UNIVERSITY OF CAPE COAST

FOREIGN DIRECT INVESTMENT, EXTERNAL DEBT, AND EXCHANGE RATE VOLATILITY IN GHANA

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BY

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A thesis submitted to the Department of Economic Studies of the School of Economics, College of Humanities and Legal Studies, University of Cape Coast, in partial fulfillment of the requirements for the award of a Master of Philosophy degree in Economics

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my original work and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature…… Date……

Name: Emmanuel Kwamena Akromah

Supervisors' Declaration

We hereby declare that the preparation and presentation of this thesis were supervised following the guidance on supervision of thesis laid down by the University of Cape Coast

Principal Supervisor's Signature…… Date……

Name: Prof. William Gabriel Brafu-Insaidoo

Co-Supervisor's Signature…… Date……

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ABSTRACT

Using annual time series data from the years 1987 to 2021, the study examined the symmetric and asymmetric effects of foreign direct investment and External debt on exchange rate volatility in Ghana. The effect of foreign direct investment (FDI) and External debt on exchange rate volatility in Ghana was investigated using the Linear Autoregressive Distributed Lag (LARDL) model. The study went ahead to examine a possible asymmetric effect of FDI and external debt on exchange rate volatility in Ghana using the Nonlinear Autoregressive Distributed Lag (NARDL) model. The results obtained from the LARDL model concluded that there is a negative effect of FDI and External debt on exchange rate volatility in the long run. The estimate of the NARDL model revealed that there is an asymmetric effect of FDI on the exchange rate volatility in the long run. However, there was an asymmetric effect of both FDI and External debt on exchange rate volatility in the short run. The study recommended that the government strengthens its regulatory frameworks to effectively manage the level of outflows, given that the decline in foreign direct investments (FDIs) is observed to have increasingly negative consequences. Also, it is crucial for Ghana to carefully manage its external debt levels. Strive for a sustainable debt profile by diversifying funding sources, monitoring debt-servicing obligations, and ensuring that borrowed funds are utilized efficiently in productive sectors that generate long-term economic benefits.

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DEDICATION

To my wife and daughters

KEY WORDS

Asymmetric

Symmetric

Exchange rate

Volatility

Foreign direct investment

External debt

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LISTS OF ABBREVIATIONS

ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag
ARCH	Autoregressive Conditional Heteroscedasticity
BOG	Bank of Ghana
BW	Bandwidth
CPI	Consumer Price Index
CUSUM	Cumulative Sum of Recursive Residuals
CUSUMQ	Cumulative Sum of Squares Recursive Residuals
DCPS	Domestic Credit to Private Sector
DW	Durbin-Watson
ECM	Error Correction Model
ECT	Error Correction Term
ERP	Economic Recovery Program
EXC	Exchange rate
EXTDEBT	External Debt
FDI	Foreign Direct Investment
GARCH	Generalized Auto-Regressive Conditional Heteroscedasticity
GDP	Gross Domestic Product
HQ	Hannan-Quinn Information criterion
IMF	International Monetary Fund
INTDIFF	Interest rate differential
LCPI	Log of consumer price index

LARDL	Linear Autoregressive Distributed Lag
NARDL	Non-Linear Autoregressive Distributed Lag
PP	Phillips-Perron
PPP	Purchasing Power Parity
SAP	Structural Adjustment Programme
SBC	Schwartz-Bayesian Criterion
SIC	Schwartz information Criterion
TRADE	Trade Openness
UIRP	Uncovered Interest Rate Parity
UNCTAD	United Nations Conference on Trade and Development
VAR	Vector Autoregressive
VEXC	Exchange rate volatility
WDI	World Development Indicator

CHAPTER ONE

INTRODUCTION

Over the past two decades, the Ghanaian economy has been greatly concerned by the volatility in the local currency. This problem has grown over time to be a significant source of worry for policymakers, investors domestic and outside, as well as policy professionals. These fluctuations in the domestic currency have an impact on how businesses plan their operations, how they pay their debts to other countries, and how well the economy is doing overall. Volatility persists despite Ghana's efforts over the past few decades to stabilize the exchange rate through several financial and economic reforms. According to Alagidede and Ibrahim (2017), stabilization of the Ghanaian exchange rate can lead to economic and employment growth.

Every year, since Ghana moved from the fixed exchange rate regime to the floating exchange system in 1983, the Ghanaian Cedi has consistently experienced substantial depreciation each year. The cedi depreciated by 4.9%,8.4%, and 12.9% in 2017, 2018, and 2019 respectively (BOG annual report; 2017, 2018, 2019). The implication is that more Ghanaian cedi is required to trade for a dollar, which is worrying for a country like Ghana, which imports more than half of its goods and services from dollarized countries. This frequent depreciation of the Cedi leads to a significantly higher cost of living, erodes national income, and creates massive unemployment (Colicev, Hoste, & Konings, 2022). This undermines confidence in the Ghanaian economy.

Exchange rate volatility has been found to have a detrimental effect on economic growth through international trade. It has been found that this

negatively affects international trade, both directly (through uncertainty and adjustment costs) and indirectly (by influence on resource allocation and governmental policies) (Côté, 1994). High exchange rate volatility may lead risk-averse agents to scale back their international trade operations when they are not entirely anticipated. The reliance on imported capital goods and the specialized structure of commodity exports can also make exchange rate volatility more detrimental to the economic activities of developing nations.

Background to study

Undoubtedly, one of Ghana's major issues is the volatility of the exchange rate. It has created a situation where international trade, employment growth, and economic activity, in general, are adversely impacted (Jack, Okyere, & Amoah, 2019; Mabadeje, 2021). It has jeopardized the stability of the financial markets, created uncertainty about the revenue to be earned from international transactions (Ramoni-Perazzi, & Romero, 2022), and made it challenging to meet Ghana's monetary policy goals. The confidence in the Ghanaian economy has also been weakened by frequent exchange rate swings (Alagidede & Ibrahim, 2017; Enu, 2017; and Insah & Chiaraah 2013). To ensure a stable exchange rate, governments, particularly in developing nations, have developed a variety of exchange rate management strategies over the years. However, they have suffered greater exchange rate volatility than in the past (Mordi, 2006).

In the 1980s, extensive financial sector reforms were implemented in Ghana as a result of the Financial Sector Adjustment Programme, which was a component of the Structural Adjustment Programme. These reforms included the abandonment of the fixed exchange rate system in favor of the free-

floating system. This move was implemented to prevent the boom-and-bust cycle of the exchange rate and to guide the nation in the right direction. The Cedi's value has become more volatile and has primarily declined against other currencies since the adoption of the flexible exchange rate, especially the US Dollar and the British Pound (Alagidede & Ibrahim, 2017).

In July 2007, when the cedi was redenominated, US$1 was equivalent to GH0.93. The cedi has dramatically lost value over time. By April 2010, the US dollar was worth 1.49 Ghana cedis. This reflects a decline of nearly 60.21 percent within roughly two and half years after the cedi's redenomination (Alagidede & Ibrahim, 2017). Additionally, the cedi was worth GH2.21 at the beginning of January 2014 and at the end of September 2014, the cedi/dollar exchange stood at GHS 3.20. This amounts to a 44.65% depreciation (Bank of Ghana, 2015).

According to Enu (2017), the most significant depreciation of the Ghana Cedi about the US Dollar took place in 2016 and 2017, when US$1 was equal to GH3.992 and GH4.552, respectively. The exchange rate was GH5.211 at the end of April 2019. The cedi depreciated by 3.9% against the US dollar in 2020. This improved performance of the cedi was as result of border closure due to the COVID-19 pandemic slowing down economic activity with accompanying low demand of foreign exchange (BOG annual report, 2020). In 2021, the cedi depreciated by 4.1% against the US dollar (BOG annual report,2021). These fluctuations highlight the high instability of Ghana's exchange rate, which appears to be an ongoing issue.

The increasing flow of foreign capital and the expansion of global trade have opened up new opportunities for developing countries in recent

decades, fostering economic integration (Ajide, Osinubi, & Dada, 2021). This integration has been observed in various aspects of the economy, such as investment opportunities, poverty reduction efforts, and domestic capital accumulation (Han & Zhou, 2022). However, it is important to note that reaping the benefits of economic integration requires a foundation of macroeconomic stability, including a less volatile exchange rate. A volatile exchange rate introduces increased risks for investors, as noted by several experts in the field. When the exchange rate exhibits significant fluctuations, it creates uncertainty and potential financial losses for those engaged in investment activities.

Therefore, maintaining a less volatile exchange rate is crucial for attracting and retaining investment capital, as it provides a more predictable environment for investors to operate in. The need for macroeconomic stability, particularly in the form of a less volatile exchange rate, underscores the importance of implementing effective policies and measures to manage exchange rate fluctuations. By minimizing exchange rate volatility, countries can enhance investor confidence, promote economic growth, and facilitate sustainable development.

Many developing countries, including Ghana, face significant budget deficits and insufficient domestic resource accumulation, resulting in a savings-investment gap (Adepoju et al., 2007). Closing this gap poses a challenge, as it often requires external sources of funding, such as debt financing (Omoruyi, 2005; Chenery & Strout, 1996). Recognizing the importance of increasing savings and investment levels, the successful attraction of foreign capital can play a pivotal role in promoting economic

growth within an economy characterized by a savings-investment gap (Hunt, 2007). To address this challenge, many economies turn to external funding sources, often resorting to external debt financing, to bridge the savings-investment gap (Omoruyi, 2005; Chenery & Strout, 1996). The alternative in this situation, is foreign direct investment (Jilenga, Xu & Gondje-Dacka, 2016).

The majority of these nations borrow in one of the major currencies rather than their own on the international financial markets (Bortz, & Kaltenbrunner, 2018) of which Ghana is not an exception. Consequently, the borrowing practices in major international currencies contribute to a situation where the domestic currency experiences pressure and volatility in the foreign exchange market. The increased demand for foreign currencies places downward pressure on the value of the cedi, making it weaker relative to the borrowed currency. This depreciation can further increase exchange rate volatility and make it challenging to maintain a stable value for the domestic currency. As a result, the domestic currency is under too much pressure, which makes the exchange rate extremely unstable. These economies are characterized, among other things, by rising external debt but comparatively declining foreign direct investment.

Most parts of the world have seen an increase in FDI inflows over the last two decades. This has corresponded with the depreciation of local currencies in Africa, particularly Ghana. According to the World Bank (2015), the flow of FDI from developed to developing nations has changed. As of 2015, 124 low- and middle-income countries experienced net capital flows from FDI totaling $1.2 trillion. Between 2008 and 2009, developing and

transitional economies also attracted more Greenfield investments than developed nations (World Bank, 2010). Developing countries and transition economies, which between 2011 and 2013 received FDI inflows between $725 billion and $778 billion, representing an increase from 43% to 54% of worldwide FDI inflows, are among the top 20 economies ranked by FDI inflows (World Bank, 2015). Net FDI inflows into Ghana during the military rule regimes averaged 0.1% between 1980 and 1984, 0.14 % between 1985 and 1989, and 0.3% between 1990 and 1991 as a percentage of GDP (African Economic Outlook, 2014). As shown in Figure 1 below, Ghana's FDI inflows have been on an upsurge since then even though have been fluctuations in certain periods.

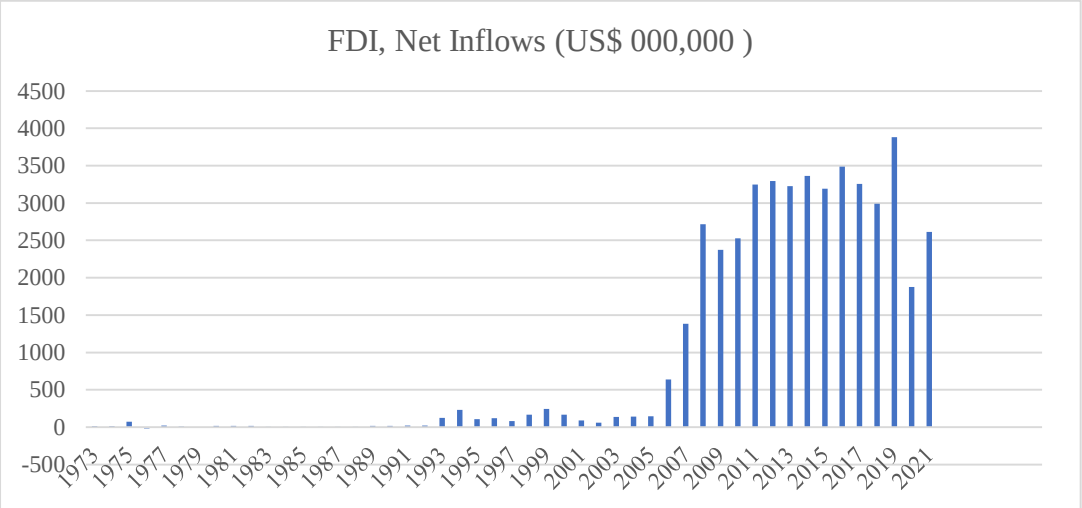

Figure 1: Trend of FDI Growth in Ghana from 1973 to 2021

Source: Author's Construct, using data from WDI

From Figure 1, the early 1990s to the mid-1990s, FDI inflows were relatively modest, ranging from 14.8 million US dollars in 1990 to 233 million US dollars in 1994. However, there was a significant increase in FDI in 1995, reaching 106.5 million US dollars, followed by a decline in subsequent years. The late 1990s witnessed a notable growth in FDI inflows. In 1998, FDI

reached 167.4 million US dollars and further increased to 243.7 million US dollars in 1999. This period reflected a growing interest from foreign investors in Ghana's economy. The early 2000s were characterized by volatility in FDI inflows. In some years, FDI experienced declines, such as in 2001 and 2002. However, there were also years of significant growth, including 2003, when FDI reached 136.751 million US dollars, and 2006, with a substantial increase to 636.01 million US dollars.

From 2007 to 2014, FDI in Ghana experienced a relatively steady growth trend. In 2007, FDI inflows reached 1383.17793 million US dollars, and the highest recorded FDI inflow during this period was in 2008, with 2714.916344 million US dollars. In more recent years, FDI inflows have shown fluctuations. After reaching a peak in 2011, FDI experienced some declines, as seen in 2013 and 2018. However, there has been a recovery in FDI inflows, with an increase in 2019 (3879.83147 million US dollars) and 2021 (2612.789793 million US dollars). Oil and gas, transportation and logistics, telecommunications, financial services, and food and beverage subsectors have received the majority of FDI (African Economic Outlook, 2020). Because FDI accounts for an average of 40% of gross fixed capital formation, FDI inflows to Ghana are very substantial (African Economic Outlook, 2020).

Similarly, external debt has also shown an upsurge as can be seen from Figure 2.

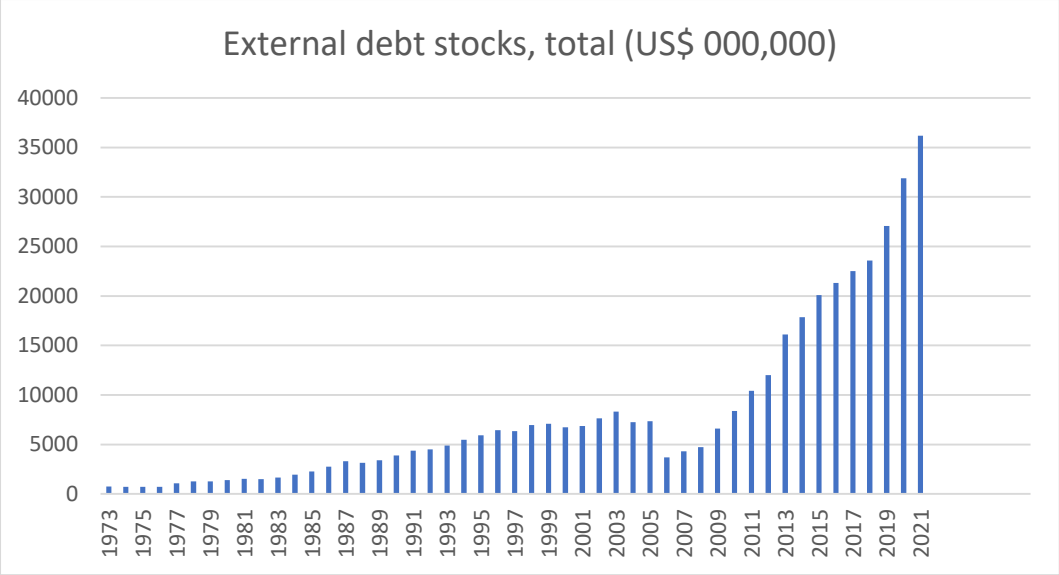

Figure 2: Trend of External Debt in Ghana from 1973 to 2021

Source: Author's Construct, using data from WDI

Figure 2 above shows fluctuations in Ghana's external debt stock over the years. From the mid-1970s to the early 1980s, external debt remained relatively stable, with minor fluctuations between 710.69 million US dollars in 1976 and 1538.83 million US dollars in 1981. Ghana experienced a significant increase in external debt during the 1980s and 1990s. The external debt stock rose from 1666.18 million US dollars in 1983 to 7103.71 million US dollars in 1999. This period reflects the challenges of debt accumulation faced by the country. Ghana embarked on debt relief programs, leading to a decline in external debt stock in the early 2000s. However, there were fluctuations during this period, with external debt reaching a peak of 8301.00 million US dollars in 2003 before declining again. From 2010 onwards, Ghana's external debt stock exhibited an increasing trend. The data shows a rise from 8365.24 million US dollars in 2010 to 36181.56 million US dollars in 2021.

The Ghanaian government has implemented specific policies to attract foreign direct investment (FDI) and manage external debt, aligning with its

development agenda (Adu-Boahen & Ntim Adjei, 2014). To promote FDI, the government has focused on creating an attractive investment climate through policies such as investment promotion, streamlining investment procedures, and reducing bureaucratic barriers. By simplifying processes and incentivizing investments, Ghana aims to attract foreign investors looking to leverage its resources, markets, and business opportunities.

In addition, the establishment of Special Economic Zones (SEZs) is a notable policy initiative. These zones offer tax incentives, infrastructure support, and favorable regulations to attract FDI in specific sectors. SEZs provide an environment conducive to investment, enabling investors to benefit from cost efficiencies, trade opportunities, and market access. Public-Private Partnerships (PPPs) have also been emphasized to attract private investment, particularly in critical infrastructure projects. These partnerships involve collaboration between the government and private sector entities, leveraging the expertise and resources of both parties to develop and finance infrastructure initiatives. By promoting PPPs, the government seeks to attract FDI while addressing infrastructure gaps that can hinder economic development.

Ghana has also implemented various investment incentives to encourage FDI inflows. These incentives include tax exemptions or reductions, duty-free importation of capital goods and raw materials, and guarantees against expropriation. By offering favorable conditions to investors, Ghana aims to enhance its competitiveness as an investment destination and attract long-term capital commitments.

In terms of managing external debt, the Ghanaian government has pursued prudent debt management strategies. This includes implementing policies to control borrowing, monitoring debt repayment schedules, and seeking favorable terms and conditions in debt agreements. By carefully managing its debt, Ghana aims to maintain sustainable levels of external indebtedness and mitigate the risks associated with high debt burdens. Furthermore, exchange rate stability is an essential aspect of Ghana's development agenda. The government has implemented exchange rate policies aimed at maintaining stability and managing fluctuations. This can include adopting a flexible exchange rate regime, intervening in the foreign exchange market when necessary, and implementing measures to manage volatility. By ensuring exchange rate stability, the government aims to create a predictable business environment for investors, reduce uncertainties, and promote overall macroeconomic stability.

From the data on FDI and external debt, it is evident that Ghana has actively pursued external funding sources to bridge its savings-investment gap. However, the consequences of these financial activities cannot be overlooked. It is crucial to acknowledge that external debts need to be repaid in the currencies they were contracted in. This creates the obligation for Ghana to generate sufficient foreign currency earnings to service its debt obligations. Additionally, while FDI inflows can contribute to economic growth and development, it is important to recognize that FDIs also have the potential to move foreign currencies out of the country through profit repatriation and import dependence. When foreign companies or investors repatriate their

profits, it can impact Ghana's foreign currency reserves and have implications for the stability of the exchange rate and overall balance of payments.

Despite recording a record high in FDI net inflows in 2019 and experiencing an upsurge in debt accumulation, the exchange rate in Ghana was expected to become more unpredictable, as indicated by the Economist Intelligence Unit. In line with this expectation, the exchange rate indeed depreciated significantly, reaching a record value of 12.9 percent since 2015, as reported by the Bank of Ghana in 2020. According to the Economist Intelligence Unit's report, the cedi is anticipated to weaken against the dollar in the future. By the end of 2023, their predictions suggest a further depreciation of about 6.5 percent. This has caused the argument about the advantages of FDI to resurface in academia (Omri et al., 2014). In the instance of Ghana, it is uncertain if the full benefits of FDIs are being realized given the current pattern of FDI inflows and the behavior of the currency. For this reason, the study seeks to critically examine the symmetric and asymmetric effect of foreign direct investment and external debt on exchange rate volatility in Ghana.

Statement of Problem

The ensuing discussions from the background suggest that exchange rate volatility continue to be a major challenge for the stability of the Ghanaian economy. The need to reduce the adverse effect of exchange rate volatility has over the years culminated into a number of research works that attempts to identify the key causes of exchange rate volatility in Ghana (For instance Odoom 2019; Adjei 2019; Enu 2017; Insah & Chiaraah 2013; Kwakye 2012). Interestingly these studies ignored the role of FDI and external

debt in the volatility of the domestic currency. All these studies focused on variables such as interest rate, inflation, current account, money supply, terms of trade, total foreign reserve, and government expenditure as the key determinants of exchange rate volatility in Ghana. None of these studies considered the role of FDI and external debt in the determination of exchange rate volatility in Ghana.

Foreign direct investment (FDI) inflows into the country have gained much attention in the past two decades due to its economic importance (Adu-boahen & Ntim Adjei 2014). There is a rapid increase in FDI over the past decades and Ghana has been absorbing much foreign direct investment into its economy and it is currently ranked among the top receiving nations of the inflow of FDI in Africa (Yeboah, 2018). In Ghana, an environment of greater capital account openness (Kamasa, Owusu, & Nkansah, 2023), FDI inflows are accompanied by other types of capital flows, such as portfolio investments or speculative investments. Combes, et al, (2019) argues that this is dangerous as it is correlated with large economic fluctuations and act as a transmission channel exchange rate volatility. Because they are sensitive to changes in environment.

The rapid inflow or outflow of capital can lead to sudden changes in the exchange rate, making it more volatile and less stable. Also, through repatriation of earnings and profit on these FDIs back to home countries with no difficulty in the case of countries with greater capital account openness (Basit & Ansari, 2018). This tends to put some pressure on the domestic currency in terms of increasing demand for foreign currency for these transactions which could have implications for the stability of the domestic

currency. In addition, given the fact that Ghanaians are not in a commanding height of the economy, such continuous inflow of FDI could affect the long run stability of the domestic currency when there are changes in the external environment.

Ghana like many developing countries faces a dire savings and investment gap which to a larger extent has constrained the speed of economic growth and sustainable development (Matuka & Asafo, 2018). The quest of the government to bridge this gap tends to rely on external sources of finance to supplement domestic revenue (Chenery & Strout, 1996). The external debt of Ghana has seen an appreciated increase. However, most external borrowings come with interest attached, which results in debt servicing (Saheed, Sani & Idakwoji (2015). Servicing external debt or the repayment of the foreign loans involves the demand for foreign currency which tends to affect the exchange rate of the country.

The interplay between Ghana's reliance on external funding, the increase in external debt, and the resulting debt servicing requirements is also a problem here. These dynamics put pressure on the demand for foreign money, perhaps leading to exchange rate volatility. Also, understanding the relationship between FDI, external debt, and exchange rate volatility in Ghana requires an exploration of the potential non-linear effects. While traditional economic theories may assume a linear relationship, there is a need to investigate the possibility of non-linear effects between FDI, external debt, and exchange rate volatility which all the studies ignored to capture the complexities of the relationship and for policy reasons.

The study, therefore, addresses the gap in the literature by examining the role played by FDI and external debt in the determination of exchange rate volatility in Ghana. To achieve this, the study employed an ARDL model to examine the possible long run effect of FDI and external debt on the volatility of Ghana's domestic currency. In addition, the study also employed the Nonlinear ARDL model to also examine the possible nonlinear effect of FDI and External Debt on the stability of Ghana's currency. This is particularly important.

Purpose of the Study

The main purpose of the study is to examine the symmetric and asymmetric effect of foreign direct investment and external debt on exchange rate volatility in Ghana.

Research Objectives

Specifically, the study seeks to:

1. Examine the effect of foreign direct investment on exchange rate volatility in Ghana;
2. Examine the effect of external debt on exchange rate volatility in Ghana;
3. Analyze the asymmetric effect of foreign direct investment and external debt on exchange rate volatility.

Research Hypotheses

1. H_0:Foreign direct investment has a significant effect on exchange rate volatility in Ghana

H_1:Foreign direct investment has no significant effect on exchange rate volatility in Ghana

2. H_0: External debt has significant effect on exchange rate volatility in Ghana

H_1:External debt has no significant effect of exchange rate volatility in Ghana

H_0:There is an asymmetric effect of foreign direct investment and external debt on exchange rate volatility in Ghana

H_1:There is no asymmetric effect of foreign direct investment and external debt on exchange rate volatility in Ghana

Significance of the Study

The relevance of the study is premised on the fact that the proper management of foreign direct investment and external debt is expedient and critical to the stability of the exchange rate in the Ghanaian economy. The study is therefore meant amongst other things to contribute significantly to literature by empirically examining the effects of foreign direct investment and external debt on the exchange rate volatility in Ghana. The findings of the study will help the government to properly manage the inflows of foreign direct investment and external debt in order to stabilize the exchange rate.

Ghana has been striving to attract FDI as a crucial component of its economic development strategy. The government has been actively promoting policies and initiatives to attract foreign investors, aiming to harness their capital, technology, and expertise to stimulate economic growth, create employment opportunities, and enhance productive capacities in various sectors. By examining the effects of FDI on exchange rate volatility, the study contributes to understanding the potential benefits and challenges associated with FDI inflows in Ghana's economy.

Additionally, the government of Ghana has been implementing measures to manage its external debt and ensure sustainable debt levels. Sustainable debt management is crucial for maintaining macroeconomic stability and reducing vulnerabilities. By investigating the effects of external debt on exchange rate volatility, the study provides insights into how debt levels and debt dynamics may impact exchange rate stability. This information can assist policymakers in formulating effective debt management strategies and policies.

Furthermore, exchange rate stability is a significant concern for the Ghanaian government as it affects various aspects of the economy, including trade competitiveness, inflation, and overall economic stability. By examining the symmetric and asymmetric effects of FDI and external debt on exchange rate volatility, the study directly addresses the government's objective of achieving exchange rate stability. It provides valuable insights into the potential channels through which FDI and external debt influence exchange rate fluctuations, helping policymakers design appropriate policies to mitigate exchange rate volatility.

Scope of the study

The scope of the study is to investigate the effects of foreign direct investment and external debt on exchange rate volatility in. The study will explore the potential non-linear effects that exist between these variables and analyze their implications for the country's economic stability and development. The study utilized quantitative research methods, drawing upon secondary data sources such as official reports, economic indicators, and relevant academic literature. The time frame of the study ranged from 1987 to

2021, ensuring the inclusion of recent and relevant information. While the study may briefly mention other jurisdictions for comparative purposes, its main emphasis is on analyzing the dynamics specific to Ghana's economy.

Limitations of the Study

The study's conclusions are based on a specific timeframe and country context (Ghana). It is important to consider that the relationship between FDI, external debt, and exchange rate volatility may vary across different countries, time periods, and economic conditions, limiting the generalizability of the findings. The second limitation is the reliance on secondary data: the reliability and validity of the conclusions are dependent on how credible the variables chosen from WDI and Bank of Ghana are.

Organization of Study

This study is organised into five chapters. Chapter One, the introductory chapter comprises the background to the study, problem statement, objectives of the study, hypotheses to be tested, significance and scope of the study as well as organization of the study. Chapter Two presents a review of relevant literature both the theoretical and empirical studies. Chapter Three captures the methodological framework and techniques adopted in conducting the study. Chapter Four examines and discusses the results with reference to both theoretical and empirical literature. Chapter Five, focuses on the summary of findings, conclusions and recommendations of the study.

CHAPTER TWO

LITERATURE REVIEW

Introduction

The aim of this chapter is to present a review of the relevant literature to the study. It is organized into two main sections. The first section presents overview of FDI, External debt of Ghana and the concept of exchange rate volatility. The second section presents the theoretical and the empirical literature review.

Overview of Foreign Direct Investment in Ghana

Recent years have seen a rise in global economic integration, which has resulted in a significant increase in the flows of foreign direct investment (FDI) and international trade (Ross, 2015). Developing nations have been identified as FDI destinations (Zhang & Daly, 2012). As a result, the majority of developing countries have implemented policies and undertaken initiatives to increase FDI inflows. International agencies like the International Monetary Fund (IMF), the United Nations (UN), and the World Bank Group have heavily spurred these efforts by developing countries (Blomstrom & Jian-Ye, 1989).

Foreign direct investment (FDI) is described as an investment that involves a long-term relationship and reflects a lasting interest and control by a resident entity in one economy (foreign direct investor or parent enterprise) in an enterprise residing in an economy other than that of the foreign direct investor. This definition comes from UNCTAD's World Investment Report (2017). Foreign direct investment (FDI) is a significant source of external financing that enables developing nations with low capital levels to access

external financing. For any country, including Ghana, attaining sustained growth requires a critical component known as foreign direct investment (FDI). Every country's economic growth is fueled in large part by foreign direct investment (FDI) (Asiamah, Ofori, & Afful, 2019). FDI is essentially an international investment when the investor gets a sizable amount of managerial control over a company that is located outside of the investor's country of residence (Ross, 2015). Under any circumstances, FDI has grown to be a significant factor in the globalization of investment activity. For instance, in 2009, FDI inflows reached $1,114 billion globally (UNCTAD, 2017).

Ghana has put a lot of effort towards luring FDI over the past few years. For instance, Ghana's Economic Recovery Program (ERP), which was first implemented in 1983, included attracting foreign direct investment as one of its primary policy goals. Another effort Ghana has made to attract FDI is the creation of the Ghana Investment Promotion Centre, which is in charge of encouraging, promoting, and facilitating investments both within and outside the country. Following these initiatives to draw FDI into the Ghanaian economy, FDI inflows into Ghana have dramatically expanded in recent years. However, the distribution of these investments is unbalanced due to the uneven FDI inflows into the various economic sectors. The UNCTAD (2003) claims that Ghana's FDI inflows have been skewed toward the mining industry. But in recent years, FDI into other sectors has increased dramatically in Ghana, with each sector significantly contributing to the nation's economic expansion (Odoom, 2019). The study of FDI in Ghana, particularly its

motivations and causes, has attracted a lot of interest as the amount of FDI in the country has increased.

Due to changes in political and policy regimes, as well as uneven growth patterns, Ghana has a troubled history of political and economic development, which is reflected in the inconsistent FDI inflows. Ghana had to execute a number of economic reform measures beginning in the early 1980s, including the structural adjustment program in 1983 and more recently, the improve Highly Indebted Poor Countries (HIPC) efforts (Ebrahim 2005). These measures were taken largely to stop Ghana's post-independence economic slide but also to lessen the effects of the debt crisis of 1980 and make it easier to attract value-added foreign direct investment (FDI).

The implementation of the SAP, the primary economic reform program, has increased the number of multinationals who have invested in Ghana (Oppong, 2022; Agbodzakey, 2022). Other studies have also concluded that Ghana's SAP has achieved some degree of success in a variety of areas, including the reduction of inflation, promotion of a climate of financial stability, elimination of the need for licenses, opening of previously closed sectors, removal of tariff barriers that prevent FDI inflows, elimination of exchange rate controls, and reduction in opportunities for the black market in foreign exchange rates (Adugu, 2022; Agbodzakey, 2022). Ghana has achieved significant FDI growth since then and can be seen in Figure 3 below

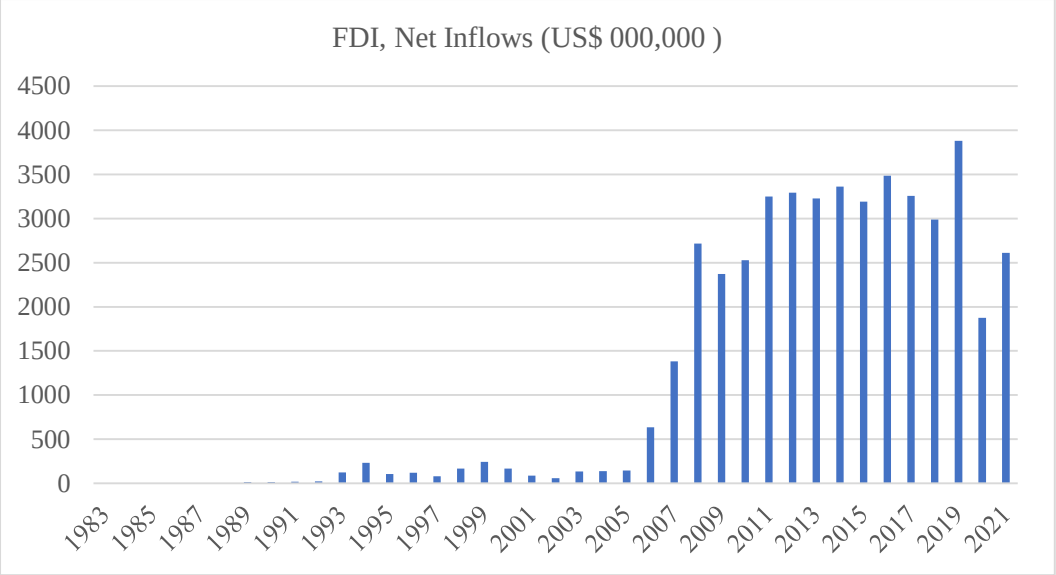

Figure 3: Trend of FDI in Ghana from 1983 to 2021

Source: Author's Construct, using data from WDI

FDI net inflows into Ghana have experienced fluctuations over the studied period. There have been years with substantial FDI growth, followed by periods of relatively slower growth. For instance, slow inflows were observed from 1983 to 1988, averaging around $4 million per year, with the biggest and lowest inflows occurring in 1985 and 1984, respectively, at $6 million and $ 2 million. A moderate inflow of $8 million per year was seen between 1989 and 1992, with the largest and lowest amounts being $22 million in 1992 and $14.8 million in 1990, respectively. Significant but erratic inflows occurred between 1993 and 1996; they peaked in 1994 at $233 million, but dropped by more than 50% the following year to $107 million. FDI inflows increased from 14.4 million USD in 1973 to a peak of 3879.83 million USD in 2019, indicating significant growth in FDI over the years.

However, it's important to note that FDI levels also varied from year to year but can be seen from Figure 3, there has been tremendous growth in FDI growth at least since 2007 with relative stability but the story is quite different

when the size of the economy is taken into consideration. As can be seen in Figure 4 below there has been significant periods of fluctuations when the size of the economy is taken into consideration

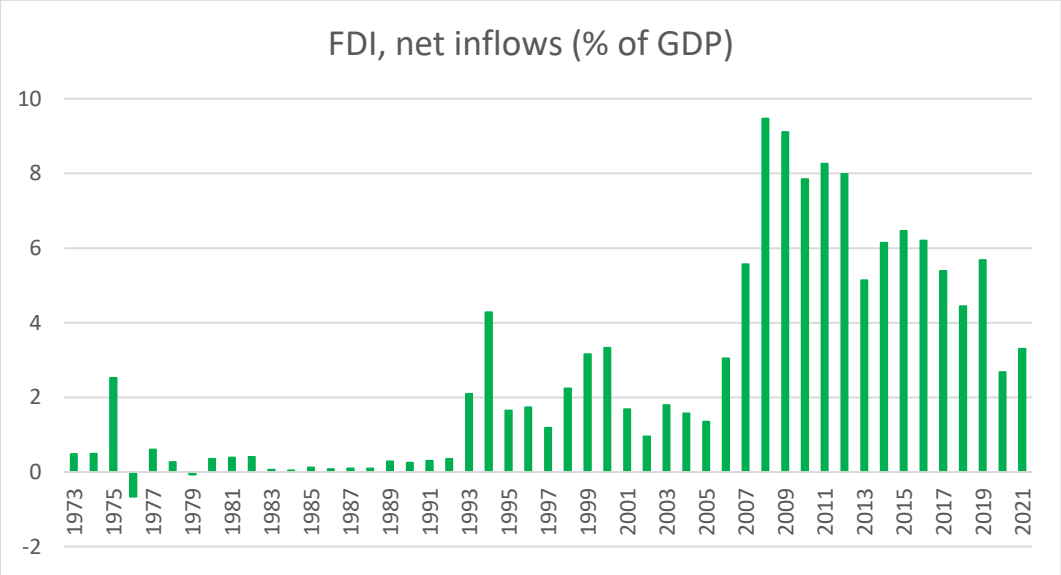

Figure 4: Trend of FDI (%GDP) in Ghana from 1973 to 2021

Source: Author's Construct, using data from WDI

While FDI levels have shown growth, some periods saw relatively smaller inflows compared to the size of the economy. For instance, the FDI net inflows as a percentage of GDP were relatively low during the years 1973-1975, 1977-1982, and 1990-1994. This indicates that despite growth in FDI, its size relative to the overall economy was relatively modest during these periods. On the other hand, there were years where FDI inflows as a percentage of GDP were higher, indicating a more significant impact of FDI on the economy. Notable years in this regard include 1993, 1994, and 2006 2008 up to 2021. However, from 2008 to 2021, there has been a declining trend in FDI as a percentage of GDP.

It is important to note that this decrease does not necessarily imply a decrease in FDI inflows, but rather reflects the relative size of FDI compared

to the current size of the economy in comparison to previous years. According to UNCTAD's Investment Trends Monitor. Almost half of FDI into Ghana was in manufacturing, while the services and mining sectors accounted for 25 and 16% of foreign investment respectively. According to the report, the amount of foreign direct investment (FDI) in investment projects has remained high (over 75% throughout time), which may be a sign of investors' growing faith in the Ghanaian economy.

Ghana's External Debt

The portion of a nation's debt that is owing to foreign creditors, such as commercial banks, international financial institutions, or governments, is known as its external debt. In most cases, the borrowing country is obligated to pay back the loans received along with interest in the currency in which they obtained the loan (Kenton, 2020). If a country with a fragile economy is unable to pay back its external debt because it is unable to turn a profit through the production and trade of goods, a debt crisis could result. Between economists and decision-makers, the issue of external debt as a growth-friendly strategy sparks intense debate. After the programs for economic recovery and structural adjustment were put into place, Ghana's external debt grew significantly.

Ghana struggled with debt throughout the early 1980s, with end-of-1982 obligations totaling US$ 577 million. The increase in global interest rates, the slump in the West, and the rise in global oil prices all contributed to this debt crisis, which also resulted from bad domestic economic management and economic policy (Adubofour, Mangudhla & Dadzie, 2021)

Future concerns about Ghana's rising external debt profile are quite important. In 2019, the Ghanaian government borrowed 2 billion US dollars from the Chinese government to finance its road, rail, and bridge networks in exchange for 5% of Ghana's bauxite reserve as part of its transformational program (Adubofour et al., 2021). Although borrowing from abroad may be thought of as the best way out of embarrassing financial situations, continued borrowing accumulates over time and appears to have a significant impact on the economies of both the present and the future generations, leading to a severe decline in living standards, a high degree of dependence on foreign countries, a decline in the value of the currency, and an overall decline in social and economic conditions.

Governments frequently have to finance their budget shortfalls through domestic or international borrowing as a result of revenue targets or unexpected expenditure projection shocks (Kenton, 2020). A graphical presentation of Ghana's debt trend is presented in Figure 5 below

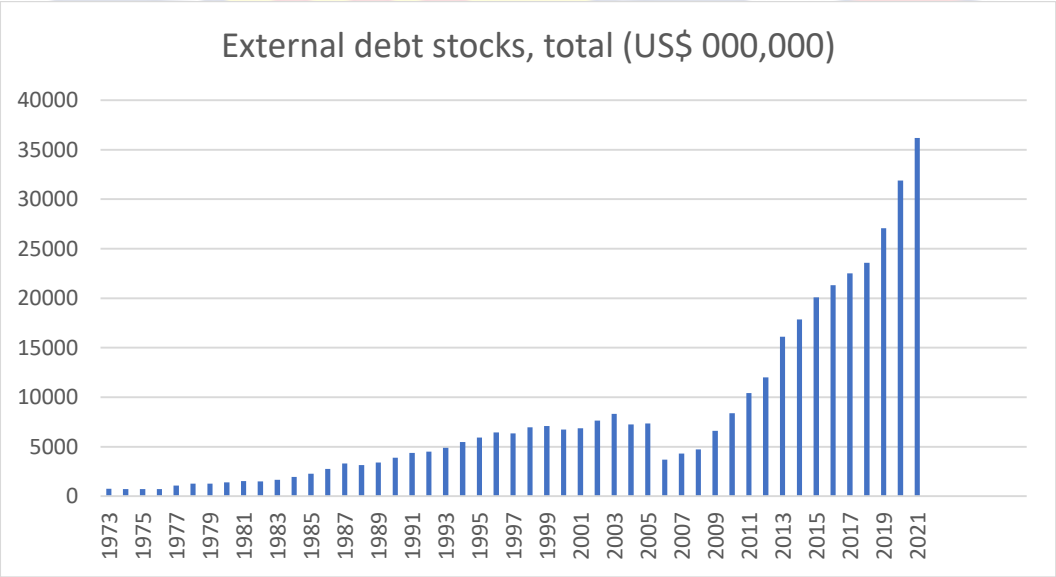

Figure 5: Trend of Ghana's External debt from 1973 to 2021

Source: Author's Construct, using data from WDI

From 1973 to 1983, Ghana's external debt stocks experienced a gradual increase, rising from 756 million in 1973 to 1,666 million in 1983. This period coincided with economic challenges and the implementation of economic recovery and structural adjustment programs. In the mid-1980s, the external debt stocks continued to rise significantly, reaching 2,256 million in 1985. This period was characterized by unfavorable global economic conditions, including high-interest rates and a slump in the West, which contributed to the debt crisis. From the late 1980s to the early 1990s, Ghana made efforts to manage its debt burden.

However, the external debt stocks remained relatively high, surpassing 3,000 million in 1989 and 4,000 million in 1990. In the following years, the debt stocks continued to fluctuate but generally exhibited an increasing trend. By 2001, Ghana's external debt stocks reached 6,860 million. Ghana's rising debt burden was consistently linked to persistent income gaps or excessively high government spending (Amo-Yartey & Turner-Jones, 2014; Kwakye, 2012). However, from 2006 to 2008, there was a notable decline, dropping to 3,699 million in 2006 and rising to 4,718 million in 2008. From 2009 to 2013, Ghana experienced a significant increase in external debt, with the stocks reaching 16,115 million in 2013. This period coincided with increased borrowing to finance infrastructure projects and developmental initiatives. Between 2014 and 2021, Ghana's external debt stocks continued to rise steadily, surpassing 36,000 million in 2021.

This indicates a substantial growth in external debt, reflecting the country's ongoing borrowing activities. It is important to note that external debt stocks alone do not provide a comprehensive analysis of a country's debt

sustainability. Factors such as debt servicing capacity, debt-to-GDP ratio, and the nature of borrowing terms are crucial for a comprehensive assessment. Overall, the data suggests that Ghana has faced challenges in managing its external debt over the years, with periods of fluctuations and increases in debt stocks.

The concept of exchange rate volatility

Hassan and Dantama (2017) argue that exchange rate volatility entails swings, fluctuations, or departures from a benchmark or equilibrium exchange rate over time. The hourly, daily, and weekly exchange rate movements are unusual for having no upper bound. Because of this variation, the value of currencies, particularly the Ghana Cedi, is extremely unstable and impossible to predict. Since the collapse of the Bretton Woods fixed exchange rate system in the early 1970s, exchange rate volatility and the risks it entails have been given more consideration in international financial management when developing effective macroeconomic policies (Bauwens & Sucarrat, 2006). Exchange rate volatility was initially thought to be brief, according to Jeong (2000). But it has endured and developed significantly over time and among nations. As a result, exchange rate volatility has become excessive and unmanageable due to the delay in reducing it in its early phases.

Uncertainty in the economy is brought on by excessive exchange rate volatility, which causes delays in investment decisions. As a result of its detrimental effects on productivity, consumption, international trade, and capital flows, volatility's unpredictability also hinders economic growth (Alagidede & Ibrahim, 2017; Insah & Chiaraah, 2013 and Oaikhenan & Aigheyisi, 2016). Finding reasons for real exchange rate volatility due to its

negative effects is important in terms of developing appropriate economic policies to minimize fluctuations. Although there is no consensus on the causal factors of exchange rate volatility, many factors have been identified in literature. According to Alagidede and Ibrahim (2017a), Al Samara (2009), Insah and Chiaraah (2013), and Oaikhenan and Aigheyisi (2016), there was a greater volatility in both the nominal and real exchange rate as a result of the switch from the fixed exchange rate regime to the flexible or free-floating exchange rate regime.

According to Hook and Boon (2000), excessive exchange rate fluctuations are a result of increased cross-border flows that have been made possible by the trend toward capital account liberalization, technological innovation, and currency speculation. Oaikhenan and Aigheyisi (2015) and Stancik (2007) both assert that country-specific factors influence exchange rate volatility. As a result, different countries experience exchange rate volatility for different reasons.

They went on to say that the method utilized, the time period of investigation, and the economic circumstances present in each country all affect how much each component influences changes in exchange rates. According to Ayhan (2016), changes to the key economic determinants increase the volatility of exchange rates by leading to sudden shifts in the exchange rate level. Additionally, changes in these variables may cause the volatility to increase further by surpassing the short-term goal for the long-term equilibrium exchange rate. These economic variables include external debt and FDI.

FDI can affect exchange rate volatility. By balancing the relative prices of traded and non-traded items, FDI might boost productivity in the sector of traded goods and hence lower real exchange rate volatility. By raising the capital stock in the host nation, FDI inflows cause an increase in the real exchange rate. FDI boosts the capital stock already in place and promotes the diffusion of technologies. Spillovers in technology result in higher non-tradeable products output and cheaper pricing. Therefore, FDI causes a decline in the real exchange rate. But as non-traded products production rises, disposable income rises as well, which boosts the value of the currency (Biswas & Dasgupta 2012).

According to Basit and Ansari (2018), an economy's FDI inflow may have an impact on the stability of the domestic currency, particularly in circumstances when the capital account is more open. Foreign investors can easily return their profits and revenues to their native countries. Due to the rising demand for foreign currency needed for these transactions, this tends to put some pressure on the native currency and may have an effect on its stability.

The vast majority of developing economies, including Ghana, are characterized by inadequate domestic resource accumulation and a large budget deficit, which results in a savings-investment imbalance (Adepoju et al., 2007). The excessive borrowing by governments of less developed nations to bridge the savings and investment gap has been shown by Matuka and Asafo (2018) to have a negative impact on the local currency. These foreign loans require the use of foreign currency for repayment. As a result, the economy can experience exchange rate volatility. Over the past few years, the

government's dollar obligations to international organizations have significantly expanded, which has impacted Ghana's exchange rate (Odoom, 2019).

Exchange Rate Regimes in Ghana

Ghana adopted a unique and relatively successful approach among developing countries in the 1980s when it decided to reorient its exchange rate strategy and undertake reforms in its exchange rate system. The objective of these reforms was to incentivize productive activities and exports while establishing an efficient exchange rate system. Following the initiation of the economic recovery program in April 1983, Ghana implemented a process to achieve these goals. To address the overvaluation of the cedi and alleviate the severe foreign exchange crisis, Ghana initiated a series of distinct devaluations as part of its adjustment measures. The previous inflexibility in the nominal exchange rate of the cedi had contributed to the crisis, and these devaluations aimed to rectify the situation (Dordunoo, 2020).

Ghana implemented a series of significant devaluations, which aimed to address the significant overvaluation of the cedi that existed before the launch of the economic recovery program. However, despite these devaluations and the pegged exchange rate arrangement, the desired exchange rate level was not achieved. By mid-1986, the cedi was still considered overvalued, evident from the substantial differential between the official and parallel market exchange rates (around 100 percent), the deterioration of the net external position of the Bank of Ghana in the first half of 1986, and the necessity to maintain restrictive international payment practices to support the official exchange rate.

While the measures implemented during this period did not completely rectify the overvaluation of the currency, they played a crucial role in improving the significant exchange rate distortions that existed at the beginning of the program. Additionally, these measures helped minimize the extent of the exchange rate adjustment that would have occurred with the introduction of a foreign exchange auction system. Furthermore, this strategy allowed for the implementation of essential fiscal and monetary adjustments and initiated the process of revitalizing the productive sectors of the economy.

In order to expedite the adjustment of the cedi to a more appropriate level, Ghana decided to transition from a fixed but adjustable exchange rate arrangement to a market-based system with an independent float (Dordunoo, 2020). Initially, a dual exchange rate system was implemented as a temporary measure, which was later replaced by a unified "retail" auction for foreign exchange. This auction system operated smoothly until it was discontinued in April 1990. The auction provided the institutional framework necessary to establish an appropriate exchange rate and gradually liberalize Ghana's exchange and trade system. The shift toward an independent floating system through a foreign exchange auction was considered crucial at this stage of Ghana's adjustment process.

A significant depreciation of the cedi was required to improve the country's balance of payments performance, and previous experiences had shown that implementing large discrete devaluations had become increasingly challenging. Moving to a floating mechanism was seen as a means of depoliticizing the exchange rate issue, as the market-determined rate would offer a more objective reflection of the cedi's equilibrium exchange rate.

Additionally, a floating arrangement was expected to enable continuous determination of the exchange rate based on underlying fundamentals, in contrast to the previous fixed exchange rate regime that relied on infrequent and substantial devaluations.

Among the different institutional arrangements available for a floating exchange rate, Ghana's authorities opted for the auction format. This choice allowed the central bank to maintain control over the nation's foreign exchange receipts, which was considered vital in minimizing capital flight. Furthermore, the auction mechanism was preferred because, in theory, it could discourage collusive behavior among commercial banks. To facilitate the transition from a pegged regime to a floating exchange rate system, a transitional mechanism was devised. On September 19, 1986, Ghana introduced a dual exchange rate system, where one of the two windows operated as a foreign exchange auction. The first window maintained a fixed exchange rate of 90 cedis per U.S. dollar, while the second window's exchange rate was determined by supply and demand through a weekly auction conducted by the Bank of Ghana.

The first window catered to debt service payments, imports of petroleum products, and essential drugs, while the second window covered the majority of external transactions. To reflect the duality of rates, foreign exchange earnings were surrendered at two different rates. Earnings from cocoa and residual oil products were surrendered at the first window exchange rate. Simultaneously, a new import licensing scheme was implemented on October 6, 1986, allowing licenses for non-consumer goods to be issued without restrictions. The new licensing system expanded access to foreign

exchange funding through the auction, and the limitations on specific import licenses, which led to monopoly rents, were eliminated.

Under the dual exchange rate system, the Bank of Ghana conducted weekly auctions for foreign exchange, primarily serving final users. Authorized dealer banks played a limited intermediary role by centralizing bids from their clients and channeling them to the Bank of Ghana. Partial surrender requirements were enforced, with most foreign exchange earnings being repatriated and sold to the Bank of Ghana. After accounting for government and public entity demands, the Bank of Ghana determined the amount of exchange to be auctioned using the marginal rate for transactions through the second window.

The objective of the auction system was to further depreciate the cedi and reduce the spread between official and parallel market exchange rates. The official exchange rate depreciated from 128 cedis per U.S. dollar at the first auction to 152 cedis per U.S. dollar at the last auction in December 1986. This narrowed the spread between auction and parallel market rates to around 20-25%, compared to the previous 100% disparity. By the end of December 1986, the real effective exchange rate had depreciated by 43% since December 1985 and 94% since March 1983. Subsequently, modifications were made to the auction operation without altering its retail nature. The exchange rate determination shifted from a marginal price-based system to a Dutch auction system, and on February 19, 1987, the two windows were unified within the auction market. From then until April 27, 1990, all transactions through the banking system were settled based on the exchange rate determined in the weekly auction.

During the 1987-1989 period, access to the auction was gradually expanded by including additional categories of consumer goods and service payments. Import restrictions were relaxed, and on January 14, 1989, the import licensing system was abolished as it became largely unnecessary. Current invisible payments were also liberalized, and by the end of 1989, only minor restrictions remained for such transactions. Measures were taken to reduce the amount of foreign exchange held in retention accounts, and cocoa exports under bilateral payments agreements were phased out by late 1990. From January 1987 to April 1990, the auction market operated reasonably well.

The flexible exchange rate regime commenced in 1990 with the implementation of inter-bank market transactions and a wholesale auction system (Adjei, 2019). However, since 1992, only the inter-bank market has been operational for foreign exchange transactions, as the wholesale auction system was abolished in April of that year. This regime adopted a flexible exchange rate approach known as managed floating, where the exchange rate was determined by the forces of demand and supply. In this framework, the exchange rate was managed directly within the inter-bank market, and the Bank of Ghana's intervention in the foreign exchange market aimed solely at smoothing short-term exchange rate fluctuations by supplying foreign exchange to banks (Adjei, 2019). There were no predetermined exchange rate targets or paths announced by the central bank.

Theoretical Review

The Purchasing Power Parity Approach

The principle of purchasing power parity is critical to the theoretical foundations of the analysis of several trade issues and exchange rate models (Craig & Douglas, 2005). The theory was credited to Gustav Cassell in 1981 even though its scholarly beginning goes back to the works of David Ricardo and English economist in the nineteenth century (Pilbeam, 1998). The theory that holds that the nominal exchange rate between two currencies should be equal to the ratio of aggregate price levels between the two countries, so that a unit of currency of one country will have the same purchasing power in a foreign country

This theory takes its root from the "law of one price" which expresses that identical product ought to be sold at identical prices. The PPP theory in this way expresses that over the long run, identical products and services in various nations should cost the equivalent in those nations. This depends on the assumption that the exchange rate will change in accordance with and wipe out arbitrage opportunity (Odoom, 2019). However, in the process of wiping out any arbitrage opportunity exchange rate fluctuate excessively or exchange rate becomes more volatile.

The PPP can be categorized into two: the Absolute and Relative PPP version. The absolute form of PPP expresses that the exchange rate between the currencies of two nations is equivalent to the ratio of the price levels in the two nations. The absolute form PPP theory equation can be written as $E = \frac{P}{PF}$ where E is the spot exchange rate (domestic currency unit in value of foreign

currency),P is the domestic price index,P^F is the foreign price index (De Jong, Mahieu and Schotman, 1998).

However, Relative form of PPP theory states that the difference in the rate of inflation between the home and foreign country will be equal to the exchange rates of the currency involved (Daniels & VanHoose, 2002). Mathematically, the relative PPP can be written as $\%\Delta Et = \%\Delta P - \%\Delta P^F$, where $\%\Delta Et$ is the change in the percentage of the rate of exchange at time t, $\%\Delta P$ is the home country's change in inflation rate and $\%\Delta P^F$ is the foreign country's change in the inflation rate (Balassa, 1964).

The exchange rate between two nations is equivalent to the ratio of the price levels within the two nations. Hence, PPP predicts that the level of exchange rates is dictated by relative prices, and adjustments in relative prices will result in exchange rate volatility. A nation with high inflation would encounter a high exchange rate volatility and subsequently a currency depreciation whilst a nation with low inflation will experience a stable exchange rate and subsequently a currency appreciation (Odoom, 2019).

The PPP theory has been subject to many criticisms from the onslaught not from the layman perspective but also the academic perspective (Ruiz-Nápoles, 2004).The law of One Price cannot hold at all times and places. Cost of transportation is an inevitable obstacle to the transaction of trade and businesses. Countries who lacked the needed transport infrastructures will experience sharp contrast in prices across different locations this can be attributed to the different cos in transporting the products. Also, the equilibrium exchange rate is not permanent measure but keeps on changing (Edwards, 1989).

The Dornbusch sticky Price Monetary Model

The sticky price monetary model was initially explained in 1976 by Dornbusch which introduced the concept of exchange rate overshooting and provided an explanation for both exchange rate volatility and misalignment from the purchasing power parity (Shahrestani, Anaraki, & Ghaffari, 2009). The Dornbusch sticky – price monetary model assumes that the exchange rate is overshooting and that in the short run prices of goods and wages take time to adjust, however the exchange rate is said to be overshooting when its immediate response to a disturbance is greater than its long-run response (Dornbusch, 1976). This model was accredited to German economist Rudiger Dornbusch. Dornbush's model was path-breaking in international economics because he was able to extend the frontiers of knowledge in understanding how the flexible exchange rate works and how it volatility affect trade (Walsh, 2011).

The model presumes that prices of goods and services are sticky in the long run but PPP only holds in long run but not feasible in the short run because prices of goods and service take time to adjust and are not flexible when compared to asset prices (Dornbusch, 1976).Thus, in this model deviations from the PPP in the short run is allowed, but the exchange rate will return to PPP in the long run (Arnold, 2010). According to Frankel (1979), a rise in the real exchange in the short run will increase the competitiveness of the economy which in turn increases net exports. Overshooting in exchange due to price stickiness, contributes to explaining the high volatility displayed by exchange rate (Al Samara, 2009). Exchange rate overshooting is an

important phenomenon because it helps explain why exchange rates change so sharply or excessively from day to day.

The Uncovered Interest Rate Parity is another assumption of Dornbusch sticky-price monetary model which holds at all times. The UIRP state there is perfect capital mobility and that both foreign and domestic assets are perfect substitute so investors are risk-neutral. This means that when the local interest rate become lower than the foreign interest rate, local currency may have to appreciate to maintain foreign investment level else investor will transfer their funds from the domestic market to the foreign market where the can earn greater returns (Pilbeam, 1998).

International Fisher Effect Theory

The theory states that exchange rate changes are balanced out by interest rate changes. The Fisher theory simply argues that real interest rates across countries are equal due to the possibility of arbitrage opportunities between financial markets, which generally occurs in the form of capital flows. Currencies with higher interest rates attract large numbers of investors seeking better opportunities for their investment. This makes the currency more attractive as a form of investment and increases the demand for the currency. In the same vein, a currency's decreasing interest rates imply a decrease in the demand for that currency and thus depreciation of the exchange rate. Nominal interest rate differentials between two countries tend to reflect exchange rate fluctuations (Fisher, 2006).

The International Fisher Effect proffers those nations with lower interest rates are observed to have lower inflation rates, which ultimately results in increases in the value of the associated currency when compared to

other nations. In the long-run therefore, a direct link is observed between interest rate differentials and subsequent changes in the exchange rate but with considerable deviations in the short-run (Odoom, 2019). The International Fisher Effect is known for not being a reliable forecaster of short-run changes in spot exchange rates.

Interest Rate Parity

The interest rate parity theory of exchange rates builds on the idea that differential interest rates between countries, assuming no capital flow restrictions, would generally influence the direction of capital flows between the countries. The basis of the theory, which also establishes its equilibrium condition, is that, if investors see foreign and domestic financial assets as perfect substitutes, then they would be indifferent about where to invest, provided the expected returns after accounting for exchange rate changes are equal for both foreign and domestic assets (Liao, 2020).

Thus, according to the theory, if the rate of interest is higher or rises (lower or falls) in one country, which makes domestic-currency assets more (less) attractive to investors relative to foreign-currency assets, the exchange rate of the home country should be expected to depreciate (appreciate) in equal amount to the interest rate differential in order to equalize the relative final returns on domestic and foreign assets. Put simply, interest differentials determine exchange rate changes. The theory's major limitation is that it excludes the effects of current account transactions on exchange rates, just as PPP also ignores capital flows between countries and therefore cannot adequately explain movements in exchange rates (Liao, 2020).

Asset-market approach

Asset-market approach to exchange rate determination model assumes that product prices are perfectly flexible and bonds of different countries are perfectly substitutable, are referred to as flexible-price monetary models (Akpesiri, & Oghenemega, 2020). Under the asset – market approach, the exchange rate now deviates from its equilibrium value not only because sticky goods prices create a real interest a real interest rate differential, but also because imperfect bond substitutability creates a risk premium (Akpesiri, & Oghenemega, 2020).

In dealing with exchange rate determination, flexible-price monetary models rely heavily upon purchasing power parity in combination with some additional assumptions or theoretical results indicating a positive relationship between a country's nominal interest rate and its prices or inflation level (as in the Fisher (1930) hypothesis). As a result, these models tend to indicate there should be a positive relationship between the interest rate differential (defined as the "home" country's interest rate minus that of a "foreign" country) and the exchange rate (defined as the price of the foreign country's currency in terms of the home country's currency) or the change in that exchange rate.

Risk aversion theory

Risk aversion theory, also known as the theory of risk preference or risk-aversion behavior, is a concept that explains individuals' or investors' tendency to prefer certainty or lower levels of risk over uncertain or higher levels of risk when making decisions involving potential gains or losses (Stefánsson, & Bradley, 2019). This disinclination can be applied to different contexts in a number of ways. In this context, the risk aversion theory FDI

reduces when exchange rate volatility rises. This is because increased exchange rate volatility reduces the certainty equivalent expected exchange rate. Since certainty equivalent levels are used in the expected profit functions of firms that make investment decisions today in order to realize profits in future periods. If exchange rates are highly volatile, the expected values of investment projects are reduced, and FDI is reduced accordingly. (Goldberg & Kolstad, 1995).

Using the argument of future expected profits, Campa (1993) extends this assertion to risk-neutral firms. According to Campa (1993), when the exchange rate gets more unpredictable, firms would postpone their decision to enter because investors are apprehensive about future expected profits. In the face of large levels of exchange rate uncertainty, risk-neutral firms will be prevented from entering foreign markets. Short-term volatility makes risk-aversion arguments more compelling since firms are unlikely to be able to modify variables quickly. Factors of production are largely set in the short run. Therefore, firms will only be risk-averse when it comes to future profit volatility.

Dual – Gap Theory

The dual gap theory of Chenery and Strout's (1965) offers a framework that demonstrates that a country's development, among other things, depends on foreign aids and foreign investment inflows. The theory advances reasons why a developing country should opt for foreign finance as a means for ensuring sustainable growth rather than relying solely on domestic resources. This is because developing countries in particular, suffer from a gap between savings and investment; where domestic savings are inadequate to

support growth. Similarly, there is a gap between export and import revenues or that their import purchasing power is inadequate to support level of growth, the need for FDI and donor inflows. This implies foreign investments are necessary in spurring growth in all sectors of these economies. The theory seems to be apt in explaining the concept of foreign debt.

Describing the theory, Sulaiman and Azeez (2012) corroborate the reason stated earlier by other researchers that the dual gap hypothesis provides the framework which indicates that the development of a nation is a function of investment, and that such investment which requires domestic savings is not sufficient to ensure that the envisaged development materializes. In view of this, the importance of foreign debt on the growth process of an economy cannot be overemphasized. The researchers argue further that external borrowing ought to hasten optimal macroeconomic performance especially when internal resources are inadequate and needs to be augmented with foreign resources such as loan. The empirical question that emerges is whether movement of capital (external debt and foreign direct investment) from the resource rich economies to resource scares economies spurs exchange rate volatility of the resource scarce economies. This study seeks to empirically examine the relationship between external debt, foreign direct investment and exchange rate volatility in Ghana.

Monetary Model of Exchange Rate Determination

The monetary model of exchange rate determination was developed by notable scholars, prominent among who is Michael I. Mussa. Mussa in his 1976 and 1984 seminal work on "Theory of Exchange Rate Determination" applied the monetary model to show that the current exchange rate is a

function of the current stocks of domestic and foreign money and the current determination of the demands for these monies, including domestic and foreign income and interest rates. According to Mussa (1984), since an exchange rate is the relative price of one nation's money in terms of the money of another nation, it is natural to think of an exchange rate as determined, at least primarily, by the outstanding stocks of these monies and by the demands to hold these stocks.

Empirical Literature Review

Insah and Chiaraah (2013) examined the sources of exchange rate volatility in the economy of Ghana. The study employed the ARDL using an annual data from the period of 1980 to 2012.The result of the study showed that external debt has a negative relationship with exchange rate volatility and government expenditure was positively related to exchange rate volatility in Ghana. The study concluded that an increase in external debt will decrease real exchange rate volatility. Also, an increase in external debt is not problematic if real exchange rate volatility management is the macroeconomic policy objective of the government.

Armah, Ofori & Andoh (2023) examined the exchange rate and interest rate differential relationship since Ghana adopted the inflation targeting regime. Using macro-data spanning 2002 to 2019 for Ghana and the United States, the study showed the nonexistence of the relationship in both the short-run and long-run between exchange rate and interest rate differential. Further, the study showed a positive but slow responsiveness of exchange rate to interest rate differential shocks from the short-run to medium term. The long-run result however shows a case of a strong and significant response of

exchange rate to interest rate differential shocks. The study recommended that the Bank of Ghana address perennial macroeconomic instability, especially on inflation which we conjecture to fuel investment uncertainty and investment insensitivity to interest rate.

Qamruzzaman et al. (2020) investigated the relationship between foreign direct investment (FDI), financial innovation, and exchange rate volatility in selected South Asian nations from 1980 to 2017. The unit root test, ARDL, nonlinear ARDL, and causality test in accordance with Toda-Yamamoto are all used in the study. This result implies that FDI inflows and exchange rate volatility move together over the long run. The results of the study also showed a negative relationship between FDI inflows and exchange rate volatility over time. These results imply that ongoing FDI inflows contribute to reducing currency market volatility.

Using monthly time series data from 1983 to 2010, Adjei (2019) examined the impact of exchange rate volatility on economic development in Ghana. The study confirmed earlier findings that real exchange rate volatility discourages investors due to the high level of risk involved in trade, thereby reducing trade and productivity in the economy. It also showed that real exchange rate volatility has a significant negative impact on economic growth. Exchange rate volatility, trade openness, and physical capital stock all have considerable detrimental effects on economic growth, according to both long run and short run estimations.

Alagidede and Ibrahim (2016) examined the causes and Effects of Exchange Rate Volatility on Economic Growth in Ghana relying on annual data spanning 1980 to 2013.The results revealed that in the short run output is

the main driver of exchange rate fluctuations in Ghana. In the long run, however, exchange rate volatility is significantly influenced by government expenditure growth, money supply, terms of trade shocks and domestic output movements.

Enu (2017) also determined the key variables that influence the frequent exchange rate depreciation in Ghana. The study uses time series data for all the variables for the period of 1980 to 2015. The data for the study period is processed by taking natural logarithm of all the variables. The study employs the Backward Elimination and Stepwise Regression method. The findings of the study suggest that agricultural output, industrial output, services output and exports have been the variables which have significantly affected the exchange rate of the Ghana Cedi against the dollar during the years under review. The results of the study suggest that to ensure a stable Ghana Cedi, policies should be directed to grow the Ghanaian economy from an import-driven one to an export driven economy through massive investment in its key sectors of the economy. This will bring more foreign exchange earnings into the Ghanaian market.

Odoom (2019) assessed the factors that determine exchange rate volatility in Ghana using monthly data from 1990 to 2017. The study concentrated on interest rate, inflation rate, current account balance, and money supply as the primary factors of exchange rate volatility in Ghana. According to the results of the regression (study), Ghana's exchange rate volatility is negatively and statistically significant impacted by the interest rate, current account balance, and money supply. The rate of inflation does, however, have a positive and statistically significant impact on the volatility of

the Ghanaian cedi. It was advised that the central bank of Ghana enhance interest rates on financial assets and maintain a low inflation rate in order to stabilize Ghana's exchange rate in light of the study's findings.

Boahen and Oteng (2014) examined the impact of exchange rate volatility on foreign direct investment in Ghana using a Vector Autoregressive (VAR) model . The study showed that changes in nominal interest rates can affect both foreign direct investment and exchange rates at the same time. The study finds that a stable interest rate and exchange rate promote foreign direct investment into the country. However, the study showed that interest rate volatility has a direct impact on the exchange rate and market attractiveness, which over time has an impact on foreign direct investment. According to the study's findings, the government should put policies into place that will stabilize both the interest rate and the currency rate. Therefore, the study recommends implementing policies that will lower imports, while also enhancing export policies and lowering government borrowing from abroad.

Adu-Boahen and Ntim Adjei (2014) used a Vector Autoregressive (VAR) model to conduct a Causality Analysis of Foreign Direct Investment, Exchange Rate, and Interest Rate Volatility in Ghana. The study also shows that a stable exchange rate increases foreign direct investment (FDI) influx into the nation, and conversely, a large FDI inflow increases exchange rate stability in the country. Additionally, it shows how interest rate volatility has a direct impact on market attractiveness and exchange rates, both of which have a long-term impact on foreign direct investment. The paper's conclusion is that the government should implement measures to stabilize the interest rate and

the currency rate. As a result, the study recommends strategies that will increase FDI inflows.

Nyarko, Nketiah-Amponsah and Barnor (2011) looked into how Ghana's exchange rate regime affected FDI inflows. The causal relationship between FDI inflows and exchange rate regimes over a 39-year period was modelled in the study (1970-2008). According to the study's findings, Ghana's FDI is not significantly impacted by the exchange rate regime. According to the study, Ghana should support its present flexible ERR with policies that are more overtly aimed at luring FDI inflows. Once more, the report advises decision-makers to strengthen Ghana's current democratic system in order to make the country a favorite for FDI inflows. The study's findings also highlight the importance of policymakers working to create and sustain an open trade framework to help FIs run their businesses effectively in an FDI-friendly climate.

Kyereboah and Agyire (2008) investigated the impact of exchange rate volatility on foreign direct investment in Ghana using a time series data from 1970 to 2002. The study demonstrated that the real exchange rate's volatility has a detrimental effect on FDI inflow and that Ghana's liberalization process has not increased FDI influx. It is also shown that although political variables and the stock of FDI are likely to attract FDI, most international investors do not take the size of the market into account when deciding whether or not to invest in Ghana.

Adusei and Gyapong (2017) used data from 1975 to 2014 to assess the effects of inflation, the rate of monetary policy, the current account balance, the money and quasi money supply per GDP, the yearly GDP growth rate, and

the total external debt on the Cedi to US dollar exchange rate in Ghana. The study found that while total external debt and annual GDP growth have a positive association with exchange rate and that exchange rate has a positive relationship with monetary policy rate and inflation. The study came to the conclusion that major predictors of the exchange rate in Ghana were inflation, monetary policy rate, annual GDP growth rate, and external debt.

Adu-Boahen and Ntim (2014) used a Vector Autoregressive (VAR) model to conduct a Causality Analysis of Foreign Direct Investment, Exchange Rate, and Interest Rate Volatility in Ghana. The study showed that foreign direct investment is impacted by exchange rate volatility. Additionally, it shows how interest rate volatility has a direct impact on market attractiveness and exchange rates, both of which have a long-term impact on foreign direct investment. The paper's conclusion is that the government should implement measures to stabilize the interest rate and the currency rate. As a result, the study recommends strategies that will increase FDI inflows.

The relationship between the depreciation of the Ghana Cedi and the influx of foreign direct investments (FDI) into Ghana was examined by Padi (2019) using multiple regression and trend analysis. The study found an inverse relationship between currency depreciation and FDI intake into the nation. Therefore, suggests that the country will receive less FDI as a result of the ongoing depreciation of the local currency.

Ellahi (2011) examined the effect of exchange rate volatility on foreign direct investment in the economy of Pakistan. Over the years 1980 to 2010, a secondary time series data set is used. The study's short run and long run estimations have been determined using the auto regressive distributed lag

(ARDL) method. Real gross domestic product (GDP), the capital account balance, trade openness, the real exchange rate, and exchange rate volatility were all included in this study as independent variables, while foreign direct investment served as the dependent variable. One of the study's key conclusions was that while exchange rate volatility has a short run negative impact on FDI influx, it has a long run favorable benefit. The study also revealed that exchange rate volatility has a negative but robust impact on FDI inflow in the long run. Exchange rate volatility also insignificant but negative impact on capital account balance in the long run.

Ajao and Igbekoyi (2013) also investigated the determinants of real exchange rate volatility in Nigeria. They used the GARCH and ECM for the study between the period of 1981 to 2013. The study's findings indicated that among the key factors affecting exchange rate volatility are the economy's degree of openness, government expenditure, changes in interest rates, and the lagged exchange rate.

A study by Mpofu (2016) investigated the causes of exchange rate volatility in South Africa. The GARCH technique was used to analyze the study's monthly time series data, which were collected between 1986 and 2013. According to the analysis, moving to a floating exchange rate system significantly reduced rand volatility. The findings also showed that trade openness had a negative impact on rand volatility when using multilateral exchange rates, but not when using bilateral exchange rates. The study also discovered that ZAR volatility was highly influenced by the volatility of output, commodities prices, money supply, and foreign reserves.

Aigheyisi and Oaikhenan (2015) conducted a study to look at the factors that influence exchange rate volatility in Nigeria from 1970 to 2013. Government expenditure, changes in interest rates, and the lagged exchange rate are among the most important significant variables that affected real exchange rate volatility throughout this time, according to their analysis using the EGARCH model.

Ezirim and Muoghalu (2006) used Nigeria as a test case to examine the relationship between the situation of the exchange rate, the foreign investment crisis, and the external debt of a less developed economy. The study focused on how Nigeria's external debt levels and burden from foreign direct investment affected exchange rate situations between the Naira (Nigeria's currency) and the dollar (US) over time, in the midst of rising global oil prices. Evidence suggested that instead of making the exchange rate crisis worse, the cost of external debt (debt service to export ratio) actually exerted negative pressure on the situation. The results also showed that the burden of foreign investments was more significant in causing currency crisis than the overemphasized debt burden variable.

In Kenya between 1993 and 2013, with a fully floating exchange rate, Odera (2015) examined the effect of external debt on exchange rate volatility. A linear model was created, and using the Ordinary Least Squares method, exchange rate volatility was regressed against inflation, interest rates, GDP growth rate, money supply to GDP ratio, and external debt to GDP ratio. The findings demonstrated that whereas interest rates had a positive and substantial impact on REER volatility, the external debt to GDP ratio had a negative and

significant impact. Money supply to GDP ratio, GDP growth rate, and inflation were found to have no appreciable impact.

Basit and Ansari (2018) analyzed the role of foreign direct investment and external debt in the determination of exchange rate in Pakistan using ordinary least square method and exact maximum likelihood method. The study revealed that external debt has a negative relationship with exchange rate and foreign investment has a positive relationship with exchange rate in Pakistan.The study concluded that the first lag of exchange rate has the significant role to determine the future exchange rate of the country.

Neaime (2009) established relationships between foreign debt and exchange rate strategies and looked at the viability of Middle East and North Africa (MENA) countries' external debt policies. Using time series econometric models, the study empirically assessed the sustainability of exchange rate and external public debt policies in 5 MENA countries (Egypt, Jordan, Morocco, Tunisia, and Turkey). The findings showed a link between budget deficit, current account deficit, and exchange rate depreciation and external public debt that was positive.

A study was conducted in 2017 by Hassan and Dantama to investigate the factors that influence exchange rate volatility in Nigeria. They used the Autoregressive Conditional Heteroscedasticity (ARCH) method to examine the factors that contributed to exchange rate volatility in Nigeria from 1989 to 2015. Quarterly time series were employed in the investigation. The results of that study demonstrated that while fiscal balance, economic openness, and oil prices have positive and statistically insignificant effects on exchange rate

volatility, net foreign asset and interest rate have a positive and statistically significant effect.

Adetan and Oke (2018) used the Error Correction Model (ECM) and Autoregressive Distributed Lag (ARDL) Bounds test technique to cointegration to explore the factors that influence exchange rate volatility in Nigeria from 1986 to 2016. Their findings demonstrated that in Nigeria, the degree of openness had a negative impact on exchange rate volatility whereas the Gross Domestic Product (GDP), interest rate, and inflation had favorable effects.

Another study by Jabeen and Khan (2014) looked at the factors that influence exchange rate volatility in the Pakistani foreign exchange market. GARCH modeling was used in the study, which used monthly data from April 1982 to November 2011. The findings demonstrated that real output volatility, volatility of foreign exchange reserves, volatility of productivity, and volatility of inflation all influence the PKR-USD exchange rate volatility. On the other side, the volatility of foreign exchange reserves and conditions of trade affects the PKR-GBP exchange rate. The volatility of terms of trade affects the PKR-CAD exchange rate. The results showed that actual shocks rather than nominal shocks are what cause exchange rate volatility in Pakistan.

In a separate Turkish study, Kilicarslan (2018) investigated the factors that influence exchange rate volatility. The study analyzed annual time series data from 1974 to 2016 to calculate real exchange rate volatility using the GARCH model. The study's findings indicated that the volatility of real exchange rates is exacerbated by increases in domestic investment, the money supply, and trade openness. The findings also demonstrated that a growth in

foreign direct investment, output, and government spending lowers the volatility of the real exchange rate.

Osinubi and Amaghionyeodiwe (2009) investigated the impact of exchange rate volatility on foreign direct investment (FDI) in Nigeria using a time series data from 1970 to 2004. Both the OLS method of estimate and the error correction model were used in the study. The findings show, among other things, that foreign investors need not worry excessively about exchange rate volatility. The analysis also demonstrates a strong positive correlation between real inward FDI and the exchange rate. This suggests that the Naira's depreciation boosts FDI coming in from abroad.

A study by Calderón and Kubota (2018) looked into the variables influencing real exchange rate volatility for 82 countries from 1974 to 2013. Panel regression analysis was used to conduct the study. The findings showed that manufacturing trade contributes to lower exchange rate volatility while non-manufacturing trade may increase exchange rate volatility. The findings also demonstrated that in a nation with a higher ratio of foreign equity than foreign debt liabilities, financial openness reduces exchange rate volatility.

Chapter Summary

This chapter reviewed relevant literature (both theoretical and empirical) on the effects of FDI and external debt on exchange rate volatility in Ghana. Theoretically, it focused on concepts and theories that underpins FDI, external debt and exchange rate volatility such as Purchasing power parity theory, Dornbusch sticky price monetary model, international fisher effect theory, interest rate parity, Risk aversion theory, Dual – gap theory and the Monetary model of exchange rate determination. A synthesis of the

empirical literature reviewed revealed that studies done on the determinants of exchange rate volatility and all the studies did not consider role played by FDI and external debt in the determination of exchange rate in Ghana. The study, therefore, addresses the gap in the literature by examining the role played by FDI and external debt in the determination of exchange rate volatility in Ghana. To achieve this, the study employed an ARDL model to examine the possible long run effect of FDI and external debt on the volatility of Ghana's domestic currency. In addition, the study also employed the Nonlinear ARDL model to also examine the possible nonlinear effect of FDI and External Debt on the stability of Ghana's currency.

CHAPTER THREE

RESEARCH METHODS

Introduction

This chapter seeks to find a systematic framework that gives the study the empirical model for the analysis and the associated econometric estimation techniques. It explores the research hypotheses in more depth, and discuss what methods are appropriate for the study, given the objectives and the nature of the study. Particularly, this chapter presents the research design, research paradigm, research approach, measurement of variables with model specifications, type of data and source and model specification. Finally, this chapter presents the estimation techniques and diagnostics tests.

Research Philosophy

In line with the objectives of the study, the study adopted the positivist philosophy within the framework of the post keynesian economics. The positivist believe that reality is stable and can be observed and described from an impartial viewpoint without interfering with the phenomena being studied (Levin, 1988). Thus, positivist philosophy allows the researcher to study social processes in an objective manner as well as explain relationships between variables. More importantly, the positivist philosophy favours the use of quantitative approaches to research as used in this study. Positivist philosophy is suitable for the development of mathematical models to investigate the relationship between quantitative measurements. Based on the positivist philosophy, this study employed the quantitative method.

Research Design

The research design is expalanatory in nature because the study seeks to examine a cause and effect . More specifically, since the objective of the study is explanatory in nature (i.e. Establish the effect of foreign direct investment and external debt on exchange rate volatility in Ghana), the study adopted the explanatory research under the quantitative approach.

Research Approach

There are three main approaches to research, namely, the quantitative approach, the qualitative approach and the mixed approach (Creswell, 2014). According to Saunders Lewis and Thornhill (2019), positivism research paradigm makes use of the quantitative research approach and therefore the quantitative research method is adopted for this study. The quantitative approach is employed because hypotheses will be deduced from theories and models which will be constructed base on these hypotheses. Since quantitative approach to research makes use of statistical analysis, the study employs inferential statistics (particularly regression) to analyze the data.

The quantitative approach employed is the casual – comparative research which conclude the cause – effect equation between two or more variables, where one variable depends on the opposite experimental variable. An independent variable is not manipulated by the experimenter and the effects of the independent variable is on the dependent variable.

Theoretical model specification

To examine the effect of FDI and external debt on exchange rate volatiltity,the study adopted the post keynesian view of exchange rate volatility. The study adopted the Post Keynesian theory of exchange rate

because it emphasis that capital flows, interest rate differential and expectations in the market drives exchange rate (Harvey, 2009). For the purpose of this study, we assume that exchange rate volatility is mainly influenced by FDI and external debt. Both FDI and external debt are components of a capital flow of an economy, the Post Keynesian view of exchange rate determination provided a better model for the study.

Keynes (1936) indicated that, in a monetary production economy, an asset's 'total expected returns' or 'own interest rate'(r) is determined by four main attributes: its expected appreciation (a), its quasi-rent or yield (q), it carrying costs (c) and its liquidity premium (l) as in equation (1). When applied to the different currencies, 'r' refers to the 'total expected returns' of an asset denominated in a specific currency, 'a' is the expected appreciation or depreciation and 'q' is the short-term interest rate of this currency, and c is the degree of financial openness of the issuer country (Andrade & Prates, 2013).

$$r = (q - c) + a + l \quad (1)$$

It is assumed that expected rates of return, r, throughout the world will be driven toward equality. It will be via this process that investors' demand for currency determines exchange rates. According to Kaltenbrunner (2015), the carrying costs of the domestic currency or financial instruments are significantly low, thereby they can be disregarded (c = 0). Nevertheless, assuming that domestic currency is a class of international asset, it has to offer pecuniary returns in order to be demanded by international investors.

Thus, assuming that interest rate is mainly responsible for currency yield, then $q = r$; expected appreciation corresponds to $a = s^e - s$;where s^e represent expected future spot exchange rate, s represent spot exchange

rate, l^* represent international liquidity premium and r^* represent foreign interest rate. We further assume that the interest rate on the money is not zero and ignore carrying costs for the moment. We therefore have;

$$r - (s^e - s) + l = l^* \quad (2)$$

$$r - (s^e - s) + l = l^* + r^* \quad (3)$$

Reformulating Equation (3) and taking into account that the system's currency return is not zero:

$$(s^e - s) = (l - l^*) + (r - r^*) \quad (4)$$

Such model (Equation 4) demonstrates the post Keynesian theory of exchange rate determination (Kaltenbrunner, 2015). The equation can also handle the empirical causality change between short-run interest rate and exchange rate fluctuation. When the international liquidity premium is constant, or change slowly, expectations on interest rate determines the currency demand. Nevertheless, substantial changes in international liquidity premia may require interest rate adjusts to keep currency demand.

Equation (4) also shows that interest rate differentials $(r - r^*)$ has to compensate for its lower liquidity premium relative to that of the leading currency, which represent the capital flow $(l - l^*)$, if demand for it is to be maintained. Therefore, if interest rates remain unchanged, agents have to expect an appreciation of the currency.

Empirical Model Specification

This study adopted the post keynesian theory of exchange rate determination, which is specified in in equation (4) above. From the model presented,exchange rate is determined by capital flows $(l - l^*)$ and interest rate differentials $(r - r^*)$ following Harvey (2009) and Kaltenbrunner (2015).

For the purpose of the study the capital flow is captured by FDI and external debt. We can therefore deduce that;

$$VEXC = f(FDI, EXTDEBT, INTDIFF, TRADE, CPI, DCPS) \quad (5)$$

For the purpose of econometric estimation, equation (5) is expressed empirically as:

$$VEXC_t = \beta_0 + \alpha VEXC_t + \beta_1 FDI_t + \beta_2 EXTDEBT_t + \beta_3 TRADE_t + \beta_4 InCPI_t + \beta_5 INTDIFF_t + \beta_6 DCPS_t + \varepsilon_t \quad (6)$$

Where the subscript "t" represents a time period, $\varepsilon_t =$ stochastic error term assumed to be white noise, while β_i , for i =0, 1, 2, 3, 4,6 are regression parameters to be estimated.

Justification, Measurement of variables and Sign expectations

Exchange rate volatility

Exchange rate volatility involves a swing or fluctuations in exchange rate over a period of time or deviations from a benchmark or equilibrium exchange rate. Exchange rate volatility is the dependent variable and will be measured by using the Generalized Auto-Regressive Conditional Heteroscedasticity (GARCH) developed by Bollerslev (1986). The GARCH model was also employed by Alagidede and Ibrahim (2017a), Adusei and Gyapong (2017), and Insah and Chiaraah (2013). Moreover, Latief and Lefen (2018); Dal Bianco and Loan (2017); Aftab, Syed, and Katper (2017) also measured exchange rate volatility by using the GARCH process.

To measure volatility, some authors have used the standard deviations where exchange rate volatility is measured according to the degree to which exchange rate fluctuates in relation to its mean overtime (Carrera, 2003; Schnabl, 2007; Gadanecz & Mehrotra, 2013). Using this measure is not

without challenges. First, it assumes that, the empirical distribution of the exchange rate is normal. Second, it does not reflect the distribution between an unpredictable component of the exchange rate process hence failing to capture the past information of the exchange rate.

The empirical flaws of this measure restrict its use hence the use of the autoregressive conditional heteroskedasticity (ARCH) or generalized ARCH (GARCH) for this study. In this study, we rely on the GARCH (1,1) not only because exchange rate best follows the GARCH process (McKenzie, 1999), but because it captures past values of the exchange rate as opposed to the ARCH. Allowing the log of the real exchange rate to depend on its previous value for the mean equation, we derive our GARCH (1,1) model as follows:

$$InEXC_t = \varphi + \delta InEXC_{t-1} + e_t \quad (7)$$

Where $e_t \approx N(0, h_t), and$

$$h_t = \varphi + \delta e_{t-1}^2 + \gamma h_{t-1} + \mu_t \quad (8)$$

The conditional variance (h_t) of equation (8) is a function of three terms:

(1) the mean φ;

(2) information about previous volatility measured as the lag of the squared residual from the mean equation e_{t-1}^2 (ARCH term); and

(3) the previous forecast error variance, γh_{t-1} (which is the GARCH term).

The exchange rate volatility derived in GARCH (1,1) is conditional on past information and therefore reflects the actual volatility perceived by investors.

Foreign Direct Investment

According to UNCTAD's World Investment Report (2017) Foreign direct investment (FDI) is defined as an investment involving a long-term relationship and reflecting a lasting interest and control by a resident entity in

one economy (foreign direct investor or parent enterprise) in an enterprise resident in an economy other than that of the foreign direct investor.

Foreign Direct Investment is considered as an inflow of foreign capital to complement domestic investment and productions and hence allows foreign investors to get involve in the domestic economy. FDI has been widely recognized as means by which investors exerts a significant degree of influence on the management of enterprise resident in other countries. Following the works of Baah (2020), Agyapong (2021), Asiedu (2013) and Esso (2010), this study measures FDI as the net inflows as a percentage of GDP.FDI is used in the study to observe how inflow of foreign capital and the involvement of foreign investors in the Ghanaian economy contribute to exchange rate volatility. The influx of FDI could have implications for the stability of the domestic currency especially in an environment of greater capital account openness. The study expects a positive relationship between FDI and exchange rate volatility.

External Debt

External debt is the component of a nation's debt borrowed from foreign creditors such as commercial banks, global financial institutions or governments. It is measured as a percentage of the GDP. Ghana's debt level and its influence on the Ghanaian economy is attributed to persistent fiscal deficits of the Ghanaian government. Revenue targets or expenditure forecast shocks often force governments to finance their budget deficits through domestic or international borrowing (Matuka & Asafo, 2018).

The high ratio of the total external debt in relation to GDP indicated that Ghana stood the risk of having accumulated debt, which may be

unsustainable in the long run. This trend if not checked may have led the country into another debt crisis, which may render the country a credit unworthiness status (BOG, 2005). External debt is employed in the study ascertain the extent by which the repayment of external debt contributes to exchange rate volatility. In this study, a negative relationship is expected between external debt and exchange rate volatility.

Trade Openness

Trade openness otherwise known as trade liberalization is the process of reducing or removing restrictions on international trade. Trade openness measures the extent of openness of the economy as the sum of total exports and import of goods and services as a percentage of GDP. According to Calderon (2004), besides monetary factors that Dornbusch (1976) argued that is the main cause of exchange rate fluctuations, there are some non-monetary factors that are important in explaining exchange rate fluctuations. Among these non-monetary factors Calderon (2004) mentioned includes the degree of trade openness of an economy. Therefore, the study employed trade openness as a control variable. In this study a negative or positive link is expected between trade openness and exchange rate volatility.

Consumer Price Index

Consumer Price Index (*CPI*) is a measure that captures the changes in the price level of a market basket of consumer goods and services purchased by the household. The CPI is a broad measure of inflation within an economy in relation to the cost of goods and services. It is a critical indicator of pricing pressures in an economy and provides a gauge of inflation. In this study, the CPI is employed to control the effect of high prices of domestic goods and

services. The increase in prices may come as result of a rise in demand in both the tradable and non – tradable sector which could result in fluctuations in the exchange rate. The study expects a positive link between CPI and exchange rate volatility.

Interest Rate Differential

Interest rate differential is the change in interest rate between two currencies of two distinct economic regions (Ndikumana & Verick, 2008). Therefore, the interest rate differential is the home interest rate minus the foreign interest rate. The interest rate differential for this study is calculated by subtracting the US federal fund rate from the Monetary policy rate of Bank of Ghana. Interest rate differential is employed as control variable because, the interest rate parity condition posits that interest rate differentials could trigger substantial flow of capital across borders which in turn can have profound impact on exchange rate movement (Armah, Ofori & Andoh 2023). The study expects a positive between interest rate differentials and exchange rate volatility.

Domestic Credit to Private Sector

Domestic credit to private sector refers to financial resources given to the private sector by the financial institutions such as banks through loans, purchases of non-equity securities and trade credits that establish a claim for repayment. It is measured as a percentage share of the GDP. Most private firms in developing economies depends on bank loans and other credit type as the source of funding due to huge capital outlay of the business and investment venture (Emran & farazi, 2008). Therefore, making credit

accessible and available to the private sector will enable them to actively participate in both domestic and international trade.

Also, a currency appreciation would tend to ease domestic financial conditions, and this would boost the demand and supply of domestic credit. Currency appreciation can also lead to a lower perception of risk on the part of lenders, and an enhanced sense of prosperity on the part of borrowers (Krugman,1999). This variable was chosen for the study because it measures the contribution of the private sector to exchange rate volatility through credit accessibility. The study expects positive link between DCPS and exchange rate volatility

Data type and sources

The study employed an annual time series data covering the period 1987 to 2021 to investigate the effects of foreign direct investment and external debt on exchange rate volatility in Ghana. Data on exchange rate (EXC) was obtain from Bank of Ghana (BOG, 2021). Time series data on foreign direct investment (FDI), External debt (EXTDEBT), Trade openness (TRADE), Consumer price index (CPI), Interest rate differentials (INTDIFF) and Domestic credit to private sector (DCPS) from 1987 to 2021 were obtained from the World Development Indicators. This period provides sufficient historical data to observe trends and patterns over three decades. The period captures economic fluctuations and allows for the examination of how FDI and external debt impact exchange rate volatility under different economic conditions. The inclusion of policy changes and reforms during this period helps understand their effects on exchange rate volatility. Comparisons between sub-periods or specific events can be made, providing insights into

changing dynamics. Additionally, the longer time series enhances the statistical robustness of your study, leading to more credible findings. However, it's important to ensure the relevance and reliability of the data used.

Estimation procedure

In order to analyze the long-run relationships as well as the dynamic interactions among the various variables of interest empirically, the autoregressive distributed lag (ARDL) cointegration procedure developed by (Pesaran et al., (2001) was used. The empirical procedure involves the following steps. First of all, the study investigated the time series properties of the data by using the Augmented Dickey– Fuller (ADF) and the Phillip-Perron (PP) tests. The unit roots test was used to check the stationarity property of the data. In the second step, it tested for cointegration using the autoregressive distributed lag (ARDL). Also, the asymmetric effect of Foreign direct investment and External debt on exchange rate volatility is investigated by utilizing the nonlinear ARDL offered by Shin et al. (2011).

Unit root tests

It is very critical to test for the statistical properties of variables when time series variables are involved. Time series data are hardly stationary at levels. Regression involving non-stationary time series often results in the problem of spurious regression. This happens when regression results show a very high and significant relationships among variables when in fact no relationship exist. Furthermore, Stock and Watson (1988) have demonstrated that the usual test statistics (t, F, DW, and R^2) will not have standard distributions if some of the variable in the model have unit roots. A series is

said to be stationary if its mean, variance, and auto-covariances are time invariant.

To ensure reliability of the results the study applied a variety of unit root tests. In particular, this study employed both the ADF and the PP tests, which are two of the most widely applied unit root tests. These tests are alike, except that they differ with respect to the way they adjust for autocorrelation in the residuals. Also, the ADF test has low power in small sample (Cheung & Lai, 1993), so the study employed the PP unit root tests to check the robustness of the estimation results. The PP nonparametric test generalizes the ADF process, allowing for less restrictive assumptions for the time series in question. The null hypothesis to be tested is that the variable under examination has a unit root against the stationarity alternative. In each case, the lag-length is chosen using the Akaike Information Criteria (AIC) and Swartz Information Criterion (SIC) for both the ADF and PP test. The sensitivity of ADF tests to lag selection renders the PP test an essential additional tool for making inferences about unit roots. The basic formulation of the ADF is specified as follows:

$$\Delta X_t = \alpha + \delta t + \rho X_{t-1} + \sum_{i=1}^{P} \lambda_t \Delta X_{t-1} + \varepsilon_{1t} \quad (9)$$

Where X_t represents the series at time t, Δ is the difference operator, α, δ, ρ, and λ are parameters to be estimated, and ε is the stochastic random disturbance term. The ADF tests the null hypothesis that a series contains unit (non-stationary) against the alternative hypothesis of no unit root (stationary). That is:

$$H_0: \rho = 0$$

$$H_1: \rho \neq 0$$

As stated earlier, the PP test is superior to the ADF test, especially in situations where time series variable in question has serial correlation and a structural break (not present in this study). This is centered on the underlying assumptions in both tests. The ADF test assumes that the error terms are independent with a constant variance however, the PP test assumes the error terms are weakly dependent and heterogeneously distributed and hence provides robust estimates over the ADF test. The PP test is specified as follows:

$$\Delta X_t = \alpha + \lambda_2 X_{t-1} + \theta\left(t - \frac{T}{2}\right) + \sum_{i=1}^{m} \theta_t \Delta X_{t-1} + \varepsilon_{2t} \quad (10)$$

In both equations (9) and (10), ε_{1t} *and* ε_{2t} are the covariance stationary random error terms. The following hypotheses are therefore tested in both situations:

H_0: *Series contains unit root*

H_1: *Series is stationary*

The null hypothesis is that the series has unit roots, indicating non-stationarity against the alternative hypothesis that it does not contain unit roots, implying stationarity. The decision rule is that, if the tau value or t-statistic is more negative than the critical values, the null hypothesis is rejected, and the conclusion is that the series is stationary. On the other hand, if the tau statistic is less negative than the critical values, the null hypothesis is accepted and the conclusion is that the series is non-stationary

Tests for cointegration

Cointegration is a property possessed by some non-stationary time series data. In this concept, two variables are cointegrated when a linear combination of the two is stationary, even though each variable is non-stationary. In particular, if one considers two-time series variables, Y and Z that are non-stationary, conventionally one would expect that a linear combination of the two variables would also be non-stationary. In order to avoid the problem of non-stationary it is necessary to make use of first (or higher) differentiated data. Such differencing, however, may result in a loss of low frequency information or long-run characteristics of the series data.

However, Engle and Granger (1987) showed that, if there is an equilibrium relationship between such variables, then for this relationship to have any meaning, a linear combination of these variables, the disequilibrium error should fluctuate around zero, that is, should be stationary. Thus, two time-series integrated in the same order 'd' are said to be cointegrated if one unique linear combination of these series exists which is integrated in an order inferior to $(d - b)$ with $b \geq 1$. After establishing that variables are stationary, it is necessary to determine whether or not there is any long-term relationship between them, this means testing for cointegration.

Autoregressive distributed lag (ARDL) approach to cointegration

In order to analyze the long-run relationships as well as the dynamic interactions among the various variables of interest empirically, the autoregressive distributed lag cointegration procedure developed by (Pesaran et al., (2001) was used. Co-integration techniques such as Engel and Granger (1987) procedure, Johansen and Juselius (1990) full information maximum

likelihood procedure, Phillips and Hansen (1990) fully modified OLS procedure, and a very recent procedure known as the Bounds testing procedure, developed by Pesaran et al. (2001) are widely used in economic literature to empirically determine the relationship among time series variables.

The Engel-Granger method has been criticized in the literature for several shortfalls which include the following: (a) problem of normalization in systems with more than two variables, (b) small sample bias due to the exclusion of short run dynamics, and (c) the inability to test hypotheses concerning the estimated coefficients in the long-run relationship. Due to these weaknesses of Engel-Granger method, Johansen and Phillips-Hansen developed procedures to avoid some of these problems, however their procedures (along with the Engel-Granger method) concentrate on or require that the variables included in the model are integrated of order one (that is the variables are *I* (1)). The choice of ARDL to estimate the model was informed by the following reasons:

Firstly, the most important advantage of the Bound test procedure is that it is applicable irrespective of whether the underlying variables in the model are purely *I* (0), purely *I* (1) or fractionally integrated. Thus, if a model includes a mixture of *I* (0) and *I* (1) variables, the most appropriate econometric method to employ is the Bound test procedure. However, there is still pre-requisite that none of the explanatory variables is of *I* (2) or higher order, that is, the ARDL procedure will, however, be inefficient in the existence of *I* (2) or higher order series.

Secondly, The ARDL cointegration procedure is comparatively more robust and relatively more efficient in small sample data sizes as is the case in this study. This study covers the period 1987 to 2021 inclusive. Thus, the total observation for the study is 34 which is relatively small (Pattichis, 1999).

Thirdly, the ARDL Model applies general-to-specific modeling framework by taking sufficient number of lags to capture the data generating process. It estimates (ρ + 1) *k*number of regressions in order to obtain an optimal lag length for each variable, where p is the maximum lag to be used, and k is the number of variables in the equation. The model is selected on the basis of different criteria like Schwarz Bayesian Criterion (SBC), Akaike Information Criterion (AIC), R-Bar Squared Criterion (RBC) and Hannan Quinn Criterion (HQC).

Furthermore, traditional co-integration methods may also experience the problems of endogeneity, whereas the ARDL method can distinguish between dependent and explanatory variables and eradicate the problems that may arise due to the presence of autocorrelation and endogeneity. ARDL co-integration estimates short-run (SR) and long-run (LR) relationship simultaneously and provide unbiased and efficient estimates. The appropriateness of utilizing ARDL model is that the model is based on a single equation framework. The ARDL model takes sufficient numbers of lags and direct the data generating process in a general to specific modeling framework (Harvey, 1981). Unlike further multivariate co-integration techniques such as Johansen and Juselius (1990), ARDL model permits the cointegration relationship to be estimated by OLS once the lag order of the model is identified. Error Correction Model (ECM) can also be drawn from by ARDL

approach (Yildirim & Sezgin, 2003). This ECM allows drawing outcome for LR estimates while other traditional co-integration techniques do not provide such types of inferences. "ECM joins together SR adjustments with LR equilibrium without losing LR information" (Pesaran & Shin, 1998).

The choice of the testing procedure essentially draws on the order of integration of the variables. In this study, a combination of $I(0)$ and $I(1)$ variables were used and this indicated that the appropriate procedure is the bounds test (BT) approach to co-integration. Thus, with a heterogeneous order of integration of the variables implies that, it is inappropriate to use the Engel-Granger, the Johansen, or the Phillips-Hansen procedures to analyze the long-run and the short-run behavior of foreign direct investment and external debt. The most relevant testing procedure is the BT procedure. To this end, the study applied ARDL technique over other cointegration techniques based on the characteristics of the data to analyze the joint effect of foreign direct investment and external debt on exchange rate volatility in Ghana.

Bounds testing / ARDL procedure

According to Pesaran and Pesaran (1997), the ARDL approach requires the following two steps. In the first step, the existence of any long-term relationship among the variables of interest is determined using F-test. The second step of the analysis requires an estimation of the coefficients of the long-run relationship and determine their values, followed by the estimation of the short-run parameters of the variables with the error correction representation of the ARDL model. By applying the ECM version of ARDL, the speed of adjustment to equilibrium will be determined.

In order to implement the bounds test procedure for cointegration, the following restricted (conditional) version of the ARDL model is estimated to test the long-run relationship among the variables of interest. The model of the study is specified as:

$$\Delta VEXC_t = \beta_0 + \alpha VEXC_{t-1} + \beta_1 FDI_{t-1} + \beta_2 EXTDEBT_{t-1} + \beta_3 TRADE_{t-1} + \beta_4 InCPI_{t-1} + \beta_5 INTDIFF_{t-1} + \beta_6 DCPS_{t-1} + \sum_{i=0}^{\rho} \theta_i \Delta VEXC_{t-i} + \sum_{i=0}^{\rho} \gamma_1 FDI_{t-i} + \sum_{i=0}^{\rho} \gamma_2 \Delta EXTDEBT_{t-i} + \sum_{i=0}^{\rho} \gamma_3 \Delta TRADE_{t-i} + \sum_{i=0}^{\rho} \gamma_4 \Delta InCPI_{t-i} + \sum_{i=0}^{\rho} \gamma_5 \Delta INTDIFF_{t-i} + \sum_{i=0}^{\rho} \gamma_6 \Delta DCPS_{t-i} + \varepsilon_t \quad (11)$$

Where Δ is the first difference operator, ρ is the lag order selected by the Schwarz Bayesian Criterion (SBC), the parameters α and βi denote the long run parameters and θ and γ_i are the short-run parameters of the model to be estimated through the error correction framework in the ARDL model, β_0 is the constant term (drift parameter) while ε_t is a white noise error term which is $\sim N(0, \sigma^2)$. All variables are defined as before.

The first step in the ARDL approach is to estimate equation (6) by applying OLS. The computed F-test (Wald test) is then used to test the existence of long-run relationship among the variables. This is done by

restricting the coefficients of the lagged level variables to zero. The null hypothesis of no long-run relationship among the variables in equation (6) is tested against the alternative hypothesis of the presence of long-run relationship among the variables.

The hypothesis tested is specified as:

$H_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$

$H_1 = \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq 0$

The existence of cointegration among the variables under consideration is tested based on the F-statistics or Wald statistics. Given that the asymptotic distribution of F-statistics is non-standard without considering the independent variables being I (0) or I (1), Pesaran et al., (2001) generated and presented the appropriate critical values according to the number of independent variables in the model of presence or absence of constant term or time trend in the model. Therefore, the calculated F-statistics is compared with two sets of critical values developed on the basis that the independent variables are $I(d)$ (where $0 \leq d \leq 1$).

The lower critical bound assumes that all variables are I (0) whereas the upper critical bound assumes the variables are I (1). If the calculated F-statistics exceeds the upper critical value, then null hypothesis of no cointegration is rejected irrespective of whether the variables are I (0) or I(1). This implies that there is a long-run relationship among the variables. Conversely, if the F-statistics falls below the lower bound then the null hypothesis of no cointegration cannot be rejected. If the F-statistics lies within the lower critical and upper critical bounds, the test is inconclusive (Pesaran & Pesaran, 1997). However, when all the variables are integrated of order zero,

$I(0)$ then the null hypothesis of no cointegration is rejected implying that there exists long-run relationship among the variables, otherwise they are not cointegrated.

In order to get the optimal lag length for each variable, the ARDL procedure estimates $(P+1)^{k+1}$ the number of regressions, where P is the maximum number of lags to be used, and k is the number of variables in the equation (Shrestha & Chowdhury, 2005). The optimal lag length of the ARDL model is selected based on the Schwarz-Bayesian Criterion (SBC) or the Akaike Information Criterion (AIC). The SBC uses the smallest possible lag length and is therefore described as the parsimonious model. The AIC chooses the maximum relevant lag length (Jalil & Naveed, 2008).

Once cointegration has been established from the ARDL model, the next step is to estimate the following $ARDL$ (P, q 1, q 2, q 3, q 4, q 5, q 6) model in order to obtain the long run and error correction estimate.

$$VEXC_t = \beta_0 + \sum_{i=0}^{\rho} \gamma_1 VEXC_{t-i} + \sum_{i=0}^{q} \gamma_2 FDI_{t-i} + \sum_{i=0}^{q} \gamma_3 EXTDEBT_{t-i} + \sum_{i=0}^{q} \gamma_4 TRADE_{t-i} + \sum_{i=0}^{q} \gamma_5 InCPI_{t-i} + \sum_{i=0}^{q} \gamma_6 INTDIFF_{t-i} + \sum_{i=0}^{q} \gamma_7 DCPS_{t-i} + \varepsilon_t \quad (12)$$

The ARDL error correction representation of the series is also estimated as

$$\Delta VEXC_t$$

$$= \gamma_0 + \sum_{i=0}^{\rho} \theta_i \Delta VEXC_{t-i} + \sum_{i=0}^{\rho} \gamma_1 FDI_{t-i} + \sum_{i=0}^{\rho} \gamma_2 \Delta EXTDEBT_{t-i}$$

$$+ \sum_{i=0}^{\rho} \gamma_3 \Delta TRADE_{t-i}$$

$$+ \sum_{i=0}^{\rho} \gamma_4 \Delta InCPI_{t-i} + \sum_{i=0}^{\rho} \gamma_5 \Delta INTDIFF_{t-i} + \sum_{i=0}^{\rho} \gamma_6 \Delta DCPS_{t-i} + \tau ECT_{t-1}$$

$$+ \epsilon_t \quad (13)$$

Where the coefficients are the short-run dynamics, while τ is the speed of adjustment of the parameter to long-run equilibrium following a shock to the system and ECT_{t-1} is the residuals obtained from equations (12). The coefficient of the lagged error correction term τ is expected to be negative and statistically significant to further confirm the existence of a cointegrating relationship among the variables in the model.

Accordingly, Engel and Granger (1987) argued that when variables are cointegrated, their dynamic relationship can be specified by an error correction representation in which an error correction term (ECT) computed from the long-run equation must be incorporated in order to capture both the short-run and long-run relationships. The error correction term indicates long-run equilibrium in the dynamic model. In order words, its magnitude shows how quick the variables converge to equilibrium when they are disturbed. It is expected to be statistically significant with a negative sign. The negative sign implies that any shock that occurs in the short-run will be corrected in the long-run. The larger the coefficient of the error correction term in absolute terms, the faster the convergence to equilibrium.

Non-linear autoregressive distributed lag methodology (non-linear ARDL)

ARDL measures the long and short-run cointegration; however, it ignores the asymmetric part. For capturing the asymmetric and the non-linear relationship between the variable of the study, we have to conduct a non-linear ARDL. The study adopts the framework of non-linear autoregressive distributed lag model (NARDL) for the following reasons. First, NARDL model allows for both the static and dynamic effect(s) of the independent variable(s) on the dependent variable unlike a static model that accounts for static or fixed effect(s) only. Second, NARDL framework offers a technique for checking the existence of a long-run relationship between variables, and that is referred to as the Bounds test. Bounds test is flexible as it accommodates both stationary and integrated series unlike other tests of cointegration, such as, Engle-Granger and Johansen tests, which considers only non-stationary series that are integrated of the same order. Lastly, NARDL allows one to capture the dynamic effect of both positive and negative changes in an explanatory variable on a particular dependent variable.

Therefore, the asymmetric effect of Foreign direct investment and External debt on exchange rate volatility is investigated by utilizing the nonlinear ARDL offered by Shin et al. (2011) and considered the following asymmetric long run regression.

$$\Delta EXC_t = (\beta^+ FDI_t^+ + \beta^- FDI_t^-) + (\gamma^+ EXTDEBT_t^+ + \gamma^- EXTDEBT_t^-) + \delta_i X_i + \varepsilon_t \quad (14)$$

Where $\beta^+, \beta^-, \gamma^+, \gamma^-$ and $\delta_i$associated with long-run pavements. $\beta^+, \beta^-, \gamma^+, \gamma^-$ measure the effects of positive and negative shocks in FDI and External debt on exchange rate volatility and δi measures the effects of control variables (trade openness, Consumer price index, interest rate differential and Domestic credit to private sector). $FDI_t^+ \; and \; FDI_t^-$ represents the positive partial sum process variation in FDI, while $EXTDEBT_t^+ and \; EXTDEBT_t^-$ represent negative partial sum process variation in external debt. It is calculated by using the following equations.

$$FDI_t^+ = \sum_{j=1}^{t} \Delta FDI_t^+ = \sum_{j=1}^{t} \max(\Delta FDI_j, 0)$$

$$FDI_t^- = \sum_{j=1}^{t} \Delta FDI_t^- = \sum_{j=1}^{t} \min\left(\Delta FDI_j, 0\right) \qquad (15)$$

$$EXTDEBT_t^+ = \sum_{j=1}^{t} \Delta EXTDEBT_t^+ = \sum_{j=1}^{t} \max(\Delta EXTDEBT_j, 0)$$

$$EXTDEBT_t^- = \sum_{j=1}^{t} \Delta EXTDEBT_t^- = \sum_{j=1}^{t} \min(\Delta EXTDEBT_j, 0) \qquad (16)$$

By incorporating the decomposition variables of foreign direct investment and External debt into the equation (11), we get the following nonlinear form of ARDL:

$$\Delta VEXC_t = \partial \Delta VEXC_{t-1} + (\beta^+ FDI^+_{t-1} + \beta^- FDI^-_{t-1}) + (\gamma^+ EXTDEBT^+_{t-1} + \gamma^- EXTDEBT^-_{t-1}) + \beta_4 Trade_{t-1} + \beta_5 InCPI_{t-1} + \beta_6 INTDIFF_{t-1} + \beta_7 DCPS_{t-1} + \sum_{j=1}^{m-1} \lambda_j \Delta VEXC_{t-j} + \sum_{j=1}^{n-1} (\pi^+ FDI^+_{t-1} + \pi^- FDI^-_{t-1}) + \sum_{j=1}^{p-1} (\rho^+ EXTDEBT^+_{t-j} + \rho^- EXTDEBT^-_{t-1}) + \sum_{j=1}^{m-1} \lambda_4 \Delta Trade_{t-j} + \sum_{j=1}^{m-1} \lambda_5 \Delta InCPI_{t-j} + \sum_{j=1}^{m-1} \lambda_6 \Delta INTDIFF_{t-j} + \sum_{j=1}^{m-1} \lambda_7 \Delta DCPS_{t-j} + \varepsilon_t \quad (17)$$

The equation (17) can be rewritten in the following manner;

$$\Delta VEXC_t = \partial e_{t-1} + \sum_{j=1}^{m-1} \lambda_j \Delta VEXC_{t-j} + \sum_{j=1}^{n-1} (\pi^+ FDI^+_{t-1} + \pi^- FDI^-_{t-1}) + \sum_{j=1}^{p-1} (\rho^+ EXTDEBT^+_{t-j} + \rho^- EXTDEBT^-_{t-1}) + \sum_{j=1}^{m-1} \lambda_4 \Delta Trade_{t-j} + \sum_{j=1}^{m-1} \lambda_5 \Delta InCPI_{t-j} + \sum_{j=1}^{m-1} \lambda_6 \Delta INTDIFF_{t-j} + \sum_{j=1}^{m-1} \lambda_7 \Delta DCPS_{t-j} + \varepsilon_t \quad (18)$$

Where $e_{t-1} = VEXC_{t-1} - (\delta^{+}FDI^{+}_{t-1} - \delta^{-}FDI^{-}_{t-1}) - \left(\mu^{+}EXTDEBT^{+}_{t-j} - \mu^{-}EXTDEBT^{-}_{t-1}\right) - \theta Trade_{t-1} - \vartheta LCPI_{t-1} - \tau INTDIFF_{t-1} - \sigma DCPS_{t-1}$ is the nonlinear error correction term with

$$\delta^{+} = \frac{-\beta^{+}}{\partial}; \quad \delta^{-} = \frac{-\beta^{-}}{\partial}; \quad \mu^{+} = \frac{-\gamma^{+}}{\partial}; \mu^{-} = \frac{-\gamma^{-}}{\partial}; \quad \theta = \frac{-\beta_3}{\partial}; \ \vartheta = \frac{-\beta_4}{\partial}; \tau = \frac{-\beta_5}{\partial}; \sigma = \frac{-\beta_6}{\partial}$$

are the associated long – run parameters.

The short-run adjustments to positive and negative FDI and external debt changes are captured by $\pi^{+}; \pi^{-}; \rho^{+} \ and \ \rho^{-}$ respectively. To gauge the asymmetric relationship between foreign direct investment, external debt and exchange rate volatility, the following NARDL is considered $VEXC_t = \alpha + \partial VEXC_{t-1} + \beta^{+}FDI^{+}_{t-1} + \beta^{-}FDI^{-}_{t-1} + \gamma^{+}EXTDEBT^{+}_{t-1} + \gamma^{-}EXTDEBT^{-}_{t-1} + \beta Trade_{t-1} + \beta InCPI_{t-1} + \beta INTDIFF_{t-1} + \beta DCPS_{t-1} + \sum_{j=0}^{m1}\lambda_j \Delta VEXC_{t-j} + \sum_{j=0}^{m2}(\pi^{+}FDI^{+}_{t-1}) + \sum_{j=0}^{m3}\left(\pi^{-}FDI^{-}_{t-j}\right) + \sum_{j=0}^{m4}\left(\rho^{+}EXTDEBT^{+}_{t-j}\right) + \sum_{j=0}^{m5}\left(\rho^{-}EXTDEBT^{-}_{t-j}\right) + \sum_{j=0}^{m6}\lambda_4 \Delta Trade_{t-j} + \sum_{j=0}^{m7}\lambda_5 \Delta InCPI_{t-j} + \sum_{j=0}^{m8}\lambda_6 \Delta INTDIFF_{t-j} + \sum_{j=0}^{m9}\lambda_7 \Delta DCPS_{t-j} + \varepsilon_t$ (19)

The existence of asymmetry long-run relationship can be analyzed in the same manner applied in linear ARDL by FPSS and WPSS statistics under the join null hypothesis of no-cointegration $(H_0: \beta_1 = 0)$ against the alternative of cointegration $(H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0)$ and the $t_{DBM} - test$ statistics of Banerjee et al. (1998) involves testing the null hypothesis of no-cointegration $H_0: \beta_1 < 0$ against the alternative of cointegration $(H_0: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq 0)$. Where nonlinear

cointegration is confirmed, the next step is to assess long - run symmetry, that is $(\beta^+ = \beta^-, \gamma^+ = \gamma^-)$ and short-run (additive) symmetry, that is $\sum_{j=1}^{n-1}(\pi^+ VEXC_{t-1}^+) = \sum_{j=1}^{n-1}(\pi^- VEXC_{t-j}^-)$; $\sum_{j=1}^{n-1}(\rho^+ VEXC_{t-1}^+) = \sum_{j=1}^{n-1}(\rho^- VEXC_{t-j}^-)$. By using a standard Wald test (Qamruzzaman, Karim, & Wei, 2019).

Diagnostics Test

Post estimation tests were carried out to ensure the robustness and goodness of fit of the model used for the study. To be sure that the estimates obtained from the model are efficient, the study carried out a serial correlation test. The study employed the Lagrange Multiplier (LM) Test of Breusch (1978) and Godfrey (1978). The LM serial correlation test has some advantages over the Durbin-Watson test for serial correlation. Unlike the Durbin-Watson statistic, the LM test may be used to test for higher order ARMA errors, and is applicable whether or not there are lagged dependent variables. The LM test the null hypothesis of no serial correlation up to the selected maximum lag length. The study also employed the Regression Specification Error Test (RESET) proposed by Ramsey (1969) to check whether the functional form of the model used in the study is correctly specified.

The RESET is a general test for; omitted variables, incorrect functional form as well as the correlation between regressors and the error term (Hall et. al. 1995). The RESET, test the null hypothesis that the correct specification of the model is linear against the alternative that the correct specification is non-linear. To examine the normality properties of the error term, the study

employed the Kurtosis test of normality. Also to make sure the estimated coefficients are efficient heteroscedasticity test was conducted.

The structural stability test is conducted by using the Cumulative Sum (CUSUM) of recursive residuals and the Cumulative Sum of Squares (CUSUMSQ) of recursive residuals as suggested by Pesaran and Pesaran (1997). This was used to determine whether the coefficients of the estimated model are stable over the study period.

Granger Causality Test

Wold (1953), noted that regression relationships may or may not involve a causal hypothesis because the introduction of a causal hypothesis makes the analysis more determinate and thus makes the ensuing conclusions more specific. This statement was further supported by Feige and Pearce (1979) who contended that causal relationships between economic variables are the bread and butter of econometric analysis.

Hence, the study of causal relationships between economic variables has been one of the main objectives of empirical Econometrics. According to Engle and Granger (1987), cointegrated variables must have an error correction representation. One of the implications of the Granger representation theorem is that if non-stationary series are cointegrated, then one of the series must Granger cause the other. This statement of causality means that X_t causes Y_t if the past values of X_t can be used to predict Y_t more precisely than just using the past values of Y_t only. Therefore, X_t is said to granger cause Y_t if X_t helps in the prediction of Y_t.

Granger causality measures precedence and information content but does not by itself indicate causality in the more common use of the term. This

type of is causality is significant for at least two reasons. First, it is tantamount to the econometric exogeneity because, a unidirectional causality that runs from the explanatory variables to the dependent variables serves a prerequisite for the consistent estimation of distributed lag models that do not involve lagged dependent variables. Second, it can be compared to leading indicators and rational expectations. Therefore, Engel and Granger (1987) noted that, it is difficult to determine the direction of causality between two related variables. His definition of causality justifies the estimation of the following models:

$$Y_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} Y_{t-i} + \sum_{i=1}^{q} \alpha_{2i} X_{t-1} + \mu_t \quad (20)$$

$$X_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} X_{t-i} + \sum_{i=1}^{q} \beta_{2i} Y_{t-i} + \eta_t \quad (21)$$

The error terms are assumed to satisfy the criteria $E(\mu_t) = E(\eta_t) = E(\mu_t \mu_s) = E(\eta_t \eta_s) = 0$ and $E(\mu_t \mu_t) = \sigma_\mu^2, E(\eta_t \eta_t) = \sigma_\eta^2$. The causality in equation (10) should run from X_t to Y_t on condition that the estimated coefficients on the lagged variable (X_t) are significantly different from zero. Put differently, the coefficients of α_i are different from zero (i.e. $\alpha_i \neq 0$). Also, causality in equation (11) runs from Y_t to X_t provided the estimated coefficients on Y_t as a group are significantly different from zero (i.e. $\beta_i \neq 0$). Bidirectional causality occurs if X_t causes Y_t and Y_t causes X_t. in other words, the lagged values of both X_t and Y_t as a group in equations (20) and (21) are significantly different from zero.

Data processing and analysis

This study employed both descriptive and quantitative analysis. Charts such as graphs and tables were presented to aid in the descriptive analysis.

Unit root tests was carried out on all variables using Augmented Dickey–Fuller (ADF) and Phillip Perron test to ascertain their order of integration in order to avoid the problem of spurious regression. Furthermore, the study adopted the Autoregressive Distributed Lag (ARDL) econometric methodology for cointegration to obtain both the short and long run parameters of the main variables involved and also the Non-linear Autoregressive Distributed Lag (NARDL) was also employed to examine the possible nonlinear effect of FDI and External Debt on the stability of Ghana's currency. All estimations were carried out using E-views 10 package.

Chapter Summary

This chapter developed and presented the methodological framework suitable for conducting the study. Annual time series data on Exchange rate, Foreign Direct Investment (FDI), External debt to GDP, Trade openness, consumer price index, Interest rate differentials, and Domestic credit to private sector from 1987 to 2021 was employed for the study. Stationarity test was conducted using Augmented Dickey–Fuller (ADF) and Phillip-Perron (PP). Moreover, Autoregressive Distributed Lag (ARDL) econometric methodology was used to examine the long-run and short-run dynamics among the variables. Finally, the Non-linear Autoregressive Distributed Lag (NARDL) was also employed to examine the possible nonlinear effect of FDI and External Debt on Exchange rate volatility in Ghana.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

The objective of this chapter is to present a detailed analysis and discussion of the results of the study. This chapter seeks to present the estimation, interpretation and discussion of the empirical results of the relationship between foreign direct investment, external debt and exchange rate volatility in Ghana. The Chapter is structured into four main sessions. The first session presents the descriptive statistics of the variables in the study. The second session presents and discuss the results of both Augmented Dickey Fuller (ADF) and Philip Perron (PP) unit root tests for stationarity. The third session presents test for cointegration using the Autoregressive Distributed Lag model (ARDL) and the Non-linear Autoregressive Distributed Lag model (NARDL). The long and short run dynamics of the models are also presented in the next section.

Descriptive Statistics

Table 1 presents the descriptive statistics on the variables for this study, which allows us to assess the distribution of the data. The descriptive statistics show the number of observations, mean, standard deviation, minimum and maximum values of variables used for the study. The mean value gives the average value of the variables and the standard deviation measures how close or dispersed the values are from the mean. The maximum and minimum indicate the range of the values used for the study.

Table 1: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
MPR	34	23.915	9.2970	12.666	45.000
USMPR	34	3.0225	2.7113	0.8000	9.2166
EXC	34	4.6003	0.24022	4.2065	5.1067
INTDIFF	34	20.929	8.2679	7.647	39.701
FDI	34	3.5859	91.312	0.092	9.4666
TRADE	34	72.197	19.839	41.08	116.04
CPI	34	78.690	91.312	0.833	305.98
DCPS	34	10.746	4.3692	3.139	15.882
VEXC	34	3.1114	3.8370	-3.699	15.1903
EXTDEBT	34	59.493	10.7460	10.746	152.7620

Source: Author's computation (2022)

From Table 1, it can be observed that a time series data spanning over a 34 – year period was employed for this analysis and it was found that all the variables have positive average values (means). Ghana's mean interest rate (MPR) is 23.915 on average between 1987 and 2021. This has an average variance of 9.297 and minimum and maximum values of 12.666 and 45.00, respectively. On the other side, the average interest rate in the US (USMPR) is 3.0225. Additionally, this has a range that ranges from 0.800 to 9.2166 with an average variance of 2.7113. It can be observed that the mean interest rate of Ghana (23.915) is higher than that of the interest rate in US (3.0225). This implies that the domestic interest rate will attract more foreign investors into the country. On the average for the period of 1987 to 2021, mean interest differentials (INTDIFF) for Ghana is 20.929.

The annual minimum value was 7.647 and the maximum value of 39.701 with average variation of 8.2679 over the years. Also, foreign direct investment (FDI) averages 3.5859 for the period under study in Ghana. This

indicate that about 3.6 percent of the GDP accounted for FDI. The extent to which foreign direct investment (FDI) deviates from the mean is 91.312 in Ghana. The highest level of FDI during the period of study is 9.4666 and the minimum value is 0.092. Trade openness (TRADE) has a mean value of 72.197 with an annual rate of variation of 19.839 over the period of study. This implies that approximately 72 percent of the GDP can be attributed to trade openness. The minimum and maximum values for trade openness are 41.08 and 116.04 respectively.

The consumer price index (CPI) as a proxy for inflation has a minimum value of 0.833 and a maximum value of 305.98. The mean value for the period is recorded to be 78.690. The consumer price index has a variation of 91.312. Domestic credit to the private sector (DCPS) has a mean value of 10.746 with a minimum and maximum value of 3.139 and 15.822 respectively. This also indicate that approximately 10.7 percent of the GDP is attributed to domestic credit to the private sector. The variation of domestic credit to the private sector over the period is also 4.3692. External debt to GDP has a mean value of 59.493 also with a minimum and maximum value of 10.7460 and 152.7620 respectively. This shows external debt (EXTDEBT) accounted for that about 59 percent of the GDP.

The extent to which external debt deviates from its mean is 3.8370 Ghana. With a minimum and greatest value of 4.2065 and 5.1067, respectively, the exchange rate (EXC) has a mean value of 4.6003 as well. In Ghana, the deviation of the exchange rate from its mean is 0.2402. Exchange rate volatility (VEXC) generated with the GARCH Model recorded a mean value of 3.11149 with an average variation of 3.8370 over the period of study.

The minimum and maximum values recorded over the years for the period under study is also -3.6990 and 15.1903.

Unit Root Test

Before carrying out the ARDL or Bounds test to cointegration, and the Granger-causality test, unit roots test was first conducted in order to verify the stationarity properties of the variables in the study. While the ARDL approach to cointegration does not necessitate the pretesting of the variable for unit roots, it is imperative to perform unit roots test to ascertain if the variables are not integrated of an order higher than one, to avoid spurious results. This is necessary, because the computed F-statistics provided by Pesaran *et al.* (2001) are not valid in the presences of *I* (2) variables

Time series variables are non-stationary by nature. According to Engel and Granger (1987), using such data will lead to spurious results. The ARDL Bounds testing of cointegration which is employed in this study requires that the dependent variable should be integrated at levels I(0) or of the first order I(1). Therefore, the augmented Dickey-Fuller (ADF) and Philips Perron (PP) tests were applied to all variables in levels and in first difference in order to formally establish their order of integration. Tables 2 and 3 show the test for stationarity at levels and the first difference for the Augmented Dickey-Fuller and Philip Perron tests respectively. The unit root is done with constant but without a trend.

Table 2: Augmented Dicky Fuller Test for Unit Root

Variables	Level	ADF Statistic	Lag	First Difference	ADF Statistic	Lag
VEXC		5.169(0.0002) ***	0		6.332(0.0001)	1
FDI		1.721(0.4117)	0	ΔFDI	4.713(0.0006) ***	0
EXTDEBT		1.321(0.6072)	0	ΔEXTDEBT	5.215(0.0002) ***	0
LCPI		3.643(0.0107) **	0	ΔLCPI	3474(0.0152) **	0
INTDIFF		1.737(0.4036)	1	ΔINTDIFF	5.627(0.0000) ***	0
TRADE		2.047(0.2661)	0	ΔTRADE	5.495(0.0001) ***	0
DCPS		1.8395(0.3556)	0	ΔDCPS	6.6744(0.0000) ***	0

Source: Author's computation (2022)

Table 3: Philips Perron Test for Unit Root

Variables	Level	ADF Statistic	BW	First Difference	ADF Statistic	BW
VEXC		5.172(0.0002) ***	1	ΔVEXC	21.769(0.0000) ***	21
FDI		1.721(0.4117)	0	ΔFDI	4.713(0.0006) ***	3
EXTDEBT		1.419(0.5610)	2	ΔEXTDEBT	5.217(0.0002) ***	1
LCPI		5.401(0.0001) ***	10	ΔLCPI	5.006(0.0069) ***	15
INTDIFF		1.736(0.4044)	0	ΔINTDIFF	5.628(0.0000) ***	3
TRADE		2.050(0.2651)	1	ΔTRADE	5.901(0.0000) ***	2
DCPS		1.8395(0.3556)	0	ΔDCPS	6.6845(0.0000) ***	1

*Note: ***, ** and * indicates the rejection of the null hypothesis of non-stationary at 1%, 5% and 10% level of significance respectively, Δ denotes the first difference, BW is the Band Width.*
Source: Author's computation (2022)

From the ADF test result in Table 2, it can be observed that at levels the null hypothesis of the presence of unit root for variables specifically foreign direct investment (FDI), external debt (EXTDEBT), interest rate differential (INTDIFF), trade openness (TRADE) and Domestic credit to private sector (DCPS) cannot be rejected since their P- values of the ADF statistics were not significant statistically at all the three conventional levels. However, exchange rate volatility (VEXC) and log of consumer price index (LCPI) are statistically significant at 1 percent. At first difference, foreign

direct investment (FDI), external debt (EXTDEBT), interest rate differential (INTDIFF), trade openness (TRADE) and domestic credit to private sector (DCPS) are all stationary and statistically significant at 1 percent, hence, we reject the null hypothesis of a unit root.

From Table 3, the PP results at level for the presence of unit root showed that all variables had unit root expect for exchange rate volatility (VEXC) and log of consumer price index (LCPI). However, at first difference, all variables are stationary and statistically significant at 1 percent, hence we reject the null hypothesis of a unit root. Therefore, we reject the null hypothesis of the presence of a unit root for both the Augmented Dicky Fuller Test and Philip Perron Test. In this way, it is clear that all the variables are integrated of order zero I(0), or order one I(1). Since the test outcome has confirmed the non-appearance of the I(2) variable, the estimation procedure is suitable for achieving the stated objectives.

Cointegration Analysis

Test Statistic	Value	k
F-Statistic	7.938784	6

Critical Value Bounds

Table 4: Bounds test result for Cointegration for Linear ARDL model

Significance	I0 Bound	I1 Bound
10 %	1.99	2.94
5%	2.27	3.28
2.5%	2.55	3.61
1%	2.88	3.99

Source: Author's computation (2022)

Test Statistic	Value	k
F-Statistic	12.6556	8

Critical Value Bounds

Table 5: Bounds test result for Cointegration for Non-Linear ARDL model

Significance	I0 Bound	I1 Bound
10 %	1.85	2.85
5%	2.11	3.15
2.5	2.33	3.42
1%	2.62	3.77

Source: Author's computation (2022)

The purpose of the bound test for cointegration is to test for the existence of a long-run equilibrium relationship. It was developed by Pesaran et al (2001), this procedure, however, has many advantages covering the old and classical cointegration tests. One advantage is that irrespective of the order of integration of the variables either at levels or order one this approach can be used. This study focuses on establishing the relationship between FDI, external debt and exchange rate volatility therefore it is imperative to test for the existence of a long run relationship among the variables.

According to Pesaran, Shin & Smith (2001) at most 2 lags can be used in the bounds test for cointegration for annual data. The F-statistics is used to test the joint null hypothesis that the coefficients of the lagged levels are zero. Thus $H_0 = \gamma 1 = \gamma 2 = \gamma 3 = \gamma 4 = \gamma 5 = \gamma 6 = 0$ against the alternative hypothesis $H_1 = \gamma 1 \neq \gamma 2 \neq \gamma 3 \neq \gamma 4 \neq \gamma 5 \neq \gamma 6 \neq 0$.

From Tables 4 and 5, the calculated F-statistics is 7.938784 and 12.65562 for the Linear ARDL model and Non-linear ARDL respectively which exceed the lower and upper bound's critical value at all significant levels leading to the conclusion that the null hypothesis of no cointegration is

rejected. This means there is a long-run relationship among the variables in both models.

The results of Long – Run Relationship

Therefore, since cointegration has been established between exchange rate volatility and the explanatory variables in the study, the study proceeded to estimate the long run impact of the explanatory variables on exchange rate volatility using both ARDL and non – linear ARDL framework.

The estimates of the selected ARDL model based on the Schwarz Bayesian Criterion (3, 3, 0, 0, 0, 0, 0) are presented in Table 6. The SBC was chosen to ensure parsimony.

Table 6: Long – Run estimates based on SBC - ARDL Approach

Dependent Variable: Exchange Rate Volatility

Independent Variable	Coefficient	Std. Err	t-Statistic	P-value
FDI	0.71138***	0.1382	5.1463	0.0001
TRADE	-0.1014***	0.0244	-4.155	0.0006
EXTDEBT	0.0836***	0.0128	6.5107	0.0000
INTDIFF	0.0714**	0.0303	2.3528	0.0302
LCPI	-0.3770	0.2830	-1.3323	0.1994
DCPS	0.3404**	0.1399	2.4330	0.0256
C	-0.6757	1.0639	-0.6535	0.5333

Source: Author's computation (2022)

From Table 6, the long run estimate of the ARDL reveals that coefficient of FDI is positive and statistically significant at 1 percent. This shows that a percentage increase in FDI inflow in the economy will cause a 0.71 percent increase in exchange rate volatility in Ghana in the long run. This indicates an adverse effect of inflow of FDI on exchange rate volatility in the long run. This can be as a result of the repatriation of profit by foreign

investors in the economy. In an environment of greater capital openness, foreign investors can repatriate their earnings and profit back to their home countries with ease. There is a high demand for foreign currency for these transactions which tend to increase exchange rate volatility in the economy. This adverse effect of FDI on exchange rate volatility lends support from the works of Qamruzzaman et al. (2020) and Basit and Ansari (2018) who also found that FDI has significantly negative effects on exchange rate volatility.

The result also shows that external debt also has a positive coefficient and statistically significant at levels. Precisely, the result shows that a percentage increase in external debt will result in a 0.083 percentage increase in exchange rate volatility in the long run and thus external debt also an adverse effect on exchange rate volatility. These findings shows that a high accumulation of external debt by public sector and the repayment of the foreign loans involves the demand for foreign currency which tends to have an aggravating effect on the exchange rate causing it to be volatile in the long run. This is in conformity with a study by Adusei and Gyapong (2017), who also found a significantly positive relationship between external debt and exchange rate volatility in Ghana. Similar finding by Odera (2015) showed that high levels of external debt had adverse effect on exchange rate causing it to be volatile.

From the results in Table 6, the coefficient of interest rate differential is also positive and statistically significant at 5 percent. This indicate that an increase in interest rate differential will result in an approximate increase in exchange rate volatility by 0.07 in the long run, all other things being equal. This suggest that an exogenous increase in the interest rate of Ghana all other

things being equal, will drive down money demand in the country and drive up its aggregate demand, leading to higher prices in the country, and through relative purchasing power parity the exchange rate will rise. This result affirms the asset – market approach exchange rate determination model, which indicate a positive relationship between interest rate differential and exchange rate. The result is consistent with the findings of Hacker et al (2012) who also found a positive relationship between interest differential and exchange rate in the long run using a wavelet approach.

From the results, trade openness has a negative relationship with exchange rate volatility and statistically significant at 1 percent. This indicates a percentage increase in trade openness will result in reduction of exchange rate volatility by approximately 0.1 percent in the long run. This implies that when the Ghanaian economy becomes more open to international trade, the high demand for imported goods will facilitate a quick adjustment of aggregate domestic price level. This will result in a reduction in the short – term effect of the money supply and reduce the effect of the exchange rate, hence rendering it less volatile. This result is consistent with the findings of Hau (2002) who predicted an inverse relationship between trade openness and exchange rate volatility. Similarly, Calderon's (2004) study found a strong negative relationship between trade openness and exchange rate volatility.

The coefficient of domestic credit to the private sector is positive and also statistically significant at a 5 percent level of significance. Precisely, a percentage increase in the domestic credit to the private sector will lead to approximately 0.3 percent increase in exchange rate volatility in the long run.

Short Run Dynamics

Once the long-run relationship among the variables has been established within the framework of the ARDL approach to cointegration, the study further estimates the short run relationships. Engel and Granger (1987) argued that, when variables are cointegrated, their dynamic relationship can be specified by an error correction representation in which an error correction term computed from the long run equation must be adopted in order to capture both the short and long run relationships. The coefficient of the ECM depicts how fast the variables converge to equilibrium following a shock and it should have a statistically significant coefficient with a negative sign. Banerjee et al. (1998) noted that, a highly significant error correction term further confirms the existence of a long-run relationship.Table 7 presents the short run dynamics.

Table 7: Estimated Short-Run ECM using ARDL (3, 3, 0, 0, 0, 0, 0)

Independent Variable	Coefficient	Std. Error	t-statistic	Prob*
VEXC(−1)	-0.5940	0.303128	-1.959835	0.0666
VEXC(−2)	-0.4583	0.214546	-2.136191	0.0475
VEXC(−3)	-0.4686	0.277716	-1.687481	0.1098
FDI	0.61131	0.544103	1.123534	0.2768
FDI (−1)	-0.1930	0.640508	-0.301418	0.7668
FDI (−2)	0.74315	0.672560	1.104963	0.2846
FDI (−3)	0.61831	0.423443	1.460211	0.1625
TRADE	-0.24171	0.097284	-2.485201	0.0237
EXTDEBT	0.19585	0.112275	2.550744	0.0207
INTDIFF	0.17454	0.112275	1.554622	0.1385
LCPI	-1.00678	0.847235	-1.188319	0.2510
DCPS	0.80260	0.487547	1.646206	0.1181
C	-1.40651	3.326230	-0.422855	0.6777
Fitted^2	0.02394	0.033728	0.710057	0.4873
ECT (-1)*	-0.888	0.307555	-29.92508	0.0000

R − squared (R^2)	0.7605	Mean dependent var	3.1859
Adjusted R − squared	0.5774	S.D. dependent var	3.9687
S. E of regression	2.5798	Akaike info criterion	5.0358
Sum squared resid	113.14	Schwarz criterion	5.6834
Log-likelihood	-64.055	Hanna-Quinn criter.	5.2469
F-statistic	4.1535	Durbin-Watson	2.1162
Prob (F-statistic)	0.0036		

Dependent Variable: Exchange Rate Volatility

Source: Author's computation (2022)

From Table 7, it can be observed that the adjusted R^2 is approximately 0.57. This means that over 50 percent of the variations in exchange rate volatility are explained by the independent variables in the model. Also, a DW statistic of approximately 2.1 reveals that there is no autocorrelation in the residuals. The coefficient of the error correction term (ECT) is negative and

statistically significant as expected at a 1 percent significance level. This actually confirms the existence of a cointegrating relationship among the variables in the model. The ECT represents the rate of adjustment to restore equilibrium in the dynamic model after a disturbance. The coefficient of the error correction term is -0.888. This implies that, about 88 percent of the deviations from the long – term exchange rate volatility caused by previous year's shocks converges back to the long run equilibrium in the current year. Acheampong (2007) indicated that, the larger the error correction coefficient (in absolute terms), the faster the variables equilibrate in the long run when shocked. The result shows that, the speed of adjustment is relatively fast in the model.

The short-run dynamics reveals that the coefficient of external debt is positive and statistically significant at 5 percent significant level. This shows that, in the short run, a percentage increase in external debt will result increases exchange rate volatility by approximately 0.19 percent. These findings suggest that in the short run increasing external debt plays a vital role in the volatility of the exchange rate. This is consistent with the long run result. Therefore, it is essential to control the rate at which the country accumulate its foreign debts. Simply put, the size of foreign-dominated currency debt must be controlled in other to reduce the country's exposure to foreign liabilities to help establish stability in rare exchange rate movements.

The short – run estimate also indicate that trade openness has a negative coefficient and is statistically significant at 5 percent significant level. This implies that a percentage increase in trade openness will result in reduction of exchange rate volatility by 0.24 percent in the short run. Similar

to the long run result, trade openness contributes to the reduction of exchange rate volatility in the Ghanaian economy in the short – run.

Table 8: Estimated long Run results based on SBC - Nonlinear ARDL Approach

Independent variable	Coefficient	Std. Error	t-Statistic	Prob.*
FDI_POS	0.731133	0.297485	2.457715	0.0302
FDI _NEG	1.474275	0.552696	2.667425	0.0205
TRADE	0.024592	0.051665	0.475995	0.6426
EXTDEBT_POS	-0.001544	0.029834	-0.051769	0.9596
EXTDEBT_NEG	0.104200	0.045706	2.279783	0.0417
INTDIFF	-0.289929	0.101516	-2.855992	0.0145
LCPI	6.321335	3.771644	1.676016	0.1196
DCPS	-0.631858	0.246368	-2.564694	0.0248
C	4.172796	2.531679	1.648233	0.1252

Dependent Variable: Exchange rate Volatility

Source: Author's computation (2022)

From Table 8, a positive shock in FDI implies that a percent increase in FDI will result in about 0.73 percent increase in exchange rate volatility in the long run. However, a negative shock in FDI implies that a percentage decrease in FDI will still result in increase in exchange rate volatility by 1.47 percent. This indicate that both the positive and negative shocks in the FDI result in an increase in exchange rate volatility. The effect of a negative shock in FDI on exchange rate is twice that of a positive stock in FDI. The result suggest that the country should not reduce FDI inflow to stabilize the exchange rate since its reduction causes more volatility in the exchange rate. There is an asymmetric effect of FDI on the exchange rate volatility in Ghana. This result is in line with a study by Qamruzzaman, et al. (2019) who also find that positive and negative shocks in FDI increases exchange rate volatility.

The effect of a positive shock in external debt shows a negative relationship with exchange rate volatility. However, the effect is insignificant. A negative shock in external debt implies that a percentage decrease in external debt will lead to an increase in exchange rate volatility by 0.10 percent at 5 percent significant level. This indicate that a fall in external debt does not necessarily help to stabilize the exchange rate in the long run.

From the result, Interest rate differential recorded a negative coefficient which is statistically significant at 5 percent significance level. This depicts that a unit increase in interest rate differential will cause approximately 0.29 reduction exchange rate volatility in the long run. Interest rate differential is a key factor in determining why an investor will invest in the local economy or may decide to invest outside Ghana. An increased interest rate differential increases the inflow of foreign currency through increased investment by foreigners in the domestic economy. This in turn helps stabilizes the exchange rate by reducing and cushioning the excessive demand for foreign currency. The significant negative relationship between interest rate differential and exchange rate volatility explains the reality that investment conditions in Ghana are critical in maintaining exchange rate stability. The coefficient of domestic credit to the private sector is also negative and significant at a 5 percent level of significance.

Table 9: Estimated Nonlinear ARDL Short Run results

Independent variable	Coefficient	Std. Error	t-Statistic	Prob.
VEXC (-1)*	-1.933272	0.196788	-9.824136	0.0000
FDI_POS**	1.413480	0.571660	2.472586	0.0294
FDI_NEG**	2.850174	1.016464	2.804010	0.0159
TRADE (-1)	0.047544	0.100517	0.472995	0.6447
EXTDEBT_POS (-1)	-0.002986	0.057613	-0.051827	0.9595
EXTDEBT_NEG (-1)	0.201447	0.085008	2.369755	0.0354
INTDIFF (-1)	-0.560512	0.190499	-2.942332	0.0123
LCPI (-1)	12.22086	7.058804	1.731293	0.1090
DCPS (-1)	-1.221553	0.477256	-2.559534	0.0250
D(TRADE)	-0.377090	0.103959	-3.627283	0.0035
D (TRADE (-1))	-0.189629	0.050168	-3.779888	0.0026
D(EXTDEBT_POS)	0.347776	0.087903	3.956338	0.0019
D(EXTDEBT_NEG)	0.367692	0.102935	3.572077	0.0038
D(EXTDEBT_NEG(-1))	0.370404	0.098965	3.742762	0.0028
D(INTDIFF)	-0.171063	0.129437	-1.321593	0.2109
D(LCPI)	19.92173	8.684661	2.293898	0.0406
D (LCPI (-1))	33.72942	9.965984	3.384455	0.0054
D(DCPS)	0.974617	0.446656	2.182031	0.0497
C	8.067151	4.778440	1.688240	0.1172
CointEq(-1)*	-0.933272	0.129907	-7.184155	0.0000

R-squared	0.946841		
Adjusted R-squared	0.924059	Mean dependent var	-0.147157
S.E. of regression	1.437786	S.D. dependent var	5.217413
Sum squared resid	43.41179	Akaike info criterion	3.819782
Log likelihood	-49.20662	Schwarz criterion	4.282359
Durbin-Watson stat	2.581898	Hannan-Quinn criter.	3.970571

Source: Author's computation (2022)

From Table 9, the Adjusted R^2 is approximately 0.92. It implies that approximately 92 percent of the variations in exchange rate volatility is explained by the independent variable. The DW statistics of 2.6 shows non –

existent of autocorrelation in the residual. The negative coefficient of the Error Correction Term (ECT) is an indication that any shocks and disequilibrium that occurs in the short run will be rectified in the long run. The rule of thumb indicates that the rate at which the variables equilibrate in the long run when shocked in largely dependent on the coefficient of the error correction term (in absolute terms) so a larger coefficient will cause the variables to equilibrate faster and vice versa (Acheampong, 2007).

The result shows that the coefficient of the lagged error correction term ECM (-1) is -0.933 and is statistically significant at 1 percent. This implies that approximately 93 percent of disequilibrium caused in the previous year's shocks converges back to the long run equilibrium in the current year.

The short run result indicates that both positive and negative shocks in FDI result in an increase in exchange rate volatility which is consistent with the long run result. This implies that a percentage increase in FDI will result in an increase in the exchange rate volatility by about 1.4 percent in the short run. Also, a percentage decrease in FDI will lead to an increase in the exchange rate volatility by approximately 2.8 percent in short run. Similar to the long run result, the effect of a negative shock in the FDI is twice that of a positive shock in FDI. This confirms an asymmetric effect of FDI on exchange rate volatility in the short run as well.

The short run result also indicates that both positive and negative shock in external debt leads to an increase in exchange rate volatility. This implies that a percentage increase in external debt will result in a 0.35 percent increase in exchange rate volatility. Also, a percentage decrease in external debt will also increase exchange rate volatility in the short run. This suggest

that in the short run even if the government reduces that amount borrowed externally the exchange rate will still worsen. This confirms of asymmetric effect of external debt on exchange rate volatility in the short run.

The result reveals that log of consumer price index has a significant positive coefficient. This implies that a percentage increase in log of consumer price index will result in approximately 20 percent increase in exchange rate volatility in the short run. Similarly domestic credit to private sectors also has a positive coefficient in the short run. The result implies that a percentage increase in domestic credit to private sector will lead to about 0.97 increase in exchange rate volatility. Trade openness has a significant negative coefficient. This implies that a percentage increase in trade openness will result in a decrease of exchange rate volatility by 0.37 percentage in the short run.

Post Estimation (Model Diagnostic) Test

The following diagnostic test were conducted for the LARDL model and NARDL model in Appendix C. The test presented in Appendix C shows that the estimated linear ARDL model and Nonlinear ARDL model passes all the diagnostic test which includes normality test, heteroscedasticity test, functional form test (Ramsey RESET) and the Breusch – Godfrey serial correlation test.

Specifically, Appendix C shows the Breusch – Godfrey Serial Correlation LM test for the existence of autocorrelation. The results of the test show the p – value of 0.4540 and 0.2397 for the linear ARDL model and Nonlinear ARDL model respectively, which are greater than the critical value of 0.05. This affirms the non – existence of autocorrelation in the Linear ARDL model and Nonlinear ARDL model. The heteroscedasticity test shows

the p -value of 0.4901 and 0.7963 for the Linear ARDL model and Nonlinear ARDL model respectively, which exceeds the critical value of 0.05, therefore, we conclude that the Linear ARDL model and the Nonlinear ARDL model are homoscedastic. The Ramsey RESET test shows that p- value of 0.49 and 0.79 for Linear ARDL model and Nonlinear ARDL model and are greater than the critical value of 0.05. This shows that there is no apparent non – linearity in the regression equations and therefore the models are linearly appropriate.

Stability Test

The cumulative of recursive residuals (CUSUM) and cumulative sum of the square of recursive residual (CUSUMSQ) are used to test for stability and consistency of the model (Pesaran et al. 2001). This is done to check the stability of the parameters in the model. The test finds the parameters of the model unstable when the cumulative and cumulative sum of squares lies outside the critical bound of the five percent significance level, when this happens the null hypothesis that all coefficients are stable has to be rejected.

Figure 1 and 2 shows the plot of CUSUM and CUSUMSQ for the estimated Linear ARDL model and Nonlinear ARDL model. The plot affirms the non – existence of structural breaks in the model because the plot of all the coefficient lies within the critical bounds at five percent significance interval. This means the estimated models are stable and the coefficient are not changing systematically throughout the study.

Linear ARDL **Nonlinear ARDL**

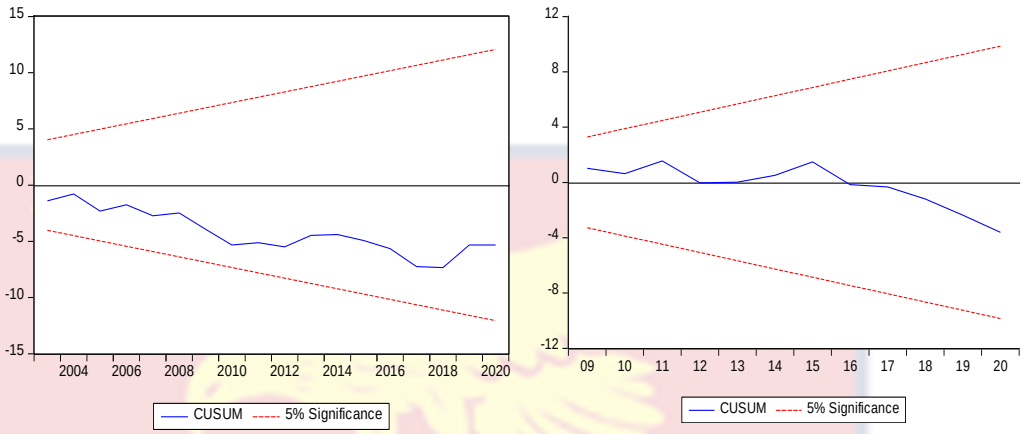

Figure 6: Stability Test from CUSUM

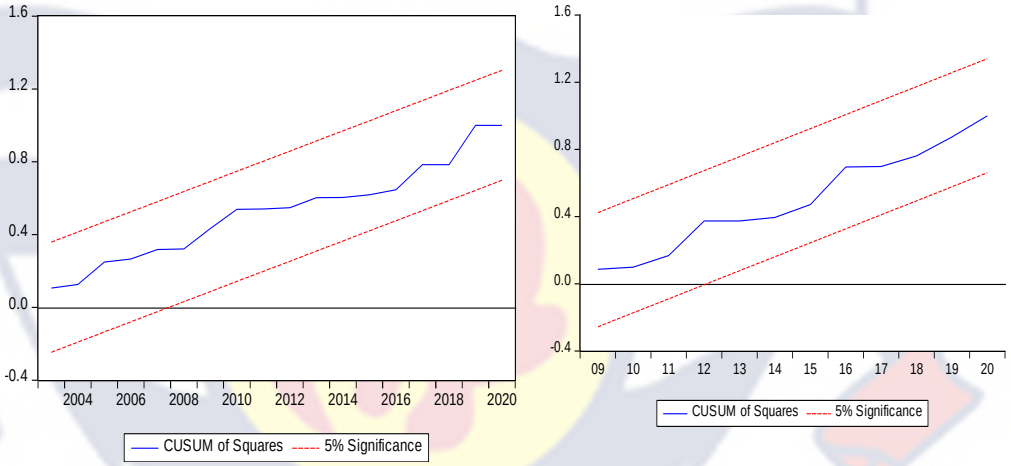

Figure 7: Stability Test from CUSUM of Squares

Chapter Summary

This chapter presented the descriptive statistics of the study. It also examined the time – series properties of the data used for the estimation and also presented and discussed the results. The unit root tests were conducted using both the ADF and PP techniques, however, some of the series had to be differenced once to achieve stationarity. The series were integrated of order I (0) and I (1). The presence of non – stationarity variable implies the possibility

of the presence of a long- run relationship. which the study verified using the bounds testing approach to cointegration.

The result showed the presence of cointegration relationship between foreign direct investment, external debt, interest rate differential, trade openness, consumer price index, domestic credit to private sector and exchange rate volatility. Foreign direct investment to have an asymmetric effect on exchange rate volatility in the long run. The results of the ECM showed that error correction for exchange rate volatility did carry the expected negative sign.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

Introduction

The aim of this final chapter is to present the summary, conclusions and recommendation for the entire. The purpose is to show the major findings of the study and also suggest policy recommendation as a remedy to ensure an improved and stabilized exchange rate. The chapter also present the direction for future research.

Summary

The main purpose of the study is to conduct an empirical investigation into the symmetric and asymmetric effect of foreign direct investment and external debt on exchange rate volatility in Ghana both in the long run and short run. The study examines the effect of FDI and external debt on exchange rate volatility in Ghana using the Linear ARDL model and Nonlinear ARDL model to analyze the asymmetric effect of FDI and external debt on exchange rate volatility in Ghana. The study used an annual time series data from the period of 1987 to 2021.The study employed foreign direct investment (FDI), External debt (EXTDEBT), interest rate differential (INTDIFF), Consumer price index (CPI), Trade openness (TRADE) and Domestic credit to private sector (DCPS).

These variables were first tested for the existence of unit roots using the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) test of unit roots. This was done in order to determine their order of integration. The ADF and the PP test revealed that all the variables employed in this study were integrated of order one ($I(1)$). The study then advanced to examine the long-

run and short-run relationships between FDI, external debt and exchange rate volatility using the ARDL approach to cointegration. The result from the cointegration test indicated the existence of a cointegrating relationship between exchange rate volatility and its explanatory variables. This outcome justified the estimation of a long-run and short-run relationships between exchange rate volatility and its explanatory variables including FDI and external debt.

The estimate of the LARDL model indicate that foreign direct investment,external debt, interest rate differential, trade openness and domestic credit private sector have a significant effect on exchange rate volatility in the long run. FDI and external debt both had a negative effect on exchange rate volatility in the long run. This implies that the coefficient for both FDI and external debt was positive, indicating that an increase in either of them leads to increase in exchange rate volatility in the long run.Interest rate differential also has a significant positive coefficient in the long run.

However, trade openness had a significant negative coefficient, indicating an increase in trade openness will reduce exchange rate volatility in the long run. With the exception of external debt and trade oppeness ,all the variables in the short run model had an insignificant effect on exchange rate volatility. The error correction term,was negative and significant. This means that the economy will be able to recover from the previous year's shock. More specifically, the error correction term implied that, about 88 percent of the previous year's disequilibrium was adjusted in the current period.

The estimate of the NARDL model shows that a positive shock in FDI will result in an increase in exchange rate volatility in the long run. However,

a negative shock will still result in increase in exchange rate volatility in the long run. This confirms an asymmetric effect of FDI on exchange rate volatility in the long run. The NARDL model also revealed that a positive shock in external debt shows an insignificant negative relationship with exchange rate volatility. However, a negative shock will lead to an increase in exchange rate volatility in the long run. The short run estimate confirms asymmetric effect both FDI and ext1ernal debt. The Error Correction term obtained from the short run estimation did carry the expected negative sign and was significant indicating that disequilibrium in the short run is corrected in the run.

Conclusions

Firstly, based on the results obtained from the LARDL model, the study concludes that there is a negative effect of FDI and external debt on exchange rate volatility in the long run. Specifically, an increase in FDI flow into the country will increase rate volatility. Likewise, an increase in external debt will also result in an increase in exchange rate volatility in Ghana in the long run.

Secondly, based on the estimate of the NARDL model, the study concludes that there is an asymmetric effect of FDI on the exchange rate volatility in the long run. However, there is an asymmetric effect of both FDI and external debt on exchange rate volatility in the short run. Considering these findings, it appears that the role of FDIs and external debt contributes to the erratic movement of the exchange rate.

Recommendations

Based on the findings of the study, the following recommendations are proposed to policymakers. Achieving a stable exchange rate is fundamental and non-negotiable. The first step in addressing this volatility will be to encourage higher-quality and more stable FDI inflows through the Ghana Investment Promotion Center (GIPC) by implementing policies that attract long-term investments with a focus on strategic sectors. This can help reduce the volatility associated with short-term capital flows and promote sustainable economic development. Also, is the need to strengthen regulatory frameworks and oversight to manage capital flows effectively and prevent speculative activities that may contribute to exchange rate volatility.

This may involve implementing measures such as capital controls or prudential regulations to manage the inflows and outflows of foreign currency. Also, as much as possible, local business must be supported to venture into the fields of some multinational companies. This will help keep reduce the number of repatriations that goes out as profits at the end of every financial year. There is also the need to encourage diversification in the sources of FDI to reduce the concentration risk and reduce asymmetric effects on exchange rate volatility. Actively seek investments from a variety of countries and regions to promote a more balanced and stable FDI inflow.

The study's finding also demonstrated that external debt influences exchange rate volatility in the long-run. The study therefore recommends that government should evolve a more efficient external debt management strategies that would ensure that foreign loans which will not enhance the value and exchange rate of the Ghanaian cedi is avoided. This may involve

prudent borrowing practices, diversification of funding sources, and careful monitoring of debt sustainability indicators. Going forward, foreign loans with concessionary low interest rates and long maturity periods should be the target of government. Institutions must also be strengthened to check misappropriation of external loan resources. Enhance debt sustainability analysis to account for potential asymmetric effects on exchange rate volatility. This can help guide borrowing decisions and ensure that the country's external debt remains manageable, even in the face of adverse asymmetric shocks.

Future Direction of Research

Future studies in the field can expand the analysis by investigating the effects of external debt and foreign direct investment (FDI) on exchange rate volatility within broader contexts such as regional blocs like the Economic Community of West African States (ECOWAS) or the entire African continent. By examining exchange rate dynamics at a regional level, researchers can gain insights into the influence of regional integration, trade agreements, and broader economic dynamics on exchange rate volatility. Furthermore, to provide a more comprehensive understanding of the factors affecting exchange rates, future studies can consider including additional variables alongside external debt and FDI. These variables may encompass macroeconomic indicators such as inflation rates, interest rates, fiscal deficits, and monetary policy measures. Additionally, factors like trade dynamics, political stability, governance, capital flows, and global economic conditions can be explored to determine their impact on exchange rate volatility. By incorporating these factors into the analysis, researchers can obtain a more

holistic understanding of the complex interactions and drivers of exchange rate fluctuations. Moreover, employing advanced econometric techniques and conducting comparative studies across different countries or regions can enhance the accuracy and generalizability of the findings, providing valuable insights for policymakers and researchers alike.

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APPENDICES

Table 10: Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.829868	Prob. F(2,16)	0.4540
Obs*R-squared	2.913510	Prob. Chi-Square(2)	0.2330

Test Equation:

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VOL1(-1)	0.063213	0.226693	0.278848	0.7839
VOL1(-2)	0.124709	0.229778	0.542735	0.5948
VOL1(-3)	-0.011099	0.202390	-0.054842	0.9569
FDI	0.072476	0.559119	0.129626	0.8985
FDI(-1)	-0.185167	0.630184	-0.293830	0.7727
FDI(-2)	-0.050693	0.642132	-0.078944	0.9381
FDI(-3)	0.090407	0.403472	0.224073	0.8255
TRADE	-0.017366	0.066897	-0.259593	0.7985
EXT_GDP	0.001849	0.041558	0.044503	0.9651
INTERESTDIFFERENTIAL	0.017235	0.104283	0.165276	0.8708
LCPI	-0.201693	0.857152	-0.235306	0.8170
DCPS	0.236894	0.477627	0.495982	0.6267
C	-1.488077	3.423058	-0.434722	0.6696
RESID(-1)	-0.269285	0.333560	-0.807306	0.4313
RESID(-2)	-0.401790	0.360799	-1.113612	0.2819

R-squared	0.093984	Mean dependent var	-2.73E-15
Adjusted R-squared	-0.698780	S.D. dependent var	1.970665
S.E. of regression	2.568511	Akaike info criterion	5.030873
Sum squared resid	105.5560	Schwarz criterion	5.724738
Log likelihood	-62.97853	Hannan-Quinn criter.	5.257056
F-statistic	0.118553	Durbin-Watson stat	2.052995
Prob(F-statistic)	0.999878		

Table 11: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.994297	Prob. F(12,18)	0.4901
Obs*R-squared	12.35748	Prob. Chi-Square(12)	0.4174
Scaled explained SS	3.088778	Prob. Chi-Square(12)	0.9949

Test Equation:

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.015523	5.842250	-0.344991	0.7341
VOL1(-1)	-0.773325	0.351344	-2.201045	0.0410
VOL1(-2)	-0.491828	0.346580	-1.419090	0.1730
VOL1(-3)	-0.538093	0.366633	-1.467662	0.1595
FDI	1.215487	0.883468	1.375813	0.1858
FDI(-1)	-0.989110	1.101236	-0.898182	0.3809
FDI(-2)	0.990621	1.158520	0.855074	0.4037
FDI(-3)	0.018634	0.719019	0.025915	0.9796
TRADE	-0.188170	0.117329	-1.603780	0.1262
EXT_GDP	0.210478	0.074907	2.809843	0.0116
INTERESTDIFFERENTIAL	0.106315	0.185874	0.571972	0.5744
LCPI	2.100613	1.515037	1.386510	0.1825
DCPS	-0.082216	0.750760	-0.109511	0.9140

R-squared	0.398628	Mean dependent var	3.758247
Adjusted R-squared	-0.002286	S.D. dependent var	4.651984
S.E. of regression	4.657299	Akaike info criterion	6.209842
Sum squared resid	390.4277	Schwarz criterion	6.811192
Log likelihood	-83.25256	Hannan-Quinn criter.	6.405867
F-statistic	0.994297	Durbin-Watson stat	2.978153
Prob(F-statistic)	0.490108		

Table 12: Ramsey RESET Test

	Value	df	Probability
t-statistic	0.710057	17	0.4873
F-statistic	0.504181	(1, 17)	0.4873

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	3.355763	1	3.355763
Restricted SSR	116.5056	18	6.472536
Unrestricted SSR	113.1499	17	6.655876

Unrestricted Test Equation:

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
VOL1(-1)	-0.594080	0.303128	-1.959835	0.0666
VOL1(-2)	-0.458311	0.214546	-2.136191	0.0475
VOL1(-3)	-0.468641	0.277716	-1.687481	0.1098
FDI	0.611318	0.544103	1.123534	0.2768
FDI(-1)	-0.193061	0.640508	-0.301418	0.7668
FDI(-2)	0.743154	0.672560	1.104963	0.2846
FDI(-3)	0.618315	0.423443	1.460211	0.1625
TRADE	-0.241770	0.097284	-2.485201	0.0237
EXT_GDP	0.195858	0.076785	2.550744	0.0207
INTERESTDIFFERENTIAL	0.174545	0.112275	1.554622	0.1385
LCPI	-1.006785	0.847235	-1.188319	0.2510
DCPS	0.802602	0.487547	1.646206	0.1181
C	-1.406514	3.326230	-0.422855	0.6777
FITTED^2	0.023949	0.033728	0.710057	0.4873

R-squared	0.760549	Mean dependent var	3.185982
Adjusted R-squared	0.577439	S.D. dependent var	3.968788
S.E. of regression	2.579898	Akaike info criterion	5.035829
Sum squared resid	113.1499	Schwarz criterion	5.683436
Log likelihood	-64.05535	Hannan-Quinn criter.	5.246933
F-statistic	4.153514	Durbin-Watson stat	2.116262
Prob(F-statistic)	0.003603		

*Note: p-values and any subsequent tests do not account for model

Table 13: Breusch-Godfrey Serial Correlation LM Test

F-statistic	1.653160	Prob. F(2,10)	0.2397
Obs*R-squared	7.702799	Prob. Chi-Square(2)	0.0212

Test Equation:

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VOL1(-1)	0.098267	0.195493	0.502663	0.6261
FDI_POS	-0.583561	0.641682	-0.909424	0.3845
FDI_NEG	0.392238	0.994512	0.394402	0.7016
TRADE	-0.128722	0.126274	-1.019385	0.3320
TRADE(-1)	0.029659	0.076170	0.389375	0.7052
TRADE(-2)	-0.019741	0.049266	-0.400695	0.6971
EXT_GDP_POS	0.034980	0.085709	0.408128	0.6918
EXT_GDP_POS(-1)	0.017833	0.078237	0.227934	0.8243
EXT_GDP_NEG	0.063543	0.104163	0.610037	0.5554
EXT_GDP_NEG(-1)	0.028737	0.086913	0.330645	0.7477
EXT_GDP_NEG(-2)	-0.047557	0.097945	-0.485545	0.6378
INTERESTDIFFERENTIAL	0.076833	0.131369	0.584866	0.5716
INTERESTDIFFERENTIAL(-1)	-0.102533	0.150174	-0.682761	0.5103
LCPI	-1.271424	8.712582	-0.145930	0.8869
LCPI(-1)	8.561527	11.78777	0.726306	0.4843
LCPI(-2)	-3.509145	9.660824	-0.363235	0.7240
DCPS	0.427556	0.508871	0.840206	0.4204
DCPS(-1)	-0.281628	0.539940	-0.521592	0.6133
C	2.844899	5.057352	0.562527	0.5861
RESID(-1)	-0.895218	0.503791	-1.776965	0.1059
RESID(-2)	-0.475600	0.516617	-0.920605	0.3789

R-squared	0.248477	Mean dependent var	-2.82E-14
Adjusted R-squared	-1.254568	S.D. dependent var	1.202938
S.E. of regression	1.806237	Akaike info criterion	4.243806
Sum squared resid	32.62494	Schwarz criterion	5.215216
Log likelihood	-44.77899	Hannan-Quinn criter.	4.560461
F-statistic	0.165316	Durbin-Watson stat	2.010357
Prob(F-statistic)	0.999676		

Table 14: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.656598	Prob. F(18,12)	0.7963
Obs*R-squared	15.38206	Prob. Chi-Square(18)	0.6356
Scaled explained SS	3.413275	Prob. Chi-Square(18)	0.9999

Test Equation:

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6.702433	6.907390	-0.970328	0.3510
VOL1(-1)	-0.249018	0.284463	-0.875396	0.3985
FDI_POS	-0.199575	0.826354	-0.241512	0.8132
FDI_NEG	-2.629253	1.469331	-1.789422	0.0988
TRADE	0.153277	0.150277	1.019967	0.3279
TRADE(-1)	-0.014719	0.111841	-0.131602	0.8975
TRADE(-2)	-0.039676	0.072519	-0.547103	0.5943
EXT_GDP_POS	0.127608	0.127067	1.004259	0.3351
EXT_GDP_POS(-1)	-0.038153	0.107877	-0.353670	0.7297
EXT_GDP_NEG	-0.141122	0.148796	-0.948426	0.3616
EXT_GDP_NEG(-1)	-0.001020	0.128169	-0.007958	0.9938
EXT_GDP_NEG(-2)	-0.095371	0.143058	-0.666660	0.5176
INTERESTDIFFERENTIAL	0.119996	0.187105	0.641331	0.5334
INTERESTDIFFERENTIAL(-1)	0.352691	0.210192	1.677946	0.1192
LCPI	-16.45435	12.55396	-1.310690	0.2145
LCPI(-1)	1.582466	16.12942	0.098111	0.9235
LCPI(-2)	-4.553724	14.40615	-0.316096	0.7574
DCPS	0.634899	0.645656	0.983339	0.3449
DCPS(-1)	0.003319	0.784109	0.004232	0.9967

R-squared	0.496196	Mean dependent var	1.400380
Adjusted R-squared	-0.259511	S.D. dependent var	2.449853
S.E. of regression	2.749420	Akaike info criterion	5.137383
Sum squared resid	90.71170	Schwarz criterion	6.016278
Log likelihood	-60.62943	Hannan-Quinn criter.	5.423881
F-statistic	0.656598	Durbin-Watson stat	2.607814
Prob(F-statistic)	0.796297		