The Impact of Foreign Exchange Rate on GDP: The Case of Ghana

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摘　要

本研究使用 1980-2020 年的年度数据尝试探究加纳汇率对经济增长的影响。本文使用最小二乘法进行多元回归分析评估影响，考虑了其他重要宏观经济变量。因此将 GDP 视为因变量，自变量包括汇率、净出口、通胀和利率。实证研究显示，汇率与经济增长有显著的正相关关系。通货膨胀则与经济增长有显著的负相关关系，利率则对经济增长无显著影响。研究结论显示，加纳汇率对于该国经济增长有正面影响，从而证实了低估本国货币短期促进经济发展的理论观点。本研究提出的政策建议是，政策制定者需要需要推出降低通胀率从而提振经济发展的货币或财政政策。政府需要从事出口导向型生产活动从而扭转贸易赤字，同时提振农业，助推消费的提高。

关键词：汇率, 国内生产总值, 时间序列, 多元线性回归, 加纳.

ABSTRACT

This research attempts to investigate the impact of Foreign Exchange rate on Gross Domestic Product (GDP) growth in Ghana using annual time series data for 1980 to 2020. The study employs the Ordinary Least Square estimation techniques using the multiple regression analysis to assess the impact, taking into consideration other important macroeconomic variables. The model for the study was therefore composed of GDP as a function of exchange rate, Net export, inflation and interest rate. The empirical results show that exchange rate is statistically significant and exerts a positive impact on GDP growth. Net export has an insignificant negative impact on GDP growth. Inflation is statistically significant and negatively impacts GDP growth, while interest rate has an insignificant positive impact. The study strongly concludes that there is a positive relationship between GDP growth and exchange rate in Ghana. This confirms the economic theory that a high exchange rate or undervaluation stimulates economic growth in the short run. The study recommends that policymakers must formulate and implement monetary fiscal policies that will continue to drive inflation downwards to enhance economic growth. Government should embark on productive activities that will increase exports more than imports to correct the trade deficit in the country, as well as implement policies that aim at boosting the main sectors of the economy such as agriculture, to enhance the consumption of domestic produce.

KEY WORDS：Exchange Rate, Gross Domestic Product, Time Series, Multiple Linear Regression, Ghana.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter One: Introduction

1.1 Background

Today's system of exchange rate acts as a critical component of the age of globalization. It is well known that the exchange rate is a key macroeconomic variable that is likely to drive the economic growth process and serve as a tool for measuring the health of the economy. In a fundamental sense, the interest in exchange rate has also reflected the fact that exchange rates have penetrating effects with consequences for prices, wages, interest rates, production levels, and employment opportunities. According to Mishkin (2007), exchange rate is the price of one currency in terms of another. Exchange rate, also known as the foreign exchange rate between two currencies specifies how much one currency is worth in terms of the other. It is the value of a foreign nation’s currency in terms of the home nation’s currency. It affects an economy and its standard of living. The reasoning behind this is that, for instance, when the Ghanaian cedi becomes more valuable in relation to foreign currencies or appreciates relative to foreign currencies, say the dollar, foreign goods become cheaper for Ghanaians and vice versa. This may tend to have a positive effect on Net export, all other things being equal. A correct or appropriate exchange rate has been one of the most important factors for the economic growth in the economies of most developed countries whereas high volatility or inappropriate exchange rate has been a major obstacle to the economic growth of many African countries of which Ghana is inclusive. Mishkin (2007) noted that exchange rates are important because they affect the relative price of domestic and foreign goods. It is further mentioned that exchange rates can be determined by the interaction between supply and demand in the foreign exchange market, and such supply and demand conditions are determined by whether the country's basic balance of payments is in surplus or deficit. It is also noted in the study that exchange rate has an inverse relationship with domestic price level and import demands while having a positive relationship with trade barriers, export demand as well as productivity. These variables, if not managed properly often lead to different economic problems which could range from economic depression,

rampaging inflation, high levels of unemployment, currency depreciation, and balance of payment deficits. Various academic literature as stated in the paper provides compelling evidence to suggest that a wrongly managed exchange rate regime can be a major impediment to improved economic performance.

Abdoh et al (2016) defined exchange rate as the number of units a currency will need to purchase a unit of foreign currency. Their paper goes on to mention that exchange rates play a very crucial role in the international trading stage. This is because exchange rates allow international trading of goods and services and also the exchange of funds between countries. The country Ghana has its national currency to be the Ghana Cedi and trades a lot with other currencies with the dollar being the standard unit of measurement in most cases. Exchange rate volatility as an area of international finance has seen intense research interest in the post Bretton Woods Era.

Surprisingly, the interest in this area of research is still very intense, and experts do not see this interest waning in the foreseeable future. Many researchers attribute interest in exchange rate volatility to the fact that it is empirically difficult to predict future exchange rate values (Killian and Taylor, 2001). The management of the exchange rate is considered to be a major policy objective to achieve a set of diverse objectives of economic growth, containment of inflation, and maintenance of external competitiveness (Khondker et al, 2012)

Stockman (1999) in his paper "Choosing an exchange rate system" comments that the exchange rate of any country is an important one in international economic policy. He further states that journalists and policymakers more often than not, treat the matter of exchange rates as perhaps the singularly most important factor a government considers in the making of economic policies. Stockman (1999) divides exchange rate into two, namely; the "pegged system or fixed" and "the floating system" citing a preference for the "floating system". Of course, others like (Abdoh et al, 2016) have further added two more divisions which are derived from the main two Stockman mentions.

Countries can adopt either the fixed, also known as the pegged exchange rate or the

flexible, also known as the floating exchange rate. With the fixed, a country's exchange rate does not fluctuate at all or fluctuates narrowly against some base currency over a sustained period. The exchange rate is pegged to a particular currency or a basket of currencies. The intervention of the government is needed to maintain the fixed exchange rate. With the flexible or floating exchange rate, however, the rate typically fluctuates over time. When a nation decides to adopt the flexible exchange rate, the exchange rate is allowed to be determined by the forces of the foreign-exchange market mechanism without the intervention of the government, unlike the fixed regime where the intervention of the government is needed to maintain it.

Gross Domestic Product is defined as the monetary value of all finished goods and services produced within the country's borders in a specific period. This usually comprises the value of the production of monetary and non-monetary goods and services within a country. An alternative concept which is the Gross National Product (GNP), includes all output of the residents of the country whether within the country’s borders or not. It is worth noting that GDP per capita does not reflect differences in the cost of living and the inflation rates of countries but is however more useful in comparing national economies on the international market. The total GDP can also be broken down into the contribution of each industry or sector of an economy. It is often considered the best standard for measuring national economic conditions (Mankiw & Taylor, 2007). It is the primary indicator used in examining the financial health status of a country as a whole. According to Tetteh-Bator et al (2018), the issues of GDP have become the most important among the macro-economic variables. They further assert that data on GDP is regarded as the important index for assessing the national economic development and for judging the operating status of the economy as a whole. Nations all over the world aim to achieve high economic growth and maintain it while managing their macroeconomic variables. In 2019, the International Monetary Fund projected GDP growth in Ghana to be 7.1 percent. The country still battles with high debt to GDP ratio, exchange rate volatility, and high poverty ratio among other issues, despite its favourable projection from the IMF.

The concepts of foreign exchange rates and gross domestic product are not new and unheard of, yet the Ghanaian economy is still crippled by its effects due to information asymmetry and the inability of the government to utilize available data in creating a lasting value. My research will thus centre around investigating and explaining the issues around these concepts in the Ghanaian economy. It will focus on assessing and evaluating the rate of the impact of the foreign exchange rate on the gross domestic product in Ghana

1.2 Significance of the study

This study attempts to examine the implications of the exchange rate on GDP growth in Ghana. The value of this study comes from its main focus on the exchange rate alone as an independent variable and how it positively or negatively impacts the GDP through its volatility. This work will give a piece of in-depth knowledge on the workings of the foreign exchange market and its transmission mechanism into other sectors of the economy especially its impact on growth. This will aid the government in designing an exchange rate policy framework that will have a positive impact on GDP. Aside from factors such as interest rates and inflation affecting the GDP of the country, the currency exchange rate is one of the most important determinants of a country's relative level of economic health. A higher-valued currency makes a country's imports less expensive and its exports more expensive in foreign markets leading to an improvement in Net export and hence the GDP. This study also seeks to assist the government in designing an exchange rate policy framework that will ensure the reduction in uncertainties in the exchange rate market to enhance the flow of trade and investment most especially capital inflow to facilitate economic growth and increase the welfare of the people. This study is also timely because, since the Economic Recovery Programme of 1983, exchange rate policy and trade liberalization have been major concerns of Ghanaian governments.

This work could also serve as the basis for further research into the impact of foreign exchange rates on Ghana's GDP or on this same variable in general to uncover other factors at play. It will serve as a stepping stone for further research and knowledge.

Other researchers may be able to infer from this study and use the information to make their analysis or draw conclusions for their research.

1.3 Statement of the problem

Before Ghana gained independence, the nation's currency was that of its colonial masters; The British West African Pounds. After independence, the currency was dropped and the Cedi was introduced. Following the drop, Ghana adopted the fixed exchange rate regime between the years 1956 to 1983. (Allor, 2020). Following the collapse of the Bretton Woods system of fixed exchange rates, several countries shifted to a more flexible system. (Alagidede & Ibrahim, 2016). Alagidede and Ibrahim (2016) go on to state that in the making of major reforms to its financial sector, chose to also switch from the fixed-rate exchange rate to the free-floating exchange rate in the 1980s. A system it has used even to this date. The performance of the Ghanaian economy in the years following its independence in 1957 was exceptional by numerous developing countries' standards. It was noted that the per capita GDP in 1960 for Ghana was US$198.6, which was higher as compared to the newly industrialized Republic of South Korea with a GDP of US$151.4. (Anaman, 2006). The growth rate of Ghana’s GDP averaged 4.42% during the periods 1957 to 1967. This glory was however short-lived. The economy steadily deteriorated throughout the 1970s characterized by political agitations, exchange rate volatility, and persistently high inflation rates.

During this period, Ghana's exchange rate policy involved the maintenance of a fixed exchange rate with occasional devaluations. This passive attitude towards exchange rate management was one of the factors which led to the crisis in the Ghanaian economy in the late 1970s and early 1980s. Jakob (2015) in his study on “Impact of Exchange Rate Regimes on Economic Growth” found out that there was a positive and significant correlation between pegged exchange rates and GDP growth after observing data from 74 countries. This is mainly due to the stability factor it offers. Contrary to this, however, Ghana's currency which had remained pegged to sterling up to 1971 could not devalue her currency when the pound sterling was devalued in November 1967 due to an increasing balance of payments difficulties, depletion of

foreign reserves, and a build-up of uncleared short-term debts. The GDP of the country during this period remained negative for four consecutive years. The Economic Recovery Programme, which was launched by the government in 1983 was characterized by massive reforms in exchange rate policy. The country shifted from the pegged or fixed exchange rate to the managed float with interventions from the Bank of Ghana mainly to smooth fluctuations in the foreign exchange market. This saw a gradual increase of 5% in GDP.

Understanding the impact of exchange rate regimes and fluctuations on a country's GDP is critical for successful economic policy implementation. This topic has become increasingly important in an economic environment where most nations are focused on increasing output, usually by allowing their currencies to depreciate. Policymakers and economists often refer to the exchange rate of a country as its key macroeconomic variable. Among the various research and studies conducted on the effect of exchange rate volatility on the Ghanaian economy, (Adjasi et al. 2008; Kyereboah-Coleman & Agyire-Tettey, 2008) as well as on its contributions and effects on economic growth, none directly hammers the impact it has on the nation's GDP. Stakeholders of the country are increasingly unable to manage the macroeconomic indicators to ensure an increasing or at the very least a constantly growing GDP rate. Despite the rapid momentum the impact of foreign exchange rate has gained across the world, its direct impact as an independent macroeconomic variable on GDP has seen very little study and discussion nationwide. The performance of the GDP may be due to several variables, policy-induced economic measures being regarded as the most significant. However, the goal of this study is to assess if the growth trend of the GDP can be impacted by the foreign exchange rate. This will help to uncover the issue of improving GDP growth and, present a study capable of making a unique contribution to knowledge. My research will also fill a knowledge gap as most research on the impact of exchange rate policy on Ghana's GDP growth has been limited to the fixed exchange rate regime or a brief period during the recovery program. This research, on the other hand, covers a longer period after the reforms.

1.4 Objective of the study.

The primary goal of this research is to determine the impact of foreign exchange rates on GDP in Ghana and to draw conclusions about the magnitude of that impact.

1.5 Research Problems

I. What is the relationship between foreign exchange rate and GDP growth?
II. Does the foreign exchange rate have a positive or negative impact on GDP growth?

1.6 Scope of the Study

This study is confined to examining the impact of foreign exchange rates on GDP growth from 2009 to 2020. This decision is based on available data after the redenomination of the Ghana cedi in 2007. The choice of study variables is guided by previous literature on the topic. Data used for analysis was taken from the database of the World Bank and the International Monetary Fund.

1.7 Organization of the Study

This research study will be organized into five chapters. Chapter One will deal with the introduction which covers the background, the statement of the problem, the research objectives and problems, significance, and the scope of the study. Chapter two will highlight the literature review and an examination of various related literature. Chapter three will focus on the research approach and methodology used for the study. It delves a little into research design, reasons for selecting the study area as well as data collection processes. It analyzes data instruments and a brief description of the data collection and analysis process. Chapter four will deal with the presentation and discussion of my research findings. It will focus on data collection and its analysis. The fifth chapter will be the last chapter of my research study. It will deal with the summary of my research process, and key findings where I will draw conclusions and make recommendations to aid in improvement.

Chapter Two: Literature Review

2.1 Introduction

This chapter is devoted to reviewing literature that is relevant to the study. This would involve the studies carried out about the Impact of Foreign Exchange Rate on GDP: A Case of Ghana. This review will narrow and make adjustments to the information obtained from all the literature sources to reflect the observations in the Ghanaian setting. It also examines the theoretical context in which the study was premised. I obtained the information on relevant literature by running internet searches on the key terms in the research topic and conducted further searches on referenced articles.

2.2 Theoretical Review

This section examines theories that deal with the impact of exchange rate on Gross Domestic Product. There are three theoretical models examined here that have been used to analyze this impact. These are the purchasing power parity theory, the traditional view of exchange rates and the structuralist or modern views of exchange rates.

2.2.1 Purchasing Power Parity theory

The purchasing power parity theory (PPP) explains how to calculate the exchange rate between two non-convertible paper currencies. There are two versions of the PPP theory, the absolute version and the relative version. According to Officer (1976), the absolute version involves the ratio of two countries' price levels while the relative version involves the price indices times a base period exchange rate. Taylor and Taylor (2004), assert that PPP is a simple theory that holds that the nominal exchange rate between two currencies should be equal to the ratio of aggregate price levels between those two countries. As a result, a unit of currency in one country will have the same purchasing power in a foreign country. Kargbo (2006) in his study on PPP and real exchange rate behaviour in Africa shows extreme support for PPP in Africa,

stating that PPP is a reliable guide for exchange rate determination and exchange rate policy reform in African countries.

2.2.2 The Traditional View of Exchange rates.

Also known as the conventional view of exchange rates. This view holds that the devaluation of a currency will have expansionary effects on economic growth. The notion here is that the devaluation of the currency will cause local goods to be affordable in foreign countries, thereby increasing their demand which will in turn lead to an increase in exports. The main case for devaluation according to Nigussie (2016) is that, when a country devalues its currency, it enhances the cost competitiveness of its exports, which is one of the main components in the determination of gross domestic product. Khondler et al (2012), also mention devaluation in their study stating that it is believed to contribute to the enhancement of external competitiveness stimulating production in the export sector. They further stated that a direct consequence of nominal devaluations will be an increase in import prices, which will likely lead to a reduction in demand for imports in the domestic economy. An increase in exports and a reduction in imports are expected to improve the trade balances, and they are of the view that many developing countries have relied upon devaluations to correct their deficit trade balances. Karahan (2020), talking about the conventional view also stated that a depreciation of the exchange rate increases the volume of Net export, which in turn increases the growth rate of the economy. This ultimately means devaluation can be used as a tool for promoting economic growth.

Opoku (2013), for the period 1980 to 2012 examined the relationship between GDP growth rate and exchange rate in Ghana. Using regression analysis, he found that a higher exchange rate led to an increase in GDP. Thus, the author determined that the traditional view or devaluation hypothesis is valid in Ghana, confirming the theory that undervaluation of the local currency stimulates economic growth.

In as much as the devaluation may be advantageous, it poses a challenge in the case of less economically developed countries that mostly rely on imported goods. (Nigussie, 2016). Although, the devaluations aid in correcting the deficit in the trade balances,

and increase the competitiveness of the local currency abroad, they might do so at a high cost, according to Khondler et al (2012). They assert the concerns that the indirect costs of devaluation might outweigh the benefits adversely, ultimately affecting the overall output growth. Due to these challenges, an alternative view was propounded, raising the possibility that depreciation could be contractionary, most especially in developing countries. This alternative view was referred to as the structuralist or the modern view. (Nigussie, 2016).

2.2.3 The Structuralist Views of Exchange Rates

This view is contrary to the traditional theory. It is also referred to as the contractionary effect of devaluation. This view holds that currency depreciation may have a contractionary effect on output employment, particularly in developing countries. This approach demonstrates how a drop in output might be caused by currency depreciation. Khondler et al (2012) stated that devaluation increases the price of traded goods, which feeds into the general price level and as a result renders a negative real balance effect, which will, in turn, result in lower aggregate demand and output. In the work of Nigussie (2016), he also stated that depreciation of the currency can cause a contractionary effect on it in many ways, however, the increase in the price of imports is the most important and requires much attention. He further stated that, if the costs of inputs rise, there is the possibility of a rise in the cost of production and firms will pass this on to their prices, leading to an increase in the general price level. This is because firms can only get rid of an increase in the cost of production by increasing their prices.

Many studies reviewed in this chapter have concluded that the rising exchange rates have a positive impact on the economy and thus have supported the devaluation theory for economic growth. However, structuralist economists argue that the rising exchange rate has a restrictive effect on economic growth, especially in developing countries (Karahan, 2020). Increases in exchange rates have a detrimental influence on economic growth because they impose restrictions on imported inputs which the production structures of developing countries are primarily reliant on. As a result of

this, the increases in the exchange rate reduce raw material imports, which has a negative influence on economic growth. In the literature reviewed in this chapter also, many studies which focused on developing countries have also shown that depreciation of the local currency caused a contraction. In the study of Adjei (2019), quantifying exchange rate volatility and investigating the impact of exchange rate fluctuations on economic development in Ghana from 1983 to 2010, the conclusion was that exchange had a significant negative impact on economic development.

2.3 Empirical review

Over the year, many studies have been conducted all around the globe to better understand the role and importance of macroeconomic variables in the development of a nation's economy. Consequently, there are a lot of studies on how exchange rates affect the economic growth of any country. There are studies on how exchange rates affect inflation, gross domestic products, imports, exports and even unemployment.

An et al (2018) wrote on the impact of exchange rates on economic growth using the ASEAN countries as a case study. In the study, they sought to determine the impact of multilateral exchange rates from 1989 to 2018 affected the economic growth of Vietnam, the Philippines, Malaysia, Singapore and Indonesia. Using the Prais-Winsten (PCSE) method, the study revealed that a 1% change in the effective exchange rate had a positive impact on the nation's economic growth increasing it by 16.2 %. The study then recommended that ASEAN countries should align their exchange rates with the real exchange rate when evaluating them, to determine the target exchange rate with a larger margin.

In the work of Aslam (2016) for Sri Lanka, the author used gross domestic product, inflation rate, exchange rate and interest rate as variables to determine the impact of exchange rates on economic growth. In these variables, the study had a gross domestic product as a dependent variable and exchange rate, interest rate and inflation rate as independent variables. Using Based on the multiple regressions model, his study concluded that the exchange rate had a positive impact on the economic growth

in Sri Lanka.

His findings supported the argument that exchange rates tend to boost the economic growth of countries. The work of (Semuel & Nurina, 2015) in Indonesia also had a similar conclusion. In their study, they also stipulated that there was a positive relationship between a country's GDP and exchange rates. And that an increase in GDP also caused an increase in exchange rates.

Adeniran et al (2014) evaluated the effect of exchange rates on economic growth from 1986 to 2013. The data were analyzed using correlation and regression analysis using the ordinary least square (OLS) method. The conclusion indicated that the relationship between exchange rate and economic growth was positive but not statistically significant. Furthermore, the research confirmed prior research arguments that developing countries are substantially better off choosing flexible exchange rate regimes.

The paper recommended that the government encourage export promotional initiatives to sustain a surplus balance of trade, as well as provide a positive environment, adequate security, effective fiscal and monetary policies, and infrastructure facilities to attract foreign investors to invest in Nigeria.

(Mwinlaaru and Ofori, 2017) authored a paper to estimate the influence of the real effective exchange rate on Ghana's economic development. The researchers sourced data from The World Bank's database, the Bank of Ghana's yearly bulletins, and information from Ghana's Ministry of Finance and Economic Planning.

The researchers used the ARDL cointegration estimation technique and discovered that the real exchange rate and economic growth were positively and significantly correlated. The paper concluded that the real exchange rate had a significant and positive impact on economic growth both in the long and short run. As a result, it was necessary to maintain exchange rate stability in the Ghanaian economy to stimulate economic growth.

Contrarily, the work of (Ahiabor & Amoah, 2019) served to prove the opposite. The purpose of the study was to determine whether real effective exchange rate fluctuations were detrimental to economic growth in Ghana. The study examined this

link using the Fully Modified Ordinary Least Squares (FMOLS) econometric technique and annual time series data from 1980 to 2015.

The research's estimated regression results indicated that real effective exchange rate fluctuations indeed had a detrimental influence on economic growth in Ghana, which was statistically significant. Additionally, the researchers evaluated models using both traditional control variables and a fresh measure of financial market fragility and found that the results were consistent.

The research suggested that the country undertook vigorous policies aimed at developing a globally competitive economy. It will aid in the promotion of Ghana's exports and alleviate some of the country's exchange rate fluctuations.

In the same year, (Adjei, 2019) undertook a study to quantify exchange rate volatility and investigate the impact of exchange rate fluctuations on Ghanaian economic development. The study spanned from the year 1983 to 2010. There were five variables of concern in total: physical capital stock, GDP, human capital stock, exchange rate fluctuation and trade openness. The researcher used ARCH and GARCH Models to estimate the volatility of the exchange rate using data from January 1983 to December 2010. The resulting exchange rate volatility variables were then employed in the growth determinant function.

Furthermore, an Autoregressive Distributed Lag Approach was used in the study's time series analysis to examine the association involving exchange rate volatility and economic development in Ghana. Based on estimates from the analysis, the study concluded that exchange rate volatility had a significant negative impact on economic development both in the long and short run. This was attributed to the considerable risk associated with investment thus discouraging international trade and growth.

The study further suggested that policymakers should try to stabilize the exchange rate as a proposal for policy execution, as this will attract more investors and boost productivity and trade, resulting in strong economic performance. Again, policymakers must strengthen the domestic industry to increase output. Imports will be reduced when the domestic manufacturing industry is strengthened. Subsidies and grants should be provided to the domestic industry as well as to enhance exports, as this will increase commercial activities and enhance the performance of the economy.

(Bamanga, 2014) worked on the influence the country's foreign exchange rate impacted Nigeria's GDP. He mentioned that the foreign exchange market in Nigeria provided an avenue for the fair exchange of currencies between Nigeria and other countries. In his study, Bamanga indicated that the reigning factor of the country's economic success; oil, was causing unpredictability in the way the foreign exchange rate was managed in the country.

The study also established that volatility in nominal and real exchange rates affected the economic success of countries. His research aimed at studying the impact of exchange rates both real and nominal on the oil and non-oil Gross Domestic Products of Nigeria. Using Time series data that span 17 years; from the year 1995 to 2011, the researcher came up with four hypotheses.

The study used the least square (LS) regression to determine the impact of foreign exchange rate on economic growth making the growth rates of oil and non-oil gross domestic product the dependent variables, while a yearly index of nominal and real exchange rates were the independent variables.

Analysis and results revealed that nominal exchange rate has a positive but negligible impact on Nigeria's Oil GDP. Furthermore, the study indicated that the country's real exchange rate also had a positive but non-significant impact on Nigeria's Oil GDP. Finally, the research work discovered that there existed a positive and significant impact between nominal foreign exchange and real exchange rate on Nigeria's Non-oil GDP. The study went on to recommend that government monetary policies should be aimed at reducing the exchange rate in Nigeria.

Lubis et al (2017) conducted similar research among the five founding members of ASEAN and arrived at a similar recommendation as Bamanga. Their work examined the influence of exchange rates on the gross domestic product (GDP) of the Association of Southeast Asian Nations' five founding members.

According to the research, a dropping exchange rate may be interpreted theoretically as a sign of a failing economy in poor countries. The researcher employed ordinary least squares to analyze a data collection of exchange rate variables in each country from 1980 to 2014, as well as a data set of gross domestic product (GDP) from 1981

to 2015.

The results indicated that the real exchange rate coefficient had a positive significant impact on the five-member nations' GDP levels. The findings indicated that currency depreciation would result in a rise in a country's GDP level. The study concludes that exchange rate depreciation encourages countries to raise their output. The increased output would meet the needs of domestic and international markets.

Idris et al (2019) using an Auto-Regressive Distributed Lag (ARDL) approach came to a contradictory conclusion. Their research rightly showed a relationship between Gross Domestic Product (GDP) and the exchange rate of the sovereign state of Nigeria; however, the relationship was seen to exist only in the long run. More so, it was revealed that the relationship was not statistically significant. With these findings, the paper suggested that the government of Nigeria explored other macroeconomic variables to strengthen the country’s currency and reduce the dollarization of the economy.

In Kenya, (Oude, 2013), looked at the impact of exchange rate volatility on Kenya's GDP from 2008 to 2012. Two theoretical perspectives were advanced; where the first stated that a rise in the value of domestic currency reduces the overhead of imported raw materials, increasing output, while the traditional view stipulates that a real appreciation reduces international competitiveness, causing Net export to fall and, as a result, a decrease in aggregate demand.

His study's model showed Gross Domestic Product as a function of the rate of exchange, inflation, exports, imports, and government spending. Regression was used to analyze the effect of the factors on GDP, and it was discovered that government spending had a significant impact on GDP.

According to the findings, exchange rate fluctuations had a significant negative impact on GDP, contracting real output growth and demand for investment and exports while raising inflation. The research stipulated that monetary measures should be developed to reduce the persistence of inflation and to ensure the stability of Kenya's exchange rates.

(Enu et al., 2013) examined the relationship between Ghana's GDP growth rate and

exchange rate from 1980 to 2012. The paper began by graphing the scatter diagram for the two variables, GDP growth rate and exchange rate, and then establishes the causative link between them using Pearson's Product Moment Correlation Coefficient (PPMC).

Finally, the study analyzed the simple linear regression using Ordinary Least Squares (OLS). Additionally, tests for autocorrelation, heteroscedasticity, and multicollinearity were conducted. There was no evidence of autocorrelation or heteroscedasticity.

Their analyses strongly suggested that a positive relationship existed between GDP growth rate and exchange rate in Ghana, confirming the theory that undervaluation (a high exchange rate) improves economic growth in the short run. As a result, policymakers should strive to maintain long-term stability in monetary and fiscal policies.

HabibAhemed et al, (2011) in their study analyzed the impact of exchange rate on macroeconomic aggregates in Nigeria. Based on the annual time series data for the period 1970 to 2009, the research examines the possible direct and indirect relationship between the real exchange rates and GDP growth. The estimation results show that there is no evidence of a strong direct relationship between changes in the exchange rate and GDP growth.

Momodu, (2015), in his study, assessed the effect of exchange rate on output level in the economy at various exchange rate regimes. The ordinary least square of regression was adopted in the analysis, and the findings revealed that exchange rate regimes in Nigeria do not influence the level of output contrary to the expectations. The recommendation was that future policies should focus on encouraging local technology to improve productivity and infrastructural facilities also improved to sustain the GDP growth.

- Theory and History of Ghana’s Exchange Rate Policy.

Before the Economic Recovery Programme, Ghana's exchange rate policy had involved the maintenance of a fixed exchange rate with occasional devaluations. This passive attitude towards exchange rate management was one of the factors which led to the crisis in the Ghanaian economy in the late 1970s and early 1980s. Up to 1971,

Ghana's currency had remained pegged to sterling. However, in November 1967, when the pound sterling was devalued, Ghana like many other countries that had their currency pegged to the sterling, did not devalue her currency. As a result of increasing balance of payments difficulties, depletion of foreign reserves and a build-up of uncleared short-term debts, in December 1971 the then government devalued the currency again, this time by 44 percent. The cedi was later revalued.

The coup d état in January 1972 resulted in a real depreciation of the currency by 25 percent. However, from 1973 the currency started appreciating and continued to do so up to 1978, largely as a result of rising government deficits and inflation. The period of the Economic Recovery Programme had been characterized by massive reforms in exchange rate policy. The country had moved from the fixed exchange rate regime to a regime of "managed float". Since 1986, the exchange rate policy of the Bank of Ghana has been the managed floating exchange rate. The Bank of Ghana's intervention in the exchange rate market has been mainly to smooth fluctuations in the foreign exchange market.

Table 2.1: Regime shifts in Ghana's Foreign Exchange Market

Episode	Date	Exchange Rate Regime
1	1983-1986	Multiple exchange rate system
2	1986-1987	Dual retail auction system
3	1987-1988	Dutch auction system
4	1988-1989	Foreign exchange bureaus
5	1990-1992	Wholesale and inter-bank auction system
6	1992-	Inter-bank market

Source: Dordunoo (1994).

The table above gives a summary of Ghana's foreign exchange market policies or regimes over the years. As stated earlier, Ghana's exchange rate system has undergone several regime changes. From the multiple exchange rate system to the dual retail auction system, where the forces of demand and supply were partially determining the cedi/dollar exchange rate. The new regime established a dual-window exchange rate system.

Moreover, the surrender of exchange earnings to the Bank of Ghana was effected at two different rates. The window one exchange rate was fixed at C90.00 per $1.00, while the window 2 exchange rate was determined by demand and supply in the weekly auction system conducted by the Bank of Ghana. Under the dual-retail auction system, the first auction was based on the marginal pricing mechanism and all the successful bidders were supposed to pay the marginal price. But from the second auction, the Dutch auction system was resorted to and under this system, the successful bidders were supposed to pay the bid price.

Following this, foreign exchange bureaus were allowed to operate to absorb the parallel market into the legal foreign exchange market. The continued existence of the premium in the parallel market led to the introduction of the wholesale auction system, which replaced the retail system. Under the wholesale auction system, the authorized dealer banks and the eligible forex bureaus were allowed to purchase foreign exchange from the Bank of Ghana for sale to their end-user customers and to meet their own foreign exchange needs. Moreover, the authorized dealers were allowed to determine freely the structure of their bids at the wholesale auction. They could now sell the foreign exchange obtained in the auction to their customers plus a margin that is determined by each authorized dealer.

The wholesale auction was based on the Dutch auction system. In the long run, the wholesale auction system was abolished in April 1992 and since then, the management of the exchange rate takes place directly in the inter-bank market. Both the commercial banks and forex bureaus operate in a competitive environment. It is therefore clear from Table 1, and the discussion above on the history of the exchange rate system in Ghana that the Bank of Ghana has been following a managed float exchange rate policy since 1986.

The Bank of Ghana's intervention in the foreign exchange market is solely at its discretion and is only to smooth wide fluctuations in the foreign exchange market. One of the objectives of this policy has been to reduce the gap between the official rate and the parallel rate. Since major foreign exchange transactions take place at the inter-bank level, the official exchange rate is first determined by the demand and supply conditions. Later on, the forex bureaus add a premium to this official exchange

rate and cater for the needs of travellers and traders who trade with the neighbouring countries.

It is worth noting that the Cedi was redenominated on July 3, 2007, with the issuance into circulation of a new currency, thus the Ghana Cedis and the Ghana Pesewas. By the re-denomination of the then old Ten Thousand Cedis was set to be one Ghana Cedis, which was equivalent to one hundred Ghana Pesewas. Thus ¢10,000 = GH¢ 1.00 = 100Gp. The new notes and coins had the same purchasing power or value. (Annual report of Bank of Ghana, 2010).

The new currency was designed to address one important lingering legacy of past inflation and macroeconomic instability. The previous note regime placed a significant burden on the economy. These burdens came in forms such as high transaction costs at the cashier, general inconvenience and high risk involved in carrying loads of currency for transaction purposes. Other reasons given by the Bank of Ghana for the change were the increasing difficulty in maintaining accounting and statistical records and problems with accounting and data processing software.

The government anticipated that this measure of change will positively influence the inflation rate. However, it came with challenges such as rescaling, cost of disposing of old notes and coins, cost of public education, the process of enlightenment and advertisement of the change to citizens among others.

- Exchange Rate

According to Azid et al. (2005), exchange rate is the price of one currency in relation to another. From a slightly different perspective, it expresses the national currency's quotation concerning foreign ones. Thus, the exchange rate is a conversion factor, a multiplier or a ratio, depending on the direction of conversion. It is believed that if exchange rates can freely move, it may turn out to be the fastest moving price in the economy, bringing together all the foreign goods with it. Onwukwe & Nwafor, 2014, stated that the movement of a currency's value relative to others has a profound effect on economies exposed to this currency. They further stated that exchange rate movements have the power to intensively affect businesses, governments, and people around the globe, due to the linked nature of modern economies. Previous research

suggests that changes in an exchange rate can have an impact on a country's economic success. Many scholars attribute Exchange Rate volatility to the difficulty of predicting future exchange rate levels.

i. Bilateral, Nominal and Real Effective Exchange Rate

The bilateral exchange rate involves a currency pair, while the effective exchange rate is the weighted average of a basket of foreign currencies and it can be viewed as an overall measure of the country's external competitiveness A nominal effective exchange rate (NEER) is a weighted with the inverse of the asymptotic trade weight. A real effective exchange rate (REER) adjusts the NEER by appropriate foreign price levels and the deflators by home country price level. Compared to NEER, a GDP weighted effective exchange rate might be more appropriate considering the global investment phenomenon (op. cit.).

ii. Spot Exchange Rate, Real Exchange Rate

Spot exchange rate refers to the current exchange rate while forward exchange rate refers to an exchange rate that is quoted and traded today but for delivery and payment on a specific date. The real exchange rate (RER) is the purchasing power of two currencies relative to one another. It is based on the GDP deflator measurement of the price level in the domestic and foreign countries which are arbitrarily set equal to one (1) in a given base year. Therefore, the level of the RER is arbitrarily set, depending on which year is chosen as a base year for the GDP deflator of the two countries. The changes in the RER are instead informative on the evolution over time of the relative price of a unit of GDP in the foreign country in terms of the GDP unit of the domestic country. If all goods were freely tradable, and foreign and domestic residents purchased identical baskets of goods, purchasing power parity would hold for the GDP deflator of the two countries, and the RER would be constant (en.wikipedia.org/wiki/exchange rate, 24/01/2011).

iii. Exchange Rate Regimes.

An exchange rate regime is how a country manages its currency to that of other

currencies and the foreign market as a whole. Stockman (1999) divides exchange rate into two, namely; the “pegged system or fixed” and “the floating system” citing a preference for the “floating system”. Of course, others like (Abdoh et al, 2016) have further added two more divisions which are derived from the main two Stockman mentions. Countries can adopt either the fixed, also known as the pegged exchange rate or the flexible, also known as the floating exchange rate. With the fixed, a country’s exchange rate does not fluctuate at all or fluctuates narrowly against some base currency over a sustained period. The exchange rate is pegged to a particular currency or a basket of currencies. The intervention of the government is needed to maintain the fixed exchange rate. With the flexible or floating exchange rate, however, the rate typically fluctuates over time. When a nation decides to adopt the flexible exchange rate, the exchange rate is allowed to be determined by the forces of the foreign-exchange market mechanism without the intervention of the government, unlike the fixed regime where the intervention of the government is needed to maintain it.

Jakob (2015), in his paper “The Impact of Exchange Rate Regimes on Economic Growth”, asserts that there is no fixed agreement on choosing the most suitable exchange rate regime to maintain macroeconomic stability. The choice of an appropriate exchange rate system must depend on the particular features of each country. He further states that free-floating exchange rate regimes adopted by developed countries might not suit developing countries whose insurance markets are not so well developed and whose economy is not stable enough to absorb the risks from the exchange rate volatility.

- Gross Domestic Product (GDP)

The gross domestic product represents the total market value of all final goods and services produced within a given period by factors of production located within a country. GDP can be calculated in three different ways, firstly by the value-added or (production) approach, which adds up the gross output of different industries and then subtracts intermediate inputs, to avoid double counting. Secondly, it can be calculated by the income (by type) approach, which measures the income earned by different

factors of production.

Amoah (2015) in his study, "Modeling GDP using Vector Autoregressive (VAR) Models: An Empirical Evidence from Ghana", established that the real exchange rate is inversely related to GDP in the long term. This implies that rises in the real exchange rate cause GDP to fall in the long run, but a decrease in the real exchange rate causes GDP to rise.

- Determinants of Gross Domestic Product.

Economic growth is the gradual improvement in a country's population's standard of living from a simple, low-income economy to a contemporary, high-income economy. An economy's growth is defined not just as a gain in productive capacity, but also as an improvement in the quality of life for its citizens. Many countries, particularly developing countries like Ghana, were having financial difficulties with resources restricted to a select number of enterprises and wealthy individuals. There are economic growth models based on reasonable-looking assumptions that predict the end of growth in a few decades, or the rapid convergence of different economies' living standards to a common level, or that produce logically possible outcomes that bear no resemblance to the outcomes produced by actual economic systems. Investors demand a higher risk premium on enterprises exhibiting distress characteristics in a failing economy. (O'Sullivan, Arthur; and Sheffrin, 2003).

My research with skeptical guidance from reviewed literature will seek to explore the prevailing situation of foreign exchange rates on GDP in the Ghanaian economy to determine whether the situation in Ghana matches what has been confirmed by other researchers in other places.

Chapter Three: Research Methodology

3.1 Introduction

This chapter explains the study's design and methodology for gathering data for the study's completion. This chapter lays out a plan for data collection, measurement and analysis. It presents the methodology, delving into the research design and approach, data description, and model specification, as well as measurement of variables.

3.2 The Methodology

The various steps are taken in studying a research problem. It entails examining the assumptions, principles, and procedures underlying a particular method of investigation. It lays out the sequential and scientific procedures that were used to conduct the study.

3.2.1 Research Design

The research design is the framework from which the work plan will flow, and it is determined by the research's purpose or objective. It serves as a roadmap for data collection, measurement, and analysis. A research design, according to (Leedy and Ormrod, 2005), is a comprehensive plan that highlights all the methods that will be used in data collection and analysis. MacMillan and Schumacher (2001) defined it as a plan for selecting subjects, research sites, and data collection procedures to answer the research questions. The research design also corresponds to the study's objectives and questions. The goal of this research was to determine the impact of exchange rate fluctuations on Ghana's GDP. As a result, the study used a descriptive research design to examine and explore the descriptive characteristics of several variables of interest.

An econometric model was established to determine the relationship between the exchange rates of the country and the GDP making use of other macroeconomic variables as well. The whole study focused on time series analysis of exchange rates and GDP using regression models. It comprises tables depicting the exchange rates and GDP of Ghana within the survey period. This served as the basic framework for

analysis.

3.2.2 Research Approach.

The research approach is a way of focusing on social phenomena to gain a better understanding of them and attempt to explain them. Quantitative, qualitative, and a combination of both are the three main research approaches. The study is based on a quantitative research methodology. Quantitative research, according to Hopkins (2008), entails the use of numerical measures to facilitate quantification and the type of relationship that exists between variables. A quantitative method was dubbed ideal for this research work. The study sought to determine the impact and level of relationship between two variables through measurements and the quantitative method was best suited for this approach.

Quantitative research has its weaknesses like knowledge produced being too abstract or theories used not reflecting the constituency's understandings. (Akmal, n.d.). However, the strength of this research design led to achieving the research objective because data analysis is relatively less time consuming and not prone to bias as compared to using a qualitative approach.

3.3 Data Description

Data is defined as raw facts that have yet to be processed into reliable information for design purposes. The primary source of data for the study was secondary. For analysis, time series data used for the study was collected from the database of the Bank of Ghana, World Bank national accounts data and the IMF. It comprised of annual data from the years 1980 to 2020 spanning 40 years. The exchange rate data used is an annual average based on monthly averages (local currency units relative to the U.S. dollar) GDP is the annual percentage growth at market prices based on constant local currency. Aggregates are based on constant 2015 prices, expressed in U.S. dollars. Inflation data used is the year-on-year changes in annual percentages of average consumer prices, taken from the IMF World Economic Outlook Database, October 2021. Net export is the difference between the percent changes in the volume of exports of goods and services and that of imports. The choice of the study variables was guided by previous empirical literature such as (Oude, 2013; Kapur et al, 1991;

Havi et al, 2013). The use of secondary data came with both pros and cons. An advantage of secondary data was its element of time saving. Because data has already been gathered and used in research, it saves time and avoids problems that may arise from gathering primary data. On the other hand, secondary data may contain inaccurate data due to human or system errors. The credibility of the Bank of Ghana, World Bank and IMF however assuaged this fear.

- Concept of Time Series Analysis.

A time series is a sequence of observations on a variable measured at successive points in time or over successive periods. The measurements may be taken every hour, day, week, month, or year, or at any other regular interval. The pattern of the data is an important factor in understanding how the time series has behaved in the past. If such behaviour can be expected to continue in the future, we can use the past pattern to guide us in selecting an appropriate forecasting method.

According to Shangodoyin et al (2002), "a time series is a set of statistical observations made sequentially in time and it is possible to observe a time variable at any instant." A time series is a time-oriented or chronological sequence of observations on a variable of interest. A time series involves the use of models to model future events based on the known past. According to Montgomery (2007), time series applies to areas such as Demography, Operation Management, Marketing and Economics.

Operations Management: Business organizations routinely use forecasts of product sales or demand for services to schedule production. Control inventories, manage the supply chain and determine staffing requirements. Forecasts may also be used to determine the mix of products or services to be offered and the locations at which products are to be produced.

Demography: Time series data can be used to understand the relationships that exist between demographic groups and the impact that have on each other or other aspects of the country’s growth. Forecasts of the population by country region are made routinely, often stratified by variables such as gender, age, and race.

Economics: Governments, financial institutions, and policy organizations require an understanding of major economic variables, such as gross domestic product,

population growth, unemployment, interest rates and inflation.

3.3.1 Data Analysis

Data collected was sorted, edited, and collated using simple tables to quickly and easily determine the overall perspective of the data, as well as to draw interpretations and meaningful conclusions. The statistical computer software programme was used to conduct the analysis. The changes in the dependent variable over the survey period were compared to the changes in the explanatory variables over the same period to establish the relationship between these two variables. Specifically, STATA and Microsoft Excel were used for simple and efficient analysis of the data.

3.4 Model Specification

In this study, analysis of the data set was done using econometric models. Econometric models are models that are used in the determination of a statistical relationship between two or more economic variables relating to an economic situation or occurrence. Under the econometric models, there exists a lot of models one can use in analyzing similar data but for this study, I used regression models. Regression analysis investigates the causal relationship between one or more independent factors and one or more economic variables to be explained (the dependent variable). It enables us to spot trends and make predictions both outside and within a set of data.

The model specifically used was the multiple linear regression model. This is a linear regression model with more than one explanatory variable. Thus, it concerns multiple-dimensional sample points with more than one independent variable and one dependent variable and finds a linear function that predicts the dependent variable values as a function of the independent variable as precisely as possible.

It should be noted that regression models are econometric models that are used to determine or estimate the relationship between an independent variable and dependent variables. That is to say, there is an occurrence or phenomenon (dependent variable) that is affected by another phenomenon (independent variable). In some cases, there are two or more independent variables. Following a similar study carried out by…, to

estimate the multiple linear regression using ordinary least squares (OLS), I employed the multiple linear regression in my study where is used exchange rates, net export, inflation and interest rates as supporting variables of GDP.

The formula for a general regression model is stated as $y_i = f(X_t, \beta) + \varepsilon_i$

Where:

- y_i is the dependent variable
- f stands for the equation's function
- X_t is the independent variable
- β for unknown parameters
- ε_i represents the error term

The Multiple linear regression model adopted in the study is stated as:

$GDP\ growth_{t=} \beta_0 + \beta_1 Exrate_t + \beta_2 NetExp_t + \beta_3 Infl_t + \beta_4 Intrate_t + \varepsilon_t$

Where $GDP\ growth_t$ is gross domestic product, $Exrate_t$ is the exchange rate using the period average, $NetExp_t$ is the Net export of the country, the difference between exports and imports, $Infl_t$ is the rate of inflation using the percent change, $Intrate_t$ is the interest rate, with t denoting time, β_0 being the intercept, β_n is the regression coefficient estimated from the sample data, and ε represents the error term in the equation.

3.5 Definition of Variables

3.5.1 Dependent Variable

These are variables that depend on the values of other variables. Such variables are expected to change as a result of experimental manipulation of the independent variable or variables. With regards to the study, the Gross Domestic Product over the period was considered the dependent variable. This variable is the value of all final goods and services produced within a country or an area during a period. According to the World Bank, it is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. This is consistent with studies that used GDP as a dependent variable, using the Vector Autoregressive model

for modelling. (Agalega & Antwi, 2013) and (Amoah, 2015).

3.5.2 Independent Variables

These are variables that are not seen depending on any other variable but are usually used to predict the values of other variables (dependent). Such variables are stable and unaffected by other variables being measured. For the study, I used the foreign exchange rate, Net export, inflation and exchange rate as independent variables or explanatory variables.

- Exchange Rate

It is defined as the price of one currency, given in terms of another. It is defined by the IMF as the official exchange rate which refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar) and retrieved from the World Bank database.

- Net Export

Net export is the difference between the exports and imports of a country during a specified period. Imports and exports of a nation are important components in calculating GDP. These are the international trade activities of an open economy such as Ghana. When exports exceed imports, it is an indication of a trade surplus while vice versa of this is an indication of a trade deficit. Theoretically, there exists an important relationship between Net export and real exchange rate due to the constant feedback loop between international trade and the valuation of a country's currency. I include Net export as an independent variable in my analysis to ascertain the extent of that relationship and how it in turn affects GDP. The study uses the difference between the percent change of the volume of exports of goods and services and the percent change in the volume of imports of goods and services as Net export data and it was retrieved from the IMF World Economic Outlook Database, October 2021.

- Inflation

Inflation is the persistent rise in the general prices of goods and services over time. According to McConnel and Brue (2008), inflation is best described as an increase in price in general, where inflation decreases purchasing power from currency. Barro

(1995) states that an increase in inflation will decrease the GDP per capita and investors. In recent times when the country has witnessed a general rise in prices, currency depreciation is widely regarded as a wrong policy choice contributing to the inflationary pressure. However, the government use devaluation as a policy strategy to increase export and overvaluation of the Ghana Cedi, hence the decision to include inflation as an independent variable in the study.

- Interest Rate

The World Bank defines real interest rate as the lending interest rate adjusted for inflation as measured by the GDP deflator. Udoka and Roland (2012) state that interest rates are one of the factors indicating the economic growth of a country, however, an increase in the interest rate of an economy results in a shrinking GDP. According to Jordaan (2013), decreasing the amount of money in circulation then increases the currency, but lowers levels of investment and consumption, hence a negative relationship exists between interest rates and exchange rates. I used interest rate as an independent variable to assess its impact on economic growth and how that ultimately affects GDP. The data used on interest rate is the monetary policy rate (%) retrieved from the Bank of Ghana database.

Chapter Four: Empirical Results, Analysis and Discussion

4.1. Introduction

The results from the selected data under investigation are presented in this chapter. The goal of this study was to see how the exchange rate impacted Ghana's Gross Domestic Product. The focus was on the period from 1980 to 2020. The data for this study was gathered exclusively from published reports obtained from the World Bank database, the International Monetary Fund and the Bank of Ghana database. Data was collected on the dependent variable and all the explanatory variables. It included the annual percentage growth of GDP and the period averages of the official exchange rate, Net export, inflation and interest rates. The data was fed into STATA version 13.0, as well as Microsoft Excel and used to compute the results and draw conclusions. Descriptive analysis with normality tests, multiple regression analysis and correlation analysis were also carried out in the study. I also run a Vector Autoregression estimate with a focus on the Granger Causality test and impulse functions.

4.2. Descriptive Data Analysis

Table 4.1: Descriptive Statistics

	N	**Mean**	**Std.dev**	**Min**	**Max**	**Skewness**	**Kurtosis**
GDP growth	41	4.489	3.597	-6.924	13.95	-0.914	5.782
Exchange rate	41	1.156	1.594	0.0003	5.596	1.529	4.140
Net export	41	-5.092	16.694	-54.942	23.814	-1.075	4.867
Inflation	41	25.848	24.796	6.698	122.245	2.722	10.626
Interest rate	41	22.317	9.792	0.00	45	0.647	3.417

Source: Based on authors' calculations

Table 4.1 presents a summary of the descriptive statistics of the variables used in this study. It shows the number of observations, means, standard deviations, minimum, and maximum values as well as the skewness and kurtosis of each of the variables. From the study, net export has a mean of (-5.092), depicting trade deficits throughout the study period. Inflation has the highest standard deviation of (24.792). Normality

tests are depicted in the table using the skewness and kurtosis statistics. The univariate normality of the variables can be accepted if the skewness statistic is within the interval (-3.0, 3.0) and the kurtosis lying in the interval (-10.0, 10.0), (Kline, 2011). The results reveal that all the variables have no substantial deviation from being normally distributed except Inflation with kurtosis of (10.626).

Table 4.2: Correlation Matrix

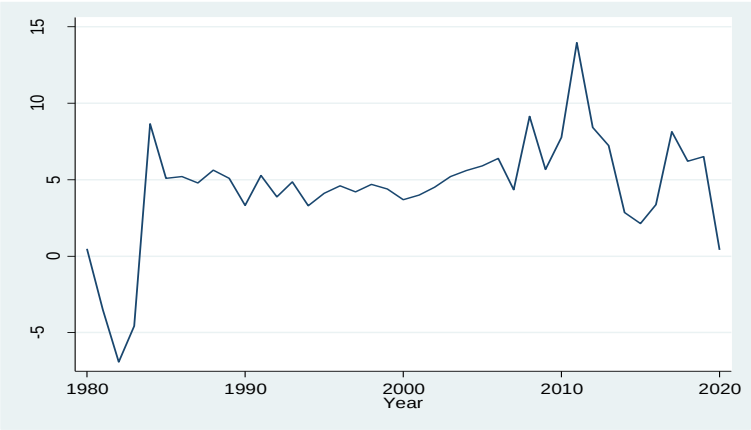
	GDP growth	**exch. rate**	**Net export**	**Inflation**	**Interest rate**
GDP growth	1.0000				
exch. rate	0.1545	1.0000			
Net export	0.1700	0.2066	1.0000		
Inflation	-0.5837	-0.3857	-0.3443	1.0000	
Interest rate	-0.0541	-0.3827	0.2494	0.1494	1.0000

Source: Based on authors' calculations

The table above presents the correlation matrix for the variables. The correlation analysis aims to know the degree of relationship between the variables. From the correlation calculated, we can infer that GDP growth is positively related to exchange rate, and Net export but negatively related to inflation and interest rates. This implies that an increase in the exchange rate and net export would cause an increase in GDP. This result can be confirmed practically as an increase in net export depicts a favourable trade balance and consequently an increase in economic growth. The degree of association between the variables, however, can be seen to be a moderate one. On the other hand, as GDP has a negative relationship with inflation and interest rates, it means an increase in the latter two would cause a decrease in the GDP. This result agrees with previous studies from the likes of (Attah-Obeng et al ,2013; Teye & Akamba, 2019).

4.2.1 Trend of Growth in Dependent and Independent variables

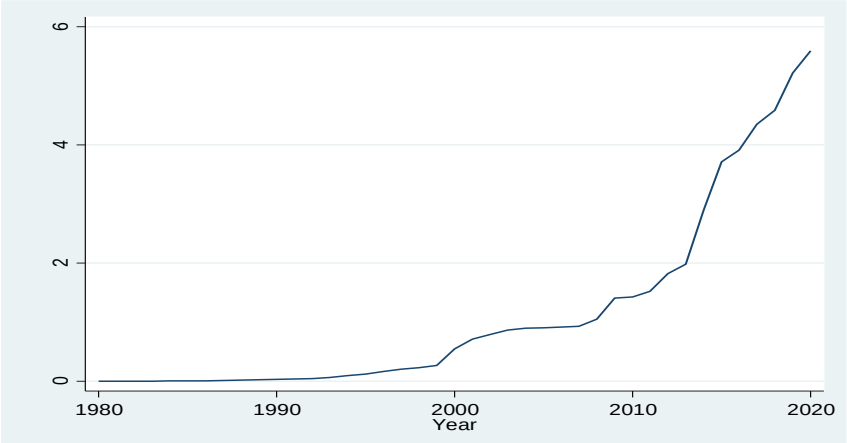
Figure 4.1: Trend Analysis in GDP growth.



Source: Based on the author's calculations

Figure 4.1 shows the time series plot for the annual GDP growth over the sampled forty-year period. It depicts the fluctuating trends in the data, although it generally increases. It reduced in the initial years and then drastically begins to increase with a peak owing to the Economic Recovery Programme initiated in 1983. GDP growth stabilizes after that period with random fluctuations over the years.

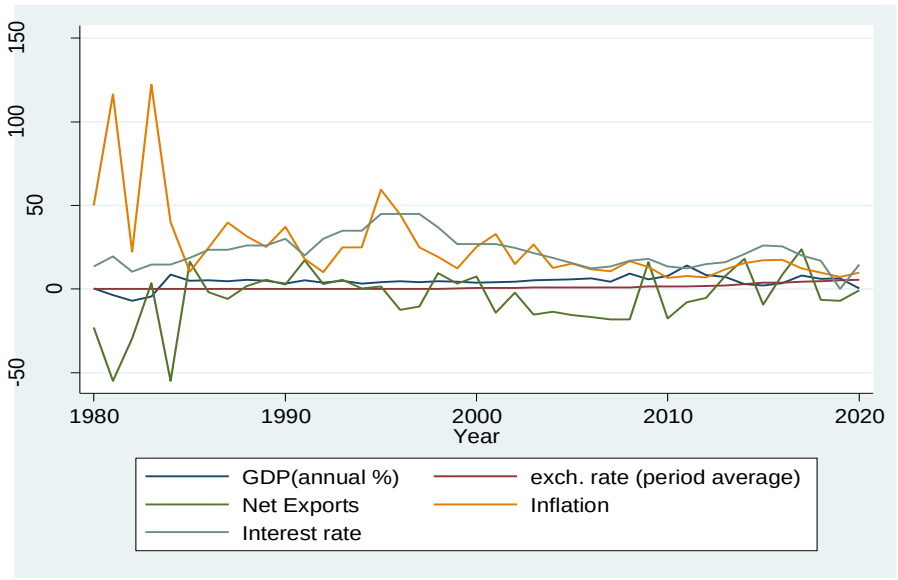
Figure 4.2: Trend Analysis in Exchange rate.



Source: Based on the author's calculations.

Figure 4.2 provides a pictorial view of the exchange rate over the study period. The figure shows the exchange rate to be heavily trended. It stabilizes from 1980 to the late 1990s and then begins an upward increase after that until the present day. The increase in exchange rate continues to remain constant with no change over the years.

Figure 4.3: Trend Analysis in Independent and Dependent variables



Source: Based on the authors' calculation

Figure 4.3 depicts the pictorial relationship between the explained variable GDP growth and the explanatory variables as well as the behaviour of the variables over the study period. The Net export showed a negative trend depicting the excess of imports in the country over the exports, putting the country in a deficit trading position with its international partners. Inflation increases at the start of the period and then begins a downward trend which can be attributed to the Economic Recovery Programme in 1983. It stabilizes over the period. The interest rate shows a constant trend over the study period as depicted by the graph.

4.3 Analysis of Data

4.3.1. Stationarity Tests.

A meaningful econometric estimation of a model using time series data requires that the data should be stationary. Time series data is usually non-stationary, and this implies that its properties change over time. According to Granger and Newbold (1974), econometric estimation using non-stationary time series data often leads to spurious results. Several tests, also referred to as unit root tests are available for testing whether a time series data is stationary or not. The stationarity of data implies that the properties of the data do not depend on the time at which the series is observed. The statistical properties of the data remain constant over time. There are two basic approaches for determining whether time series is stationary or not. The formal tests used are the Augmented Dickey-Fuller (ADF) and Phillips-Peron tests. This study follows the likes of Khondler et al (2012), and Karahan (2020), who use the Augmented Dickey-Fuller test to ascertain the stationarity of the time series variables. The result of the ADF test is presented in Table 4.3 below.

Table 4.3: Augmented Dickey-Fuller Test

Variables	**Level**	**First Difference**	**Result**
GDP	-3.509**		I(0)
lexchrate	-3.602**		I(0)
Net exports	-4.113***		I(0)
linfl	-2.999**		I(0)
d_interest	-1.538	-3.760***	I(1)

Source: Based on the author's calculation.

Note: *, ** and *** indicate the significance level at 10%, 5% and 1% respectively.

The Augmented Dickey-Fuller test was used to detect the presence of unit root in the study variables. The null hypothesis states that there is the presence of unit root in the variables as against the alternative which states that there is no unit root. The test was carried out at levels and first difference. However, some variables do not show exponential growth and hence were not transformed. I compared the absolute value of the calculated t-statistics to the critical values. If the absolute value of the t-statistics is

higher than the critical values, then we reject the null hypothesis, otherwise, we fail to reject the null hypothesis. From the table it can be seen that exchange rate and inflation was stationary at the level, indicating significance at 5% respectively. GDP and net exports indicate significance at 5% and 1% respectively. Based on these results, the null hypothesis of unit root was rejected.

On the other hand, the interest rate was non-stationary at level, which means we fail to reject the null hypothesis indicating the presence of unit root. However, at first difference, it indicated stationarity at the 1% significance level. As a result, the null hypothesis of unit root is rejected and the data is stationary.

4.3.2 Regression Results

Table 4.4: Empirical Results with GDP growth as Dependent Variable

	1	**2**	**3**	**4**	**5**
Intercept	5.7051	4.6756	13.0076	4.5921	10.0428
Exchange rate	0.7025				0.4478
	(4.20) ***				(1.79) *
Net export		0.0366			-0.0108
		(1.08)			(-0.35)
Inflation			-2.8627		-1.6256
			(-4.17) ***		(-1.63)
Interest rate				-0.1044	-0.0239
				(-1.08)	(-0.28)
R^2	0.3119	0.0289	0.3089	0.0296	0.3501
Adjusted R^2	0.2942	0.0040	0.2912	0.0040	0.2758
F-value	17.67	1.16	17.43	1.16	4.71
P>F	0.0001	0.2880	0.0002	0.2886	0.0038

Source: Based on the author's calculation.
Note: *, ** and *** indicate the significance level at 10%, 5% and 1% respectively.

- Interpretation

For the study analysis, I performed a multiple regression analysis as well as a simple linear regression which was an additional analysis. I regressed each of the independent variables on the dependent variable while holding the other variables constant and then performed a multiple regression analysis by regressing the dependent variable together with all the independent variables.

Table 4.3.2 gives a summary of the regression results using the STATA software. Different models and regressions were analyzed and divided into columns. The table shows the coefficients of the variables as well as t-statistics. In the first column, I performed a simple linear regression with the exchange rate being the explanatory variable and GDP growth, the explained variable. Based on previous studies and economic theory, it is expected that there will exist a positive relationship between GDP growth and exchange rate in Ghana. The results show that the exchange rate has a positive effect on GDP growth, with a coefficient of 0.7025. This implies that a unit increase in the exchange rate will lead to a 70.25% increase in GDP holding other independent variables constant. This positive relationship between both variables can be confirmed by the correlation results previously mentioned. This result also agrees with economic theory and is consistent with other empirical literature such as Attah-Obeng et al (2013), and Semuel & Nurina (2015) who analyze the effect of a selected few macroeconomic variables on GDP in Indonesia. The intercept or constant value of 5.7051 shows that GDP will still experience a 5.7051 increase when the exchange rate is zero, all other factors held constant. The regression result however signifies a larger magnitude of the relationship between both variables. The model is valid or statistically significant to explain the impact or influence that the exchange rate has on GDP with an f-value of 17.67 and p-value of 0.0001 which is significant at both 1% and 5% significance levels. Economically, the exchange rate also explains about 31.19% of the total variations in the GDP growth with a coefficient of determination(R-square) of 0.3119. This means there exists an unexplained variation in GDP growth of about 69% which is catered for by other macroeconomic variables.

The exchange rate greatly affects exports and imports and is only a part of the factors which influence GDP growth.

Net export, calculated as the difference between the exports and imports is also having a positive influence on GDP with a coefficient of 0.0366. This can be explained as an increase in net export will lead to a 0.0366 unit increase in GDP growth. This is statistically not a significant relationship. This can be confirmed by a p-value of 0.288, which shows that the coefficient of the independent variable is not significant to explain the dependent variable. It is insignificant at all significance levels with an F value of 1.16 and a p-value of 0.2880. I would attribute this to the excess of imports over exports in Ghana which led to Net export having negative values all through the study period and hence cannot be significant enough to explain GDP at this point. However, if net export is stated at zero, all other variables being constant, GDP growth will have an increase of 4.6756 and significant at 1%. In summary, the results show a positive insignificant relationship between GDP growth and Net export in Ghana.

The third column shows the results between GDP growth and inflation from the simple regression analysis. From the correlation calculated, GDP growth and Inflation are negatively correlated and this is further confirmed by the regression result. Suva and Fiji (2004) state that inflation has a negative relationship with GDP growth and this is consistent with the study. Inflation is significant in influencing GDP at all significance levels with a p-value of 0.000. It negatively influences the dependent variable with a coefficient of -2.8627. This means a unit increase in the inflation rate will cause GDP growth to decrease by -2.8627%. However, this is not statistically strong enough. On the other hand, the result supports the economic theory that as inflation increases, the central bank raises interest rates as a control measure, and this, in turn, increases the borrowing rate. Incidentally, the amount of money borrowed by individuals and companies decreases. This, in turn, reduces the amount of money in circulation, which results in low economic output. The model is also very valid and significant to explain GDP growth because of an f critical of 0.0001 showing

significance at all levels. About 34% of the variations in GDP growth can be statistically explained by inflation, which is not a good fit. This means that, even though the country experiences an uncontrollable spiral of inflation resulting in a significant decrease in GDP growth, there are other macroeconomic variables that better explain the variations.

The interest rate has a negative relationship with GDP growth as shown by the regression output. This is consistent with previous studies, such as that of Agalega & Antwi (2013). Based on economic theory, it is expected that there will be a negative relationship between interest rates and GDP growth. As earlier stated, interest rates increase the cost of borrowing. The result of this is an adverse effect on economic growth, hence GDP. The coefficient of the independent variable is
-0.1044 which means that an increase in interest rates will cause a 0.1044-unit decrease in GDP growth. The results show an insignificant negative relationship between the variables, with a
t-critical value of 1.08. Economically, interest rate variations act as a control measure for inflation volatility and may explain its insignificant relationship with the dependent variable. However, it can also be due to errors in gathering data for the analysis. The results show a coefficient of determination of 0.0296, which means only 2.96% of the variations in GDP growth can be explained by interest rates. This is both economically and statistically insignificant. Interest rates have an insignificant negative relationship with GDP growth. This implies that, even though an increase in interest rate will negatively affect GDP growth, there are other macroeconomic variables whose effects are significantly more paramount.

After running a series of simple linear regression analyses with the dependent variable and each of the independent variables, I run a multiple linear regression analysis on the model. The fifth column of Table 4.3.2 gives a summary of the regression results. GDP growth was again used as the dependent variable with the exchange rate, Net export, inflation, and interest rates being the independent variables. The results show that the exchange rate has a significant positive relationship with GDP growth, and is

statistically significant at the 10% significance level. A unit increase in the exchange rate will cause a 44.48% increase in GDP, holding the other variables constant. In this model, net export has an insignificant negative relationship with GDP growth. It has a coefficient of -0.0108 and is insignificant at 1%, 5%, and 10% significance levels. The country had unfavourable trade balances, with imports exceeding exports over the study period. This may account for the negative relationship, holding all the other variables constant. Exports in Ghana lack the required quality to become competitive in the world market and as a result, the country remains a net importer. Economically, an increase in exportation and a decrease in importation will cause an increase in economic growth. In Ghana, however, there is high importation of inputs, implements, and equipment, which can be a major cause of this adverse relationship.

Inflation shows a negative relationship with GDP growth. An increase in inflation will lead to a -1.6256 decrease in GDP growth, holding other variables constant. A rise in the general price of goods and services increases the cost of living. The result of this is a fall in real income, personal consumption, and the standard of living. Exports become expensive which leads to a fall in exports and an increase in imports. This ultimately affects the trade balance and further confirms the inverse relationship that net export has with GDP growth in the multiple regression model, largely owing to the presence of inflation. This result is consistent with previous literature such as (Enu & Hagan, 2013) who concluded that there is a strong negative linear relationship between GDP growth rate and inflation rate in Ghana.

The interest rate has a negative insignificant relationship with GDP growth as depicted by the results from the multiple regression analysis. Holding the other variables constant, an increase in interest rate will decrease the GDP growth rate by 0.0239. With a p-value of 0.784, it showcases insignificance at all the significance levels. Economically, an increase in the interest rate causes an increase in the cost of borrowing which in turn reduces borrowing as individuals, companies and small-scale industries find it difficult to borrow money at higher costs. This reduces the amount of money in circulation, ultimately impacting economic growth adversely, hence a decline in GDP growth. The results from the multiple regression further confirm this.

From the analysis, when all the explanatory variables are stated at zero, holding all

other factors constant, GDP growth will increase by 10.0428, and this is significant at all the significance levels. The model has an F value of 4.71 and an f critical value of 0.0038, which is statistically significant at all levels and is valid to explain GDP growth. A coefficient of determination (R-square) of 0.3501 (0.3501*100) means that about 35% of the variations in GDP growth can be explained by the independent variables used in the study. The rest 65% can be explained by other factors that influence GDP growth but are not considered in the study. All four explanatory variables play a role in the growth rate of GDP but the impact of other macroeconomic variables which are not captured in this study outweigh the explanatory variables used. Other macroeconomic variables such as Foreign direct investment, government expenditure, and unemployment among others.

4.3.3 Vector Autoregression Model (VAR)

This statistical model is used to capture the relationship between multiple quantities as they change over time. It describes the evolution of a set of endogenous variables over time. Before moving on to the VAR analysis itself, it was necessary to determine the suitable lag time to use. The main point was to determine the Granger Causality as well as the impulse functions. I applied the lag function to determine the lag which best suited the analysis as shown in the Appendix. I then performed additional analysis as indicated in the Appendix to check the stability of the VAR model and to test for residual autocorrelation. The STATA outputs for all these are shown in the Appendix.

- Granger Causality.

After running the regression analysis, I applied the Granger causality to further test the relationship between GDP growth and exchange rate as well as the other variables. The idea behind this test is to determine if one variable predicts another variable or if the past values of one variable predict the future values of another variable. It can also be stated as if one variable Granger causes another variable. It is strictly about prediction and not causality. However, if the test shows no Granger causality, we can conclude that there is no causal relation between the past values of one variable and the future values of the other. To explain the Granger test between the exchange rate

and the annual GDP growth rate, then we say: Is it the exchange rate that causes the GDP growth, or is it the GDP growth that causes changes in the exchange rate. The same applies to the other variables. The results are presented in Table 4.5 below.

Table 4.5 The Granger Causality Test Result

Null Hypothesis	**F-statistic**	**P-value**
Exrate does not Granger cause GDP	0.7148	0.4039
GDP does not Granger Cause Exrate	2.8148	0.1028
Netexp does not Granger cause GDP	1.2395	0.2736
GDP does not Granger cause Netexp	2.1021	0.1565
Infl does not Granger cause GDP	0.0013	0.9715
GDP does not Granger cause Infl ***	8.8295	0.0055
Int.rate does not Granger cause GDP	1.0371	0.3159
GDP does not Granger cause Int.rate	0.4422	0.5107

Source: Based on the author's calculation

Note: *** rejects the null hypothesis at a 1% significance level

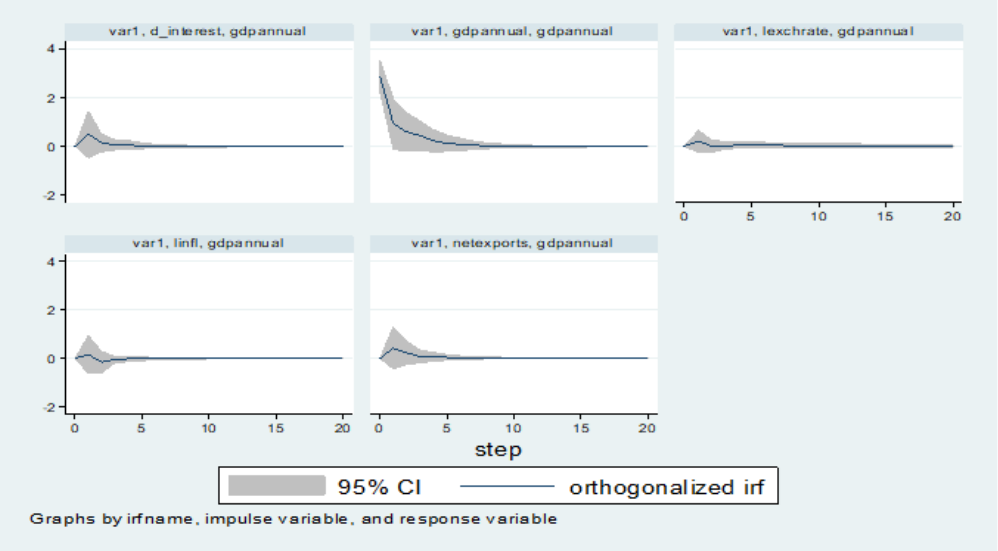
The null hypothesis states that there is no relation or Granger causality, as against the alternative which states that there exists Granger causality. From the results above, the test predicts that changes in exchange rate do not Granger cause GDP growth rate as the p-value is 0.4039. In the same vein, GDP growth does not Granger cause changes in the exchange rate as the p-value is also 0.1028. Hence, we fail to reject the null hypothesis in both instances. The test further shows that the rest of the variables do not Granger cause GDP growth, therefore we fail to reject the null hypothesis. However, the results also show that the GDP rate does Granger cause the changes in

inflation rate and is significant at the 1% level since the p-value is 0.0055. The null hypothesis is therefore rejected.

- Impulse Response Graph

Due to the difficulty in interpreting coefficients generated by the VAR, I used the impulse response graphs to interpret the results. Though the Granger causality test is advantageous, it only shows that there is a predictive feature or a potential relationship but not the direction of this prediction. The impulse response graph on the other hand gives an insight into the direction of the relationship. There are impulse variables, which are the independent variables in this study, and the response variable is the dependent variable. The main idea is, to try to determine the effect of the shock in the impulse variable on the response variable. Simply put, the response of a variable given an impulse in another variable. This is graphically shown in Figure 4.4 below.

Figure 4.4: Impulse Response Graph



Source: Based on the author's calculation.

The graph shows that a positive shock on GDP will cause GDP to increase in response by the shock amount. The decline in the graph illustrates that over time, the effects of the shock decline to 0. Similarly, a positive shock on the exchange rate will cause GDP to increase slightly but easily reverts to 0. The response of GDP to inflation shows a different but expected pattern. A shock in the inflation rate caused GDP to

climb down in the initial periods but thereafter stabilize at 0 in the subsequent periods. The graphs indicating shocks in the independent variables are shown in the Appendix.

Chapter Five: Summary of Findings, Conclusion and Recommendation

5.1 Summary of Findings

The study was to determine the impact of exchange rate on GDP growth in Ghana for the period 1980 to 2020. Additional three variables were considered since exchange rate is also influenced by certain macroeconomic variables. The study employed the methods of line plots to analyze the trend over the study period, correlation analysis and multiple linear regression estimated using the ordinary least squares. For in-depth analysis, I performed simple linear regression on the four independent variables, exchange rate, Net export, inflation and interest rate, using the GDP growth as the dependent variable. After the simple linear regressions, I run a multiple linear regression and thereafter, a granger causality test.

The relationship between exchange rate and GDP growth in Ghana is an important one for policymakers. From both analysis, exchange rate is consistent in terms of its direction of input and influence on GDP growth. How movements in the exchange rate affect overall economic activity has been a subject of long-standing controversy in macroeconomics. The results of the study however show that exchange rate has a positive impact on growth and is also consistent in terms of its direction of influence. The low impact of the other independent variables renders their effect in the regression model somehow low.

5.2 Policy Implications and Recommendations

The management of the exchange rate would always remain a delicate task for policymakers. The empirical findings in this study however provide more invaluable knowledge for policy formulation and implementation in Ghana. It is obvious from the findings of the study that exchange rate has had a significant influence on the

improvement of the GDP growth rate. All the analysis carried out confirm that exchange rate positively impacts GDP growth. This means an increase in exchange rate leads to an increase in GDP growth and vice versa. Net export, inflation and interest rates show negative relationships respectively with the explained variable, GDP growth. Due to this, the government in conjunction with the Central Bank must formulate and implement monetary fiscal policies that will continue to drive the inflation rate downwards to enhance economic growth and stability. A weak domestic currency can push up the inflation rate in a nation that is a big importer, such as Ghana, because of higher prices for foreign products. When this happens, it may induce the Central Bank to raise interest rates to counter the effects of inflation, as well as support the currency. In the same vein, a strong currency exerts a downward push on inflation. The Central Bank may move to keep the interest rates low to keep the currency from getting stronger.

The government should also look to embark on productive activities that will increase exports more than imports. A weak domestic currency or high foreign exchange rate increases economic growth by boosting exports and making imports more expensive, thereby forcing consumers to prioritize domestic sectors by buying domestic goods. This can be done by creating new local industries and factories and investing in those already in existence to increase the domestic sector. The government can also pursue specific export incentives for selected primary commodities. This can increase the diversification of the economy, increase export earnings and correct the trade balance. Additionally, the government can also improve upon GDP growth by formulating and implementing policies that aim at boosting the main sectors of the economy such as agriculture, and industry, among others.

5.3 Limitation and Further Study.

The major limitation of the study has to do with the model. The model is limited such that, other macroeconomic variables have not been included in the model. I realize that the model is a bit simplified, and for future research I would want to add more regressors or use a different method of analysis such as the Autoregressive

Distributive Lag(ARDL). Another has to do with the outcome of certain variables which could indicate an error in the gathering of regression data. This however does not compromise the validity of the findings as the main independent variable achieved its expected result. In terms of model limitation, further studies may add other factors such as political, or other macroeconomic factors that may also affect GDP growth. The sample size and study period can also be expanded to improve the accuracy of research results and avoid errors. Further studies can also focus on the individual exchange rate regimes and how they have influenced GDP growth

5.4 Conclusion

This research explored the impact of foreign exchange rate on GDP growth in Ghana from 1980 to 2020. I examined the relationship that exists between the dependent variable, GDP growth and the independent variables by using the ordinary least squares estimation method. The empirical evidence revealed that exchange rate has a significant positive influence on GDP growth, with interest rates having an insignificant positive relationship. This means that a continuous degree of depreciation of the local currency will positively affect the trade balance, thereby impacting GDP growth positively. It is worth noting that, continuous depreciation of the local currency may have adverse effects in the long run. Additional findings reveal a negative relationship between inflation and GDP growth, as well as Net export and GDP growth largely due to trade deficits throughout the study period

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Appendix

Data Used: Secondary Data from 1980 to 2020

Year	GDP (annual %)	exch. rate (period average)	Net export	Inflation	Interest rate
1980	0.4717	0.0003	-23	50.005	13.50
1981	-3.5031	0.0003	-54.9	116.504	19.50
1982	-6.9237	0.0003	-29.5	22.485	10.50
1983	-4.5637	0.0009	3.4	122.245	14.50
1984	8.6476	0.0036	-54.942	40.03	14.50
1985	5.0916	0.0054	16.278	10.301	18.50
1986	5.1992	0.0089	-1.894	24.539	23.50
1987	4.7949	0.0154	-5.763	39.758	23.50
1988	5.6282	0.0202	1.728	31.369	26.00
1989	5.0859	0.0270	5.467	25.237	26.00
1990	3.3288	0.0326	2.521	37.241	30.00
1991	5.2818	0.0368	17.214	18.097	20.00
1992	3.8794	0.0437	3.018	10.049	30.00
1993	4.8500	0.0649	5.661	24.942	35.00
1994	3.3000	0.0956	0.469	24.874	35.00
1995	4.1124	0.1199	1.534	59.317	45.00
1996	4.6025	0.1635	-12.53	44.487	45.00
1997	4.1964	0.2048	-10.464	24.825	45.00
1998	4.7004	0.2312	9.539	19.208	37.00
1999	4.4000	0.2666	3.201	12.471	27.00
2000	3.7000	0.5449	7.584	25.113	27.00
2001	4.0000	0.7163	-14.05	32.932	27.00
2002	4.5000	0.7924	-2.072	14.846	24.50
2003	5.2000	0.8668	-15.296	26.626	21.50
2004	5.6000	0.8995	-13.634	12.666	18.50
2005	5.9000	0.9052	-15.698	15.095	15.50
2006	6.3999	0.9151	-16.634	11.683	12.50
2007	4.3468	0.9326	-18.1	10.729	13.50
2008	9.1498	1.0523	-18.032	16.505	17.00

2009	5.6830	1.4050	15.928	13.139	18.00
2010	7.7690	1.4300	-17.631	6.698	13.50
2011	13.9500	1.5206	-7.828	7.676	12.50
2012	8.4280	1.8249	-5.402	7.072	15.00
2013	7.2430	1.9814	7.769	11.666	16.00
2014	2.8560	2.8966	18.176	15.486	21.00
2015	2.1210	3.7146	-9.327	17.153	26.00
2016	3.3740	3.9098	8.659	17.455	25.50
2017	8.1290	4.3505	23.814	12.372	20.00
2018	6.2000	4.5853	-6.339	9.837	17.00
2019	6.5080	5.2174	-6.92	7.144	0.00
2020	0.4140	5.5957	-0.794	9.885	14.50

Source :(IMF World Economic Outlook Database, World Bank National Accounts & Bank of Ghana)

Table 4.1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
gdpannual	41	4.489068	3.59675	-6.9237	13.95
exchratepe~e	41	1.156068	1.593817	.0003	5.5957
netexports	41	-5.092439	16.69389	-54.942	23.814
inflation	41	25.84785	24.79618	6.698	122.245
interestrate	41	22.31707	9.792061	0	45

Table 4.2: Correlation Matrix

	gdpann~l	exchra~e	netexp~s	inflat~n	intere~e
gdpannual	1.0000				
exchratepe~e	0.1545	1.0000			
netexports	0.1700	0.2066	1.0000		
inflation	-0.5837	-0.3857	-0.3443	1.0000	
interestrate	-0.0541	-0.3827	0.2494	0.1494	1.0000

Stationarity Tests

```
. dfuller gdpannual, lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        39

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -3.509            -3.655            -2.961           -2.613
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0078
```

```
. dfuller lexchrate, lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        39

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -3.602            -3.655            -2.961           -2.613
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0057

.
.

. dfuller netexports, lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        39

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -4.113            -3.655            -2.961           -2.613
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0009

. dfuller linfl, lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        39

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -2.999            -3.655            -2.961           -2.613
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0350

. dfuller interestrate, lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        39

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -1.538            -3.655            -2.961           -2.613
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.5144

. gen d_interest = interestrate - L.interestrate
(1 missing value generated)

. dfuller d_interest, lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        38

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -3.760            -3.662            -2.964           -2.614
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0033
```

Regression Analysis

```
. reg gdpannual l_exchrate
```

Source	SS	df	MS		
Model	161.373324	1	161.373324	Number of obs	= 41
Residual	356.091009	39	9.13053868	F(1, 39)	= 17.67
				Prob > F	= 0.0001
Total	517.464332	40	12.9366083	R-squared	= 0.3119
				Adj R-squared	= 0.2942
				Root MSE	= 3.0217

gdpannual	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
l_exchrate	.7025204	.1671057	4.20	0.000	.3645172	1.040524
_cons	5.705102	.553501	10.31	0.000	4.58554	6.824663

```
. reg gdpannual netexports
```

Source	SS	df	MS		
Model	14.9489547	1	14.9489547	Number of obs	= 41
Residual	502.515378	39	12.8850097	F(1, 39)	= 1.16
				Prob > F	= 0.2880
Total	517.464332	40	12.9366083	R-squared	= 0.0289
				Adj R-squared	= 0.0040
				Root MSE	= 3.5896

gdpannual	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
netexports	.03662	.0339981	1.08	0.288	-.0321477	.1053876
_cons	4.675553	.5867228	7.97	0.000	3.488794	5.862312

```
. reg gdpannual linfl
```

Source	SS	df	MS		
Model	159.835781	1	159.835781	Number of obs	= 41
Residual	357.628552	39	9.16996287	F(1, 39)	= 17.43
				Prob > F	= 0.0002
Total	517.464333	40	12.9366083	R-squared	= 0.3089
				Adj R-squared	= 0.2912
				Root MSE	= 3.0282

gdpannual	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
linfl	-2.862746	.6856928	-4.17	0.000	-4.24969	-1.475801
_cons	13.00763	2.09448	6.21	0.000	8.771144	17.24411

```
. reg gdpannual d_interest
```

Source	SS	df	MS		
Model	14.8151552	1	14.8151552	Number of obs	= 40
Residual	486.106448	38	12.792275	F(1, 38)	= 1.16
				Prob > F	= 0.2886
Total	500.921604	39	12.8441437	R-squared	= 0.0296
				Adj R-squared	= 0.0040
				Root MSE	= 3.5766

gdpannual	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
d_interest	-.1044113	.0970215	-1.08	0.289	-.3008211	.0919986
_cons	4.592113	.5655199	8.12	0.000	3.447278	5.736948

```
. reg gdpannual lexchrate netexports linfl d_interest
```

Source	SS	df	MS	Number of obs	=	40
				F(4, 35)	=	4.71
Model	175.37593	4	43.8439826	Prob > F	=	0.0038
Residual	325.545673	35	9.30130495	R-squared	=	0.3501
				Adj R-squared	=	0.2758
Total	500.921604	39	12.8441437	Root MSE	=	3.0498

gdpannual	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lexchrate	.4478258	.2496411	1.79	0.081	-.0589727	.9546242
netexports	-.0108206	.0311797	-0.35	0.731	-.0741188	.0524775
linfl	-1.625631	.9986336	-1.63	0.113	-3.652965	.4017029
d_interest	-.0239485	.0868508	-0.28	0.784	-.2002649	.1523679
_cons	10.04284	2.741108	3.66	0.001	4.478096	15.60759

Vector Autoregression Estimates

```
. varsoc gdpannual lexchrate netexports linfl d_interest
```

Selection-order criteria
Sample: 1985 - 2020 Number of obs = 36

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-425.388				16666	23.9104	23.9872	24.1304
1	-301.596	247.58	25	0.000	69.9867*	18.422*	18.8826*	19.7416*
2	-288.161	26.869	25	0.362	144.884	19.0645	19.9089	21.4838
3	-270.103	36.117	25	0.070	268.781	19.4502	20.6784	22.9691
4	-243.923	52.359*	25	0.001	418.604	19.3846	20.9967	24.0032

Endogenous: gdpannual lexchrate netexports linfl d_interest
Exogenous: _cons

```
. var gdpannual lexchrate netexports linfl d_interest, lags(1/1) dfk small

Vector autoregression

Sample:  1982 - 2020                            No. of obs      =        39
Log likelihood = -371.9552                      AIC             =  20.61309
FPE            =  623.9166                      HQIC            =  21.07222
Det(Sigma_ml)  =  132.3225                      SBIC            =  21.89275

Equation           Parms      RMSE     R-sq        F       P > F
------------------------------------------------------------------
gdpannual              6   2.87841   0.3697   3.870479   0.0072
lexchrate              6  .219989   0.9934   990.8952   0.0000
netexports             6   14.5241   0.1540   1.201301   0.3301
linfl                  6    .43985   0.5816   9.175594   0.0000
d_interest             6   5.80671   0.1586   1.243669   0.3113
------------------------------------------------------------------

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
gdpannual    |
  gdpannual  |
         L1. |   .4059433   .1749202     2.32   0.027     .0500654    .7618212
             |
    lexchrate|
         L1. |   .2145057   .2537078     0.85   0.404    -.3016666     .730678
             |
  netexports |
         L1. |   .0330275   .0296661     1.11   0.274    -.0273286    .0933836
             |
       linfl |
         L1. |  -.0368059   1.022873    -0.04   0.972    -2.117857    2.044245
             |
  d_interest |
         L1. |   .0955244   .0938009     1.02   0.316     -.095315    .2863637
             |
       _cons |   3.544678   3.345443     1.06   0.297    -3.261678    10.35103
-------------+----------------------------------------------------------------
lexchrate    |
  gdpannual  |
         L1. |  -.022429    .0133687    -1.68   0.103    -.0496278    .0047698
             |
    lexchrate|
         L1. |   .9311095   .0193902    48.02   0.000     .8916598    .9705592
             |
  netexports |
         L1. |   .0041663   .0022673     1.84   0.075    -.0004465    .0087792
             |
       linfl |
         L1. |  -.0692901   .0781755    -0.89   0.382    -.2283393    .0897592
             |
  d_interest |
         L1. |  -.002191    .007169    -0.31   0.762    -.0167763    .0123944
             |
       _cons |   .4681523   .2556834     1.83   0.076    -.0520396    .9883442
-------------+----------------------------------------------------------------
netexports   |
  gdpannual  |
         L1. |    1.27968   .8826257     1.45   0.157    -.5160359    3.075395
             |
    lexchrate|
         L1. |  -1.047116   1.280178    -0.82   0.419    -3.651657    1.557425
             |
  netexports |
         L1. |   .0290651   .1496913     0.19   0.847    -.2754842    .3336143
             |
       linfl |
         L1. |  -5.265735   5.161291    -1.02   0.315    -15.76646     5.23499
             |
  d_interest |
         L1. |   .0107175   .4733076     0.02   0.982     -.952234    .9736691
             |
       _cons |    4.67646   16.88069     0.28   0.783    -29.66756    39.02048
-------------+----------------------------------------------------------------
linfl        |
  gdpannual  |
         L1. |  -.0794257   .0267296    -2.97   0.005    -.1338075    -.025044
             |
    lexchrate|
         L1. |  -.0994373   .0387691    -2.56   0.015    -.1783136    -.020561
             |
  netexports |
         L1. |   .0070213   .0045333     1.55   0.131    -.0022017    .0162444
             |
       linfl |
         L1. |  -.026169    .1563053    -0.17   0.868    -.3441746    .2918366
             |
  d_interest |
         L1. |   .0140252   .0143337     0.98   0.335     -.015137    .0431874
             |
       _cons |   3.230183   .5112175     6.32   0.000     2.190103    4.270262
-------------+----------------------------------------------------------------
d_interest   |
  gdpannual  |
         L1. |   .2346505   .3528723     0.66   0.511    -.4832736    .9525747
             |
    lexchrate|
         L1. |  -1.055424   .5118129    -2.06   0.047    -2.096716   -.0141331
             |
  netexports |
         L1. |   .0497606   .0598463     0.83   0.412    -.0719977    .1715189
             |
       linfl |
         L1. |   -2.95661   2.063475    -1.43   0.161    -7.154783    1.241562
             |
  d_interest |
         L1. |  -.1296881   .1892276    -0.69   0.498    -.5146746    .2552983
             |
       _cons |   5.992006   6.748872     0.89   0.381    -7.738678    19.72269
------------------------------------------------------------------------------
```

. varstable

Eigenvalue stability condition

Eigenvalue	Modulus
.9349138	.934914
.5909444	.590944
-.1165683 + .3374175*i*	.356986
-.1165683 - .3374175*i*	.356986
-.08246071	.082461

All the eigenvalues lie inside the unit circle.
VAR satisfies stability condition.

. varlmar

Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	60.3119	25	0.00009
2	23.9478	25	0.52239

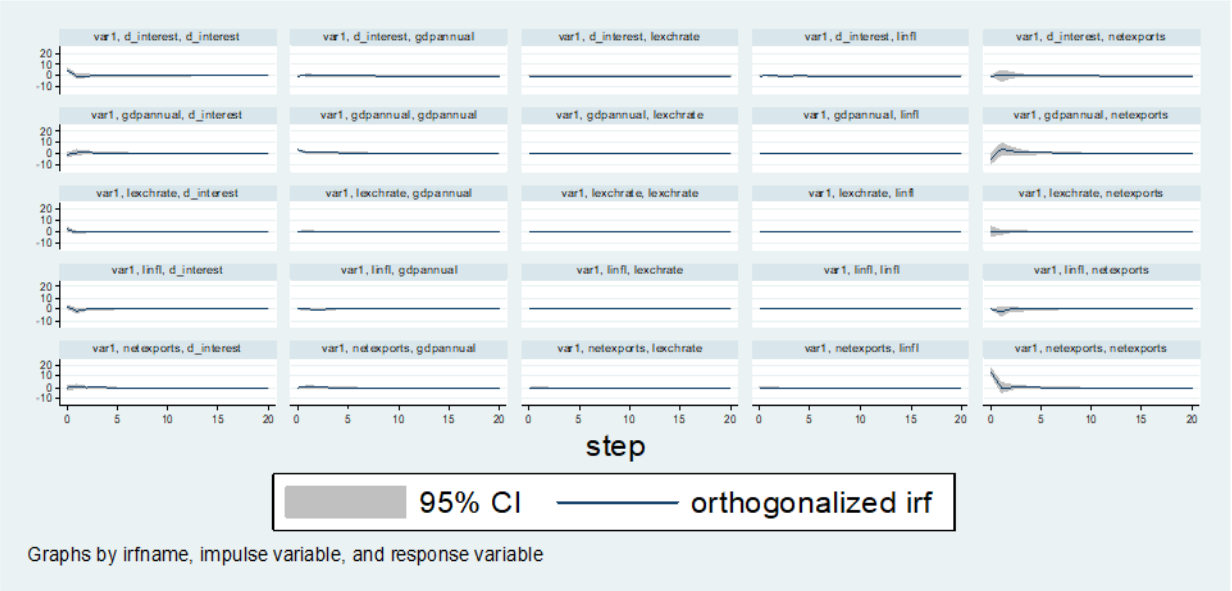
H0: no autocorrelation at lag order

. vargranger

Granger causality Wald tests

Equation	Excluded	F	df	df_r	Prob > F
gdpannual	lexchrate	.71484	1	33	0.4039
gdpannual	netexports	1.2395	1	33	0.2736
gdpannual	linfl	.00129	1	33	0.9715
gdpannual	d_interest	1.0371	1	33	0.3159
gdpannual	ALL	.9736	4	33	0.4352
lexchrate	gdpannual	2.8148	1	33	0.1028
lexchrate	netexports	3.3767	1	33	0.0751
lexchrate	linfl	.7856	1	33	0.3818
lexchrate	d_interest	.0934	1	33	0.7618
lexchrate	ALL	1.8729	4	33	0.1386
netexports	gdpannual	2.1021	1	33	0.1565
netexports	lexchrate	.66903	1	33	0.4193
netexports	linfl	1.0409	1	33	0.3150
netexports	d_interest	.00051	1	33	0.9821
netexports	ALL	1.4271	4	33	0.2468
linfl	gdpannual	8.8295	1	33	0.0055
linfl	lexchrate	6.5785	1	33	0.0151
linfl	netexports	2.3989	1	33	0.1310
linfl	d_interest	.95741	1	33	0.3350
linfl	ALL	6.3798	4	33	0.0006
d_interest	gdpannual	.44219	1	33	0.5107
d_interest	lexchrate	4.2524	1	33	0.0471
d_interest	netexports	.69135	1	33	0.4117
d_interest	linfl	2.053	1	33	0.1613
d_interest	ALL	1.3157	4	33	0.2845

Impulse Response Graphs.



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Date: 24/02/2022

Resume

Name: Emilia Lagble

Date of birth: 11th November, 1997

Nationality: Ghanaian

Gender: Female

Languages: English, Beginner in Chinese

Education:

2020-2022 Master in Finance, School of Banking and Finance, University of International Business and Economics (UIBE)

2015-2019 Bachelor of Commerce in Accounting, School of Business, University of Cape Coast (UCC)

Awards

- Excellence in Academic Performance 2020, UIBE, 2nd prize.
- Chinese Government Scholarship 2020
- Deans' Award for High Academic Performance, UCC, 2016-2018

Work Experience:

February 2021– Present: Administrator, Ros Auto Company Limited

- Responsible for the disbursement of funds.
- Record keeping and account preparations
- Oversee the finance activities of the company
- Keeping track of cars and revenue generated from each

September 2019- 2020: National Service Personnel, Directorate of Finance, CHLS UCC, Cape Coast

- Prepared payment and journal vouchers for the college
- Assisted in overseeing college funds as well as bank transactions
- Assisted in the recording and reimbursement of college imprest
- Wrote and disbursed college cheques

June 2017 to August 2017, Internship: GCB Bank Limited, Ho Poly Branch

- Gained customer service skills by addressing customer needs.
- Assisted the counter manager in processing card and account requisitions
- Assisted customers in banking activities.

Volunteer Activities

Impact Zone 2018, CELF AFRICA: Educated local entrepreneurs on the importance of savings and keeping financial records.

Skills

Proficient in Microsoft Word, Access, Excel, PowerPoint and Stata.