

12-1-2018

Sources of Currency Depreciation in Ghana

Hilarious Edem Anku

Southern Illinois University Carbondale, ankuhilarious@yahoo.com

Follow this and additional works at: <https://opensiuc.lib.siu.edu/theses>

Recommended Citation

Anku, Hilarious Edem, "Sources of Currency Depreciation in Ghana" (2018). *Theses*. 2444.
<https://opensiuc.lib.siu.edu/theses/2444>

This Open Access Thesis is brought to you for free and open access by the Theses and Dissertations at OpenSIUC. It has been accepted for inclusion in Theses by an authorized administrator of OpenSIUC. For more information, please contact opensiuc@lib.siu.edu.

SOURCES OF CURRENCY DEPRECIATION IN GHANA

By

Hilarious Edem Anku

B.S., University of Louisville, Kentucky, 2017

A Thesis

Submitted in Partial Fulfillment of the Requirements for the
Master of Science Degree

Department of Economics
in the Graduate School
Southern Illinois University Carbondale
December 2018

THESIS APPROVAL

SOURCES OF CURRENCY DEPRECIATION IN GHANA

By

Hilarious Edem Anku

A Thesis Submitted in Partial

Fulfillment of the Requirements

For the Degree of

Master of Science

in the field of Economics

Approved by:

Dr. AKM Mahbub Morshed, Chair

Dr. Sylwester Kevin

Dr. Scott Gilbert

Graduate School

Southern Illinois University Carbondale

November 6, 2018

AN ABSTRACT OF THE THESIS

Hilarious Edem Anku, for the Master of Science Degree in Economics, presented on November 6, 2018 at Southern Illinois University Carbondale.

TITLE: SOURCES OF CURRENCY DEPRECIATION IN GHANA

MAJOR PROFESSOR: Dr. AKM MAHBUB MORSHED

This paper investigates the factors driving the real exchange rate in the Ghanaian economy. The paper aimed at finding the principal factor(s) that influence the real exchange rate and explains the channels by which these factors exert their influence using standard empirical methods of vector autoregressive (VAR) models. The paper established that inflation rate differentials and interest rate differentials influence the exchange rate through the expectations medium. Domestic and foreign money supplies which are exogenous macroeconomic variables were also found to be important in the Ghanaian money market as far as the exchange rate matters. The paper also highlighted how the great recession in the United States may have affected the cedi/dollar rate of exchange after this economic event swept through the United States generating spillover effects on economies around the world.

ACKNOWLEDGEMENTS

I wish to extend my profound gratitude to the members of my thesis committee for going the extra mile to help in the completion of this work. I also extend my appreciation to all the professors of the department of Economics for their efforts in the teaching of Economics; without their efforts I could not have produced this work.

To my colleague students in the department, I thank all of you for being some of the best friends I have made in my academic life. Above all, your suggestions and encouragement were a great booster when the going got tough.

And to all other staff of the department, I could not be more grateful for your work and help each time it was needed. Thank you!

TABLE OF CONTENTS

<u>CHAPTER</u>	<u>PAGE</u>
ABSTRACT.....	i
ACKNOWLEDGEMENTS.....	ii
LIST OF TABLES.....	vi
LIST OF FIGURES.....	vii
CHAPTERS	
CHAPTER 1 – Introduction.....	1
CHAPTER 2 – An Overview of Ghana’s Macroeconomy.....	3
2.1- The Political System, Government and Demographics.....	3
2.2- General Growth Trends.....	4
2.3- Sectoral Analysis of the Ghanaian Economy.....	5
2.4- Notable Facts and Developments in Fiscal Policy.....	7
2.5- Monetary System Facts and Developments.....	10
2.6- Current Account Facts and Developments.....	14
CHAPTER 3- Literature Review.....	16
3.1- Theoretical Review.....	16
3.2- Empirical Review of Ghana’s exchange rate.....	17

CHAPTER 4- Theoretical framework and Methodology.....	20
4.1- The Monetary Model.....	20
4.2- Specification of the Empirical Model.....	20
CHAPTER 5- The Data, Data Sources and Empirical Methodology.....	22
CHAPTER 6- Presentation of Results.....	24
6.1- Unit Root Tests.....	24
6.2- Johansen Cointegration Test Results.....	24
6.3- Results of the Error Correction Model.....	25
6.4- Diagnostic Test Results.....	26
6.5- Test of Model Stability.....	26
CHAPTER 7- Analysis of Results.....	27
7.1- The Long Run.....	27
7.2- The Short Run.....	29
CHAPTER 8- Conclusion and Policy Implication.....	31
REFERENCES.....	32
APPENDICES	
APPENDIX A.....	35
APPENDIX A.1.....	36

APPENDIX A.2.....	36
APPENDIX A.3.....	37
APPENDIX A.4.....	39
VITA.....	41

LIST OF TABLES

<u>TABLE</u>	<u>PAGE</u>
Table 1- ADF(k) Unit Root Test Results.....	25
Table 2- Johansen Cointegration Test results.....	25
Table 3-Results of the Error Correction Model.....	26
Table 4- Diagnostic Test Results.....	27

LIST OF FIGURES

<u>FIGURE</u>	<u>PAGE</u>
Figure 1- Trend of the growth rate 1990 to 2016.....	5
Figure 2- Evolution of growth trends of the major Sectors 1990 to 2016.....	6
Figure 3- The yearly fiscal deficit as a percent of GDP 1990 to 2016.....	8
Figure 4- The national debt as a percent of GDP 1990 to 2016.....	9
Figure 5- Government Spending versus Government Revenue 1990 to 2016.....	10
Figure 6- Trend of the rate of inflation 1990 to 2016.....	12
Figure 7- Exchange rate depreciation 1990 to 2016.....	14
Figure 8- Test of Model Stability.....	27

CHAPTER 1

INTRODUCTION

As a developing economy, many challenges confront Ghana. While the economy has been making giant strides, some of these economic challenges prove to be very nimble and difficult to contain. Speaking about difficult challenges in the Ghanaian economy, one that frequently comes into sharp focus is the exchange rate. The exchange rate remains one of the most hotly debated policy issues among experts in Ghana.

An important fact about the Ghanaian economy is its dependence on imports. Due to rising capital investments of transition economies such as Ghana, this is not unusual. International trade and finance as well as trade openness are all on the increase. These developments and facts provide a reason why the exchange rate is such an essential factor in the Ghanaian economy. This is a reason why this paper takes interest in the monetary matters of the economy, the exchange rate being majorly interesting and intriguing for further study.

During the Bretton Woods era, the fixed exchange rate systems were in place and during these periods, the exchange rate regime in the Ghanaian economy was very stable. The collapse of the Bretton Woods forced a policy redirection in the monetary environment and Ghana subsequently adopted the floating exchange rate system. The floating system, however, quickly evolved into a managed floating system as time went by.

In view of the foregoing, the Ghanaian currency has experienced relative weakness by means of incessant depreciations over time since the floating exchange rate system began. As such, the natural question arises as follows: Why does the cedi always depreciate? For the

purposes of conducting a formal analysis I ask: *What are the sources of currency depreciation in Ghana?*

In this paper, I intend to investigate the factors that determine the exchange rate in the Ghanaian economy. In so doing, my aim is to focus on and isolate the most important factors that influence the rate of exchange of the Ghanaian currency. I employ standard econometric techniques to achieve this goal.

The rest of this paper is organized as follows: section 2 presents a general overview of the Ghanaian economy. Section 3 reviews relevant literature on the subject matter. Section 4 presents the theoretical framework and methodology. Section 5 looks at the data, data sources and empirical methodology. Section 6 presents the results. Section 7 is an analysis of the results. Section 8 presents the conclusions and implications for policy.

CHAPTER 2

AN OVERVIEW OF GHANA'S MACROECONOMY

2.1 The Political System, Government and Demographics

Unlike many other countries in the West African sub-region, Ghana has a very stable political climate, it is one of the most politically stable states in the region. Ghana has a unitary system of government which means that, as far as economic and political decision making goes, major policy initiatives in the country (political and economic) follow a top-down approach. The government is made up of an executive branch, a legislature and a judiciary. All three branches have specific roles in the economy, however, much of economic policy and planning falls on the executive and legislative branches of the government.

In the region, the area covered by Ghana (the land mass) can be described as mid-size relative to larger countries like Nigeria and Niger but the population of the country is second behind Nigeria. It has always been the case in this region that Ghana's population comes second only to Nigeria. Official census figures recorded in 2010 put the population headcount at 24.65 million (Ghana Population and Housing Census Report, 2010). Official population estimate in 2018 is 29.58 million people, approximately 30 million people. The estimated labor force stands at 14 million (World Bank Est., 2017).

With GDP per capita at \$1,513, the World Bank classifies Ghana as a lower middle-income country. As a developing nation in transition (United Nations Classification), unemployment remains a major challenge. The unemployment rate in 2016 was 5.5 percent. Even though this statistic looks quite good, it must be viewed with great caution because, as a developing nation in transition, the unemployment rate is not a very reliable measure of the

health of the economy since such data is often notoriously inaccurate. As such, the level of income may be a better measure of the health of the economy. In 2016, income per capita in PPP dollars was \$4,301 (World Bank).

2.2 General Growth Trends

Ghana's economy suffered many setbacks in the 1980s mainly due to political upheavals which precipitated fiscal and monetary imbalances. Referred to as the lost decade by Fischer (1991), like most economies in Africa, the period between 1979 and 1989 was a period of economic stagnation and negative growth in Ghana. As a result of stagnant growth, Ghana joined the IMF's structural adjustment program (SAP) in 1983. As part of the structural adjustment program, an economic recovery program (ERP) was also implemented to restore the ailing Ghanaian economy to positive growth. The economy responded well to many of the economic recovery programs and growth bounced back in the 1990s.

Over the period 1990 to 2016, the Ghanaian economy expanded quite slowly but steadily. In the 1990s, growth of the Ghanaian economy was not particularly strong. The average growth rate over the decade spanning 1990 to 1999 was 4.27 percent. Though characterized by the typical boom and bust of growth trends, growth of the Ghanaian economy was much stronger in the millennium and beyond. Between 2000 and 2010, the growth rate averaged 5.78 percent, a marked improvement over the previous decade (see figure 1).

In the millennium, the growth story of the Ghanaian economy continued. From 2008 to 2013, the growth rate averaged 8.76 percent. In this period, Ghana achieved its highest economic growth rate of 14.05% in 2011 as the result of the combination of two factors: 1) exportation of petroleum crude from its newly discovered oil fields. 2) high prices of Ghana's

primary commodity exports in the international markets (Darko, 2015). However, gross domestic product fell again, quite noticeably, in 2014, 2015 and 2016 largely due to an energy crisis that rocked the economy.

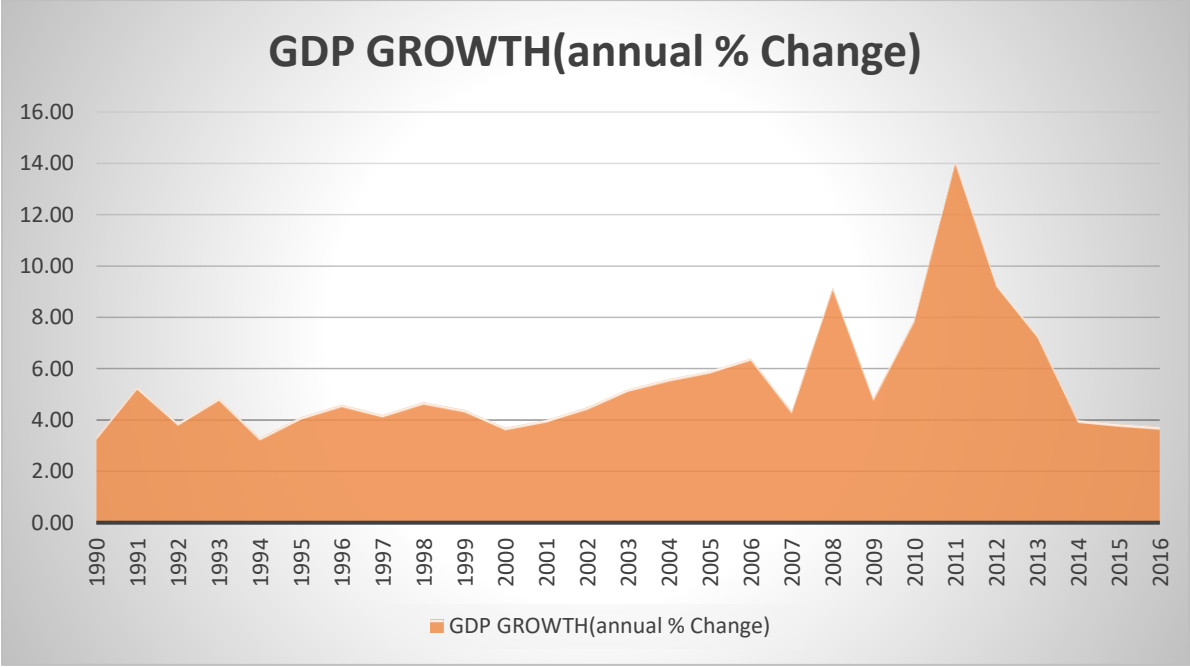


Figure 1: Trend of the growth rate 1990-2016

Despite all the weaknesses of the Ghanaian economy, speaking in broad terms, Ghana’s economy is one of the better performing economies in the West African sub-region. By measure of gross domestic output, Ghana’s economy is the second largest behind Nigeria in the West African Sub-region.

2.3 Sectoral Analysis of the Ghanaian Economy

Four major sectors are prominent in the Ghanaian economy. These are agriculture, industry, manufacturing and the services sector. Agriculture was the mainstay of the Ghanaian economy in the very early years contributing a lion share to total output. However, with the Ghanaian economy undergoing major structural changes, agric is no longer the mainstay of the

economy. Over the period covering 1990-2016, growth in the agricultural sector of the economy slowed compared to other sectors. Indeed, the agricultural sector recorded the lowest average growth rate of 3.9 percent annually over a period of two decades from 1993 culminating in the sector’s dwindling dominance (Baah-Boateng, 2013). The agricultural sector’s contribution to GDP declined from 30.83 percent share in 2010 to 19.60 percent share in 2016.

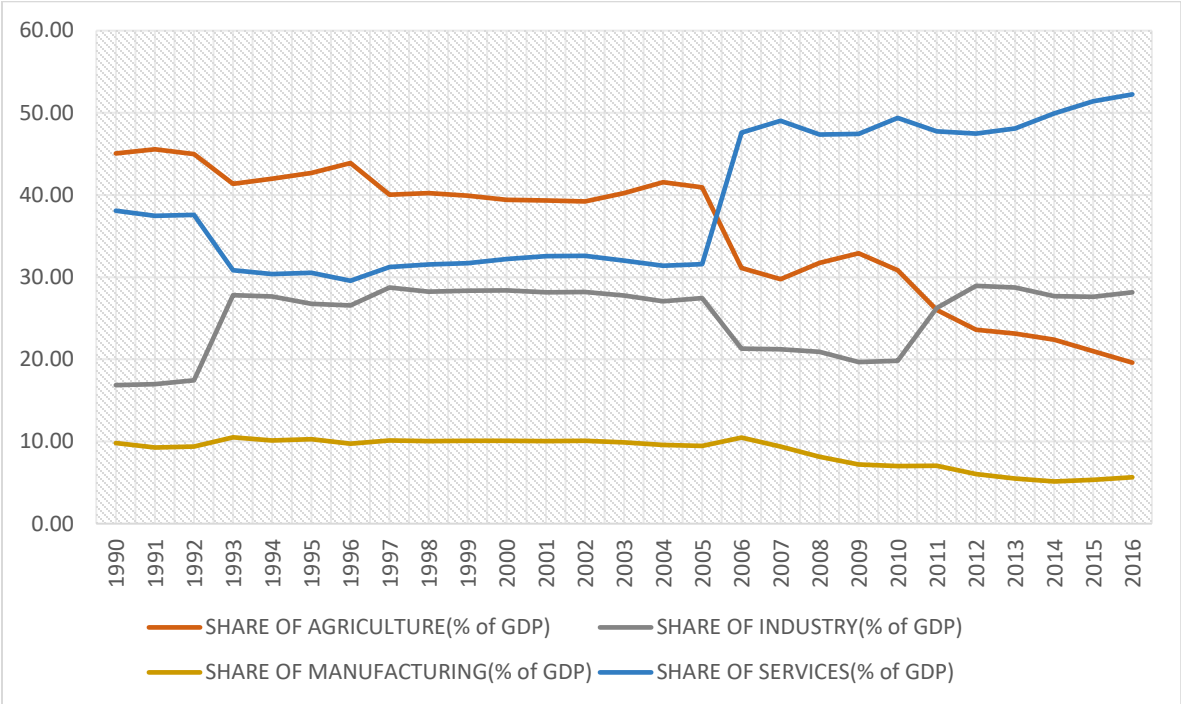


Figure 2: Evolution of growth trends of the major sectors 1990-2016

While the agricultural sector has been slowing, services and industry gathered momentum (see figure 2). The services sector experienced rapid growth and expansion between 1990 and 2016. By 2006, the services sector became the largest sector of the economy accounting for 47.60 percent of total GDP while growth in the Agric sector continued to ease. As a result of more growth, the services sector in 2016 accounted for more than half of the total GDP recording 52.24 percent share of GDP effectively making the Ghanaian economy a service dominated economy (see figure 2). The strong growth in this sector was spurred by improved growth

performance in trade, hospitality and financial services (Alagidede, Baah-Boateng and Nketia-Amponsah, 2013).

Industry on the other hand has also been expanding modestly behind services. In 1990, this sector accounted for only 16.86 percent of GDP. This figure jumped to 28.16 percent of GDP in 2016. This is another indication that while agriculture was on the decline, gains in industry were being made. By 2016, the industrial sector which used to be third largest sector came in second behind services. Between 1990 and 2016, most of the growth in the industrial sector was driven largely by expansion in the extractive subsectors of the economy as mining and construction activities witnessed accelerated growth (Baah-Boateng, 2013).

Manufacturing, however, has not seen much improvement over the period under review. Manufacturing, in 1990 accounted for 9.81 percent of the total GDP being the least in terms of contribution to national output. Some marginal gains were made between the period 1993 to 2002 as the sector recorded an average of 10.11 percent share of contribution to GDP. But the sector went into decline thereafter. The sector actually shrunk from 9.81 percent of GDP in 1990, up to 10.11 percent average share of GDP between 1993-2002 and down to a meager 5.63 percent of GDP in 2016 (see figure 3).

2.4 Notable Facts and Developments in Fiscal Policy

In Ghana, fiscal policy is primarily the responsibility of the executive and legislative branches of government. According to Adam and Mihalyi (2017), the fiscal story of Ghana is pro-cyclical in that government spending goes through a cycle of increasing and decreasing expenditure. Such cycles are typical across developing countries, especially those heavily reliant on exporting primary commodities (Adam and Mihalyi, 2017). Usually, Ghana's fiscal policy is

inclined towards high spending as fiscal managers seek to boost economic activity with the view to expanding total output. This affinity to high expenditure is both a matter of necessity on the one hand and vice on the other. Between 1990 and 2016, the spending dichotomy persisted. The pro-cyclicality of the of the fiscal picture is reflected in the year-on-year fiscal deficit as shown in figure 1.

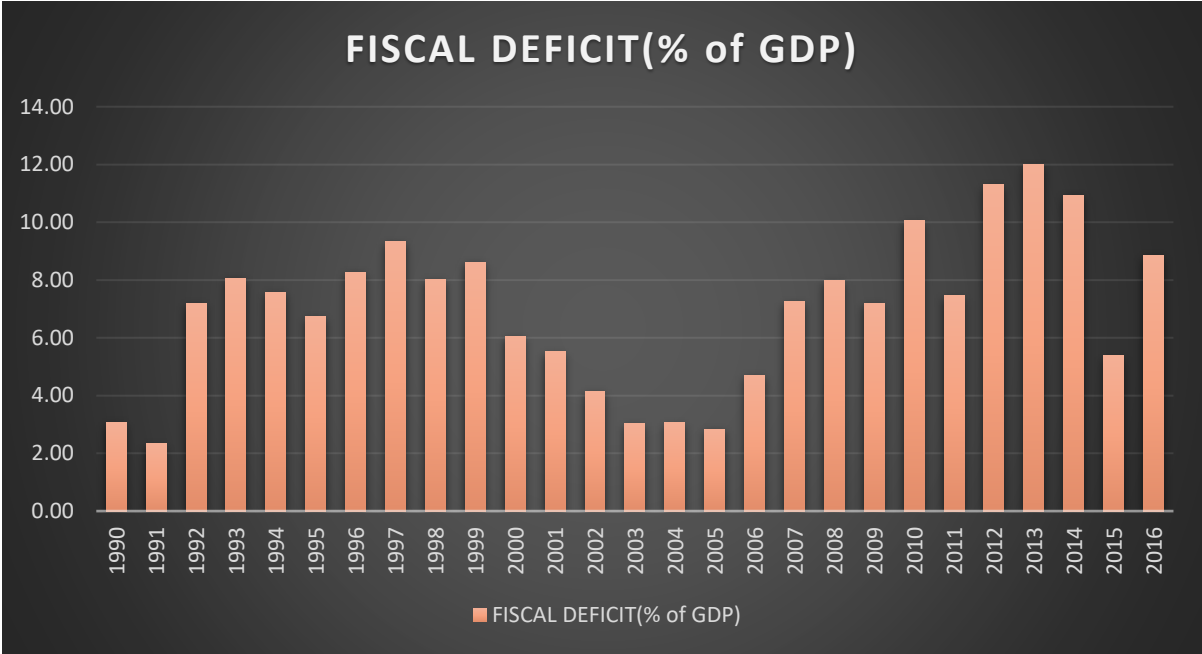


Figure 3: The yearly fiscal deficit as a percent of GDP 1990 to 2016

Despite the complications of expansionary fiscal policy on the Ghanaian economy and what those complications could portend for output, interest rates, inflation and the exchange rate, fiscal managers pursued high spending nonetheless. Between the period under review, the debt situation of the country worsened rapidly owing to excessive budget overruns. It followed that, debt as a percent of GDP rose steadily and significantly. In the year 2000, the debt to GDP ratio reached an all-time high of 111.95 percent creating a fiscal crisis. Inflation in that year rose to 25.19 percent and gross domestic product fell from \$12.56B in 1999 to \$8.11B in 2000.

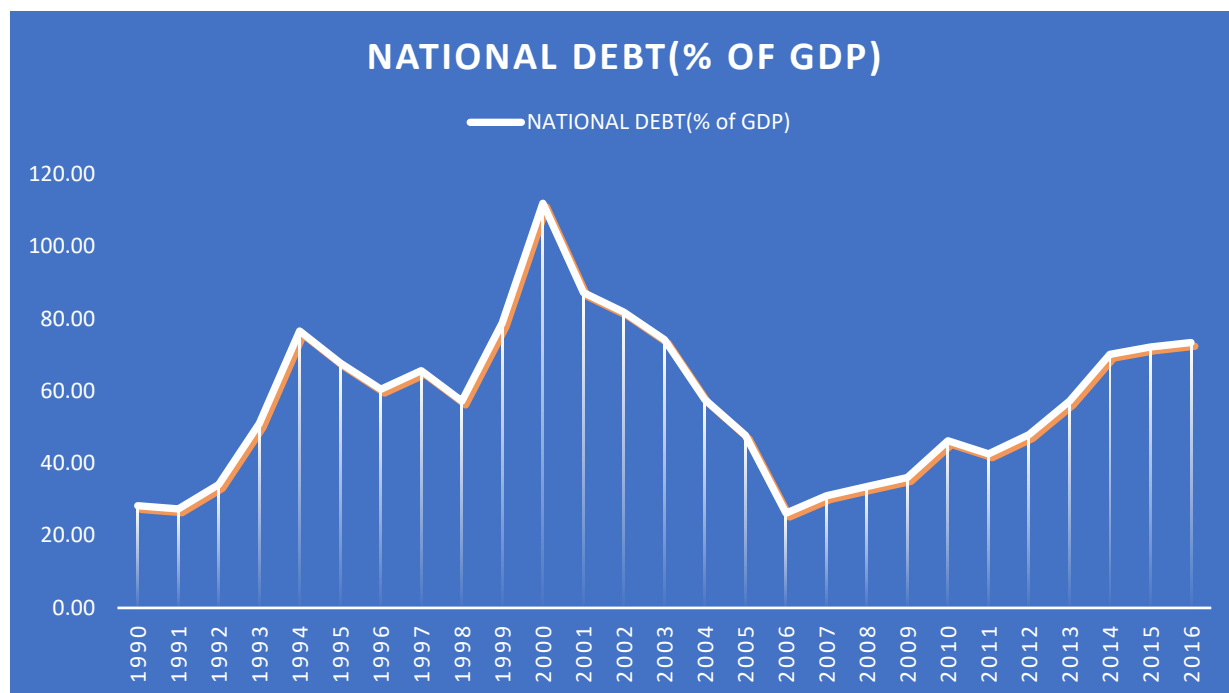


Figure 4: The National Debt as a percent of GDP 1990-2016

In 2001, fiscal managers together with the IMF crafted some solutions to avert the problems. Consequently, the stock of public debt which stood at 111.95 percent of GDP in the year 2000 went down to 26.22 percent of GDP by the end of 2006 (Asiamah et al, 2014). Unfortunately, in 2007, six years after a major fiscal crisis, the ever-present temptation of fiscal expansion derailed the gains of the previous years so that the debt position of the economy began to worsen once again. The debt to GDP ratio again rose steadily from 31.04 percent in 2007 to 73.41 percent in 2016 bringing in its wake all the attendant problems and implications on output, inflation, interest rates and the exchange rate.

With a high inclination to expansionary fiscal policy, one would expect a strong revenue generation to match expenditure. Taxation is the major source of government revenue. As such, a wide range of taxes are levied on income, goods and services. Government revenue comes from taxes such as corporate taxes, income taxes, commercial taxes and taxes on goods and services

among many others. From 1990 to 2000, government revenue as a percent of GDP consistently underperformed expenditure which explains the debt build-up that eventually resulted in the fiscal crisis of 2001 leading Ghana to the IMF. IMF conditions helped impose some fiscal discipline on fiscal managers. As such, spending cuts and strong revenue performance brought some relief between 2002 and 2011. Yet, the situation deteriorated again starting in 2012 as expenditure outstripped revenue setting in motion the cycles once again. High spending coupled with inadequate revenue mobilization continues to be major points of worry in fiscal policy.

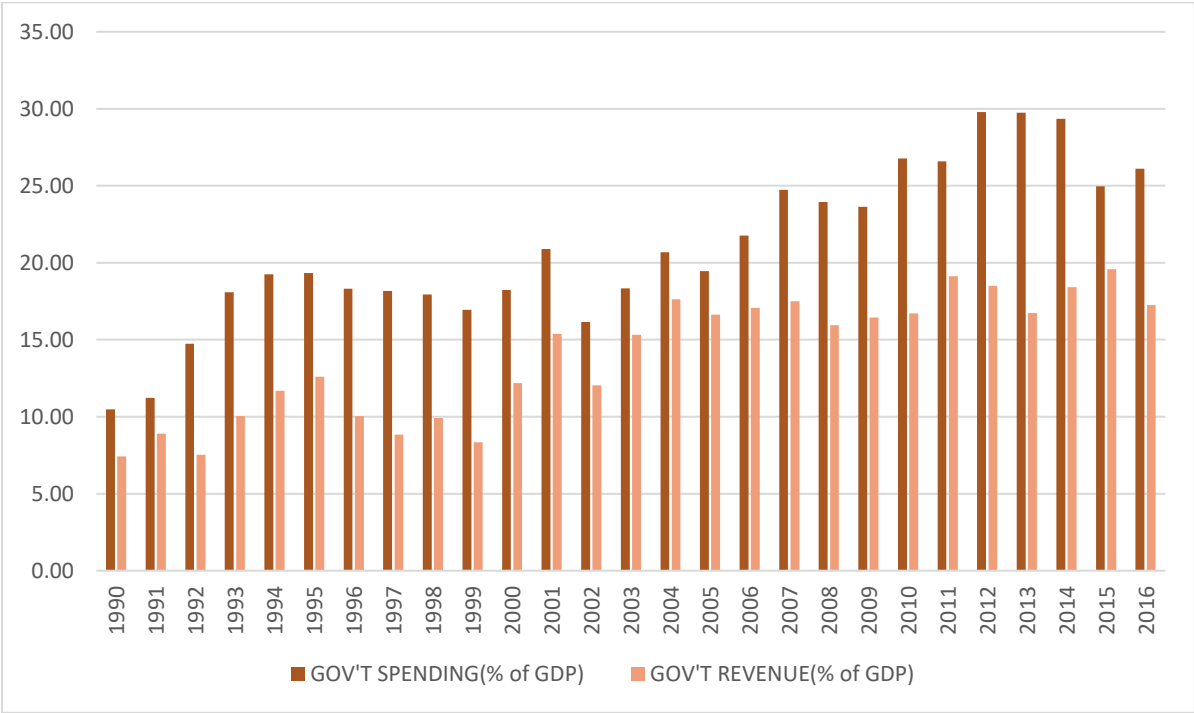


Figure 5: Government Spending versus Government Revenue 1990-2016

2.5 Monetary System Facts and Developments

The central bank, popularly known as the Bank of Ghana (BoG) is the main body responsible for monetary policy. The main focus of monetary policy in the Ghanaian economy is to maintain stable inflation and exchange rates and also ensure balance of payments equilibrium

(Alagidede, Baah-Boateng and Nketia-Amponsah, 2013). Like most economies around the world, the bank’s main tool in achieving macroeconomic targets is the policy rate. To this end, a monetary policy committee meets periodically to review macroeconomic conditions and other key economic indicators. This review of economic conditions informs monetary policy.

Over the years, the Ghanaian economy struggled at keeping stable inflation and exchange rates. The difficulties of the economy in these respects are well documented. Regarding the inflation rate, there were several instances in Ghana when the economy experienced hyperinflation. For instance, in 1983, the inflation rate was 122.9 percent. Earlier in 1977 and 1981, the inflation rate was 116.5 percent respectively. Meanwhile, average inflation rate for 1976, 1978, 1979 and 1980 was 58.43 percent. From 1983, monetary authorities worked to bring the situation under control. Subsequently, between 1990 and 2016, the rate of inflation slowed down quite remarkably.

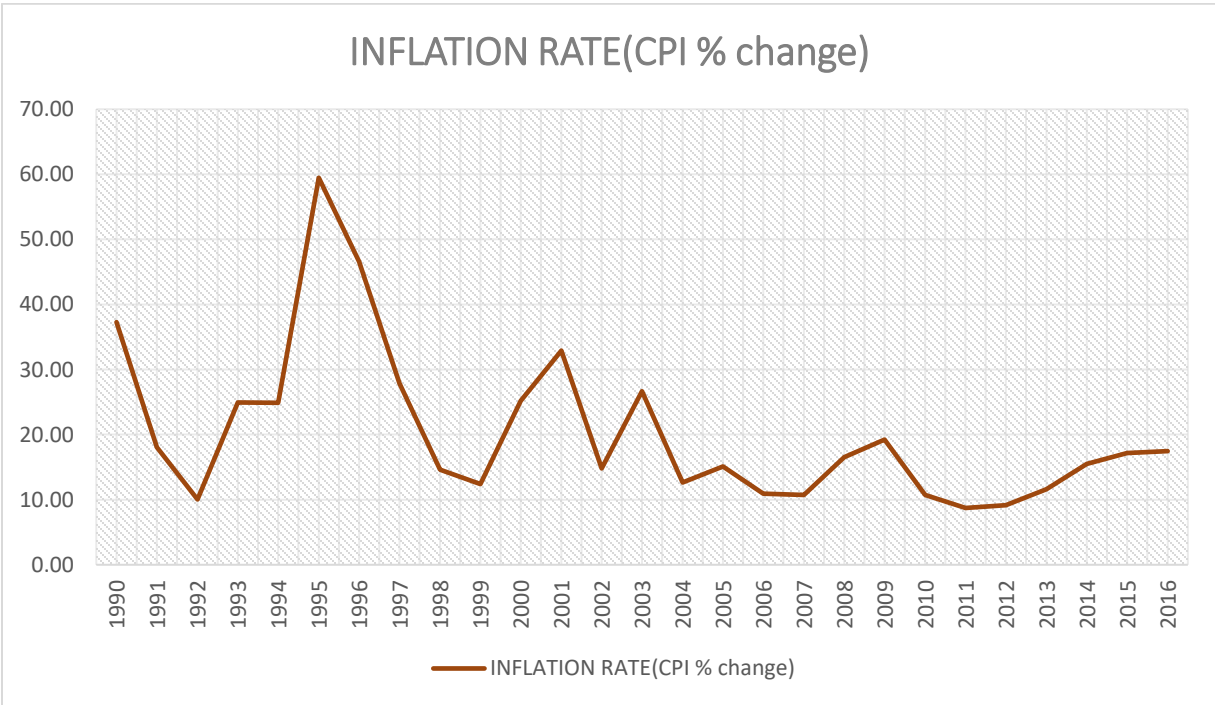


Figure 6: Trend of the rate of inflation 1990 to 2016

Even though some success has been achieved slowing down the rate of inflation, troubles with inflation remain. Between 1990 and 2016, the period under the consideration of this paper, another instance of hyperinflation occurred in 1995. The rate of inflation in that year was 59.46 percent. The inflation rate trended down again beginning in the following year, 1996. The downward trend continued until 2001 when the inflation rate increased again to 32.91 percent. The average rate of inflation during the period under consideration is 20.41 percent, still an unacceptably high level of inflation. Many studies have consistently tied the inflation problem of the economy to fiscal indiscipline, high budget deficits and poor revenue generation (Tsikata and Amuzu, 1997, Alagidede et al, 2013, Baah-Boateng, 2013, Asiamah et al, 2014).

In respect of the Ghanaian currency-the Cedi, the story has not been rosy either. From independence(1957) through much of the Bretton Woods era, Ghana operated a fixed exchange rate system. From 1957 to 1966, the value of the cedi was pegged to the British Pound. Then the value became pegged to the US dollar between 1966 and 1983. During these periods, the cedi enjoyed maximum stability. However, in April of 1983, Ghana adopted a floating exchange rate system as part of the structural adjustment program (SAP) that the country embarked upon.

Since the switch to a floating exchange rate system, the Ghanaian currency has experienced chronic instability even to present times. Before 1983, the fixed exchange rate systems were in place and the cedi/dollar rate of exchange was stable implying that depreciations or appreciations were non-existent. Beyond 1983, however, stability disappeared, and extreme volatility engulfed the foreign exchange regime. The cedi went into a depreciation spiral sprinkled only with pockets of stability and strength. For instance, during the first quarter of 1986, about 0.01 cedi could exchange for a dollar; however, by the end of April 2015, the rate had risen to 3.84, representing a depreciation of 98.7% over the period (Adu, Karimu and Tei-

Mensah, 2015). The cedi has been losing value against all of Ghana’s major trading partners, but this paper focuses on the cedi/dollar rate of exchange.

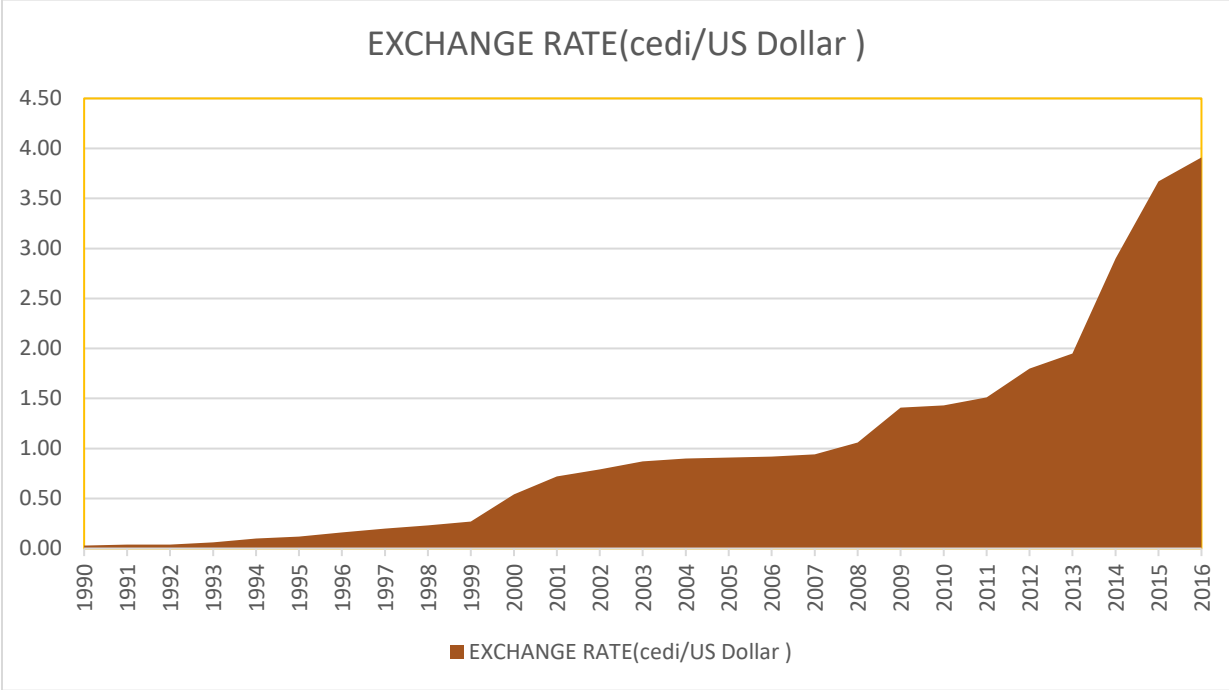


Figure 7: Exchange rate depreciation 1990 to 2016

The Ghanaian currency’s problems continued from the 1990s into the millennium. Successive years of particularly high inflation and high debt starting in 1993 into the millennium caused the cedi to plunge even further; the currency was practically in free fall. So serious was the exchange rate problem that, in each year, depreciation of the cedi was not in doubt, it was only a question of the degree. To deal with the problem, monetary authorities and government embarked upon a redenomination of the currency in the year 2007 (Bank of Ghana monetary reports, 2007). The redenomination exercise simply replaced the old fiat with new fiat setting ten thousand old cedis equal to one new cedi which is also equivalent to one hundred pesewas (ie. $\text{¢}10,000 = \text{GH¢}1 = 100\text{Gp}$, new paper bills were printed in this exercise).

By redenominating the currency, the free fall of the cedi was arrested. The cedi/dollar rate of exchange reversed suddenly to 0.94/1 whittling down exchange rate pressures in the economy. Nevertheless, since these actions were not backed by any changes to key real variables in the economy, the cedi began to depreciate again almost immediately (see figure 7). From 2008 onwards, the cedi lost value steadily and, in the process, any gains from the redenomination exercise were quickly wiped away. Between 2013 and 2014 for example, the cedi depreciated by 28.74 percent cumulatively. In 2015, the cedi lost 15 percent in value against the dollar. The cedi's chronic depreciation problems still exist.

2.6 Current Account Facts and Developments

A major aspect of the Ghanaian economy relates to trade. Trade policy in the Ghanaian economy is heavily tilted towards trade liberalization so that goods and services are freely exchanged with the rest of the world. Ghana's openness to trade reached a high of 116.05 percent of GDP in the year 2000. Between 1990 and 2016, the average trade openness stood at 75.65 percent of GDP. These statistics underscore the importance of trade to the entire Ghanaian economy. Trade remains at the heart of economic growth efforts around the world and much so for Ghana (Tetteh, 2015).

A large chunk of the national income comes from the export of raw natural resources. Commodities such as gold, cocoa beans and petroleum crude are the top exports. Lately, technological improvements and growth resulted in agricultural goods like nuts, cashews and cocoa paste (semi-finished cocoa beans) becoming an integral portion of the country's export mix. In 2016, these agricultural goods put together brought Ghana a total of \$1.02B in export earnings. This figure is the second largest earning behind the three leading exports; gold, cocoa

beans, and petroleum crude whose earnings totaled \$12.80B. In the past five years, exports of Ghana increased at an annual rate of 1.6 percent, from \$14.6B in 2011 to \$16.5B in 2016.

The Ghanaian economy is hugely import dependent mainly because the manufacturing sector of the economy is still work in progress. Imports include both capital goods and consumption goods with capital goods leading the pack. Between 1997 and 2005, imports as a percent of GDP averaged 57.22 percent while between 2010 and 2016, the average imports to GDP ratio was 49.67 percent. The list of goods that Ghana imports is exhaustive. However, the leading imports are cars, delivery trucks, refined petroleum, cement and frozen fish. In 2016, total imports amounted to \$12.5B. Even though import pressure is present in the economy, imports have been slowing since 2011 at a rate of 1.9 percent. Fortunately, exports maintained a strong showing posting an annual growth rate of 1.6 percent since 2011. Subsequently, Ghana's economy posted a positive trade balance of \$3.97B in 2016.

From this overview, it can be seen that the Ghanaian economy has been grappling with major fiscal and monetary difficulties, a situation that implicates real variables like the exchange rate, inflation rate, interest rates and output. It is also obvious that the Ghanaian currency faces enormous challenges. It is also important to note that being an economy dependent on imports, the exchange rate is critical in the economy. Meanwhile, the Ghanaian economy demonstrates much potential especially in the areas of trade so that if difficulties and challenges in the exchange rate space can be kept at bay, the economy can do even much better.

CHAPTER 3

LITERATURE REVIEW

3.1 Theoretical Review

The exchange rate is the price of domestic currency per unit of foreign currency. This is the nominal value of the exchange rate. The real exchange rate requires a more rigorous definition. According to Lansana Daboh (2010), the external real exchange rate concept (also referred to as the purchasing power parity (PPP) definition) considers the real exchange rate as the price of foreign goods relative to that of domestic goods, where both prices are expressed in the same currency. That is, it defines the real exchange rate as the nominal exchange rate adjusted for the relative price levels of foreign and domestic economy. This is given as follows:

$$RER = e \left(\frac{P^*}{P} \right)$$

Where: RER is the real exchange rate, e is the nominal exchange rate, defined as domestic currency per unit of foreign currency, P* is foreign price level and P is domestic price level. This paper follows this definition of the real exchange rate.

In the literature, another theoretical matter of importance in the study of exchange rates is the issue about which approach is most appropriate for measuring the exchange rate while at the same time also appropriate for studying the factors that determine it. According to the disequilibrium models of exchange rate determination (Dornbusch,1976), variations in both nominal and real exchange rates are due to nominal disturbances which are expected to have a transitory effect on the real exchange rate. On the contrary, disequilibrium models of exchange rate determination rely on permanent real shocks to explain movements in the real and nominal

exchange rates (Stockman, 1987). However, the empirical studies following these theoretical contributions have produced mixed results on the relative importance of real or nominal shocks in accounting for movements in the real and nominal exchange rates (Adu et al, 2015).

Lastrapes (1992) reported that fluctuations in the real and nominal exchange rates are primarily due to real shocks of all frequencies, thus lending support to equilibrium models of Stockman (1987). Clarida and Gali (1994), however, found that nominal shocks were more relevant in explaining movements in the real exchange rate. Many empirical works have either confirmed the importance of real variables or affirmed nominal variables as more relevant in the determination of the real exchange rate. For example, Chowdhury (2004), Hamori and Hamori (2011) in their studies, found that real variables explained most of the variation in the real exchange rate while Muntaz and Sunder-Plasmann (2013) reported a strong response of the exchange rate to nominal shocks in their study of the exchange rates of the UK, Euro area and Canada.

Since there is evidence from previous studies that both real and nominal shocks affect the real exchange rate one way or the other, this paper combines both real and nominal variables to investigate the sources of fluctuations in the rate of exchange between Ghana and the United States (the cedi/dollar rate of exchange). The paper follows the assumptions of the PPP concept.

3.2 Empirical Review of Ghana's exchange rate

Morrissey et al (2004) conducted a study that examined Ghana's real exchange rate response to capital inflows. The study employed vector autoregressive (VAR) models and the Johansen system of equations approach to examine relationships between economic variables. The estimation methods allowed for the interdependence and inter-relationships of

macroeconomic fundamentals to be identified in the determination of the exchange rate. Their findings established that short-run movements in the exchange rate are inspired by changes in trade volume. In the long run, they reported that capital flow is the most significant driver of the real exchange rate in Ghana.

Owusu-Afriyie et al. (2004) derived a model of exchange rate determination for Ghana and employed the technique of cointegration analysis to empirically investigate the principal factors driving the Cedi/Dollar rate of exchange. The basic model was augmented with political variables to examine potential impacts of politics on the exchange rate. Their results showed that macroeconomic fundamentals are important determinants of the cedi/dollar rate of exchange. The model also revealed that speculation was important in explaining exchange rate movements but not so much for political variables.

Yemidi (2010) conducted a study focused on the variables that explain variation in the exchange rate of the Ghanaian economy. He made use of quarterly data covering 24 years (1985 – 2008). His model, primarily based on the purchasing power parity concept, was done using cointegration, granger causality test and vector error correction mechanism. Excessive government expenditure coupled with past information on exchange rate, he noted, tend to have dominant effect on the rate of exchange.

Fiagbor (2013) examined the relationship between the real effective exchange rate (REER) and other macroeconomic variables in Ghana. This was to ascertain whether or not there exist short run and long run causal relationships among the variables of interest. With a focus on foreign aid, empirical models were developed for the real exchange rate. Data covering 32 years(1980 – 2011) were used. Vector autoregressive (VAR) and vector and error correction

(VEC) techniques were used in this study. The results showed that government expenditure, foreign aid, terms of trade among others influenced the real exchange rate.

Sackey (2001) studied the factors that influence real exchange rate in Ghana. The researcher postulated a relationship between the real exchange rate with commercial policy, terms of trade, inflows of external aid (defined as real Net Official Development Assistance to Ghana), government consumption, and technological progress as the explaining variables. The cointegration approach was used to examine the aid-real exchange rate relationship employing annual time series data covering the period 1962 - 1996. The study revealed that foreign aid inflows results in real exchange rate depreciation.

CHAPTER 4

THEORETICAL FRAMEWORK AND METHODOLOGY

4.1 The monetary model

For the model in this paper, f is a function that defines the relationship between the nominal exchange rate and other macroeconomic variables at time t . The model is expressed such that the nominal exchange rate is a function of macroeconomic variables as follows:

$$ER_t = f(R_t, USM_t, GM_t, GX_t) \dots\dots\dots 4.1.1$$

where R_t , USM_t , GM_t and GX_t are all related to the nominal exchange rate. Equation 4.1.1 can further be expressed as follows:

$$ER_t = R_t^{\beta_1} USM_t^{\beta_2} GM_t^{\beta_3} GX_t^{\beta_4} \dots\dots\dots 4.1.2$$

(The β_s represent the degree to which each variable influences ER_t). Taking log transformations of equation 4.1.2 yields a linear equation as follows:

$$LnER_t = \beta_1 LnR_t + \beta_2 LnUSM_t + \beta_3 LnGM_t + \beta_4 LnGX_t \dots\dots\dots 4.1.3$$

where $\beta_i = \frac{\partial f}{\partial x}$. Equation 4.1.3 contains both real and nominal macroeconomic variables. As such, this model postulates that changes in both real and nominal variables cause the real exchange rate to deviate from its equilibrium level.

4.2 Specification of the Empirical Model

To estimate and test the model above, an empirical formation of it was identified and tested using traditional cointegration methods. Based on the theoretical model, the real exchange

rate is determined by the real interest rate, US money supply, Ghana money supply and Government expenditure. The empirical specification is as follows:

$$\ln ER_t = \beta_0 + \beta_1 R_t + \beta_2 \ln USM_t + \beta_3 \ln GM_t + \beta_4 GX_t + \varepsilon_t \dots\dots\dots 4.2.1$$

where: β_0 is an intercept and ε_t is a stochastic error term. The following notations have been used: ER_t is the nominal exchange rate which is a proxy for the real exchange rate; R_t is the nominal interest rate differentials between Ghana and the United States (1 year T-bill rates have been used); USM represents the US money supply (M2) ; GM represents Ghana money supply (also M2); US money supply and Ghana money supply in this model capture the dynamics of money supply in determining the nominal exchange rate. GX represents Ghana government expenditure (government expenditure here is the yearly government expenditure as a percent of GDP). The government expenditure variable takes care of the effects of expansionary fiscal policy which increases income thereby affecting the nominal exchange rate. In this model, the short run and long run dynamics of the real exchange rate are captured and explained by the β s (1 to 4).

CHAPTER 5

THE DATA, DATA SOURCES AND EMPIRICAL METHODOLOGY

To test the validity of the model above, data covering the period 1990-2016 was collected from three main sources: the World Bank, IMF and the Bank of Ghana. Data was not always readily available for the demands of this study. Hence, some variables had to be proxied using their closest data available. The real interest rate could not be observed, as such, 1 year T-bill rates were used as proxy. (ie. The nominal interest rate differentials were used in the error correction model)

Traditional econometric techniques were applied to the data using the **Eviews** software. With appropriate lag lengths, the variables were tested for stationarity using Augmented Dickey-Fuller tests of the form:

$$\Delta Y_t = \mu + \gamma t + \beta Y_{t-1} + \delta \Delta Y_{t-1} + \delta_{p-1} \Delta Y_{t-p+1} + \varepsilon_t$$

Results of the Dickey-Fuller tests are presented in table 1. After confirming stationarity via the Augmented Dickey-Fuller unit root tests, tests of cointegration were carried out to ascertain the existence of cointegrating relationships between the dependent variable (the nominal exchange rate in this case) and the explanatory variables. The max-eigen value and trace statistics of the Johansen approach to cointegration were used as guidelines. Both statistics confirmed cointegration of the variables at conventional levels which is also a confirmation of equation 4.3 in this paper. Results of the Johansen cointegration tests are reported in table 2.

Subsequently and with the appropriate lag lengths, an error correction model of the form:

$$\Delta X_t = \pi_0 + \pi X_{t-1} + \pi_1 \Delta X_{t-1} + \pi_2 \Delta X_{t-2} + \dots + \pi_p \Delta X_{t-p} + \varepsilon_t$$
 was executed to estimate

equation 4.4.1. Results of the error correction model are reported in table 3. This representation summarizes the cointegration relationship between the variables.

To ascertain the statistical accuracy of the model, diagnostic tests were conducted to check for any possible statistical errors. Serial LM test confirmed no serial correlation, Breusch-Pagan-Godfrey test of heteroskedasticity also confirmed homoskedastic errors, the histogram normality test returned normality of residuals, the CUSUM stability test confirmed stability of the model at the 5% level. Results of diagnostic tests are reported in the results section.

CHAPTER 6

PRESENTATION OF RESULTS

6.1 UNIT ROOT TESTS

TABLE 1: ADF(k) UNIT ROOT TEST RESULTS							
LEVELS				FIRST DIFFERENCES			
VARIABLE	k	A	B	VARIABLE	k	A	B
ER	1	-3.644	-1.062	Δ LnER	1	-3.903***	-4.103**
GX	1	-1.902	-2.624	Δ GX	1	-5.310***	-5.396***
RD	1	-2.356	-2.750	Δ RD	1	-6.098***	-5.955***
LnUSM	1	-2.741**	-2.881	Δ LnUSM	1	-6.393***	-6.283***
LnGM	0	-4.702***	-5.553***	Δ LnGM	1	-6.455***	-6.292***
1% crt value		-3.711	-4.356	1% crt value		-3.724	-4.374
5% crt value		-2.981	-3.595	5% crt value		-2.986	-3.603
Notes:							
1.k is the number of lags included in ADF Test							
2. A = ADF with constant only; B = ADF with constant and trend							
3.*** denotes significance at 1% level and **denotes significance at 5% level							

6.2 JOHANSEN COINTEGRATION TEST RESULTS

TABLE 2

Null	Trace Statistic	5% Crt value	Max-Eigen Statistic	5% Crt value
None*	137.1088	69.8189	70.1630	33.8769
Atmost 1*	66.9458	47.8561	29.8222	27.5843
At most 2*	37.1236	29.7971	17.7747	21.1316
Atmost 3*	19.3489	15.4947	14.6301	14.2646
Atmost 4*	4.7188	3.8415	3.8415	3.8415

*Trace test indicates 5 cointegrating equations at the 5% significance level

*Max-Eigen value test indicates 2 cointegrating equations at the 5% significance level

6.3 RESULTS OF THE ERROR CORRECTION MODEL

TABLE 3

VARIABLE	COEFFICIENT AND T-STATISTIC
$\Delta \text{LnER}(-1)$	-0.106 (-0.547)
$\Delta \text{LnER}(-2)$	0.035 (0.194)
$\Delta \text{RD}(-1)$	0.004 (0.936)
$\Delta \text{RD}(-2)$	-0.009 (-2.410)**
$\Delta \text{GX}(-1)$	-0.026 (-2.001)*
$\Delta \text{GX}(-2)$	0.012 (1.090)
$\Delta \text{LnUSM}(-1)$	0.046 (2.007)*
$\Delta \text{LnUSM}(-2)$	0.044 (2.083)*
$\Delta \text{LnGM}(-1)$	0.506 (5.040)***
$\Delta \text{LnGM}(-2)$	0.071 (1.118)
Constant	0.215 (3.845)***
ECT(-1)	-0.151 (-5.338)***
$R^2 = 0.79$ Adjusted $R^2 = 0.59$ DW = 1.95 F-Statistic = 3.98 Prob(F-statistic) = 0.012	

Notes: T-Statistics are in brackets; * denotes significance at the 10% level, ** denotes significance at the 5% level and ***denotes significance at the 1% level.

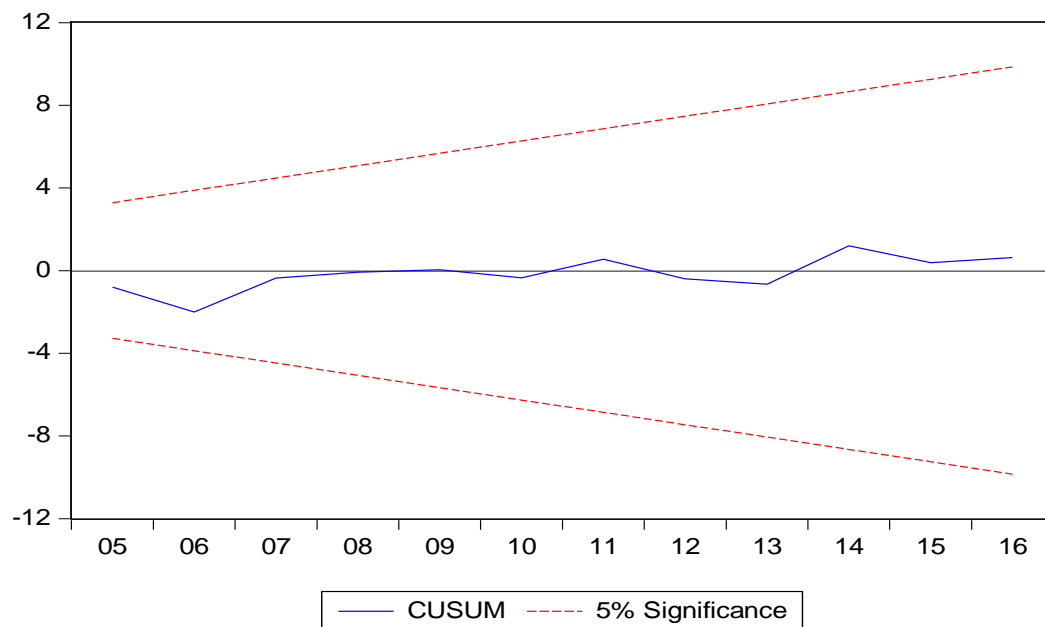
6.4 DIAGNOSTIC TEST RESULTS

TABLE 4

Test	Test Statistic	Null Hypothesis	Probability
Serial LM Test	Chi-Squared (4.744)	No serial Correlation	0.0933
Heteroskedasticity Test	Chi-squared (17.743)	Homoskedastic errors	0.2764
Normality Test	Jarque-Bera (0.470)	Normal errors	0.7906

Note: Test statistics are in brackets

6.5 TEST OF MODEL STABILITY



CHAPTER 7

ANALYSIS OF RESULTS

From the results, it is imperative to notice that the fundamentals of the Ghanaian economy are key to maintaining a stable exchange rate regime. Specifically, fundamental economic variables such as the inflation rate, the interest rate and money supply are critical in this regard. The results in this study show that changes in the rate of inflation, the interest rate or money supply ultimately affect the cedi's rate of exchange. As such, volatility or stability of the cedi can also be traced back to these economic variables.

The error correction term in this study is negative and statistically significant at the 1% level. This result confirms that a long run equilibrium rate of exchange exists for the cedi. The error correction term also reveals that deviations from the long run equilibrium which occur in the previous period are corrected at an adjustment speed of 15.1%. This result also affirms that the exchange rate tends to revert to its long run equilibrium level after deviating from it. As noted in the literature review section, further analysis of these results in the following paragraphs follow the assumptions of the PPP concept.

7.1 The Long Run

As mentioned earlier and supported by the error correction model, changes in the inflation rate, the interest rate and money supply can cause the exchange rate to deviate from the long run equilibrium path. In the long run, prices in the economy are adjustable, hence, the price level is flexible. An important economic variable shown in this study to be of paramount importance in determining the exchange rate is money supply. In this respect, when the Bank of Ghana announces an increase in the money supply, money supply does not grow immediately;

the prevailing level of money supply in the economy remains operational momentarily (at least for a brief period of time). The price level, on the other hand, responds instantly (The price level increases as demand rises) causing real money supply to fall.

This phenomenon means that real money demand outweighs real money supply briefly. To maintain equilibrium between real money supply and real money demand, interest rates rise to restore equilibrium in the money market. Since interest rates are rising, one would expect the exchange rate to appreciate but such is not the case. This is because the rising interest rate is a result of an increasing price level which increasing price level is interpreted by economic agents to mean higher price levels in the future, all else being constant. In other words, economic agents come to expect higher inflation rates even in the future; economic agents sensing loss of purchasing power (due to the rising price level) move their asset holdings into dollar denominated assets causing demand for the dollar to rise. The domestic price per unit of the dollar subsequently rises culminating in a depreciating cedi each time this phenomenon repeats itself.

The observed exchange rate data of the Ghanaian economy also affirms the results above. Even though interest rates are relatively higher in the Ghanaian economy, the exchange rate does not appreciate as would be expected. Rather, we observe a sustained depreciation of the currency most of the time. As such, it can be said that expectations about inflation are a major driving force of the cedi's rate of exchange so that deviations (extreme volatility, mostly depreciation) from the long run equilibrium are chiefly influenced by money supply. The rate of inflation, the major vehicle through which disturbances to the exchange rate find expression becomes a critical signal upon which economic agents act invariably resulting in depreciation(s) or appreciation(s) of the currency.

7.2 The Short Run

Interest rate differential(lagged) is statistically significant in the short run. In the short run, the equilibrium exchange rate is determined by interest rate differentials. Prices do not adjust immediately in the short run; hence the price level is deemed inflexible in this circumstance. However, the exchange rate (which is also a price) is more amenable to change, as such, it can adjust freely in the short run to equilibrate aggregate demand and aggregate supply. When government expenditure increases, output increases and disposable income rises. Such increases in income raises the demand for real money balances. All else being constant, rising incomes must be accompanied by interest rate increases resulting in a violation of the requirements of interest rate parity in exchange rate determination. Consequently, the exchange rate adjusts correspondingly to restore equilibrium temporarily (short run).

In the case of Ghana, the scattered pockets of currency appreciation are a result of interest rate differentials. In the Ghanaian economy, government spending is one preferred way of increasing domestic output. The resultant increases in output raises demand for real money balances which pushes interest rates up. Accordingly, interest rates are quite high in the Ghanaian economy. In these cases, demand for the cedi rises causing it to appreciate as investors seek to profit from the high interest rates in the short run. It must be noted that this situation is not the norm (especially against major currencies like the US dollar) as the Ghanaian currency depreciates more than it appreciates. However, when the cedi appreciates, this is the mechanism by which it does.

Zakari and Owusu-Afriyie (2004) in their paper found that increases in US money supply strengthened (appreciation) the cedi in the short run. This result is consistent with theory; however, it fails to take into account major events like the great recession (2008 economic

downturn) which affected economies around the world. This is not a weakness of their work since their study was done prior to the great recession which happened in 2008.

The results in this study show that increases in US money supply depreciates the Ghanaian cedi. This is evidenced in the lagged US money supply variables in the error correction model which are significant at the 10% level. This result reflects the effects of the happenings in the US money market on the cedi-dollar rate of exchange. To deal with the economic downturn in the US caused by the great recession, US money supply increased sharply causing interest rates to fall to historic lows in the United States. The dollar weakened in this process. But consumption and investment in the United States increased resulting in a steady rise in US output. On the flip side, volume effect and value effect dynamics played out in the Ghanaian economy as a result of the happenings in the United States. Demand for US goods is always high in economies like Ghana hence increased US output and a weak dollar means increased demand for US goods in Ghana resulting in increased upward pressure on the nominal exchange rate hence a depreciating cedi as shown by the positive and statistically significant lagged effects of US money supply in this model.

CHAPTER 8

CONCLUSION AND POLICY IMPLICATION

This study was primarily focused on identifying the major factors that account for exchange rate movements in Ghana. To this end, data covering the period between 1990 and 2016 was collected and analyzed. The vector error correction model was adopted as the preferred empirical method in analyzing the data.

The results reveal that a long run equilibrium exists for the exchange rate in Ghana and the exchange rate fluctuates around this equilibrium level. Factors such as the money supply (both domestic and foreign), the inflation rate differentials, interest rate differentials and government expenditure are important economic variables in determining the long run equilibrium exchange rate.

In the long run, expectations play a major role in determining the exchange rate. By this way, inflation rate differential was found to be the major vehicle by which expectations drive movements in the exchange rate of the Ghanaian economy. Specifically, higher levels of domestic inflation rate relative to foreign inflation rate result in a depreciation of the cedi against the dollar. In the short run, however, differences in interest rate is the major driver of exchange rate fluctuations. Relatively higher interest rates in the Ghanaian economy brings about a strengthening of the Ghanaian cedi.

In all, the major takeaway from the results of this study is that the fundamentals of the Ghanaian economy are important in the determination of the exchange rate. For the Ghanaian economy to enjoy some stability in the exchange rate market, macroeconomic planning needs to target the inflation rate and keep it in check.

REFERENCES

- Adu, G., Karimu, A., & Mensah, J. T. (2015). An Empirical Analysis Of Exchange Rate Dynamics And Pass-Through Effects On Domestic Prices. *International Growth Center*.
- Alagidede, P., & Ibrahim, M. (2016). On The Causes And Effects Of Exchange Rate Volatility on Economic Growth, Evidence From Ghana. *Journal Of African Business*.
- Bacchetta, P., & Wincoop, E. V. (2000). Does Exchange Rate Stability Increase Trade And Welfare. *Econpapers*.
- BoG. (2007). *Bank of Ghana Annual Reports*. Accra, Ghana: Bank of Ghana.
- Canetti, E., & Greene, J. (1991). Monetary Growth And Exchange Rate Depreciation As Causes Of Inflation In African Countries: An Empirical Analysis. *International Monetary Fund* .
- Christian, D. (2015). Determinants of Economic Growth in Ghana. *Leibniz Information Centre for Economics*.
- Claessens, S., & Kose, A. (2017). Asset Prices And Macroeconomic Outcome: A survey. *The World Bank* .
- Daboh, L. (2010). Real Exchange Rate Misalignment In The West African Monetary Zone. *Journal of Monetary And Economic Integration*.
- Devereux, M., & Lane, P. (2003). Understanding Bilateral Exchange Rate Volatility. *Journal Of International Economics* .
- Elkhafif, M. (2003). Exchange Rate Policy And Currency Substitution: The Case of Africa's Emerging Economies. *African Development Review*.
- Enders, W. (1995). *Applied Econometric Time Series*. United States : John Wiley & Sons, Inc.

Ferretti, G. M., & Razin, A. (2000). Current Account Reversals and Currency Crises: Empirical Regularities. In P. Krugman, *Currency Crises* (pp. p. 285 - 323). Chicago: University of Chicago Press.

Gyima-Brempong, K. (1991). Export Instability And Economic Growth in Sub-Saharan Africa. *University Of Chicago*.

Hau, H. (2002). Real Exchange Rate Volatility And Economic Openness: Theory And Evidence. *Journal of Money, Credit And Banking*.

J.O, A., S.A, Y., & Olatoke, A. (2014). The Impact Of Exchange Rate Fluctuation On The Nigerian Economic Growth. *International Journal Of Academic Research In Business And Social Sciences*.

Joseph, K. (2012). Determination of Real Exchange Rate Misalignment for Ghana. *Institute of economic affairs ghana*.

Mumuni, Z., & afriyie, e. o. (2004). Determinants of The Cedi/Dollar Rate of Exchange in Ghana: A Monetary Approach. *Bank of Ghana Working Papers*.

Ojo, A., & Alege, P. (2014). Exchange Rate Fluctuations And Macroeconomic Performance In Sub-Saharan Africa: A Panel Cointegration Analysis. *Asian Economic And Financial Review*.

Opoku-Afari, M., Morissey, O., & Lloyd, T. (2004). Real excahnge rate response to capital inflows: A dynamic analysis for Ghana. *Center for Research in Economic Development and International Trade*.

Razafimahefa, I. (2012). Exchange Rate Pass-Through in Sub-Saharan African Economies And its Determinants. *International Monetary Fund Working Papers*.

Reinhart, C., & Rogoff, K. (2002). FDI to Africa: The Role Of Price Stability And Currency Instability. *International Monetary Fund*.

Rodrik, D. (2008). The Real Exchange Rate And Economic Growth. *Brooking Institution, Havard University*.

Sackey, H. A. (2001). External Aid Inflows And the Real Exchange Rate in Ghana. *African Economic Research Consortium*.

Summers, L. (2000). International Financial Crises: Causes, Prevention And Cures. *The American Economic Review*.

Tenreyro, S. (2007). On The Trade Impact Of Nominal Exchange Rate Volatility. *Journal Of Development Economics*.

APPENDICES

Appendix A

Definition of the real exchange rate

The nominal exchange rate is the price of domestic currency per unit of foreign currency. The real exchange rate is defined as the nominal exchange rate adjusted for the relative foreign and domestic price levels following Lansana Daboh (2010). Hence:

$$RER = e(P^*/P) \text{ where}$$

RER = real exchange rate

e = nominal exchange rate

P* = foreign Price level

P = domestic Price level

Appendix A.1

The monetary model

The monetary model proposes that the real exchange rate in the Ghanaian economy at time t is a function of the real interest rate (R_t), US money supply (USM_t), Ghana money supply (GM_t) and Ghana government expenditure (GX_t).

$ER_t = f(R_t, USM_t, GM_t, GX_t)$. Changes in R_t , USM_t , GM_t and GX_t impact the nominal exchange rate thereby affecting the real exchange rate. Expanding the function f and taking log transformations of it yields a linear equation (ie. Eqn 4.1.3).

To estimate equation 4.1.3, the following specification was used:

$$LnER_t = \beta_0 + \beta_1 LnR_t + \beta_2 LnUSM_t + \beta_3 LnGM_t + \beta_4 LnGX_t + \varepsilon_t$$

Further analysis of the model and results follow the assumptions of the PPP concept.

Appendix A.2

Output of the vector error correction model

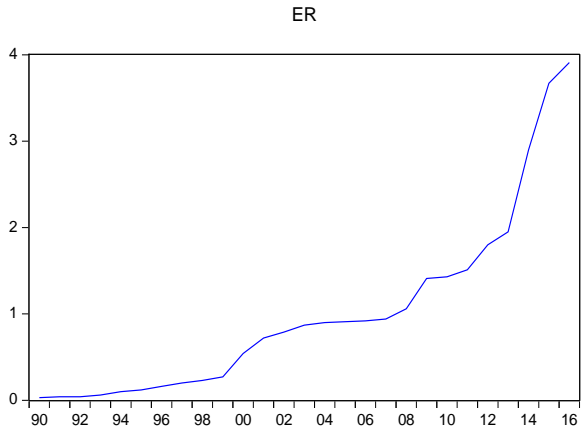
Dependent Variable: D(LNER)
 Method: Least Squares (Gauss-Newton / Marquardt steps)
 Date: 11/02/18 Time: 17:46
 Sample (adjusted): 1993 2016
 Included observations: 24 after adjustments

$$\begin{aligned}
 D(LNER) = & C(1)*(LNER(-1) - 0.0610770846351*RD(-1) - \\
 & 0.217646509888*LNUSM(-1) + 2.7834412924*LNGM(-1) - \\
 & 0.102726910786*GEX(-1) - 5.43606208922) + C(2)*D(LNER(-1)) + \\
 & C(3)*D(LNER(-2)) + C(4)*D(RD(-1)) + C(5)*D(RD(-2)) + C(6) \\
 & *D(LNUSM(-1)) + C(7)*D(LNUSM(-2)) + C(8)*D(LNGM(-1)) + C(9) \\
 & *D(LNGM(-2)) + C(10)*D(GEX(-1)) + C(11)*D(GEX(-2)) + C(12)
 \end{aligned}$$

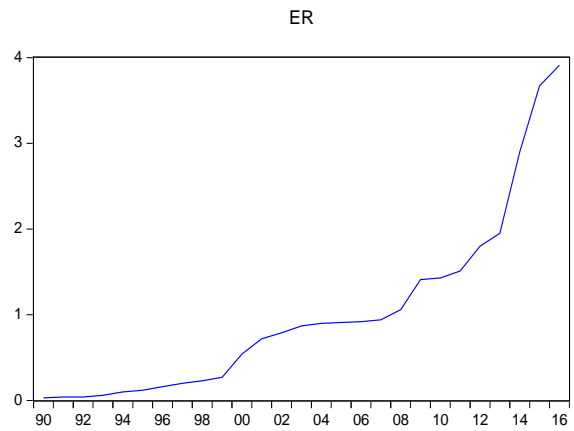
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.150672	0.028229	-5.337585	0.0002
C(2)	-0.105814	0.193359	-0.547243	0.5942
C(3)	0.035169	0.181135	0.194161	0.8493
C(4)	0.003902	0.004167	0.936314	0.3676
C(5)	-0.009140	0.003792	-2.410485	0.0329
C(6)	0.046082	0.023080	1.996604	0.0691
C(7)	0.044317	0.022349	1.982934	0.0707
C(8)	0.495851	0.100376	4.939925	0.0003
C(9)	0.071331	0.063810	1.117860	0.2855
C(10)	-0.025776	0.012879	-2.001320	0.0685
C(11)	0.012589	0.012846	0.979937	0.3465
C(12)	0.214907	0.055895	3.844828	0.0023
R-squared	0.785251	Mean dependent var		0.190934
Adjusted R-squared	0.588397	S.D. dependent var		0.174166
S.E. of regression	0.111738	Akaike info criterion		-1.238459
Sum squared resid	0.149826	Schwarz criterion		-0.649432
Log likelihood	26.86151	Hannan-Quinn criter.		-1.082190
F-statistic	3.989012	Durbin-Watson stat		1.952008
Prob(F-statistic)	0.012506			

Appendix A.3

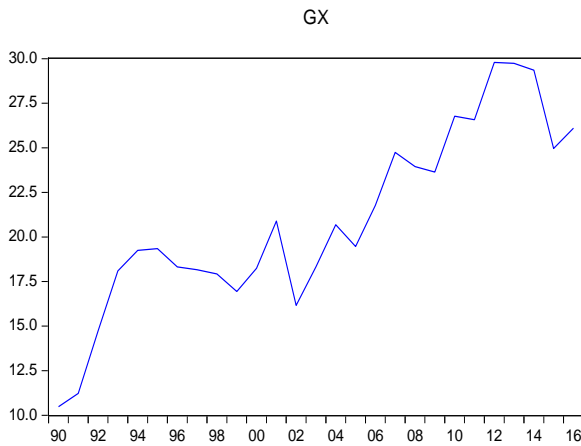
Graphs of variables at Level (A = ADF with constant only; B= ADF with constant and trend)



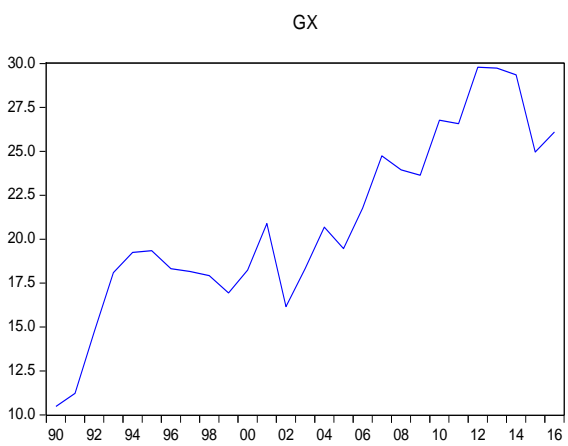
(A)



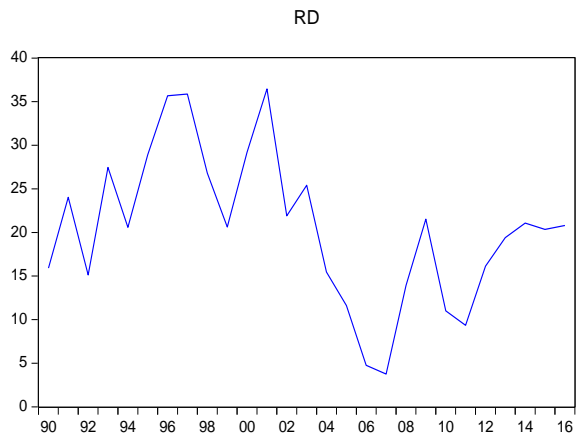
(B)



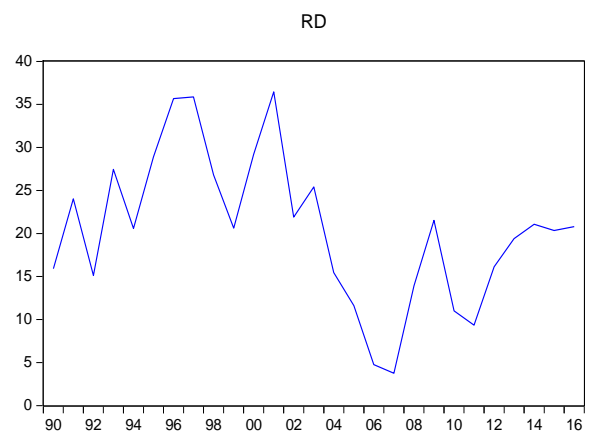
(A)



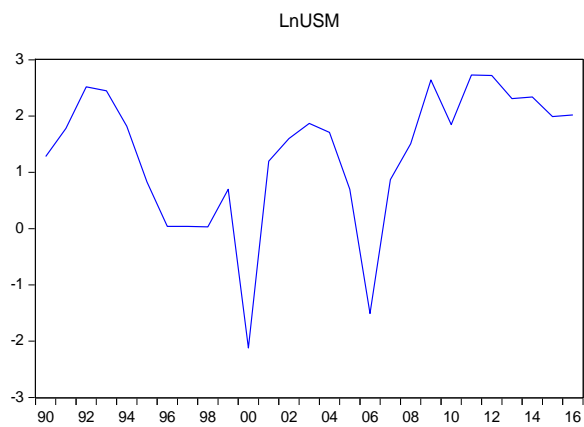
(B)



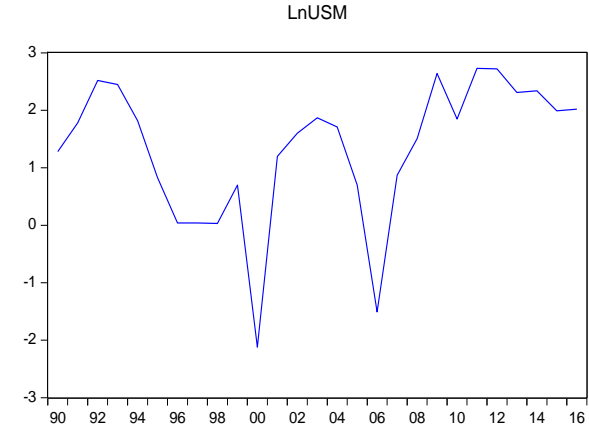
(A)



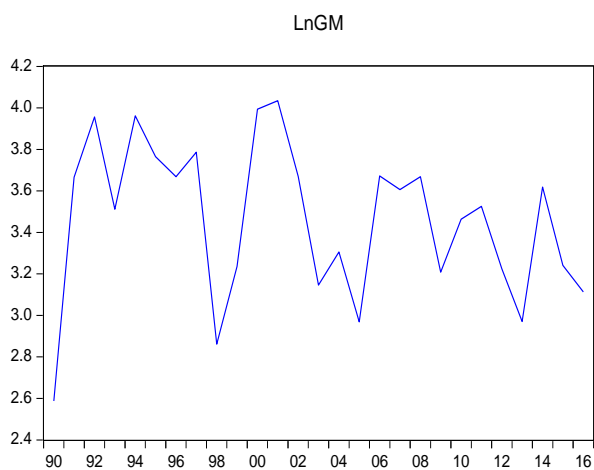
(B)



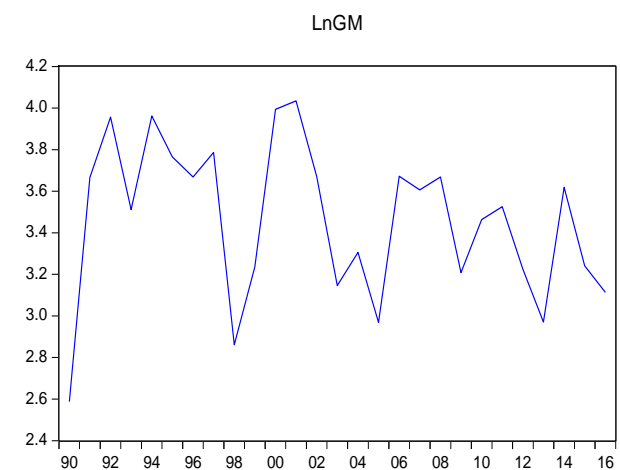
(A)



(B)



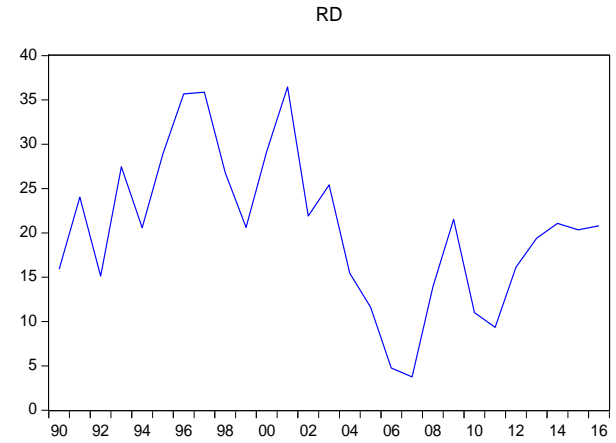
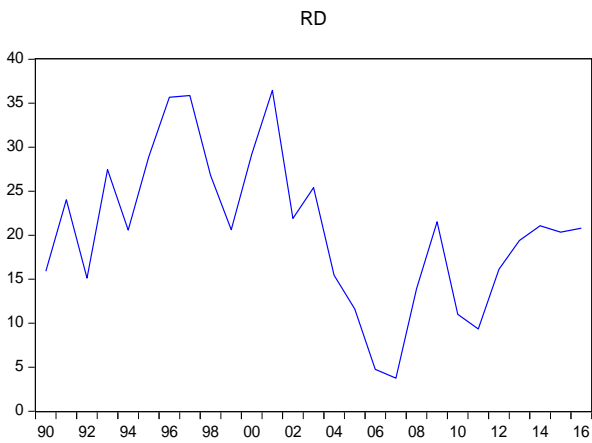
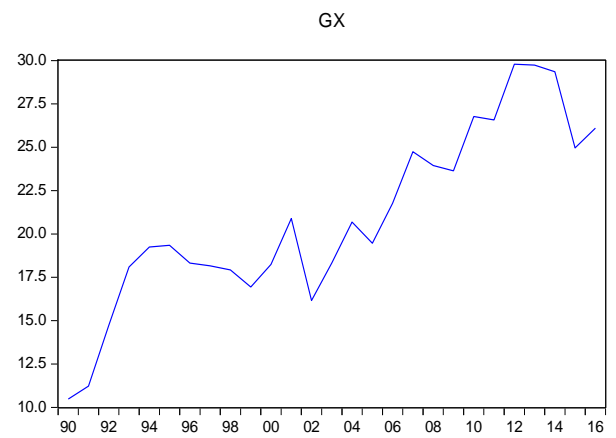
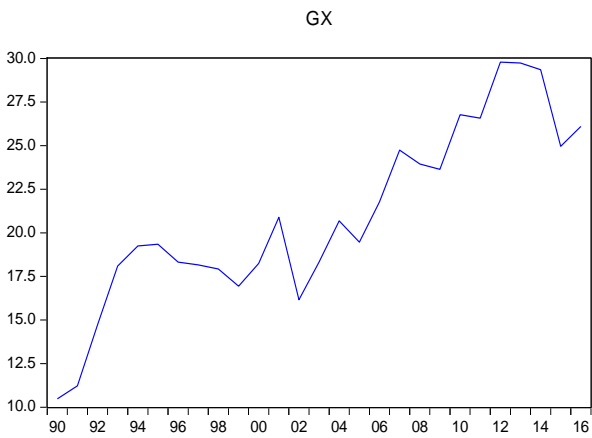
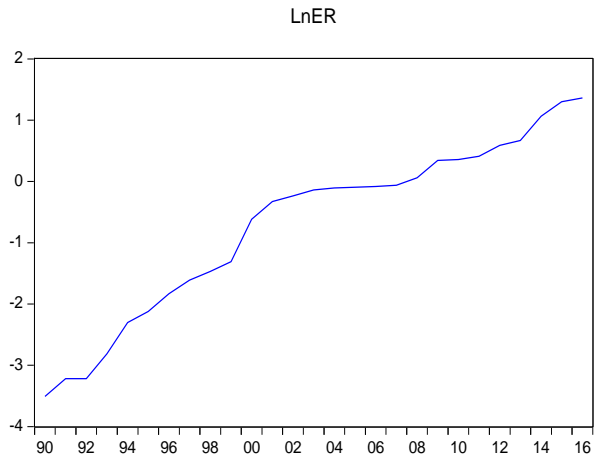
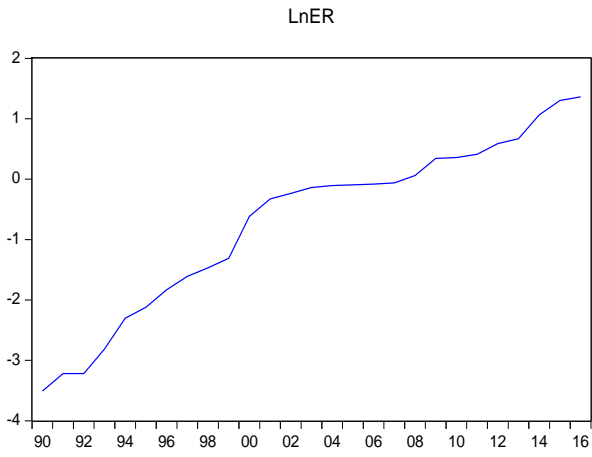
(A)

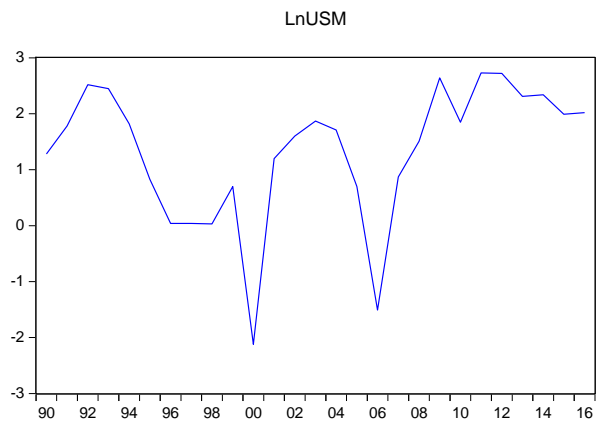


(B)

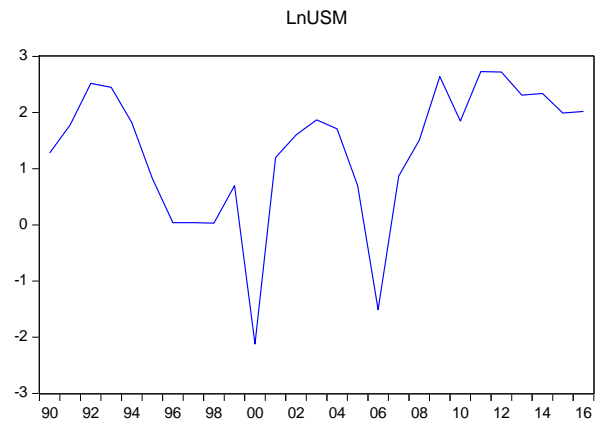
Appendix A.4

Graphs of Variables in First Differences

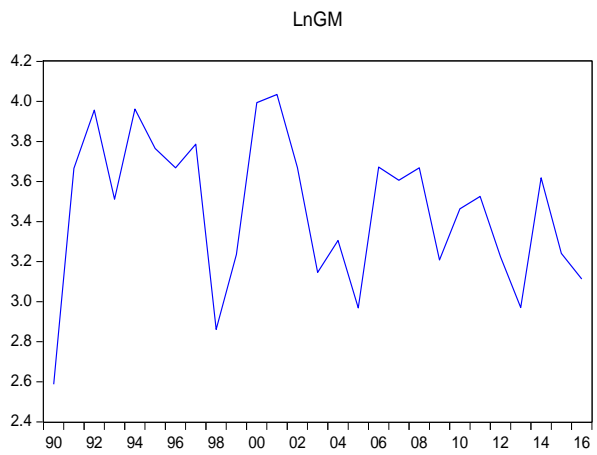




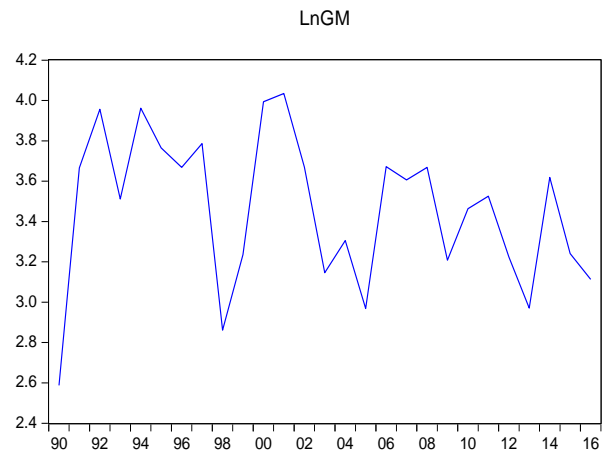
(A)



(B)



(A)



(B)

VITA
Graduate School
Southern Illinois University Carbondale

Hilarious Edem Anku
ankuhilarious@yahoo.com

University of Louisville, Kentucky
Bachelor of Science, Economics, May 2017

THESIS PAPER TITLE: SOURCES OF CURRENCY DEPRECIATION IN GHANA
MAJOR PROFESSOR: DR. AKM MAHBUB MORSHED