2,300,000.00
2016	May	3.8113	4,800,000.00
2016	Jun	3.8824	3,750,000.00
2016	Jul	3.9389	202,600,000.00
2016	Aug	3.9449	1,800,000.00
2016	Sep	3.9563	1,400,000.00
2016	Oct	3.9665	1,350,000.00
2016	Nov	3.9718	3,550,000.00
2016	Dec	4.0969	6,850,000.00
2017	Jan	4.2359	103,750,000.00
2017	Feb	4.3728	2,250,000.00
2017	Mar	4.4842	1,550,000.00
2017	Apr	4.1983	1,200,000.00
2017	May	4.2376	6,600,000.00
2017	Jun	4.3322	7,300,000.00
2017	Jul	4.367	2,800,000.00
2017	Aug	4.3879	6,300,000.00
2017	Sep	4.4036	2,400,000.00
2017	Oct	4.3811	3,100,000.00

2017	Nov	4.3946	3,300,000.00
2017	Dec	4.4124	8,000,000.00
2018	Jan	4.4209	5,800,000.00
2018	Feb	4.4195	2,100,000.00
2018	Mar	4.4136	1,400,000.00
2018	Apr	4.4053	950,000.00
2018	May	4.4139	4,907,494.91
2018	Jun	4.4625	106,400,000.00
2018	Jul	4.6474	5,300,000.00
2018	Aug	4.7083	1,750,000.00
2018	Sep	4.7393	5,000,000.00
2018	Oct	4.7922	15,000,000.00
2018	Nov	4.7911	6,000,000.00
2018	Dec	4.8224	214,500,000.00

Output of Analysis

Vector Autoregression Estimates
Date: 07/22/19 Time: 08:57
Sample (adjusted): 2014M03 2018M12
Included observations: 58 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	INTERBANK...
INTERBANK_RATE(-1)	0.635970
	(0.12831)
	[4.95665]
INTERBANK_RATE(-2)	0.298760
	(0.12330)
	[2.42309]
C	0.308477
	(0.10969)
	[2.81237]
R-squared	0.954921
Adj. R-squared	0.953282
Sum sq. resids	0.814271
S.E. equation	0.121675
F-statistic	582.5435
Log likelihood	41.41283
Akaike AIC	-1.324580
Schwarz SC	-1.218006
Mean dependent	3.944497
S.D. dependent	0.562939

Dependent Variable: INTERBANK_RATE
Method: Least Squares
Date: 07/22/19 Time: 08:54
Sample: 2014M01 2018M12
Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INTERVENTION__USD_	3.01E-08	8.55E-09	3.516663	0.0008

R-squared	-32.816035	Mean dependent var	3.892467
Adjusted R-squared	-32.816035	S.D. dependent var	0.621392
S.E. of regression	3.613489	Akaike info criterion	5.423751
Sum squared resid	770.3807	Schwarz criterion	5.458656
Log likelihood	-161.7125	Hannan-Quinn criter.	5.437404
Durbin-Watson stat	0.340734		

Pairwise Granger Causality Tests
Date: 07/22/19 Time: 08:47
Sample: 2014M01 2018M12
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
INTERVENTION USD does not Granger Cause INTERBANK RATE	58	0.71232	0.4951
INTERBANK RATE does not Granger Cause INTERVENTION USD		0.11155	0.8947