

**AN EXAMINATION OF THE RELATIONSHIP BETWEEN EXCHANGE
RATE AND KEY MACROECONOMIC VARIABLES IN GHANA: AN
AUTOREGRESSIVE DISTRIBUTED LAG (ARDL) APPROACH.**

By

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Bed (foundations)

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DECLARATION

CANDIDATE'S DECLARATION

I hereby declare that this project is the result of my own original research and that no part of it has been presented for another degree in the University or elsewhere.

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ABSTRACT

The study examines the influence of key macroeconomic variables on the exchange rate of Ghana Cedi (GH¢) against the US Dollar (\$). The macroeconomic variables were money supply, interest rate, and inflation. Monthly data from May, 2000 to May, 2014 were used for the study. Using Autoregressive Distributed Lag (ARDL) approach to co-integration, the results show that there is co-integrating relationship between the variables, indicating a long-run equilibrium relationship among them. The study has established that the past exchange rate (lag of exchange rate) significantly affect current exchange rate. The study has also found a causal relationship between broad money supply (M2+) and current exchange rate. The study recommends among other things that Government and policy makers must pay careful attention to macroeconomic fundamentals due to their significant short and long-term effect on the countries exchange rate stability. Also, government must try to manage currency speculation since it has significant impact on the exchange rate of the country.

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KNUST

DEDICATION

I dedicate this project work to my wife, Mrs. Josephen Osei Kwakye and my newly born son, Psalmist Kwakye Wiredu.



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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

The importance of exchange rate to the socioeconomic development of every free market economy cannot be underestimated. The importance of exchange rate has even become more pronounced given the level of liberalization and international trade among countries. It has helped to facilitate trade among countries with different currency systems. As a result of its importance, exchange rates are among the most monitored, analysed and governmentally manipulated macroeconomic variables. The extent to which exchange rates are managed can affect the growth and development of a nation. As succinctly stated by Edwards (1994, p. 61) —it is not an understatement to postulate that the behaviour of exchange rate occupies an important position in governments' policy evaluation and design.

Over the past few decades, a number of researchers and academicians have stated that exchange rate is important not only because it helps to facilitate international trade, but it also influences resource allocation in diverse sectors of the economy. Aron, Elbadawi, and Kahn,(2002)expressed that exchange rate has direct influence on employment, trade flow, balance of payment, the arrangement of production and consumption, as well as outside loans of a country.

As indicated by Bah and Amusa (2003), a nation exchange rate is vital in light of the fact that it decides to an expansive degree its development and serves as a measure of worldwide aggressiveness. The authors further clarified that exchange rate guides generation and spending in the local economy.

Fast advancement in monetary administrations and worldwide capital business sector has been seen as of late. As an aftereffect of this pattern, the dynamics of exchange rates have an expanding effect on the general macroeconomics circumstance in nations around the globe. This applies especially to rising open economies, where local money related approaches do not have an effect on world interest rates. For these nations, the exchange rate turns into a noteworthy instrument to adjust to changing outside conditions. The critical function performed by the real exchange rate implies that developing economies must accomplish more to direct their strategies in order to get this macroeconomic relative value right. . The "right" real exchange rate, as indicated by (Otieno, 2013) is one that does not stray too a long way from its equilibrium value.

Each country on the globe has an objective to experience a vigorous economy. An economy that encounters development, stable prices and generally shared riches has been the aspiration of most governments around the globe. Ghana is the same in this admiration. The exchange rate, another financial indicator, is a key determinant of a country's economy. With the expectation of complimentary business sector economies, the exchange rate is urgent in the line of worldwide exchange. A steady or solid money implies a country can import things less expensive than it would if its money was powerless. Exchange rate is also a vital factor investors have to look at because it has power to affect the value of their money.

The Ghana Cedi, which was first made available for use in 1965, has seen instability in the course of recent decades. At some point, it performs well against major worldwide currencies while slipping in worth amid different periods. Over the previous year, notwithstanding, the money has been performing badly against major worldwide currencies, particularly the US dollar. Case in point, in 2014, the cedi lost around 36%

of its worth against the US dollar (See Figure 1.1). The present study tries to look at the key macroeconomic variables that influence the stability of the Ghana cedi.

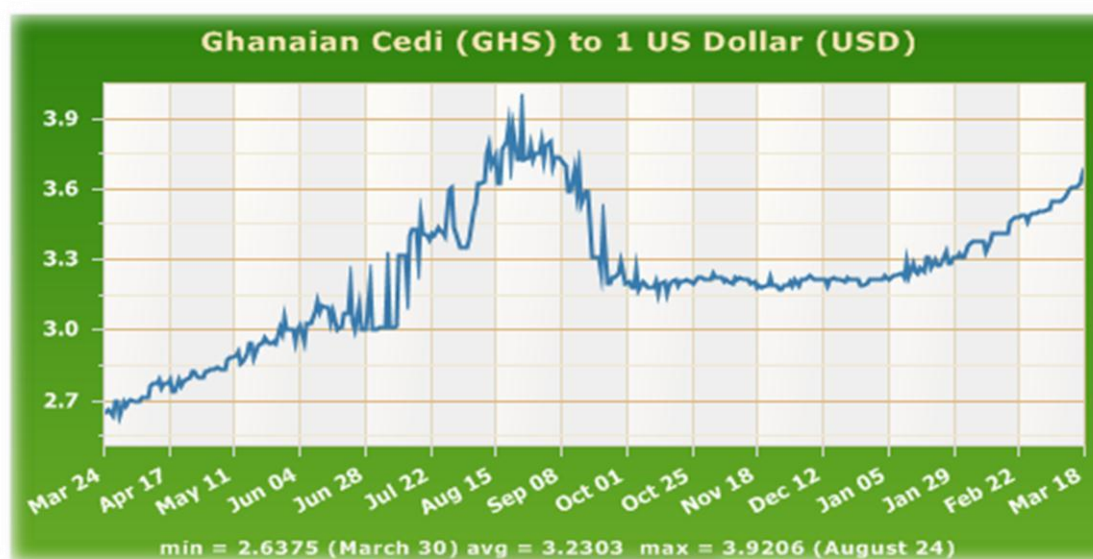


Figure 1.1 Historical Exchange rates between the Ghana cedi and US dollar (March, 2014 to March, 2015)

Ghana as an emerging economy has gone through various exchange rate regimes; from fixed to flexible or floating. Various factors both economic and political have influenced the choice of exchange rate regime. History makes it somehow clear that the military regimes were more in favour of the fixed exchange rate regime while the civilian regimes (democratically elected governments) preferred the flexible exchange rate regimes. Notwithstanding the political regime in place, there are underlying economic factors that have influenced the direction of exchange rates in the country. Balance of payment, inflation and interest rates are some of the macroeconomic factors that have influenced the stability of the currency against major international currencies.

1.2 PROBLEM STATEMENT

Ghana is currently practicing the floating exchange rate regime. The level of the Ghanaian cedi exchange rate continues to be dictated by the powers of demand and

supply in the foreign trade market. While this regime offers the country some level of monetary independence, the country has lost the control to tie domestic prices down; making it susceptible to international pressures. The year 2014 was a difficult year for Ghana in terms of the depreciation of its currency against major currencies in the world. For instance it lost about 36% of its value against the US dollar. This greatly affected economic activities as a result of the Country's over reliance on imports. Even though the situation has somehow stabilized, the Ghana cedi continues to lose value against major currencies, especially against the US dollar in recent years.

Though the relationship between exchange rates and macroeconomic variables is well documented on advanced economies, the same cannot be said about emerging economies like Ghana. Given the important role played by real exchange rate to the growth and development of emerging economies, there is the need to examine the key factors influencing exchange rate. The purpose of this study is to bridge the literature gap by examining empirically the economic factors that affects the stability of the Ghana Cedi against major trading currency, the US Dollar.

1.3 OBJECTIVES OF THE STUDY

The objectives of the study are categorized into general and specific

1.3.1 General Objectives

The general objectives of the study is to examine the relationship between exchange rate, inflation, interest rate and money supply in Ghana

1.3.2 Specific objectives

1. To examine the long run relationship between exchange rate and macroeconomic variables

2. To examine the short-run relationship between exchange rate and other macroeconomic variables
3. To obtain the causal relationship between real exchange rate and other macroeconomic variables.

1.4 RESEARCH QUESTIONS

1. Is there a long-run relationship between exchange rate and macroeconomic variables in Ghana?
2. Is there a short-run relationship between exchange rate and macroeconomic variables in Ghana?
3. What is the nature of the causal relationship between exchange rates and macroeconomic variables in Ghana?

1.5 STUDY HYPOTHESIS

Based on the objectives of the study, the following hypothesis are tested

H1: Exchange rate has significant correlation with the macroeconomic variables (Inflation, Interest Rate (MPR) and money supply).

H2: There is long-run relationship between exchange rate and macroeconomic variables (Inflation, Interest Rate and money supply).

H3: There is short-run relationship between exchange rate and macroeconomic variables (Inflation, Interest Rate and money supply).

1.5 BRIEF METHODOLOGY

The study employs secondary data to examine the relationship between exchange rate and other macroeconomic variables. The data set comprised of monthly time series data

for Ghana over the sample period 2000 to 2014. The data was sourced from the official website of the Bank of Ghana (BOG). The Cedi Exchange Rate with the Dollar was used as the dependent variable whiles inflation, monetary policy rate (Interest rate) and money supply were designated as the independent variables. A time series analysis was performed to examine the long-run and short-run relationship between the variables. To test the stationarity of variables, Augmented Dickey Fuller (ADF) test is used. Autoregressive distributed lag (ARDL) approach to co-integration has been applied to estimate the long run relationship between the cedi/dollar exchange rate and explanatory variables with the use of EVIEWS statistical software.

1.6 SIGNIFICANCE OF THE STUDY

Exchange rate is important because it directly affects the trading relationship between two countries. The exchange rate has been a strategy target, and in most exchange rate regime changes the point is to keep up a steady and aggressive real exchange rate. —Various researchers have contended that exchange rates are essential not just for accomplishing maintained general financial execution and worldwide intensity, but have an important effect on allocation of resources among diverse areas of the economy, foreign trade flows and balance of payment, job, structure of production and consumption and external debt crisis“ (Aron et al., 1997).Understanding the main factors affecting exchange rate stability will provide insight for policy making.

Factors influencing fluctuations in exchange rate could be political and economic and also in the short or long run. The findings of this study will help policy makers know, for instance, what can be feasibly done to limit the fluctuation in the values of the currencies, what forces are involved in the fluctuations of currency value, and how the behaviour of exchange rate can be estimated and predicted. Also, the findings of the

study will contribute to the existing body of knowledge thereby extending the frontiers of knowledge in the field of knowledge management in public organisation.

1.7 SCOPE OF THE STUDY

The study employs only secondary data from 2000 to 2014 in the analysis. The cedi to dollar exchange rate was used as the dependent variable due to the fact that most of the international trading is done with the use of the US dollar. Though exchange rates are affected by political and economic variables, the study concentrates on macroeconomic variables that affect exchange rates. All other factors aside macroeconomic indicators are not considered for the purposes of this study. The macroeconomic variables considered are Inflation, Monetary Policy Rate (Interest Rate) and Money Supply.

1.8 STRUCTURE OF THE STUDY

The research is structured into five main chapters. Chapter One is devoted to introduction of the study, which covers the background of the study, the problem statement of the study, the objectives and research questions of the study, a brief methodology, significance of the study, limitations and organisation of the study. Chapter Two reviews relevant theoretical and empirical literature on the factors influencing exchange rates. Chapter three covers the methodology employed in the research which includes research design, Study population, sources of data, econometric model employed and the analysis technique employed to analyze the data. Chapter Four gives definite presentation, analysis, interpretation and discussion of the results of the study. Chapter Five is dedicated to the summary of the findings, conclusion and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Every country, at one point in history or another, has adopted various exchange rate regimes. From the fixed exchange rate regime that dominated in the 1970's to the flexible exchange rate which has become the other of the day in many developed and emerging economies. Depending on the type of exchange rate regime adopted, other macroeconomic variables may be affected in one way or the other. The objective of the study is to determine the macroeconomic variables that affect exchange rate in Ghana. This chapter reviews literature on the various exchange rate regimes as well as Ghana's history with the various exchange rates regimes. The chapter also reviews theoretical and empirical literature on the subject of exchange rate and how it affects key macroeconomic variables. The chapter begins by defining key concepts and how they relate to the study. Secondly, theoretical literature is reviewed to appreciate the theoretical underpinnings of the study. Finally, empirical studies relating to the study are reviewed with the view of comparing and contrasting key findings.

2.2 History of Ghana's Exchange rate system

After Ghana's Independence in 1957, the Ghana pound was adopted for use in Ghana and it has been used from the years 1957 to 1965. During these times the rate of the Ghana pound was almost equivalent to the British pound. However in 1965, a new currency called the cedi was introduced to replace the Ghana pound.

The first cedi which was introduced in 1965 was rated at 2.4 cedis to be equivalent to 1Ghana pound, but after two years, in 1967 a second cedi was introduced at the rate of

2cedi to be equivalent to 1British pound and 2 cedi to 0.98 US dollars. This second cedis devalued rapidly in some months after its introduction rate at 2 cedi = 1 British pound to 2.45 = 1 British pound. The early stages of the cedi, the country adopted and used the Managed Exchange rate regime, but during its later years in 1978 the floating regime was adopted, which raised inflation rate of the cedi to depreciate significantly. This effect on the cedi forced the ruling political regime to re-rate the cedi at 2.75 cedis = 1 British pound (IEA, 2013).

2.3 Trends in Ghana's Macroeconomic Indicators

As at the year 2006, there were significant improvements in the performance in the country's economic activities. The table below depicts these improvements as shown by Ghana's Macroeconomic Indicators



Table 2.1 Trends in Ghana's Macroeconomic Indicators

Year	Ghana's macroeconomic indicators	Improvement (Achievement)
2006	i. Overall government fiscal deficit ii. GDP growth iii. Net foreign direct investment	i. Increased from 6.6% to 12.4% ii. Increased from 5.6% to 6.2% iii. Increased from 1.6% of GDP in 2001 to 6.2% which is 4.28% less as recorded in 1994 (AGC effect)
1994	Ashanti Goldfield Company Limited (AGC) now AngloGold Ashanti saw market capitalization	Increase of 34.37% of GDP from 1.9% in 1993
2006	Interest rate (on Monetary Policy)	Dropped from 40.95% by end of 2001 to 9.95%
2006	The Cedi against Dollar depreciation	Decrease from 104.4% in 1992 to 2.0%
2012	The Cedi against Dollar depreciation	Increased from 2.0% in 2006 to 17.4%
2001	Inflation rate	Dropped from 59.56% in 1995 to 32.91%
2006	Inflation rate	Dropped to 10.96% by the end of 2006,
2013	Inflation rate	Increased again to 13.5% by the close of the year
2007	Monetary Policy Rate	dropped from 45% in 1996 to 12.5%
2013	Monetary Policy Rate	Moved up to 18% by December, 2013
2006	Overall fiscal deficit	Increased from 8.0% of the GDP in 2002 to 12.4% of GDP in 2006.

2.4 History of International Exchange Rates System

Countries in recent history, have adopted different Exchange Rate Systems, however according to Brue and McConnell (1996), Gold Standard, the Breton Woods System, and the 'Managed' Floating System are the three commonly used ones that have been identified. There are detailed elaborations on each of these identified Exchanged Rate Systems

The Gold Standard, 1876-1913

The Gold Standard was an international monetary system that dominated the money market during the years of 1876 – 1913, which according to Bruce and McConnell (1996), was fixed sort of exchange rate system. There are three important requirements that a country must meet in order to be eligible to be on the Gold Standard. The requirements are;

- i. The country's currency or monetary unit must be defined based on a defined quantity of Gold.
- ii. Between the country's stock of gold and its domestic money a permanent relationship is maintained.
- iii. Gold must be considered a free- flow commodity i.e. it should be allowed to move freely in and out of the country (Salvatore, 1995).

Hence all countries under this regime had the value of their currency defined in terms of gold as a requirement, in order to establish a constant relationship between various national currencies. This regime was implemented using a simple rule which was based on the rate differences between the currencies under the regime.

Example, US\$ gold rate was \$20.67/oz, against £4.2474/oz of the British pound

Thus the rate calculation is US\$/£.

$\$20.67/\pounds4.2472 = \$4.8665/\pounds$. Which implies that $\$20.67/\text{oz}$ of US gold could be used in exchange of $\$4.8665/\pounds$ of British gold.

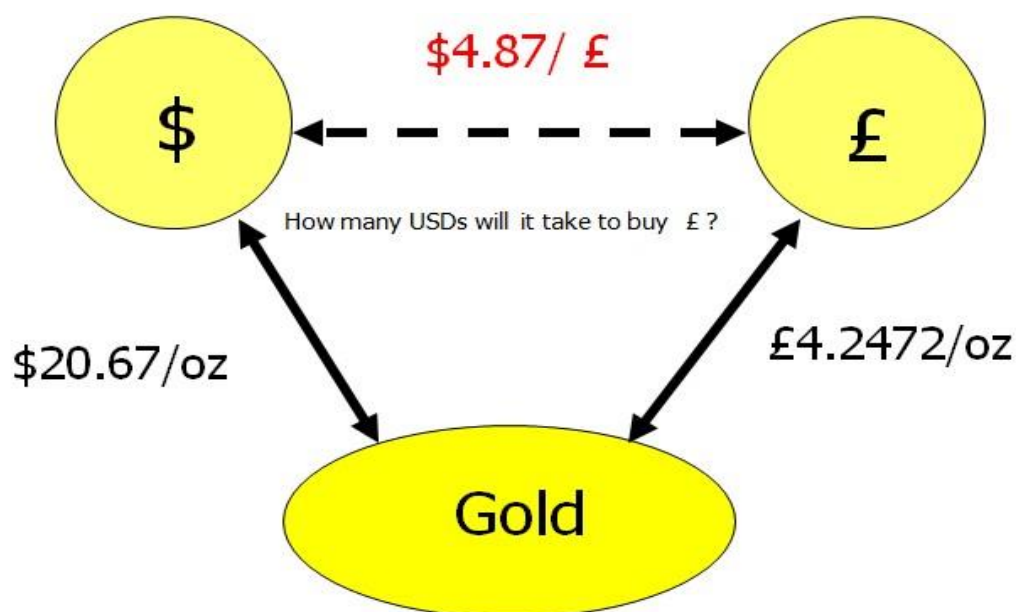


Figure 2.1 Illustration of us dollar/Pound exchange rate using the gold standard It was very essential that countries maintain adequate gold reserves to back its currency's value to keep the system in balance. Because gold was been sold or bought by governments on demands of any country on their own fixed rates and the exchange rates were fixed, hence each country needs adequate quantity of gold in reserve to meet the exchange rate at any time during a transaction and this requirement kept the system running.

However, the outbreak of the World War 1 destabilized the system as the free movement of gold was interrupted hence some major nations suspended their transactions. During the periods of 1914 and 1944 when the wars and the German hyper-inflation were on the surge, it became impossible for many countries to maintain the gold reserves to back up their currency.

Bretton Woods and the IMF, 1944

According to (Brue and McConnell, 1996), a new International Monetary System called the Bretton Wood System was established, to re-establish the exchange rate system that was destroyed by the World War 1. This system seemed to have promoted the advantages of the Gold Standard (fixed exchange rate), while it avoided its weakness (domestic macroeconomic readjustments). The International Monetary Fund (IMF) was established to oversee the operation of this new system. Under this regime the US currency gained an enviable position as the currency against which each participating country's exchange rate would be established hence calculating their gold par value of their currency. However the agreed rate was at 1% against the currency of the participating country, which was later extended to 2.5%. The IMF ensured that no currency devalues beyond 10% of its value, however, any currency that suffer up to 10% devaluation was allowed without approval from the IMF.

Fixed exchange rates, 1945-1973

Diverging fiscal, monetary policies and external shocks were what caused the Bretton Woods and IMF to collapse long after the World war 2. The US dollar became the main currency held by the central banks, particularly for web exchange rate values. Along the way, the US had persistent growing deficit in its balance of payment, causing heavy capital outflow of the dollar, in order to finance this deficit and meet investors and business demands for the dollar. The dollar finally started losing the confidence that foreign investors had in it because its outflows have caused its value to go beyond the ones the foreigners had. This lack of confidence forced President Nixon to suspend official purchases or sale of gold on August 15, 1971 and it was this suspension that ended the 37-year old policy of Dollar convertibility into gold at \$35 per ounce. This

suspension finally cut the link between gold and the international value of the Dollar, thereby allowing the value of the Dollar to be determined by market forces.

Floating Exchange rate regime

The current exchange rate system called the Floating Exchange Rate could best be described as a system of managed floating exchange rate (Kensen, 1994), which was adopted by most countries after the unsuccessful attempts to reinstall the Bretton Woods System, after its demise. Though the exchange rate is floating, there were no wide fluctuations, it was a stable system. Because the central banks ensured that occasionally they intervene to prevent wide fluctuations. Exchange rates of most leading countries were allowed to float in relation to the US dollar. There was major appreciation of the currencies of these leading countries against the US dollar. However in 1973, the system was rendered infeasible hence the dollar, along with the other major currencies were allowed to float.

2.5 Contemporary Exchange rate Regimes

All countries have at least a defined currency in which values of goods and services can be quoted - the dollar in the US, the euro in France, the pound sterling in the UK, the yen in Japan, and the cedi in Ghana and many more... The role of exchange rate in international trade becomes very vital as it allows us to compare the prices of goods and services produced in different countries. Below is a table of all the contemporary exchange rate systems.

Table 2.2 Contemporary Exchange Rate Regimes

Currency Regime	Attribute of Regime
-----------------	---------------------

1.”Exchange arrangement with no separate legal tender (Dollarization)”	—Currency of another country circulates as sole legal tender or the member belongs to a monetary or currency union in which the same legal tender is shared by the members
2. “Currency Board Arrangements”	—A monetary regime based on an implicit legislative commitment to exchange domestic currency for a specified foreign currency at a fixed exchange rate, combined with restrictions on the issuing authority to ensure the fulfillment of its legal obligation
3. “Other conventional fixed peg arrangements”	—The country pegs its currency (formally or <i>de facto</i>) at a fixed rate to a major currency or a basket of currencies (a composite), where the exchange rate fluctuates within a narrow margin or at most + or - 1% around a central rate
4. “Pegged exchange rates within horizontal bands”	—The value of the currency is maintained within margins of fluctuations around a formal or <i>de facto</i> fixed peg that are wider than + or - 1% around a central rate
5. “Crawling pegs”	—The currency is adjusted periodically in small amounts at a fixed, preannounced rate or in response to changes in selective quantitative indicators
6. “Exchange rates within crawling pegs”	—The currency is maintained within certain fluctuating margins around a central rate that is adjusted periodically at a fixed preannounced rate or in response to changes in selective quantitative indicators
7. “Managed floating with no preannounced path for the exchange rate”	—The movement of exchange rate is mainly influenced by the monetary authorities by intervening directly in the foreign exchange market without specifying, or precommitting to, a preannounced path for the exchange rate

8.” Independent floating”	—The exchange rate is market determined, with any foreign exchange intervention aimed at moderating the rate of change and preventing undue fluctuations in the exchange rate, rather than establishing a level for it.
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Dollarization

Dollarization is when one country adopts the currency of another country (usually the US dollar) as its official currency. Many opt for this due to reasons such as: □

To avoid the instability of their currency against the dollar

- To reduce devaluation arising from inflation.
- To be able to integrate with the US and other dollar based markets.

In theory it looks like the dollarization saves a country from all financial challenges, but practically they would also forfeit certain benefits such as;

- It loses sovereignty over its monetary policy.
- it also loses seigniorage (i.e., possibility of profiting from printing its own currency)

Panama since 1907 and Ecuador since 2000 are examples of countries that have opted for the dollarization. There are many countries that have also adopted —dollarization via the —euro

Currency Board

Currency Board is another currency regime where a country’s central bank commits to back its monetary base -- its money supply—entirely with foreign reserves at all times. Hence every time the domestic currency is to be introduced into the economy, additional unit of foreign exchange reserves must first be obtained. In all there are about eight countries that have adopted the Currency Board to fix their exchange rates including Hong Kong and Argentina.

Monetary Union

The Monetary Union comprises of a gathering of nations utilizing a common currency issued by a regional bank. The advantage of monetary union is that it decreases the time irregularity problem by requiring multinational agreement on policy, and lessens real exchange rate instability. A potential downside of Monetary Union is that nations enduring asymmetric shocks lose a stabilization tool. The cost depends on the extent of asymmetric shock and the availability and effectiveness of alternative adjustment tools.

Traditional Peg/ Fixed Regime

Under the Fixed exchange rate administration, a nation's currency is fixed against a single currency or currency baskets. This implies that as the reference currency value rises and falls, so does the currency pegged to it (Krugman & Obstfeld, 2003). The uniqueness of the fixed rate is that, it stays unaltered for long time, i.e. it doesn't rely upon changes in supply and demand in the money, however the change happens as a consequence of its formal correction (degrading or revaluation) by central bank (Edwards & Losada 1994). With a fixed rate the central bank regularly sets the different rates on individual exchanges. Here are a few favorable circumstances connected with the fixed exchange rate system.

- First, its predictability is quantifiable since the values are fixed against major trading currencies.
- Second, it boost the confidence in the monetary policy of the government since it decreases government expenses spend to control inflation,
 - Enabling the promotion of trade and stimulation of the flow of capital.
 - It also stabilizes inflation by reducing inflationary pressure in the labour and financial markets.

- Finally, it enables imported goods to have a stable price. However, the nations with fixed exchange rates lose control over autonomous domestic financial strategy to accomplish internal stability, is one major drawback of this regime.

Float with Discretionary Intervention/Managed Floating

Under this regime, the exchange rates are determined in the foreign exchange market, however in managed floating system, supply and demand changes are not the only determining factor but also the central banks of the country have a strong impact on value of exchange rate, as well as various temporary market distortions. Authorities can and do intervene, as at when they choose, it is not compulsory. It is also often accompanied by a separate nominal anchor, such as an inflation target. This arrangement provides a way to mix market determined rates with exchange rate stabilising intervention in a non-rule-based system. But it does not place hard constraints on monetary and fiscal policy.

Free Floating System/Pure Float

In free floating system, the exchange rate is formed under the influence of the market demand and supply and may vary significantly in size. This size of the demand for foreign exchange is determined by the needs of the country in imports of goods and services, tourist spending in the country, demand for foreign financial assets and demand for foreign currency in connection with the intentions of residents to invest abroad (Deverux and Engel 1998). This regime has the advantage of eliminating the requirement to hold large reserves, even though it does not provide an expectation anchor. Because the exchange rate regime does not place restrictions on monetary and fiscal policy; time inconsistency problem could arise unless otherwise addressed by other institutional measures.

2.6 Theoretical Literature Review (Exchange Rate Theory)

Most of the economic misalignments facing nations are corrected using one of the basic but very essential economic principles known as the Exchange Rate. Structural adjustment programmes across the world are as the result of the application of Exchange Rate. It has also been used as a strategic policy vehicle for directing the direction of flow of economic resources (skilled labour, capital, managerial knowhow, and foreign exchange) into import and export sectors. However, according to Schaling (2008), the sustainability of economic growth and development is based on the stability of the exchange rate regime being deployed. Several theories have been propounded to help in the determination of exchange rate; among these theories are the Purchasing Power Parity, Uncovered Interest Parity, Monetary Model and Portfolio Balance Approach. However, this study examined purchasing power parity and uncovered interest rate parity in detail.

2.6.1 Purchasing Power Parity

According to Kuttner & Posen (2006), —the purchasing power theorem assumes that the normal equilibrium rate of exchange existing between two inconvertible currencies is determined by the ratios of their purchasing powers; hence the rate of exchange tends to be established at the point of equality between the purchasing powers of the two currencies.

The theory of Purchasing Power (PPP) is traditionally, the starting point of where exchange rate analysis begins. The PPP theory (in its absolute version) posits that the equilibrium exchange rate equals the ratio of domestic to foreign prices (Frenkel, 1976). Meaning according to the PPP, the value of any given amount of money should be the

same across different countries when expressed in one common currency. The PPP doctrine is based on the Law of One Price (LOOP), which states that for any good i ,

$$P_t(i) = E_t P_t^*(i)$$

Where:

$P_{(t)}$ is the domestic-currency price of good i in period t

E_t is the nominal exchange rate in period t , defined as the domestic price of a unit of foreign currency

$P_t^*(i)$ is the foreign-currency price of good i in period t .

2.6.2 Uncovered Interest Rate Parity

Uncovered Interest Rate Parity (UIRP) is one of the key connections in international financial markets and constitutes a key basis of some primary exchange rate determination hypotheses“ Hilde (2009). It expresses that the nominal interest rate differential between two nations must be proportionate to or ought to be an impartial indicator of the future change in the spot exchange rate. Hence, the investors‘ normal profit on the domestic and international assets expressed in the same currency ought to be equivalent irrespective of the national markets within which the foreign deposit is invested. The disappointment of the interest rate differential to be the unbiased indicator uncovered interest rate parity puzzle (Cook, 2009). The assumption is that if UIRP holds, investors‘ cannot pick up an arbitrage opportunity because of high yield currency is expected to depreciate by a sum pretty nearly equivalent to the interest rate differential between two nations. An infringement of this relationship shows that capital markets are not effective and there is a probability of arbitrage opportunity (Cook, 2009). Likewise, any discoveries reflecting a reverse relationship is called forward premium puzzle (Cook, 2009). The fundamental assumption underlying UIRP is the

productive business sector speculation where the price ought to completely reflect all information accessible to the market participants and subsequently no gainful open doors will be conceivable in the market. This implies that exchange rates will rapidly change in accordance with any new information, which ought to instantly be reflected in the exchange rate.

2.7 Empirical literature Review

Various empirical studies have been conducted to analyze the effect of key macroeconomic variables on exchange rate in both advanced and emerging economies. Case in point, Nucu (2011) explored the impact of key macroeconomic variables such as Gross Domestic Product (GDP), Inflation, money supply, interest rate and balance of payment (BOP) on the exchange rate of the Romanian currency against major currencies (USD, EUR). The discoveries of the study show that there is negative relationship between exchange rate and GDP. Then again, the study discovered positive relationship between exchange rate, inflation and interest rate.

Edwards (2000) additionally analyzed the dynamic relationship between exchange rate administrations, capital streams and currency crises in developing economies. The study draws on lessons learned through the 1990s, and manages probably the most critical arrangement discussions that rose after the Mexican, East Asian, Russian and Brazilian emergencies. The discoveries demonstrate that under appropriate conditions and arrangements, floating exchange rates can be viable and effective.

Taylor (2001) examines the failures of liberalised strategies in Argentina. He says that Argentina has failed in keeping up the liberalised strategies about capital streams and a firm currency. Argentina had anti-inflation project based on freezing the exchange rate in the early 1990s. This implies that the money supply inside the nation and the supply

of credit to firms are fixed specifically to international reserves. So if the nation gets capital inflows, the supply of money and credit increases, resulting in a considerable increase in local prices.

Harberger (2003) considered the effect of financial development on real exchange rate. He found that there is no deliberate association between financial development and real exchange rate. Husain, Mody, and Rogoff (2004) found in their study that little access to global capital is accessible for the poor nations, so low rate of inflation and more elevated level of durability is connected with fixed exchange rate administration in those nations. On the other hand, they discovered no strong relationship between economic performance and exchange rate administration in the emerging economies. They additionally found that developed economies may encounter durable and slightly higher amount of growth rate without more level of inflation in flexible exchange rate regime.

Due and Sen (2006) examined the connections between the real exchange rate, level of capital streams, volatility of flows, financial and money related arrangement markers and the present record surplus for Indian economy for the period 1993Q2 to 2004Q1. The estimations show that the variables are cointegrated and each Granger causes the real exchange rate.

The empirical literature has also produce conflicting results in light of geographical grouping. For instance, Bahmani-Oskooee and Rhee (2002) researched the impact of currency depreciation on output in Asian nations. He observed that in numerous Asian nations depreciation is contractionary. Additionally, Bahmani-Oskooee and Rhee (1997) utilizing Korean quarterly information over the period 1971-1974 used

Johansen's cointegration and error-correction model. Their error-correction model affirmed that there exists a long-run relationship between output, money and the real exchange rate variables. They concluded that real depreciations were expansionary in the long run and the most vital expansionary effect of real depreciation appeared with a lag of three quarters. Christopoluos (2004) on the other hand, researched the impact of currency devaluation on output expansion in 11 Asian nations over the period 1968-1999. He found that, over the long run, the devaluation applies a negative effect on output growth for five nations while for three nations deterioration enhances growth prospects. De Silva and Zhu, (2004) considered the instance of Sri Lanka and applied the VAR method. Utilizing quarterly information over the period 1976-1998, they concluded that devaluation enhanced the trade balance but had a contractionary effect on the Sri Lankan economy.

Different researchers have discovered mixed results in researching the effect of devaluation on output growth and inflation in sub-Saharan nations. For instance, Khan (1998) researched the effect of changes in real exchange rate on both output and inflation for twenty-two Sub-Saharan nations for the period 1980-1996. The outcome showed that, devaluation increases both output and inflation. In a related study, UbokUdom (1999) utilized yearly data to look at the relationship between exchange rate variations and the development of domestic output in Nigeria between 1971 and 1995. He utilized ordinary least squares (OLS) and found that depreciation is contractionary on output. Furthermore, Odusola and Akinlo (2001) explored the effect of exchange rate depreciation on output and inflation in Nigeria. Using quarterly data for the period 1970-1995, with an impulse response function, they discovered expansionary effect of exchange rate depreciation on output in both the medium and long run, yet a contractionary impact in the short run. Canetti and Greene (1991) utilized

a VAR system to examine the relative quality of exchange rate and monetary in propagating inflation in Ten African nations (including Sierra Leone) amid 1978-1989. Granger causality tests were conducted to show the direction and significance levels of key variables. The study demonstrates that inflation is driven by money supply and exchange rate depreciation. The study by Elbadawi (1990) likewise demonstrates that depreciation of the parallel exchange rate applied a significant impact on inflation in Uganda. Likewise, Harberger (2003) explored the effect of economic growth on real exchange rate. He found that there is no systematic association between financial growth and real exchange rate.

In Romania, Nucu (2011) researched the relationship between exchange rate, GDP, money supply and interest rate. The exchange rate of Romania against the US dollar was used. The information was gathered for the period 2000 to 2010. The findings of the study show that there is negative relationship between exchange rate, GDP and Money supply.

2.8 Relationship between macroeconomic variables and Exchange rate Like any price, exchange rate strays from the valuation premise - the purchasing power of currencies – under the influence of demand and supply. The correlation of such supply and demand relies upon several factors. Multiple factor exchange rate mirrors its association with other economic categories - expense, price, cash, interest, the balance of payments, and so on. In this section, various macroeconomic variables are talked about to inspect their association with exchange rate volatility. They are Inflation, GDP, Interest Rate and Money Supply.

Exchange rate and Inflation

Exchange rate developments can have some impact on domestic prices through direct and indirect channels, through their impact on total supply and demand. The direct channel can show through the law of one price in light of purchasing power parity theory (PPP). It has been reported that exchange rate between two currencies is determined by relative developments in the price levels in the two nations. Purchasing Power Parity (PPP) states that value levels between two nations are equivalent when communicated in the same currency at any span of time. Therefore, if PPP holds, exchange rate volatilities translate into relative developments in the domestic price level; i.e. pass-through is equivalent to one. In a little open economy (an international price taker), a depreciation of the domestic currency will bring about higher import costs (both for completed merchandise and intermediate inputs), which will at last be transmitted to higher domestic costs (Hyder and Shah, 2004).

Exchange rate variations can likewise influence domestic price through its direct impact on aggregate demand. Depreciation of the local exchange rate decreases the foreign price of domestic products and services, and in this way expands foreign demand, resulting to an increment in net exports and thus aggregate demand and real output. The increment in domestic demand and real income may bid up input prices and consequently causing labour to request for higher wages to keep up a real wage.

—The nominal wage increase may result to further price increase (Hyder and Shah, 2004). Besides, depreciation may expand the domestic price of imported merchandise and service and in this way prompt consumption exchanging for domestic products and services, which will build their requests and raising domestic prices.

Exchange rate and Interest Rate (MPR)

Throughout the years an important factor for fluctuation in exchange rate has been interest rate differential i.e. the difference in interest rates between major countries. Currencies with higher interest rates attract huge number of investors searching for better opportunities for their investment. This makes the currency more appealing as a sort of investment and increases the demand for the currency. The opposite relationship exists for decreasing interest rates i.e. lower interest rates tend to decrease exchange rates Ezirim et al (2012).

Money Supply and Exchange rate

Money supply shows the measure of cash flowing in the economy. An Expansionary fiscal policy (increment in money supply) implies approaches to increase demand in the economy. Expansionary financial strategy ordinarily will include lower interest rates – to make it less expensive to get and support both consumption and investment. This is prone to inflation in the economy. This domestic inflation will make merchandise moderately less competitive and export will fall. Consequently, there will be less demand for the currency and its value will have a tendency to fall on the Exchange rate markets. In this way a high increment in money supply is likely to lead to depreciation of the domestic currency.

2.9 History of Exchange Rates in Ghana

Prior to the advent of the economic recovery program, Ghana's exchange rate policy had involved the maintenance of a fixed exchange rate regime with occasional devaluation, and exchange rationing. However, from 1988, the country adopted the flexible exchange rates regime in whose wake the national currency, the cedi (¢), has experienced instability for the most part.

Ghana adopted an independent currency and monetary policy from the time of independence in 1957. After operating with fixed type exchange rate regime for a considerable number of years, the country adopted a more flexible regime in 1983, which has more or less been kept in place. Over the years however, the currency which has been changing several times, has seen massive depreciation against major foreign currencies. This has fueled inflation, eroded nation income and undermined confidence in the economy.

According to literature, depreciation is driven in part by short term demand and supply shocks, some seasonal in nature. But the long-term trend depreciation reflects more fundamental factors; in particular instability

Ghana adopted a fixed exchange rate regime in the management of its exchange rate between 1970 and 1985. During this period, the Ghanaian cedi was pegged to the main convertible currencies, notably the British pound and the American dollar, respectively. Beginning 1986, the country adopted a managed floating exchange rate, and in September of the same year, the government adopted an auction market approach in order to accelerate the adjustment of the exchange rate and to achieve the object of trade liberalization, leaving it partially to market forces (demand and supply) to determine the cedi-dollar rates. Following the adoption of a floating exchange rate in 1986, the cedi depreciated by 95.6 percent in 1987, but the depreciation rate of the cedi eased off between 1988 and 1991. In 1988, the foreign exchange bureaux system was established in an attempt to absorb the parallel market into the legal foreign exchange market. These foreign exchange bureaux were fully licensed entities operated by individuals, groups or institutions. In March 1990, the country introduced the wholesale auction to replace the weekly retail auction, which resulted in the operation of a composite exchange rate

system, namely the inter-bank and a wholesale system. However, the wholesale auction system was abolished in April 1992 and replaced by the inter-bank market. Since then, both the commercial banks and the Foreign exchange Bureau have operated in a competitive environment. Depreciation which stood at 57.4 percent in 1993, decline to 2.3 percent in 1998, before attaining its highest value of 99.4 percent in 2000. Between 2001 and 2007, the rate of depreciation of the cedi slowed down, but the value of the cedi fell sharply between 2008 and 2009, partly due to the redenomination of the domestic currency.



CHAPTER THREE

METHODOLOGY

3.1 INTRODUCTION

In Chapter two, the researcher concentrated on the review of relevant literature on the topic being studied. This chapter seeks to explain the methodology adopted for the study. Specifically, the chapter examines the research design, sources of data, econometric model specification as well as the data analysis technique adopted.

3.2 RESEARCH DESIGN

The study is designed to use time series data to examine the relationship between macroeconomic variables and exchange rate volatility in Ghana. Monthly data on macro-economic variables made up of Cedi/Dollar exchange rate, Monetary Policy Rate (Interest rate), Inflation and Money Supply. Data on these variables were obtained from the official website of the Bank of Ghana (BOG). The monthly time series data used in the study spans from May, 2000 to May, 2014. The main time series analyses used is the Autoregressive Distributed lag (ARDL) approach to cointegration developed by Pesaran (2001). EVIEWS statistical software was used to perform the analysis.

3.3 RESEARCH APPROACH

Research approach, as indicated by Saunders et al. (2009) portrays the methodology for examining and interpreting research results. It can be quantitative or qualitative. Quantitative approach is one in which investigator basically uses post positivist cases for creating information (i.e. cause and effect thinking, reduction to particular variables and hypotheses and inquiries, utilization of instrument and observation and the test of hypotheses), utilizes procedures of inquiry , for example, experiments and surveys and

gathers information on predetermined instruments that yield measurable information (Creswell, 2003).

Qualitative research is multi system in nature, including an interpretive, naturalistic way to deal with its topic. This implies that subjective analysts study things in their common settings, endeavoring to comprehend or translate phenomena regarding the implications individuals convey to them (Newman and Benz, 1998). Qualitative methodology is one in which the inquirer frequently makes learning cases construct basically with respect to constructivists points of view (i.e. the various importance of individual encounters, significance socially and generally built, with a purpose of adding to a hypothesis or example) or backing or participatory point of view (i.e. political, issue-situated, synergistic or change arranged) or both. It likewise utilizes systems of request, for example, stories, phenomenology, ethnography, grounded hypothesis studies or contextual analyses. The analyst gathers open-finished, rising information with the essential goal of creating subjects from the information (Creswell, 2003).

For the reasons of this study, the quantitative methodology has been adopted. This is on the grounds that the researcher depended on time series data which lend itself for statistical analysis. Likewise, hypotheses have been developed which should be statistically tested. Lastly, the study tries to examine cause and effect relationship among the variables, which makes quantitative approach suitable for that reason.

3.4 SOURCES OF DATA

The study employed secondary data in examining the relationship between exchange rate and key macroeconomic indicators. Data on the macroeconomic indicators were sourced from the Bank of Ghana (BOG) official web site.

3.5 ECONOMETRIC MODELS

An econometric model represents the basic features of an economic phenomenon. To analyse time series data, a number of econometric models needs to be employed.

Among the models considered in this study are Pearson's correlation analysis, Unit root test, and autoregressive Distributed Lag (or bound) test. These models are further discussed as follows.

3.5.1 Correlation Analysis

The study utilized Pearson's Correlation coefficient to focus the relationship between the variables utilized. The correlation coefficient measures of how two data series are firmly related. Specifically, the correlation coefficient measures the direction and degree of linear relationship between two variables. A correlation coefficient can have a maximum value of 1 and a minimum value of - 1. The correlation coefficient is the covariance of two variables (X and Y) divided by the product of their sample standard deviations. The model used to estimate the correlation coefficient is shown below:

$$r = \frac{n \sum x_i y_i - \sum x_i \sum y_i}{\sqrt{[n \sum x_i^2 - (\sum x_i)^2][n \sum y_i^2 - (\sum y_i)^2]}}$$

From the formula, x and y are the variables being correlated, while n is the number of observations

The model tests whether the correlation coefficient (r) is significantly different from 0 or not.

H₀: The correlation coefficient is equal to 0 (r=0)

H1: The correlation coefficient is not equal to 0 ($r \neq 0$)

3.5.2 Unit Root Test

Economic variables are expected to be stationary before they can be used for meaningful statistical analysis. However, in practice, many economic time series are non stationary and thus causing the conventional OLS-based statistical inferences to be misleading or spurious. To avoid this problem, the variables were subjected to stationarity test. Augmented Dickey-Fuller (ADF) and Q-Statistics were used to examine the existence of unit root in the variables. ADF is applied to the level variables as well as to their first differences in logarithmic terms. The null hypothesis tested that the variables under investigation have a unit root, against the alternative that they do not have. Augmented Dickey Fuller tests whether ρ is equal to 0 or not.

$$\Delta Y_{t-1} = \alpha + \beta Trend + \gamma Y_{t-1} + \epsilon_t \quad (1)$$

The Augmented Dickey Fuller test (ADF) tests the null hypothesis (H_0) against the alternative hypothesis (H_1)

H_0 : Economic variable has unit root

H_1 : Economic variable does not have a unit root

3.5.3 Cointegration Model

A number of methods are available to perform cointegration analysis among time series variables. The most common ones are Eagle-Granger (1987) test, and the maximum likelihood based Johansen (1991; 1995) and Johansen-Juselius (1990) tests.

However, due to the low power and other problems associated with these test methods, the OLS based autoregressive distributed lag (ARDL) approach to cointegration has

become popular in recent years. In addition, the ARDL model can be applied even if the variables are of different order of integration (Pesaran and Pesaran 1997). It is also argued that using the ARDL approach avoids problems resulting from non stationary time series data (Laurenceson and Chai 2003). Another advantage of the ARDL method over other methods is that the variables don't need to integrate at the same order before it can be applied. For instance, it can be used in studies where the variables are a mix of I(0) and I(1) series. Hence, we adopt the ARDL modeling approach for cointegration analysis in this study. The model is generally given as:

$$y_t^* = f_0 + f_1 X_t^*$$

Which can have the following ARDL(1,1) specification:

$$y_t = \alpha_0 + \alpha_1 X_t + \beta_1 y_{t-1} + \beta_2 X_{t-1}$$

Where the long run elasticity is given by the ratio f_1

$$= (\alpha_0 + \alpha_1) / (1 - \beta_1)$$

And the error-correction model analogous to the dynamic equation from the Engle-Granger procedure is given by:

$$\Delta y_t = \alpha_0 + \alpha_1 X_t + (1 - \beta_1) ECM_{t-1}$$

Based on this study, the econometric model of ARDL – Auto Regressive Distributed Lag model was used to examine the relationship between the dependent and independent variables and their respective lags is given as:

$$\Delta EXR_t = \alpha_0 + \alpha_1 EXR_{t-1} + \alpha_2 EXR_{t-2} + \alpha_3 INF_{t-1} + \alpha_4 INF_{t-2} + \alpha_5 MPR_{t-1} + \alpha_6 MPR_{t-2}$$

$$\alpha_7 M2_{t-1} + \alpha_8 M2_{t-2} + \epsilon_t$$

Where:

EXR= Exchange rate (between the cedi and US dollars)

INF= Inflation (Consumer price index)

MPR= Monetary Policy Rate (Interest Rate)

M2= Money Supply

ϵ_t = Error Term

In order to examine the long run equilibrium relationship among the variables, the ARDL bound testing approach is used. To investigate the existence of long run relationship among the variables, we conduct a bound test based on the joint Fstatistics test to observe the joint significance of the lagged level variables. To achieve this, the null hypothesis of no cointegration is stated as:

$$H_0 = \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = \alpha_7 = \alpha_8 = 0$$

Against the alternative hypothesis,

$$H_1 = \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq \alpha_6 \neq \alpha_7 \neq \alpha_8 \neq 0$$

If the computed F-statistics exceeds the upper critical bound, $I(1)$ we accept the alternative hypothesis that the variables are integrated in the long-run. There is no cointegration when the lower critical bound value, $I(0)$ is greater than the computed Fstatistics. When the computed F-statistics lies between the upper and lower critical bound (i.e. $I(0) \leq F \text{ value} \leq I(1)$), the result is inconclusive. The critical values of the

F-statistics in this study are obtained from Narayan (2005). For a given specification level, both the lower bounds and upper bounds critical values are used with both time trend, $I(0)$ and without time trend, $I(1)$.

3.5.4 Lag Selection

The optimal ARDL model can be achieved with the selection of optimal number of lags. The optimal model can be selected using the model selection criteria like Schwartz-Bayesian Criteria (SBC) and Akaike Information Criteria (AIC). In this study, the optimal model is selected on the basis of their prediction power by comparing the prediction errors of the model. To ascertain the appropriateness of the ARDL model, the diagnostic and the stability tests are conducted and are reported accordingly.

3.6 VARIABLE SELECTION AND DESCRIPTION

The purpose of this research is to ascertain the short and long-run relationship between exchange rate and key macroeconomic variables. The main variables considered are Cedi-dollar (¢/\$) exchange rate (EXR), Inflation (INF), Monetary Policy Rate (MPR) and Broad Money (M2+). These variables are defined as follows;

Exchange Rate (EXR): (Cedi-US Dollar Exchange Rate)

Businesses in modern days are to somewhat affected by international activities as a result of globalisation. Thus, exchange rate changes may affect the competitive position of companies and industry operations as well. The cedi/dollar exchange rate was used as the dependent variable since the dollar is the main foreign currency used in Ghana to transact international business and trade.

Inflation (INF)

Inflation is a sustained increase in the general level of prices for goods and services. It is measured as an annual percentage increase. In a small open economy (an international price taker), a depreciation of the domestic currency will result in higher import prices (both for finished goods and intermediate inputs), which will ultimately be transmitted to higher domestic prices (Hyder and Shah, 2004). Thus a fall in the Ghana cedi is expected to increase the rate of inflation, all other things being equal.

Monetary Policy Rate (MPR) or Interest Rate

Throughout the years another imperative variable for developments in exchange rates has been interest differential i.e. the difference in interest rates between major nations. Currencies with higher interest rates attract huge number of investors looking for a superior open doors for their investment. This makes the currency more appealing as a form of investment and increases the demand for the currency. The opposite relationship exists for diminishing interest rates i.e. lower interest rates have a tendency to reduce exchange rates. In this manner we anticipate that high interest rate will have a positive relationship with exchange rate.

Money Supply

Money supply shows the measure of cash circulating in the economy. An Expansionary financial arrangement (increment in money supply) implies strategies to increase demand in the economy. Expansionary financial strategy regularly will include lower interest rates – to make it less expensive to get and encourage both consumption and investment. This is liable to increase inflation in the economy. This domestic inflation will make goods and services relatively less competitive and export demand will fall. In this manner, there will be less demand for the currency and its worth will have a

tendency to fall on the exchange rate markets. Hence a high increment in money supply is prone to depreciation of the domestic currency.

CHAPTER FOUR

DATA ANALYSIS AND PRESENTATION OF RESULTS

4.1 INTRODUCTION

The chapter that preceded this one examined the methodology and sources of data for the study. This chapter is designed to analyse and present the results based on the specific objectives of the study. The chapter begins by examining the descriptive statistics of the various variables, as well as the correlation among these variables.

The test of unit root would be provided and briefly explained. The Autoregressive Distributed Lag (ARDL) approach to cointegration will then be applied to examine the existence of long run relationship among the variables. Finally, the results obtained from the analysis will be discussed and compared with existing literature on the subject.

4.2 DESCRIPTIVE STATISTICS

Table 4.1 provides a summary of the descriptive statistics of the variables used in the model. The result shows that while some of the variables are normally distributed, others are not. For instance, the exchange rate variable is normally distributed based on the Jarque-Bera test. The result further reveals that money supply and inflation have the highest standard deviations, supporting the general intuition that inflation and money supply in developing economies are highly volatile. The kurtosis values of three of the variables are below the benchmark for normal distribution of 3, indicating near

normality. Comparing the standard deviation figures with their corresponding mean values, it can be deduced that it is low, showing that the values do not deviate significantly from their means.

Table 4.1 Summary of Descriptive Statistics

	LNEXR	LNINF	LN2M	LNMPR
Mean	0.0837	2.7393	8.3849	2.8816
Median	-0.0759	2.6741	8.3623	2.8332
Maximum	1.0619	5.0460	10.3213	3.3142
Minimum	-1.0145	1.8469	6.2003	2.5257
Std. Dev.	0.3896	0.4698	1.1819	0.2671
Skewness	0.1789	1.0736	-0.1015	0.4137
Kurtosis	2.8372	5.2444	1.8580	1.8020
Jarque-Bera	1.1137	69.5463	9.6974	15.2794
Probability	0.5730	0.0000	0.0078	0.0005
Observations	173	173	173	173

Source: Field Data, 2015

4.3 CORRELATION ANALYSIS

Correlation matrix of all variables included in the study is shown in Table 4.2. The result from the correlation analysis indicates that inflation and interest rate both have negative significant relationship with cedi/dollar exchange rate. However, the result shows that there is positive relationship between exchange rate and liquidity (M2+).

The correlation result shows that the independent variables are not highly correlated, indicating that there is no problem of multicollinearity among the independent variables. Pallant (2011) argues that having correlation of more than 0.8 or 80% between independent variables suggest some form of multicollinearity. However, the Pearson's correlation coefficients in Table 4.2 clearly show that there is no problem with multicollinearity.

Table 4.2 Pearson's Moment Correlation Coefficient

		Exr	Inf	m2	Mpr
Exr	Pearson Correlation	1			
	Sig. (2-tailed)				
Inf	Pearson Correlation	-.458**	1		
	Sig. (2-tailed)	.000			
m2	Pearson Correlation	.955**	-.607**	1	
	Sig. (2-tailed)	.000	.000		
Mpr	Pearson Correlation	-.595**	.770**	-.771**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	173	173	173	173

** . Correlation is significant at the 0.01 levels (2-tailed)

4.4 UNIT ROOT TEST

Economic variables are expected to be stationary before they can be used for meaningful statistical analysis. However, in practice, many economic time series are non-stationary and thus causing the conventional OLS-based statistical inferences to be misleading or spurious. To avoid this problem, the variables were subjected to stationarity test. The Augmented Dickey-Fuller (ADF) test was performed on all the variables at level and first difference to ascertain the stationarity of the variables. The ADF test the null hypothesis that there is unit root in the data as against the alternative hypothesis that the variables are stationary. The result of the ADF unit root test shows that all the variables are non-stationary at level but become stationary at first difference.

The Augmented Dickey Fuller test (ADF) tests the null hypothesis (H_0) against the alternative hypothesis (H_1)

H_0 : Variable has unit root

H_1 : Variable does not have a unit root

In Table 4.3a, we fail to reject the null hypothesis of unit root. This is because the p-values are greater than 5% level of significance ($P \geq 0.05$). In Table 4.3b, all the variables have p-values less than 0.05 ($P \leq 0.05$), which leads us to reject the null hypothesis of unit root in the variables. It can therefore be concluded that all the variables are integrated at order 1 or are $I(1)$. Figure 4.1 corroborate the result of the Dickey Fuller unit root tests. It can be observed from the figure that at level, the variables exhibit some form of trend, but when differenced, there are no visible trends. The result paves way for the cointegration analysis using ARDL.

Table 4.3a ADF Unit Root Test at Level (Using Schwarz Info Criteria)

Variables	Test statistics	Critical value	P-Value	RESULT
-----------	-----------------	----------------	---------	--------

LNEXR	-0.247	-2.878	0.920	Non-stationary
LNMPR	-1.654	-2.878	0.453	Non –stationary
LNINF	-2.213	-3.468	0.203	Non-stationary
LN2M	-1.118	-3.471	0.679	Non –stationary

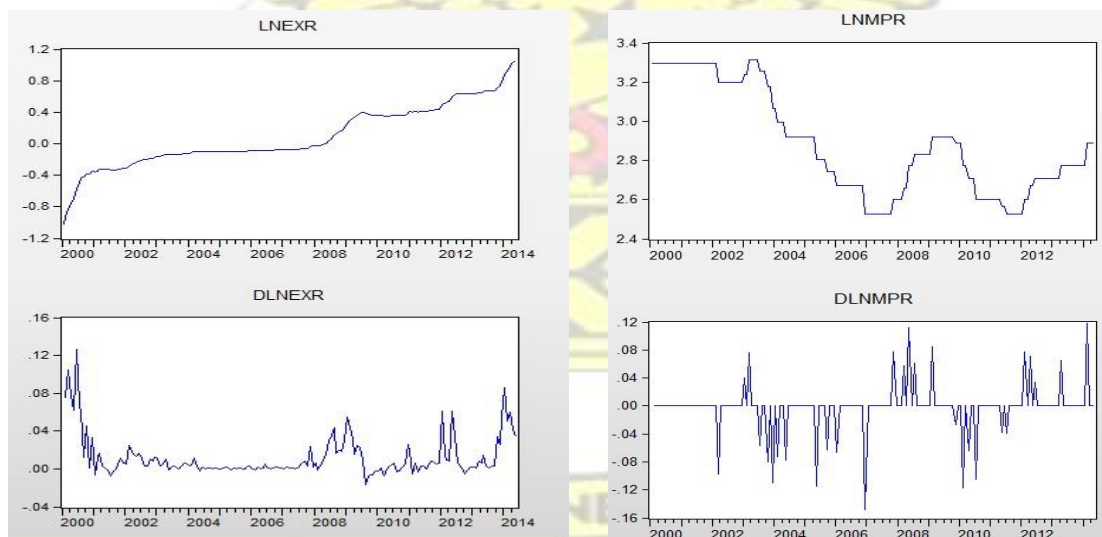
Output from EVIEWS Statistical Software

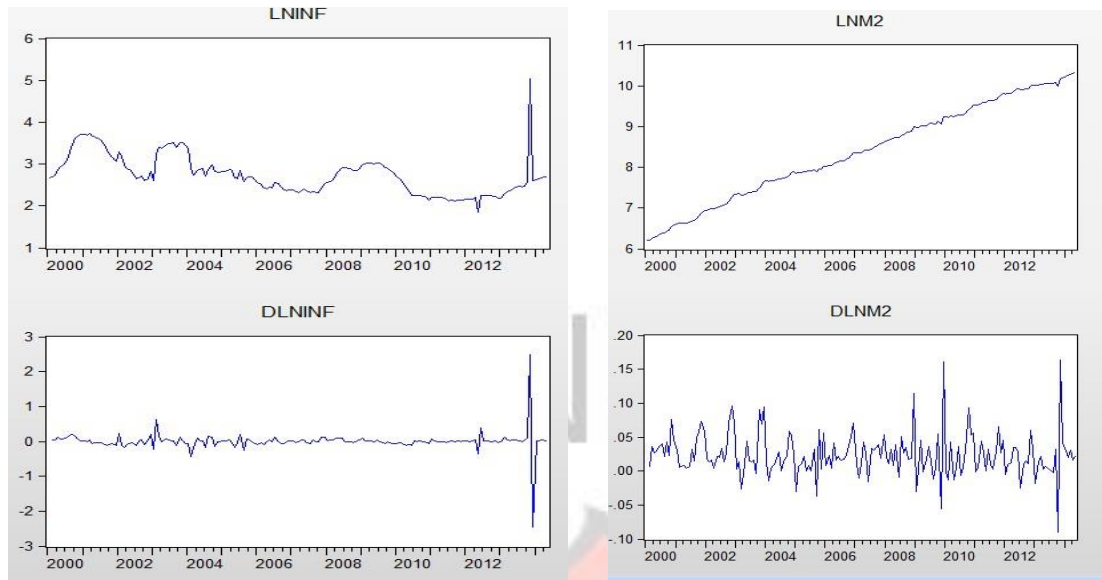
Table 4.3b ADF Unit Root Test at First Difference (Using Schwarz Info Criteria)

Variable	Test Statistics	Critical value	P-value	Result
Δ LNEXR	-5.461	-3.469	0.000	Stationary
Δ LNMPR	-7.012	-3.469	0.000	Stationary
Δ LNINF	-13.424	-3.468	0.000	Stationary
Δ LN2M	-3.182	-3.471	0.022	Stationary

Output from EVIEWS Statistical Software

Figure 4.1 Graphical representations of various variables at level and first difference





4.5 AUTOREGRESSIVE DISTRIBUTED LAG (ARDL) ANALYSIS

The optimal ARDL model can be achieved if the right or optimal number of lags is selected. The optimal number of lags was selected using selection criteria such as Akaike information criteria (AIC), Schwartz –Bayesian Criteria (SBC) and Hannan Quinn Criteria. The result as presented in Table 4.4, indicates that 2 is the most optimal number of lags for the model. This is because all the three criteria (AIC, SBC and HQC) support lag two as against lag four.

Table 4.4 Lag Selection Criteria

Number of lags	Akaike info criteria (AIC)	Schwartz-Bayesian Criteria (SBC)	Hannan-Quinn Criteria (HQC)
4 LAG	-5.87	-5.48	-5.71
2 LAG	-5.90	-5.66	-5.81

Table 4.5 Optimal model based on the lag selection

Variable	Coefficient	Std. error	t-statistics	Prob
C	-0.2706	0.0851	-3.1782***	0.0018
Δ (LNEXR(-1))	0.4319	0.0698	6.1872***	0.0000
Δ (LNEXR(-2))	0.2898	0.0682	4.2500***	0.0000
Δ (LNINF(-1))	-0.0046	0.0047	-0.9825	0.3274
Δ (LNINF(-2))	0.00081	0.0039	2.0549**	0.0415
Δ (LNMPR(-1))	0.00160	0.0306	0.5223	0.6022
Δ (LNMPR(-2))	-0.0212	0.0298	-0.7087**	0.4796
Δ (LNM2(-1))	0.0717	0.0313	2.2921**	0.0232
Δ (LNM2(-2))	0.0036	0.0335	0.1076	0.9144
LNEXR(-1)	-0.0534	0.0169	-3.1661***	0.0019
LNINF(-1)	0.0039	0.0039	1.0054**	0.3162
LNMPR(-1)	0.0254	0.0118	2.1461**	0.0334
LNM2(-1)	0.0229	0.0069	3.3333***	0.0011
R-squared	0.6493	Adjusted R-squared	0.6225	
F-statistic	24.2211	Prob (F-statistic)		0.0000
Durbin-Watson stat	2.0157			

4.5.1 Diagnosis of the model

The presence of serial correlation in the model was tested using Breusch-Godfrey Serial Correlation LM Test: the result is presented in Table 4.6. It can be observed that the p-value is greater than 0.05, meaning that we fail to reject the null hypothesis that there is no serial correlation in the model.

Table 4.6 Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.714760	Prob. F(2,155)	0.4909
Obs*R-squared	1.553532	Prob. Chi-Square(2)	0.4599

The stability of the model was also tested using Cusum Test. The Figure shows that there is stability in the model since the blue line falls within the red boundaries.

Figure 4.2 Graphical presentation of the Cusum Test



4.5.2 Bound Testing and Long-Run Relationship

The bounds-testing procedure identifies the long-run relationship(s) between exchange rate and macroeconomic variables. The AIC yields 2 lags used for the bounds-testing for the I(0) and I(1) component specifications. The results of the bounds-testing procedure are reported in Table 4.7.

Table 4.7 Bounds-Testing Co-Integration Analysis

Test Statistics	Value	Level	Critical value bounds of the F-Statistics: Unrestricted Intercept and no Trend	
			I(0)	I(1)
F-Statistics	4.452*			
Chi-Square	16.88	90%	2.73	3.77
		95%	3.23	4.35
		99%	5.15	6.36

Source: Pesaran et al. 2001

Pesaran *et al.* (2001) supply *bounds* on the critical values for the *asymptotic* distribution of the F-statistic. The rule of thumb is that if the computed F-statistic falls below the lower bound we would conclude that the variables are I(0), so no cointegration is possible, by definition. If the F-statistic exceeds the upper bound, we conclude that we have cointegration or long-run relationship between the variables. Finally, if the F-statistic falls between the bounds, the test is inconclusive. From the result in Table 4.7, the value of our F-statistic exceeds the upper bound at the 5% significance level; we can conclude that *there is evidence of a long-run relationship between the study variables.*

Table 4.8 Short run and LONG Run ARDL Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.0003	0.0016	-0.2194	0.8266
Δ (LNEXR(-1))	0.7168	0.1660	4.3168***	0.0000
Δ (LNEXR(-2))	0.0923	0.1226	0.7527	0.4527
Δ (LNINF(-1))	-0.0057	0.0038	-1.4743	0.1424
Δ (LNM2(-1))	0.1047	0.0322	3.2490***	0.0014
Δ (LNM2(-2))	-0.0098	0.0372	-0.2639	0.7922
Δ (LNMPR(-1))	0.0618	0.0310	1.9934**	0.0479
Δ (LNMPR(-2))	-0.0111	0.0315	-0.3530	0.7245
ECT(-1)	-0.3613	0.1883	-1.9185**	0.0568
R-squared	0.5833	Adjusted R-squared	0.5625	
F-statistic	28.0005	Prob (F-statistic)	0.0000	
Durbin-Watson stat	1.9762			

4.5.3 Adjusted R-squared

The Adjusted R-squared value of 0.5625 implies that about 56.25% of the variations in the dollar exchange rate are explained by MPR, INF and M2+. This means there are other variables which can explain 43.72% of variations in exchange rate. Further, the F-statistics value of 28.0 (prob. 0.000) indicates that MPR, INF and M2+ jointly and significantly affect exchange rate in Ghana.

4.5.4 The error correction model

The variable ECT (-1) indicates the error correction model. The coefficient is negative and statistically significant. The coefficient of the ecm (-1) measures the speed of adjustment of the exchange rate to its long run values. The result implies that exchange rate disequilibrium is corrected at the rate of 36.1%.

4.6 CAUSAL RELATIONSHIP AMONG VARIABLES.

A number of arguments have been made regarding the impact of certain macroeconomic variables on exchange rate. This study sought to empirically examine the extent to which macroeconomic variables such as inflation, money supply and interest rate (MPR) cause exchange rate and vice versa. To achieve this objective, Granger Causality test was conducted. The findings are presented as follows.

4.6.1 Granger Causality between exchange rate and inflation

In Table 4.9, the result of the granger causality test between exchange rate and inflation is presented. From the result, it can be observed that the null hypothesis that inflation does not Granger cause exchange rate is rejected at 5 percent level of significance. Thus, it can be concluded that inflation Granger cause exchange rate.

This means that inflation plays an important role in determining exchange rate in Ghana. However, the null hypothesis that exchange rate does not Granger cause inflation is not rejected since the p- value is greater than 0.05 ($p=0.07>0.05$).

Table 4.9 Granger causality test between inflation and exchange rate

Null Hypothesis	F-statistics	Probability	$\alpha= 0.05$
INF does not Granger Cause EXR	13.9467	0.000	Rejected
EXR does not Granger Cause INF	2.6368	0.0746	Not Rejected

Source: Analysis of Field Data, June 2015

4.6.2 Granger Causality between monetary policy rate (interest rate) and exchange rate

In Table 4.10, the result of the granger causality test between MPR and exchange rate is presented. From the result, it can be observed that we fail to reject the null hypothesis that MPR does not Granger cause exchange rate. This is because the pvalue of 0.13 is greater than 0.05. On the other hand, we reject the null hypothesis that exchange rate does not Granger cause monetary policy rate and conclude that exchange rate of Ghana significantly affect the monetary policy rate.

Table 4.10 Granger causality test between monetary policy rate and exchange rate

Null Hypothesis	F-statistics	Probability	$\alpha = 0.05$
MPR does not Granger cause EXR	2.0096	0.1373	Not rejected
EXR does not Granger cause MPR	7.4156	0.0008	Rejected

Source: Analysis of Field Data, June 2015

4.6.3 Granger Causality between broad money supply and exchange rate

In Table 4.11, the result of the granger causality test between exchange rate and money supply is presented. From the result, it can be observed that the null hypothesis that broad money supply does not Granger cause exchange rate is rejected at 5 percent level of significance. Thus, it can be concluded that broad money supply Granger cause exchange rate. This means that broad money supply significantly affect the value of the country's local currency against the US dollar. However, the reverse is not valid.

Table 4.11 Granger causality test between money supply and exchange rate

Null Hypothesis	F-statistics	Probability	$\alpha = 0.05$
M2 does not Granger Cause EXR	16.3009	0.000	Rejected
EXR does not Granger Cause M2	1.9324	0.1480	Not Rejected

Source: Analysis of Field Data, June 2015

4.7 DISCUSSION OF RESULTS

The result of the relationship between exchange rate and key macroeconomic variables gives intriguing perspectives to examination and discussion. The outcome discovered a cointegration relationship between exchange rate and inflation, interest rate and money supply. This infers that over the long run, these variables move together. The outcome is in concurrence with Ezirim, et al (2012) who likewise utilized the same technique in Nigeria. Using autoregressive distributed lag approach, they found that exchange rates developments and inflation are cointegrated, associating both in the short run and over the long run.

The outcome further demonstrates that immediate past exchange rate has significant effect on the current exchange rate. The outcome demonstrates that previous months' exchange rate has a critical effect on current exchange rate. The outcome is not surprising on the grounds that most people in developing economies like Ghana, where the financial system is yet to develop fully, base their expectation about the exchange rate on the immediate past history of the exchange itself. This implies that if the currency is depreciating, it bounds to depreciate further on the grounds that it will engender buying or hoarding to hedge against further depreciation and its attendant potential exchange losses.

The result also shows that in the short run inflation significantly cause current exchange rate. In other words, the past month's inflation has significant impact current exchange rate in Ghana. This finding is in agreement with the findings of Nuku (2011) who established that inflation significantly cause exchange rate. The result implies that, there is the need for policy makers and government to focus on the stability of prices due to the short and long run relationship that exist between exchange rate and inflation.

The outcome likewise demonstrates that in the short run, MPR (interest rate) does not significantly cause cedi/dollar exchange rate fluctuations. In Ghana, the Bank of Ghana is the establishment that influences interest rates in the nation. High interest rates may be seen as nominally increasing the monetary value of a creditor. Based on the interest rate parity theory, a high interest in Ghana compared with a low interest rate in say United State (US) essentially means the Ghana cedi would have to depreciate in real value in order to restore. In this manner, government and the bank of Ghana Monetary policy committee must take into consideration interest rates of its major trading partners like US before coming out with an interest rate that will not significantly affect the value of the local currency. The findings in this study agree with that of Nucun (2011) who found no causal relationship between exchange rate and interest rate (MPR). The outcome likewise demonstrates that there is a causal relationship between Money supply and exchange rate. This outcome is in concurrence with Ezirim et al. (2010) who discovered a causal relationship between exchange rate and money supply and in Nigeria.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

The previous chapter provided the analysis and discussion of the secondary data collected from the Bank of Ghana web site. This chapter provides the summary of the key findings regarding the relationship between exchange rate and key macroeconomic variables based on the results obtained from the analysis. The chapter also provides a brief conclusion and recommendations based on the key findings.

5.2 SUMMARY OF KEY FINDINGS

The main focus of the study was to examine the short and long-run relationship between exchange rate, inflation, interest rate (monetary policy rate) and money supply (M2+). The study employed monthly economic data from May 2000 to May 2014. Descriptive statistical analysis, correlation analysis and cointegration analysis were performed.

Using Augmented Dickey Fuller Unit Root Test, the preliminary result obtained shows that all the variables are integrated at order 1, i.e. $I(1)$. This means that all the variables exhibited unit root at level but became stationary at first difference.

The lag selection criteria revealed that the optimal number of lags for the ARDL model was 2. The lag 2 model was tested to be stable using Cusum test. The presence of serial correlation in the model was tested using Breusch-Godfrey Serial Correlation LM Test and it was established that there is no serial correlation in the model. The Pesaran bound testing procedure revealed a cointegration relationship among the variables. This implies that there is a long-run relationship between the variables or they move together in the long run. The error correction model indicates that the speed of adjustment of exchange rate to long run equilibrium is 36.1%

The result shows that lag of exchange rate cause current exchange rate. In other words past months exchange rate has an impact on the current exchange rate in Ghana. This means that variations in cedi/dollar exchange rate are influenced not only by economic fundamentals but also speculation based on past history of exchange rate itself.

The result also shows that in the short run inflation cause current exchange rate in Ghana. In other words, the past month's inflation has significant impact on current exchange rate in Ghana. The result implies that, there is the need for policy makers and government to focus on stability of prices due to the short run relationship that exist between exchange rate and inflation.

The findings further revealed that inflation and broad money supply Granger Cause exchange rate. However, in both cases, the reverse was not valid. Also, it was discovered that exchange rate Granger Cause monetary policy rate, but the reverse is not valid.

Finally, the result also shows that in the short run, MPR (interest rate) does not significantly cause cedi/dollar exchange rate fluctuations.

5.3 CONCLUSION

The study used Autoregressive Distributed Lag approach to cointegration to test the short and long-run relationship between exchange rate, monetary policy rate, inflation and money supply. Data for the study was obtained from the official web-site of the Bank of Ghana (BOG). The researcher used monetary data from May 2000 to May 2014. This time period was chosen based on availability of data. The analysis was performed using EVIEWS statistical software. Augmented Dickey Fuller test

conducted shows that all the variables are integrated at order 1, i.e. $I(1)$. The bound testing conducted revealed a long run relationship between exchange rate and the macroeconomic variables, implying that in the long run exchange rate, interest rate, inflation and money supply move together. The study further revealed that lag one of exchange rate ($exr(-1)$) causes current exchange rate. The study further established that lag one of money supply cause exchange rate fluctuations in Ghana. It can therefore be concluded that variations in cedi/dollar exchange rate is influenced by a combination of both economic fundamentals and speculation based on past history of exchange rate itself.

5.4 RECOMMENDATIONS

Based on the findings of the study, a number of recommendations are made for the consideration of future researchers, financial analysts and policy makers. First, future studies should include Balance of Payment or Current account balance between Ghana and its trading partners since these variables have been found to influence exchange rate in developing economics.

Second, given the result obtained, it is important for the Government and policy makers to pay careful attention to macroeconomic fundamentals due to their significant short and long-term effect on the country's exchange rate stability.

The study found that fluctuations in cedi/dollar exchange rate are affected by a blend of both economic fundamentals and speculation based on past history of exchange rate itself. This implies that the government and policy makers must impart trust in the economy to lessen speculation in the market.

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