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The response of the Ghana Stock Exchange Composite-Index to domestic and foreign monetary policy shocks.

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Acknowledgement

Abstract

The marked volatility of the Ghana Stock Exchange (GSE) during some periods have prompted an in-depth study to analyze how the monetary policy functions such as the foreign interest rate, the real GDP growth rate, the real inflation rate, the domestic interest rate, the rate of growth in money supply and the exchange rate impact on stock market performances in Ghana. This study utilizes a structural vector-autoregressive (SVAR) econometric model by which the impulse response functions (IRF) and the forecast error variance decomposition (FEVD) are used to analyse the relationship of the variables to changes in the GSE-CI value. In line with economic theory, a contractionary foreign and domestic monetary policy shocks cause the Ghana Stock Exchange Composite Index (GSE-CI) to decline. From the study, we found out that the foreign monetary policy innovations in response to the 2007 financial crisis have little impact on the Ghana interest rate and as such accounts for a very small percentage of the fluctuations to the Ghana Stock Exchange Index. During the QE, the monetary policy innovations (the shocks to the foreign and domestic interest rate) increased slightly in explaining the variations to the GSE-CI.

Finally, the exchange rate responds significantly to a contemporaneous shocks to the ineterst rate to affect the GSE-CI. Thus, a shock to the domestic interest rate has the capacity to reorient the exchange rate of the Ghanaian economy. Thus, domestic interest rate shocks through its operations with the exchange rates will significantly impact on the performance of the Ghana Stock Exchange.

Chapter one: Introduction

Chapter two: Background of research

Chapter three: Theory and literature review

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List of abbreviations

BoG	Bank of Ghana
BoE	Bank of England
BoJ	Bank of Japan
CEPA	Centre for Policy Analysis
CIEA	Bank of Ghana's Composite Index of Economic Activity
DJIA	Dow Jones Industrial Average
ECB	European Central Bank
EIA	US Energy Inflormation Administration
EMH	Efficient Market Hypothesis
FDI	Foreign Direct Investment
FOMC	Federal Open Market Committee
FR	Foreign Interest Rate
GIPC	Ghana Investment Promotion Centre
GoG	Government of Ghana
GSE	Ghana Stock Exchange
GSEASI	Ghana Stock Exchange all Share Index
GSE-CI	Ghana Stock Exchange Composite Index
GDP	Gross Domestic Product
HDI	Human Development Index
HIPC	Highly Indebted Poor Country
IAPM	International Asset Pricing Models
IT	Inflation Targeting
IMF	International Monetary Fund
LIBOR	London Interbank Offered Rates
LSAP	Large Scale Asset Purchases
MBS	Mortgage Backed-Securities

MDRI	Multilateral Debt Relief Initiative
M-F	Mundell-Fleming model
MT	Monetary Targeting
MOPC	Monetary Policy Committee
NPA	National Petroleum Authority
NPL	Non-performing loans
NYSE	New York Stock Exchange
OECD	Organization for Economic Co-operation and Development
OIS	Overnight Indexed Swap
OMO	Open Market Operations
PRGF	Poverty Reduction and Growth Facility
QE	Quantitative Easing
YTD	Year -to-Date

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

From January 2000 to December 2017, Ghana underwent a series of monetary developments such as the pursuit of an inflation targeting strategy, the redenomination of the local currency and the integration of the Ghana stock market into the international financial market. Over the same period, the US economy also went through a cycle of booms and busts: ranging from the financial crisis in 2007 to 2008 which spilled-over to affect the global economy. In response, the Bank of Ghana was required to implement policy decisions to prevent the short-term liquidity crisis in the early years of 2000 from morphing into a long-term economic insolvency on the domestic market. The Ghanaian economy within this period transitioned to record GDP growth rate of 9.1 percent in 2008 from the 2000 figure of 3.7 percent and a further rise of 14.0 percent in 2011. Also, the rate of inflation fell to 18.1 percent in 2008 from the 2000 figure of 40.5 percent and further trended down to 8.58 percent in 2011, while the exchange rate also stabilized to augment the working of an efficient financial market.

Monetary policy strategies which involve the use of different measures such as credit controls, open market operations, bank reserve requirements etc. have been implemented by Central banks of nations to provide support to their economies. Typically, the Central bank of a country has a set of objectives such as attaining price stability, maintenance of balance of payments equilibrium, creation of employment, output growth, and sustainable development through regulating the supply of money (Quartey & Afful-Mensah, 2014). The Central bank to stimulate an economy may utilize instruments of monetary policy: open market operations, the discount rate or the reserve requirements. These tools can also effectively manage the liquidity conditions in the financial markets to deliver stability in the price levels of all goods and services in the economy.

The monetary policy rate serves as the benchmark interest rate of monetary authorities. The policy rate which is the chiefly used tool of monetary policy could have an indirect effect on the macroeconomic variable through the policy transmission mechanism. Ireland (2010) defines the monetary policy transmission mechanism as the process by which monetary policy decisions induce changes in the stock of money supply or short-term interest rates to affect real macroeconomic variables. That is, the policy transmission mechanism is when adjustments in

monetary policy rates interact with other macroeconomic variables such as: inflation, the rate of money supply growth, economic growth rate, exchange rate, interest rate, unemployment levels, etc. to affect changes in the economy.

The revival of the interest in monetary policy and its associated effects on the macro-economy reflects monetary developments such as the evolution of other forms of money such as the narrow money (M0 and M1) and broad money (M2, M2+, M3) to bolster the global economy. The narrow money involves all currency (notes and coins) in circulation, till moneys, banker's deposits and other money equivalents that are easily convertible to cash. The broad money makes up the savings deposits, time deposits, and certificates of deposits, foreign currency and money market funds that have a maturity of more than 24 hours.

In the post-2008 era through 2014, the Central banks of many developed economies such as the Federal Reserve of US, the Bank of England (BoE), the European Central Bank (ECB), and the Bank of Japan (BoJ) among others because of the adverse economic effect of the global financial crisis instituted monetary policy measures to provide stimulus. The Central banks of these large economies responded to this widespread economic crisis by implementing unconventional monetary policy measures to induce spending, bolster industrial productions, reduce unemployment and ensure proper functioning of their local markets. Joyce, Miles, Scott, and Vayanos (2012) emphasize that unconventional monetary policy involve actions by the Central bank to influence the prices and output of the economy through the purchases of long-term assets to increase liquidity while reducing the rate on short-term financial instruments. It could take the form of the use of negative interest rates, as is the case in Denmark. In the event of appropriate measures to revive the ailing global financial system and boost investors' confidence, the Federal Reserve, ECB, BoE, pursued interest rate cuts, capital injection and guaranteed lending facilities to steady the declines on stock market indices.

Ghana presents a good example of a small open economy that has periodically become susceptible to macroeconomic developments and the policy responses in the US, European Union (EU), Japan, and China etc. The financial crisis which originated from the US's own subprime mortgage market resulted in a slowly marked growth rate for Ghana which has strong trade relations with the US and the EU. During the economic downturn, the US and the EU tightened their external finances to economies that were politically and economically unstable. This therefore contributed to the bloat of the current account deficit of such economies that relied extensively on portfolio inflows to finance their current account (Gurara & Ncube, 2013).

However, Ghana during the QE program enjoyed a breather as most investors who sought a premium on their investments diverted their funds away from relatively riskier countries to the political and economic stable destinations.

1.2 Problem of the study

In 2007, the global economic weakness resulted in the drops of stock indices around the world with the broad-based indices of the New York Stock Exchange (NYSE): S&P 500 and the DJIA recording minimal gains of 5.49 and 6.43 percent, compared with year-to-date (YTD) returns of 15.79 and 16.29 percent recorded in 2006, respectively, based on historical data retrieved from investing.com. The blue-chip stock index on the London Stock Exchange (FTSE 100) also followed suite to record YTD gains of 3.80 percent in 2007 compared with 10.71 percent recorded in 2006. However, the Nikkei 225 of Japan was completely battered with the global economic crunch with the benchmark index recording an YTD loss of 11.13 percent in 2007 compared with 6.92 percent gains recorded in 2006[1].

Despite the comparatively poor performance of global stock indices which sent the major indices tumbling, the Ghana Stock Exchange All Share Index (GSEASI) was an exception.   Based on data retrieved from the Ghana Stock Exchange, the analysis made indicated that the principal index of the bourse closed 2007 at 6,595.63 points, a year-to-date return of 31.84 percent and continued its green YTD trajectory of 58.16 percent at an index level of 10,431.64 in 2008. Similarly, on December 2013, the GSE Composite Index (GSE-CI) closed higher at 2,145.2 points to clinch a YTD gain of 78.8 percent compared with a 2012 point of 1,199.72 at a YTD of 23.8 percent[2].

After the global financial crisis, Lim, Mohapatra, and Stocker (2014) posit that of about 62 percent growth of global gross outflows from the US went to developing countries. The funds were transferred to enhance the global monetary conditions in 2009. Of these transfers, the QE accounted for 5 percent of the outflows to developing economies. Foreign outflows from the US to developing nations during the pursuit of QE rose by $406 billion to $598 billion, contributing immensely to the support on the stock markets and the real exchange rate in these regions. Due to the lower interest rates on investments in the US and the EU, emerging and developing

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[1] Investing.com. Major world indices. https://www.investing.com/indices/major-indices / Accessed 01.03.18
[2] Annual Reports Ghana. Market data.
http://www.annualreportsghana.com/Home/Documents/Miscellaneous/Archive/ARG---GSE-Market-Returns-(1990-2017).aspx/ Accessed 01.03.18

economies that had stable political and economic environment with appreciably promising investment returns became the ideal investment destinations of most funds.

Many factors such as exchange rate, inflation etc. have been studied to investigate the relationship that exists between monetary policy and the performance of stock markets across time (Humpe & Macmillan, 2009). Theoretically, monetary policy decisions through the operations of the financial markets affect other macroeconomic variables both in the short and long term. The changes in the policy decisions could move from interest rates to exchange rates through to stock prices. The stock market performance is also "all other things being equal" dependent on macroeconomic variables such as real gross domestic product, inflation, real interest rate, real effective exchange rate, amount of capital flows from overseas, amount of money supply and unemployment reports etc. which are influenced by both monetary and fiscal policies.

Much work has been devoted to the interaction between monetary policy and stock returns (Adam & Tweneboah, 2008; Kyereboah-Coleman & Agyire-Tettey, 2008), but with less focus on how the policy decisions interacts with external factors to affect the Ghanaian stock market. The stock market and the money market may be classified as perfect substitutes, in that a movement in the returns of stock prices would lead to a shift of the demand curve for money-market instruments "all other factors being constant." In the long term, an increase in the policy rate which translates to higher interest rates would inform investors to move funds away from the stock market to interest-bearing instruments.

Ghana is chosen for the analysis for the following reasons: Most research on the effect of monetary policy on other macroeconomic variables has been carried out in advanced economies such as the US, Europe, Asia (Hsing, 2013; Kontonikas & Kostakis, 2013; Parrado, 2001). However, much less work has been conducted on African countries and especially Ghana. In addition, the Ghana Stock market experienced much volatility since the implementation of QE in line with the global stock market response to the policy. This study will therefore contribute to the existing literature on monetary policy by estimating the reactions of the Ghana's stock market to Ghana's and the US's monetary policy strategies during 2000-2017. The study utilizes monthly data to estimate the relationship between monetary policy shocks in Ghana and how it inter-relates with the US monetary policy decisions to affect the Ghana stock market.

The study is conducted in two phases. Firstly, we conduct an anlysis on the response of the local stock market to the domestic monetary policy shocks. Secondly, we identify the response of

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the Ghana Stock Exchange Composite-Index to changes in the US interest rate in the advent of QE. Specifically, the study seeks to answer the following questions:

1.3 Research questions

1. How does the Ghana stock market respond to domestic monetary policy shocks?
2. How does the policy rate in Ghana interact with the US monetary policy rate during QE to affect the Ghana Stock market?

There has been increasing interest in studying the relationship that exist between stock markets and interest rates and how the domestic stock market reacts to external economic variables during crisis. In line with the fore-going questions above, the Bank of Ghana has been interested in identifying the response on the Ghanaian economy to foreign shocks and the appropriate policy decisions it has to embark on at different economic instances. Financial and economic analyst have been interested in identifying the effectiveness of monetary policy decisions in impacting the Ghana Stock Exchange. The study is conducted by analyzing both the short-and long-run dynamic relationship between monetary policy rates and stock market using monthly data from January 2000 to December 2017, using the Johansen's cointegration rank test. A structural vector autoregressive (SVAR) model would be utilized to explain the instantaneous relationships among the variables that are considered in the study. This thesis seeks to provide detailed information to the Government of Ghana, the Bank of Ghana, investors, policy analysts, financial role players in Ghana and around the globe concerning monetary policy developments, and to make contributions on the current debate in literature as to wether the Bank of Ghana should be concerned about monetary policy decisions in the US.

1.4 Organization of study

The thesis comprises of six chapters. The first chapter introduces the study and identifies the difficulties faced by Ghana's monetary authorities from the QE applied by the US. Chapter 2 provides some background into Ghana's monetary policy since the 1980 and presents selected macroeconomic indicators before giving a historical context to the use of QE and non-conventional monetary policy. Chapter 3 provides a theoretical foundation for use of monetary policy and how its effects can be transmitted across countries, review of the existing literature to small open economies and a formal theoretical treatment of when QE is required. The literature on the interrelationship of several macroeconomic variables are also detailed. The data and

variables to be used in the analysis are identified and the model to be estimated is constructed in chapter 4. The results and important insights are reported and discussed in chapter 5. The conclusions, limitations of the study and suggestions for possible further research are highlighted in chapter 6.

CHAPTER TWO
BACKGROUND OF RESEARCH

2.1 Introduction

The importance of monetary policy largely stems from the potency of it in addressing unemployment, price instabilities in an economy. Monetary authorities have relied extensively on the effectiveness of the policy rate in anchoring the price stability objective of economies and keeping inflation in check. However, the monetary policy rate does not work in isolation but relates directly through the interest rate channel and indirectly through its influence on the exchange rate and asset prices to affect the macroeconomy.

Despite the differing views on the effectiveness and reliability of the choice of an appropriate channel by which monetary policy decisions affect national output, financial and monetary economists alike have had keen interest in explaining how the policy decisions operate in the economy and how such decisions impact the interest rate, unemployment, inflation, exchange rate and asset prices. The monetary transmission mechanism is very dynamic in its relationship with several economic variables on uncertain time lags, thereby making it difficult to predict the precise effect of a specific transmission mechanism on the economy. Thus, the effect of a policy decision on the economy and its linkages with other economic indicators varies across different time periods. In light of this, Boudoukh, Richardson, and Whitelaw (1994) have attempted to classify the impact of monetary policy decisions on the real economy as an empirical question. However, Cassola and Morana (2004) and Ioannidis and Kontonikas (2008) have shown significant transmission of policy decisions on real GDP, inflation, real interest rate, stock returns, money supply and the exchange rate.

The monetary policy decisions are undertaken with an eye on the aggregate demand through its efforts to offer incentives for the monitoring of the asset prices as well as stem inflationary pressures in the short-run. In the same manner as consumption, monetary policy influences the wealth of an economy by reinforcing a process of portfolio adjustments. This portfolio adjustment in the wealth of a nation may take place through the interest or exchange rate channel. Ghana presents a classical example of an economy that has undergone monetary policy adjustments since independence in 1957.

2.2 Macro-economic Outlook (Ghana)

Several macro-economic variables interrelate to affect the Ghanaian economy. The Ghanaian economy is influenced by the interactions of the fiscal and monetary data that prevail in the economy at a period.

2.2.1   Selected Ghana Economic Data (2000-2017)

The table 1 below gives an overview of how the Ghanaian economy has fared since 2000 to 2017. In the table, historical data on inflation, GDP growth rate, budget deficit, public debt percent of GDP, monetary policy rate, GSE-Composite Index and the foreign exchange reserves are outlined.

Table 1. Summary of macro-economic variables (2000-20017)

Year	Inflation (y-o-y %)	GDP Growth (y-o-y %)	Budget Deficit (% of GDP)	Public Debt (%of GDP)	Monetary Policy Rate (%)	GSE-Composite Index (YTD %)	FX. Reserves (Months Cover)
2000	40.5	3.7	8.5	188.6	27.0	16.55	0.8
2001	21.3	4.2	4.4	147.3	27.0	11.42	1.5
2002	17.0	4.5	6.3	140.0	24.5	45.96	2.0
2003	31.3	5.2	3.4	127.6	21.5	154.67	3.9
2004	16.4	5.6	3.2	97.9	18.5	91.33	3.8
2005	13.9	5.9	2.0	83.4	15.5	-29.72	4.0
2006	10.9	6.4	7.8	46.1	12.5	5.21	3.4
2007	12.7	6.3	5.5	48.4	13.5	31.21	2.5
2008	18.1	9.1	11.5	33.6	17.0	58.16	1.8
2009	16.0	4.8	6.4	36.33	18.0	-46.58	2.4
2010	8.58	7.9	8.8	37.81	13.5	32.25	3.2
2011	8.58	14.0	4.3	39.67	12.5	-3.10	3.10
2012	8.84	9.3	11.8	47.8	15.0	23.81	3.00
2013	13.5	7.3	10.1	56.8	16.0	78.81	3.10
2014	17.0	4.0	10.2	70.2	21.0	5.40	3.9
2015	17.7	3.8	7.5	72.2	26.0	-11.77	2.8
2016	15.4	3.7	10.3	73.1	25.5	-15.33	3.5
2017	11.8	7.9	4.5	68.27	20.0	52.73	3.9

Sources: Ministry of Finance-Ghana, Bank of Ghana, and Ghana Statistical Services

2.2.2 Background on Ghana's Economy (2000-2017)

The Ghanaian macro-economy over the period 2000-2017 has gone through prolonged macroeconomic booms and busts due to domestic and foreign market fundamentals. This section presents an overview of the Ghanaian economy with reference to the data contained in the table 1.

2.2.2.1 Real and Fiscal Developments

From the data above in table 1, the Ghanaian macroeconomy has chartered through booms and busts for the period of the research due to domestic and foreign economic developments fiscal instabilities which has resulted in the deficient performance of the national budget than planned in the duration of the studies. The fiscal slippages in the Ghanaian economy have been underscored by slow economic growth, high budget deficit, weakened currency, and problems with energy supply, low international reserves, falling commodity prices, high public debt burden, high interest rates, and the Government of Ghana's usual penchant to spend beyond its revenue collection limits. According to Owusu-Nantwi and Erickson (2016), following the lower revenue generation due to weak tax regimes and low incomes, developing nations prefer to take on debts to finance governments budget. In Ghana, the usual demand by government to take more debts culminated in an unsustainably high debt to GDP which averaged 198.3 percent and a budget deficit of 8.5 percent of GDP in 2000[3]. According to the summary report by the Centre for Policy Analysis Ghana (CEPA), in the face of the macroeconomic instabilities, the International Monetary Fund (IMF), the World Bank, and other bilateral donor agencies provided support to the ailing Ghanaian economy through cancellation of debt and debt relief under the Highly Indebted Poor Country (HIPC) initiative and Multilateral Debt Relief Initiative (MDRI) in July 2004. The government of Ghana beforehand embarked on economic program under the theme Poverty Reduction and Growth Facility (PRGF) from 1999-2002 to solicit for support to enhance considerable strides to reduce poverty.

According to the data presented in table 1, the Ghanaian economy during the commencement of the stabilization programs in early 2000 together with improved economic management policies by the government of Ghana led to a turnaround with the public debt percent of GDP taking a sharp decline from 188.6 in 2000 to 97.9 in 2004. In the same period (2000-2004), the Government of Ghana's pursuit of fiscal consolidation, monetary discipline, and prudence in

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[3] Centre for Policy Analysis. The current state of the macro economy of Ghana 2000-2009. http://siteresources.worldbank.org/INTGHANA/Resources/CEPA_2009_Executive_Summary_final_distributio n.pdf. Accessed on 01.03.18

public expenditure contributed to the reduction in inflation rates from 40.5 percent in 2000 to 16.4 percent in 2004. In the face of improved macroeconomic management in Ghana, the real GDP growth took an upward trend from a decade low of 3.8 percent in 2000 to register its 2004 growth rate at 5.6 percent. Improvements in the fiscal and monetary positions of Ghana provided support for a sustained economic growth which thereby culminated in a decline in the government of Ghana's fiscal deficit from 8.5 percent of GDP in 2000 to 3.2 percent of GDP in 2004. The positive strides in the macro-economy were due to modernization of agricultural production which contributed immensely to the 2004 real-GDP with a remarkable 7.5 percent growth[4].

Notwithstanding the improvements in the government of Ghana's fiscal activities from 2000 to 2004, the 2006 budget of the government of Ghana resulted in a shortfall of 7.8 percent of GDP from 2.0 percent of GDP in 2005. The budget shortfalls were due to increased statutory payments, domestic interest payments and external debt service payment which rose by 10.0 percent from the 2005 figure of GHc1.8 billion to GHc 2.4 billion in 2006[5]. The fiscal situation in Ghana came under severe stress in 2006 as signs of pick-ups in inflation in the USA and other developed economies led most Central banks around the globe to respond by tightening monetary policy. These financial developments in the developed economies might have resulted in a slowdown of capital outflow to developing economies. According to the 2007 government of Ghana budget statement, in the eight-months-to the third quarter of 2006, following the rise in prices of crude oil on the international commodity market and the implementation of full cost-pass through policy by the National Petroleum Authority (NPA) of Ghana, there was a supply-side shock which invariably posed downside risk by engendering inflation expectations in the domestic market. In the period of these inflationary pressures, the Central bank moved from monetary targeting to pursue inflation-targeting to stem the growing inflation pressures in the economy. This according to table 1. resulted in an end of year inflation figure of 10.9 percent in 2006 from 13.9 percent recorded in 2005.

Between 2007/2008, the global economy witnessed an economic crisis, as well as hikes in prices of oil and food. In this period, according to the historical quotes from the Wall Street Journal, the major benchmark index of the US the S&P500 witnessed a downward movement from 1,418.30 in the opening of 2007 to 903.25 to close the index level in 2008, while the DJIA followed suit to

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[4] Ministry of Finance, Ghana. 2005 Budget Statement. https://www.mofep.gov.gh/sites/default/files/budget-statements/Budget2005.pdf/. Accessed 03.03.18
[5] Ministry of Finance, Ghana. 2007 Budget Statement. www.mofep.gov.gh/sites/default/files/budget-statements/budget2007.pdf/. Accessed 03.03.18

close 2008 at an index level of 8,776.39 from 13,264.82 recorded in the opening of 2007. Conversely, data from the US energy Information Administration (EIA) showed crude oil price witnessed a sharp increase from its 2007 opening price of $60.77 per barrel to end July 3rd, 2008 at a high of $145.31 per barrel before trending down to end 2008 at $44.60 per barrel. Despite the decline in investor's optimism and consumer's confidence about the global economy, the Ghanaian economy however witnessed mixed reports within the same period. The mixed reports in Ghana was due to a combination of external shocks, depreciation of the exchange rate and unsustainable macroeconomic policies which sparked rises in inflation rates from 12.7 percent in 2007 to 18.1 percent in 2008. Due to the economic downturn in the advanced economies, Ghana's external balances deteriorated owing to less revenue generation due to weak demand for exports, as well as slowdown in donor supports, declines in remittances and private capital inflows to the Ghanaian economy. The all-time hike in the price of crude oil based on oil price figure from the EIA from US$99.64 per barrel in January 2008 to a record high of US$145.31 in July 2008 on world market resulted in misses in the 2008 macroeconomic targets that were set by the 2008 budget, and thereby provided the incentive for rises in cost of productions.

Despite the slow global economic growth on the backdrop of the financial crisis, the Ghanaian economy chartered through to record an economic growth rate of 9.1 percent in 2008 backed by strong growth in bank credit. The increased accessibility to credit followed the interest rate developments which played critical role in the management of the Ghanaian economy. From the data above in table 1, the GDP growth rate further inched-up to 14.0 in 2011 as the issuance of many banking licenses to several foreign banks paved way for increased competition among banks. However, the public debt percent of GDP inched up from 33.6 percent in 2008 to 39.67 percent in 2011. The increase in the public debt was due to the increase in the portion of interest paid as a ratio of total revenue and grants as the means of financing for government budget shifted from bilateral and multilateral medium to commercial borrowing which required periodic interest payments with the principal amount to be paid on maturity.

The economic landscape of Ghana attained a turn-around with real GDP growth declining consistently from 14.0 percent in 2011 to 7.3 percent in 2013 and going down further to 3.7 percent in 2016 as shown in table 1. From the table 1, the public debt percent of GDP furthermore ballooned with the figures increasing to 56.8 percent in 2013 from 39.67 percent in 2011 and further rising to clinch 73.1 percent in 2016. The persistent increases in the public debt was due to excessive debt taken by the government of Ghana as the Bank of Ghana continued to finance more than 10 percent of the Government of Ghana's (GoG) budget.

The GoG's austerity measures coupled with domestic and external debt burdens and exacerbated macroeconomic imbalances resulted in slow rate of growth, high public debt percent of GDP and accelerated inflation rates. Investor's expectation of a downturn in the Ghanaian economy resulted in a rise in the rate on short-term instruments compared with long-dated instruments.

2.2.2.2 Monetary Developments

Due to the economic turbulences in the post 1990's in the Ghanaian economy which resulted in the rate of inflation picking at 40.5 percent and the Ghana Cedi depreciating by 49.5 percent against the US dollar in 2000, the Ghanaian Parliament passed a legislation that restricted the Bank of Ghana (BoG) to finance not more than 10 percent of the GoG's budget. The BoG'S legislation was premised on the fact that, money supply growth had been key to the inflationary pressures in the Ghanaian economy especially during 2000-2004 when the economy moved from monetary base control to an inflation targeting approach after 2006 (Kwakye, 2012).

The BOG in a bid to mop us the excess liquidity pursued contractionary monetary policy which therefore gave way for the effective operationalization of open market operations (OMO). Because of the key role of interest rate developments in the stabilization agenda of the Ghanaian economy, the figure in table 1 shows the monetary policy committee of the Central bank has consistently lowered the policy rate which stood at 27.0 percent in 2000 to 12.5 percent as at 2006. Under OMO, rises in rates of interest provided support to the domestic market which enhanced their increased purchases of government securities. Through tightened monetary policy, the Central bank succeeded in lessening the growth of broad money supply to 34.5 percent by June 2002. This was because money growth had been considered as the principal nominal anchor of a government's stabilization policies (Muço, Sanfey, & Taci, 2004). However, the broad money in the months to December 2003 rebounded to grow at 50.5 percent due to a 191.4 and 26.8 percent growth in net foreign and domestic assets respectively. Despite the difficulty in the control of money supply growth, the rate of inflation which were exhorbitantly high lowered to steady at 12.7 in 2007 before trending down to record single digit figures.

Because of the financial crisis in the USA in 2007/2008 which spilled over to affect the world economy, growth in the global economy fell from 4.229 percent in 2007 to -1.735percent in

2009[6]. The Ghanaian economy which trades predominantly with the USA and the European Union (EU) was not insulated from the global economic crunch considering the effect of the downturn on commodity prices as most investors flew to alternative investments as a form of haven. This thereby affected the flow of capital to developing economies. Despite the sluggish rate of growth in the international world, the Ghanaian economy continued to show a buoyant growth as data from the Bank of Ghana's Composite Index of Economic Activity (CIEA) which reflects the gains in economic activity as well as improved business and consumer sentiments showed an upward movement by 6.8 percent in Q3 of 2008.

In the event of excessive borrowings by the government of Ghana which resulted in raises in the public debt percent of GDP, the government of Ghana undertook policies to lengthen its domestic maturity debt profile by enhancing some benchmark bonds to assist secondary markets trading[7]. In spite of this, the rates on treasury securities remained unsustainably high with the short-medium term instruments (91 and 182-day treasury bills) rising above the yields on the medium-long term (1 year, 2 years, 3 years and 5 years) notes and bonds. In that regard, the cost of interest in Ghana compared unfavorably to yields on corresponding investments in its Sub-Saharan African peers. According to data from the Bank of Ghana, the 91and 182-day GoG treasury securities stood at 25.81 and 26.04 percent respectively at the 2015 openeing, up from the 2014 opening figures of 19.22 and 18.66 percent for the 91 and 182-day instruments respectively. These high rates were mainly due to fiscal overruns that were exacerbated by high budget and current account deficits, accelerating inflation, weakened foreign reserves, loss of policy credibility and the domestic financing of the fiscal deficit. In terms of inflation, the rates escalated from the 2013 figure of 13.5 percent to 17.0 percent in 2014, and 17.7 percent in 2015. During this time, the Central bank correspondingly hiked the policy rate from 16 percent in 2013 to 21.0 percent in 2014 and a further upward adjustment to 26 percent in 2015.

2.3 History of Monetary Policy in Ghana

The issue about whether Central bank's monetary policy decisions have any effect on stock market performance can similarly not be ruled out in the case of Ghana. Monetary policy correlates with the rate of interest that is, the price for loanable funds, the monetary base, and the

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[6] World Bank Group. GDP growth (annual %). https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG/. Accessed on 02.03.18

[7] Ministry of Finance, Ghana. 2017 Annual Debt Management Report. https://www.mofep.gov.gh/sites/default/files/reports/economic/2017-Annual-Debt-Management-Report.pdf/. Accessed on 01.06.18

reserve requirements of the banking sector to streamline economic operations to ensure stability of prices. Since the Great Financial Crisis of the 20th century (1914), that is, during the gold standard era, the volatilities of inflation and real output has encouraged the US Central bank to implement prudent monetary and fiscal policies to anchor the economy.

Monetary authorities around the world have resorted to either direct or indirect monetary policy in attaining stability and efficiency within their economy. Within the global environment, monetary policy has evolved from a system of direct credit controls to more of indirect approaches. In Africa, less of such transformations in monetary regimes had taken place until in the 1990's when economies within the sub-region begun to consciously institute indirect forms of such strategies (Quartey & Afful-Mensah, 2014). However, the absence of a developed secondary market for the trading of existing financial instruments in the 1990's made the use of the indirect monetary policy challenging (Ncube, 2008).

In the case of Ghana, monetary policy strategies have been dynamic and in line with the global characteristics to significantly affect other macroeconomic variables (Quartey & Afful-Mensah, 2014). Thus, the implementation of monetary policy may be adjusted periodically to affect related macroeconomic variables. In Ghana, the system for the delivering of an appropriate monetary policy approach to attain stability of prices has evolved from two distinct phases since independence: the monetary targeting regime from 1983-2006 and the inflation targeting regime after 2006 to date.

2.3.1 Monetary Targeting (MT) Framework
The effectiveness of monetary policy centers on the operating target that is used for achieving its aims. In that way, monetary authorities have been keen on having an independent Central bank that is isolated from the activities of the political cycle to deliver its main objective of price stability. Monetary targeting approach had been implemented in most advanced economies in the 1970's to curb inflationary pressures that persisted in the economies. Its implementation was successful in Germany and Switzerland in the 1970's while it was unsuccessful in the USA, UK and Canada (Mishkin, 2001a). According to the author, the unsuccessful implementation of monetary targeting approach in the case of the US stemmed from its failure to offer reliable relationship between monetary aggregates to nominal GDP and inflation when the Federal Reserve begun using monetary aggregates as medium to reduce unemployment rates and smoothen interest rates. This means that satisfying the monetary aggregate target will not

produce the desired goal of inflation expectations. The implementation of monetary gradualism failed in Canada because the monetary aggregate (M1) which was used as a policy tool to anchor inflation within its targets also failed. Mishkin (2001a) links the failure to the instability among economic variables and monetary aggregates as well as the lackadaisical approach of Central banks in the pursuit of inflation by the monetary targeting approach. In Germany, monetary targeting approach was successful because it was flexible in its operations. The Central bank (Bundesbank) successfully allowed the inflation rate to vary over-time and converge to its long-run inflation expectations.

According to Quartey and Afful-Mensah (2014), monetary policy in Ghana has transformed from the system of direct instruments to a market based approach where the amount of money supply is the main tool used by the Central bank. Unlike in the inflation-target where the Central bank fixes the price of assessing credit through the interest rate channel, the monetary targeting used intermediate targets such as exchange rate rules or monetary aggregate targets to achieve consistent policy of price stability (Croce & Khan, 2000). Mishkin (2001a) alludes to the fact that monetary targeting strategies are composed of the possibility for the dependence on the information that arises from the use of monetary aggregates, monetary aggregates targets declarations and a systematic order by which large systematic deviations are excluded from the monetary targets.

However, the capacity of the exchange rate to optimize monetary policy objectives were constrained as the directive was geared towards containing exchange rate pressures arising from domestic and external shocks. However, under flexible exchange rate regimes, monetary authorities move away from interest rate strategies to monetary aggregates to determine inflation in the long-run. This contradicts the Wicksellian natural rate which is the rate that is expected to keep the long-run inflation at stable. According to Croce and Khan (2000), the capacity of monetary aggregates as a viable instrument of monetary policy is equivalent to the stabilization of the inflation rate to meet its targets. The breakdown of the Bretton Woods arrangements for the adoption of a fixed or quasi-fixed exchange rate has made the pursuit of inflation control increasingly difficult especially following the integration of the global capital market.

In Ghana, the monetary targeting regime took the form of credit-control approach (1983-1991) and Open Market Operations (OMO) (1992-2006). Under the monetary targeting framework, different classes of money and credit (MO, M1 etc.) were added to the money supply to target monetary aggregates to rein-in inflation pressures. Kwakye (2012) indicates that the Central

bank discontinued the use of the credit-control system due to its inability to attain inflation targets owing to increases on the amount of money supply. The breaches in the amount of money in circulation in the Ghanaian economy were because of higher budget financing due to excessive government spending. Under the second variant of the monetary-targeting regime, OMO was tasked to deal with the level of liquidity in the Ghanaian financial market through the purchase and sale of government securities.

2.3.2 Inflation Targeting (IT) Framework

In New Zealand (1990), Canada (February 1991), Israel (December 1991), United Kingdom (1992), Finland and Sweden (1993) present clearer examples of nations that adopted the inflation targeting approach. On the introduction of several substitutes to money during the financial crisis, central banks abandoned the monetary targeting regime due to its ineffectiveness in the fight against inflation in the short run, and adopted the inflation targeting framework for conducting monetary policy.

According to Mishkin (2001a), the inflation targeting approach involves five important elements which includes: publicly announcing the medium-term targets for inflation, governmental commitment to achieve price stability to realize its long-run primary goal, the identification and inclusion of prospective indicators aside monetary aggregates for monetary policy decisions, information symmetry of monetary policy strategies through public communication, and the utmost priority of monetary authorities in the attainment of inflation objectives. Thus, the process of IT starts with a joint public announcement by the central bank that specifies a specific quantitative target for the attainment of inflation at a particular period of time (Croce & Khan, 2000). This commitment by the central bank is very important in appropriate policy choices as it reduces future course of monetary policy uncertainties and instead enhance credibility and accountability. Woodford (2003) emphasize the relevance of the IT framework which leaves monetary authorities to be committed to an assigned target rather than acting discretionary in the selection of policies that seems best to society at a point in time. Thus, inflation targeting strategy relies on rules as it operates under constrained conditions to realize policy consistency. According to Kwakye (2012), the bank of Ghana moved away from the use of monetary aggregates to affect the economy and pursued inflation-targeting framework due to enormous structural changes in the economy which required a corresponding increase in money demand as monetary targeting resulted in rise of money growth compared with rate of inflation growth.

Under the IT approach, the Central bank uses interest rates with the help of forecasted inflation targets to provide some stability to the economy. In line with the Taylor's rule, the Central bank under IT regimes periodically adjust the policy rate, which is the rate at which it lends to commercial banks in response to macro-economic developments. Taylor (1993) suggests setting an inflation-forecast targeting at each decision point where the interest-rate decisions are because of that date forward for inflation. The monetary policy committee occasionally adjusts the policy rate to also keep inflation in check. The IT approach of monetary policy which is deemed to enhance transparency and ensure effective inflation management is currently adopted in economies such as United Kingdom, Norway, Sweden, Canada, New Zealand, Brazil, Poland, South Africa, Ghana among others.

During the financial crisis in 2007-2008, the Bank of Ghana adopted the IT approach to prevent the global crisis from influencing the inflation expectations of Ghana. The financial crisis resulted in monetary excesses owing to persistent deviations between the actual federal funds rate and the historical approximated regular rate as described by the Taylor's rule. Therefore, the Federal Reserve during the 31st January 2007 FOMC meeting continued its tight monetary policy strategy and maintained the Federal funds rate at 5.25 percent on concerns about inflation risk. Despite a lower core inflation data owing to continued growth in business investment on the back of increased net exports spurred in part by falling US dollars, there remained somehow elevated inflation outlook due in part by weaknesses in the mortgage market. According to Taylor (2009), the Federal Reserve carefully considered the low interest rate with anticipation of a further rise in rates at a measured pace. Due to monetary and financial sector developments such as the term structure of interest rates, money and credit conditions, asset and labor market conditions (Croce & Khan, 2000), the Bank of Ghana therefore sparked a change in policy objective to protect the Ghanaian market.

From the second quarter (Q2) 2007, Ghana witnessed an expansion of its reserve money with an expansion of the domestic credit deposit mobilization by the banking sector. The broad money (M2+) grew by 4.40 percent in June 2007 from its June 2006 figure of 25.7 percent. The growth in the M2+ was underpinned by increased credit from banks to the private sector. The increased credit of banks to the private sector cushioned the measure of financial deepening in Ghana (based on broad money to nominal GDP) to rise from 39.0 percent in 2002 to 55.4 percent in Q2 2007. On the money market front, stable inflation rates led the interest rates on long-dated instruments of the government of Ghana treasury securities to raise vis-à-vis a corresponding

slide on short-term securities. Also, the 182-day T-bill rate and the government of Ghana 1-year fixed rate note declined by 24 and 70 basis points respectively in the first half of 2007. Likewise, the inflation rate declined from 17.0 percent in 2002 to clinch at 10.70 percent in Q2 2007 owing to ease on the currency ratio as the currency outside the banking system went down from 43.7 percent to 24.3 within the same period.

According to Bawumia (2010), the IT framework implemented by the Central Bank in Ghana has been the most resilient to external shocks as well as efficient and effective in battling inflationary pressures which is seen as a monetary phenomenon. With increased pursuit by the Bank of Ghana to achieve economic stability amid macro-economic imbalances; the Central Bank specifically outlined its main objective of price stability by indicating in the (BoG) Act 2002 (Act 612), section 3 that:

> *"(1) the primary objective of the Bank is to maintain stability in the general level of prices. Bank of Ghana Act, 2002 Act 612 5*
>
> *(2) without prejudice to subsection (1) the Bank shall support the general economic policy of the Government and promote economic growth and effective and efficient operation of banking and credit systems in the country, independent of instructions from the Government or any other authority."*

According to Mishkin (2001b) in a similar instance to the Reserve Bank of Australia, he opined that the adoption of the IT regime has similarly provided sustenance to the bank in its easing of inflation-expectations during the East Asian crisis. However, the IT approach has been one of the most subdued due to high domestic demand owing to expansionary fiscal policies, as well as the challenges associated with the exchange rate. For the inflation targeting approach to be effectively implemented, Croce and Khan (2000) suggest that the medium of measure of inflation to be used should be clearly specified, effective decision of the target level of inflation, firm decision on the adoption of either inflation target point or target ranges and the appropriate choice of policy horizon to determine the length of time it takes for the target path to decline. Thus, the IT framework to be effective should have an inflation target as a yardstick as well as the clearly specified duration for the attainment of the IT objective.

2.4 The Financial Crisis

In the period of the financial crisis in 2007 to 2009 which began with a combination of debt and mortgaged back securities, the crisis stemmed from the decline in housing prices in the US sub-prime mortgage market. Monetary authorities in a bid to stem the crisis from deteriorating into international markets implemented unconventional monetary policy decisions.

2.4.1   Quantitative Easing (QE) and its effect on emerging African economies

At the onset of the financial crisis in 2007-2008, monetary policy committee of the Federal Reserve outlined their plans and actions of prudent monetary strategies to find lasting solutions to the crash that had damaged the financial systems and caused deep recessions. The world's largest economies mainly the Federal Reserve of the US, the BoE, the BoJ, the ECB among others embarked on trends of aggressive monetary actions by reducing their policy rates to near zero to keep the crisis in check. In addition to the reductions in interest rates, other monetary policy measures were enacted to provide support to their economies which included but not limited to purchases of securities and the forecast of future interest rate expectations[8] by the Central banks.

According to the IMF, advanced economies responded to the economic meltdown which affected the global markets with non-conventional monetary policies to restore confidence in the intermediary role of financial markets, and to provide further monetary accommodation policies for guiding the global economy. The non-conventional monetary policy took the form of QE by which the Federal Reserve resorted to asset purchases. QE is an extreme form of traditional open market operations of Central banks. During the global economic crunch, the ECB failed to adopt the unconventional monetary policy (QE). However, the ECB and the BoJ quantitative easing measures were directed on lending to banks, while the Federal Reserve and the BoE relied extensively on bond purchases to prevent financial instability. Likewise, the BoJ in 2001 implemented similar QE strategy by resorting to printing of money to buy assets, making the first attempt of QE under such type. By this measure, the bank sought to increase its reserves by purchasing ¥400 billion worth of government issued bonds each month to raise its reserves to ¥5 trillion.

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[8] Danmark Nationalbank (Q3 2012 Monetary Review). Negative Interest Rate. https://www.nationalbanken.dk/en/publications/Documents/2012/10/MON3Q_P1_2012_Negative%20Interest%20Rates.pdf /Accessed 12-05-18

In the 2007-2008 crisis, the Federal Reserve resorted to several QE programs. The Federal Reserve's QE program took the form of credit easing, operation twist and QE proper. Within a year (from November 2008 to November 2009), the Federal Reserve had purchased $300 billion worth of treasuries and debt of government sponsored mortgage agencies at a value of $175 billion while it bought $1.25 trillion worth of mortgage backed securities (MBS). Thus, QE programs for the US amounted to US$1.75 trillion during the first tranche. In similar situation during the Euro-crisis, QE programs for Europe amounted to EUR 489 billion as at December 2011[9] of which they sought to stimulate their economies by increasing bank lending to spur households and firms spending. The first tranche of the US QE resulted in a depreciation of the US dollar thereby generating debates on its possible effect through the "currency wars" on the global economy. The US pursued the QE with a second tranche (QE2) in November 2010 until June 2011 of which it bought $600 billion worth of treasuries within the period. The maturity extension program "operation twist" continued from September 2011 to December 2012 by which the Federal Reserve bought $667 billion worth of treasuries. The third round of monetary easing (QE3) began in September 2012 of which the Federal Reserve injected US$40 billion monthly through the purchases of mortgage backed securities. The Federal Reserve followed up with additional treasury purchases on December 2012 through which it sought to prevent the economy from moving into a deflationary trap and as well breathe stability into the US economy.

Figure 2. Graphical representation of Central banks asset purchases programs during QE.
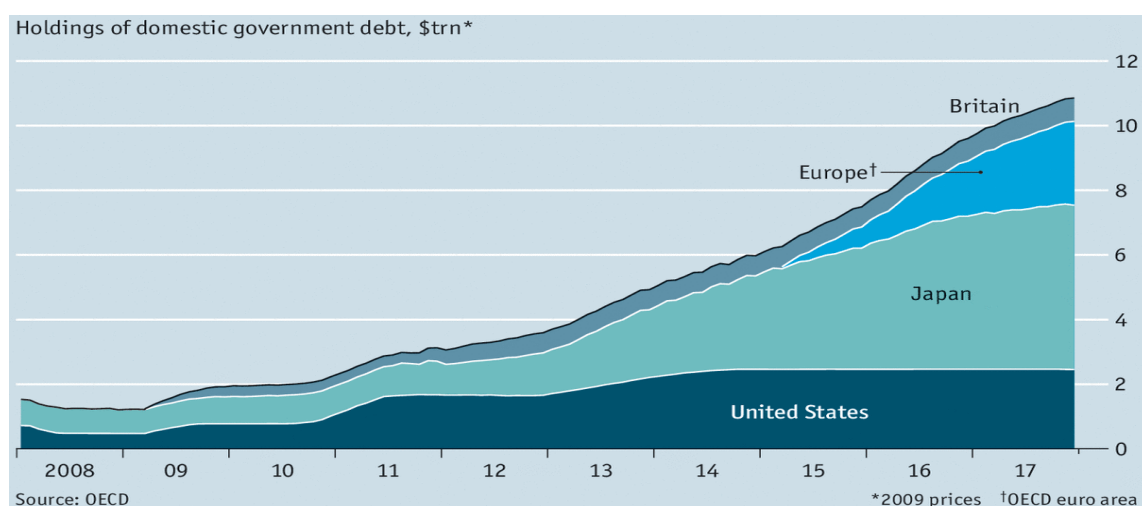
Economist, "Central banks", Economic and Financial Indicators, 2 Jun 2018, p. 81.

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[9] AFDB (28-11-2012). Global Quantitative Easing and its Impact on Emerging Economies. https://www.afdb.org/en/blogs/afdb-championing-inclusive-growth-across-africa/post/global-quantitative-easing-and-its-impact-on-emerging-economies-10058/. Accessed on 01.04.2018

From figure 2, since the carrying-out of asset-purchases programmes since the 2007-08 financial crisis, most central banks have sought to stimulate economic growth and reduce borrowing costs. This lead yields on governement bonds to fall with the OECD reporting that more than $9 trillion of global sovereign bonds were trading at negative rates last summer (2017). From the graph above, the Bank of Japan now holds over 40% of the country's government debt. Monetary policy has diverged between America and Europe with the Federal Reserve starting to reduce the size of its balance-sheet while the European Central Bank intends to continue asset purchases until inflation is close to the target of just under 2 percent.

Quantitative easing provided support to troubled economies around the globe as expansionary rich-world policies caused a movement of capital inflows. Unlike the ECB that prohibits member nations from directly providing fiscal support to its member nations, QE made it possible for purchasing troubled sovereign debts of member nations thereby providing the impetus for the proper conduct of monetary policy at the bloc. The increased inflow of capital to troubled nations in the Eurozone during QE by the ECB resulted in a reduction in government borrowing costs[10]. In terms of the exchange rate, the increased foreign purchases of troubled EU member nation's debts weakened the euro-blocs shared currency (Euro), which thereby provided support to the export industry. This provided support to the private sector through corresponding reductions in private borrowing cost. In the case of the USA, the first tranche of QE for the period 2008 to 2010 corresponded to declines in corporate borrowing cost by a percentage point. Successive QE program by the Federal Reserve by which it bought $600 billion worth of treasuries in late 2010 corresponded declines in corporate rates by 13 basis points[10].

The QE impacted developing and emerging economies through portfolio rebalancing of which it resulted in increases in capital flows as well as provided supports to weaker currencies in the regions. Under portfolio rebalancing, investors who sold their securities to the Central bank diverted the proceeds of their investment into other assets, thereby providing the impetus for higher asset prices. However, portfolio rebalancing encouraged exports as the US dollar weakened comparatively against its international trading partners thereby enabling it to compete favorably on the international market. At the start of the QE, investment driven African economies that were knitted into the global financial markets were largely exposed to the effects of the QE. Ghana and other investment driven African emerging economies benefitted

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[10] The Economist (14-07-2012) QE, or not QE? https://www.economist.com/node/21558596 . Accessed on 20-05-18.

extensively from a massive inflow of funds because of the US QE policy. By keeping benchmark interest rates at low levels, QE facilitated the bond markets of African countries on the international capital front by moving foreign investors with higher risk appetite to consider emerging economies including Ghana with stable economic and political environment as possible investment destinations.

 In 2013, the Sub-Saharan African economies raised about US$ 5billion through Eurobond issues, with Ghana issuing a 10-year bond that raised US$750 million at a yield of 8 percent. Other economies in the region such as Rwanda, Gabon and Nigeria mobilized US$400 million worth of 10-year bonds at a yield of 6.88 percent, US$1.5 billion at a yield of 6.38 percent and US$500 million at a yield of 6.63 percent respectively[11]. However, the beginning of the tapering in the USA brought unintended consequences to developing and emerging economies as excess flow of liquidity inadvertently interfered with their currency, exports and inflation data.

In 2013, comments from the US Federal Reserve Chairman (Ben Bernanke) of a possible end to QE sent negative signals to the global financial markets. The US's plans of tapering which indicated of a possible rate hike therefore posed downside risk to capital outflows, exchange rates and stock markets in several emerging and developing economies. The spillovers of monetary policy decisions in the advanced economies to developing economies therefore called for the international monetary policy coordination by the IMF to assess the adverse implications of monetary policy decisions and how it can promote macroeconomic and financial stability in the global economy (Kawai, 2015).

Though it could be noted that the QE contributed to the flow of capital to developing economies thereby cushioning their economic growth rates, the launch of QE had unintended consequences on most economies too. These unintended consequences came around currency wars, exchange rate volatilities and inflationary pressures. Roberts and Deichmann (2011) in their cross-country research analyzed the relationship between growth spillovers and geographical proximity. On their research, they found significant strong heterogeneous growth spill-over effects from Organization for Economic Co-operation and Development (OECD) countries to African countries but weak relationship among countries in the Sub-Saharan African region.

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[11] AFDB (11-06-2014) The impact of quantitative easing on Africa and its financial markets. https://www.afdb.org/en/blogs/afdb-championing-inclusive-growth-across-africa/post/the-impact-of-quantitative-easing-on-africa-and-its-financial-markets-13300/. Accessed on 01.04.2018

2.4.2 Policy Responses to the Financial Crisis

In the first quarter of 2007, global oil prices eased considerably from its last peak in August 2006 average figure of $73.04 per barrel and thereby provided support for attainment of robust growth path for the world economy. The growth mark in the world was also bolstered by impressive 2006 Q4 GDP growth of 3.5 percent for the US, 2.8 percent for the Eurozone and 8.8 percent for Asian economies excluding Japan. At these times, the prospects of inflation pressures in the global economy declined significantly on the assumption of oil price declines thereby casting slur on possibilities of monetary tightening by Central banks around the world. However, member countries of the G7 hiked their policy rates steadily from 3.65 percent to 3.80 percent in March 2007 on concerns that low oil prices could reinforce rises in inflation through the output gap. These were done to drain out excess liquidity in the economy to rein-in excess lending.

In Africa, monetary authorities of several countries adopted indirect strategies during the times of the QE. For instance, in South Africa, the Monetary Policy Committee of the Reserve Bank however adopted a wait-and-see strategy during 2007 at the time where most advanced economies had launched contractionary monetary policy in respect of the QE. The Reserve Bank however, left their repo rate unchanged at 9.0 percent. Ghana was not an exception to this strategy as the Monetary Policy Committee of the BoG left the policy rate unchanged at 12.5 percent from December 2006 to October 2007 for fear that; further lift on rates could exert pressure on the cost of borrowings. The lower interest cost resulted in the monetary expansion of the Ghanaian economy in 2007, following the growth in broad money base of 38.83 percent in November 2007 from 18.55 percent in January 2006. The increase in domestic expansion by the financial systems resulted in increased investor's optimism about the domestic market. This therefore necessitated a shift in investors preferences for long dated investment instruments following the governments motive of restricting the public debt from short term into medium-long term duration. As at end of Q3, the portion of long dated instruments in investments rose by 1.6 percent from its 2006 figure of 61.4 percent to 63 percent in 2007.

The Ghana Cedi during the time of the monetary tightening in 2007 was relatively stable. The local currency wounded its 2007 fortunes against currencies of its major trading peers on the currency market following the redenomination of the local currency in July 2007 on grounds of security, portability and time spent in counting. The Cedi depreciated against the US Dollar, the Euro and the Pound to clinch their year-to-date losses at 5.08 percent, 18.56 percent and 7.78 percent respectively. The rate of depreciation of the Ghana Cedi compared unfavorably against

its 2006 year-to-date figures of 1.14 percent and 12.30 percent respectively against the US Dollar and the Euro. In the case of the Pound Sterling, the Cedi depreciated by 15.50 percent in 2006, making it favorable compared with its 2007 figure. The Cedi failed to realize gains against the US dollar despite the decline in the monetary policy rate from its 2006 figure of 5.25 percent to 4.75 percent in September 2007 and a further wind-down to 4.50 percent in October 2007.

2.4.3 Implications of the financial crisis on the Ghanaian economy

Owing to the integration of the global financial systems, macroeconomic policies in advanced economies may spillover to other international economies. The spillover may take the form of foreign direct investment (FDI) into the domestic market by which such inflows are expected to subsist the technological process, productivity levels, employment levels and the rate of economic growth. According to Sekkat and Veganzones-Varoudakis (2007), the basic economic factors, trade and exchange market policies and the investment climate form the basis of FDI flows into an economy. In other instance, McQueen and Roley (1993) in their research on the response of stock prices to macroeconomic news showed that the effect of macroeconomic news on the economy resides not on the informational content but also on investors response to such news across different stages of the business cycle. Thus, the basic contributing factor to the spillover of the global financial crisis to emerging and developing economies were hinged on differences in the rate of returns on capital across countries, investors portfolio diversification strategy and the size of the domestic market (Anyanwu, 2011). The spillover of the financial crisis resulted in increased foreign direct investment (FDI) which according to stood out as a principal element in the integration of the world economy.

The Financial crisis of 2007-2008 generated a stream of stunning news about failures of banks to service debts, low international reserves, weak financial systems and a weakened currency. Despite the growing global macroeconomic instabilities, the Ghanaian economy remained somehow insulated from the major contagion from the developed world into developing economies. The Ghanaian economy remained resilient and benefited from liquidity flows owing to political stabilities as well as improved microeconomic base. The surge in capital flows to the local economy were due to major local financial developments that made it possible for the domestic market to compete favorably on the international grounds, and a decline in US federal reserve funds rate that encouraged investors in the developed economies to seek higher returns in a similar politically stable environment. Osei (2012) illustrates in his research on the aid-private capital flows-growth nexus for Ghana that total private capital flows which consists of FDI and

other capital flows increased substantially in the post 2000 era. Total private capital rose to US$ 2.25 billion in 2007 from the 2000 figure of US$630 million. This contributed immensely to the efficient movement of funds on to the Ghana financial market. In 2009, the quantum of total private capital nosedived to US$2.08 billion.

However, the policy implications of the QE on the Ghanaian economy were hinged on the appropriateness of the use of the private capital inflows into the local economy from the advanced economies. Thus, whether the inflows were used to finance rising fiscal deficits as was in the case of Brazil, Mexico and Venezuela in the 1980's or were used to sponsor the private sector investments as was the case of Chile and Argentina (Edwards, 1998) played crucial role in the basis of private capital inflows. Due to structural reforms in Ghana in 2007 such as the redenomination of the Cedi, the integration of the domestic capital market into the Eurobond market, investments into the generation, transmission and distribution of electricity, FDI's remained in line with investor's aims and objectives. This is due to the positive correlation between capital flows and growth records. The UNDP's Human Development Index (HDI) on the basis of health, income and education showed an improvement in growth prospects for Ghana by rising from its 2000 figure of 0.485 to 0.554 in 2010 and further increasing to 0.579 in 2015. Osei, Morrisey and Lloyd (2005) in their research on Ghana using data for the period 1966 to 1998 identified a correlation between official transfers (aids) and the Government of Ghana's fiscal expenditure. They identified that increased official transfers to Ghana reduced the domestic financing of the Government's budget through reductions in borrowings and rather expanded the tax net.

CHAPTER THREE
THEORY AND LITERATURE REVIEW

3.1 Introduction

Most open economy models continue to rely on the Mundell-Fleming (M-F) Framework despite the increasing prominence of works on the relationship between asset prices and aggregate demand. This research conducts an empirical analysis of monetary policy and its effect on the performance of the Ghana Stock Exchange with emphasis on the impact of US QE on the Ghana stock market.

In establishing the appropriate monetary policy rate to anchor the economy into stability, the Central bank allows for the interrelationships and co-existence between the domestic economy and the international scene. In the context of the national level, the monetary policy committee members need to consider domestic economic conditions as well as the nations that directly or indirectly influence its local activities. In this paper, we base our theory on the Mundell-Fleming model.

3.2 Mundell-Fleming Model

The Mundell-Fleming (M-F) model is an extension of the traditional IS-LM models where a country operates in an open economy with perfect mobility of capital. The model portrays the existence of a short-run relationship between the interest rate, nominal exchange rate and the output of an economy. The model gives a systematic analysis of how international capital mobility under different exchange rate regimes contribute to the effectiveness of macroeconomic policies. The Mundell-Fleming model can be reduced to three equations: equilibrium in the goods market, equilibrium in the money market and the balance-of-payments equilibrium.

The model assumes sticky prices for goods and services at both home and foreign countries in the short-run. However, increases in the amount of money supply could have a direct effect on both economies price levels. The consumer price makes up the price of all goods and services imported into the economy. In times of depreciation of the domestic currency, the price of imported goods and services become expensive and this reinforces a rise in inflation at the local economy. However, the price of the imported good in the foreign currency reduces and this could affect a fall in the CPI of the foreign economy. Under the money market of the M-F model, adjustments in the money supply has the capacity to alter the balance of payments through their

effects on the interest rate and hence on capital movements and output. In a two-country model, the M-F model predicts that an expansionary monetary policy would increase the amount of money in circulation which then could result in a depreciation of the local currency and then affect the local output. Mundell (1963) assumed that monetary easing in an economy due to an expansionary monetary policy could result in the depreciation of the local currency but invariably increase output. Thus, there exist two offsetting impacts: firstly, through the depreciation of the local currency, and secondly through increased demand for foreign produced due to expansion of the output in the domestic economy.

Under the Mundell-Fleming framework, the local economy can borrow or lend freely on the international market. However, the domestic economy is so small that it cannot alter the prevailing international interest rate on the world market. Therefore, the domestic economy takes the world market interest rate as given. The theoretical model for the study is based on the writing of Gandolfo and Gandolfo (2001). The model incorporates an analysis on the balance of payments in addition to the balance in the goods and money market for a two-country model under the assumption of a flexible exchange rate. Therefore, aggregate demand, interest rate, exchange rate, exports, imports, money demand and money supply are included in the theoretical framework. Gavin (1989) landmark study on stock market and exchange rate dynamics for a small open economy introduced stock prices into the Mundell-Fleming model. Stock prices were introduced into the model because it was observed that current and expected future profitability movements affected investment and consumption which are key components of the aggregate demand through relative prices and wealth effects. Also, the stock market formed the link between fluctuations around future profit and interest rates as well as current consumption and investment decisions. Similar studies by Parrado (2001)also incorporated the JP Morgan EMBI index as a measure of risk premium in his analysis on the effect of foreign and domestic monetary policy in a small open economy: the case of Chile.

In the goods market equation,

$$y = A(y,i) + X(r) - rm\,(y,i,r) \qquad (1)$$

Where $0 < A_y < 1,\ A_i < 0,\ X_r > 0,\ 0 < m_y < 1,\ m_i < 0,\ m_r < 0$ and $A_i\text{-}m_i < 0$

r represents the nominal exchange rate, that is the foreign currency per unit of domestic currency. i denotes the interest rate with the aggregate demand dependent on the income (y) and the interest rate (i). The aggregate demand is composed of the domestic demand (A) and the foreign

demand ($X(r)$). The A_y and A_i measure the partial derivatives of A with respect to income and interest rate respectively. The national expenditure (A=C+I) according to Blanchard (1981) is determined by the value of shares in the stock market, current income and through public spending and taxes. Since A involves both foreign and domestic commodities, introducing the interest rate in equation (1) logically explain its introduction as an explanatory variable into the import function. A rise in interest rate involves a decline in demand for both domestic and foreign commodities.

Given that A represents both domestic and foreign resident's expenditure on goods, while (m) represents imports in our flow model, then A-m < 0, explains the expenditure by local residents on domestically produced goods.

A_i-m_i < 0 represents the effect of the interest rate on domestic expenditure on locally produced goods. There exists an inverse relationship between the interest rate and the portion of consumption by domestic residents on locally produced output.

$$M^* = L \ (y, \ i) \qquad (2)$$

$$L_y > 0, \ L_i < 0$$

Equation (2) shows the money market equilibrium. The (M^*) represents the stock of money and (L) the demand for money. The stock of money (M^*) is a function of the monetary base and the interest dependent money multiplier. According to the M-F model, an adjustment to monetary policy under the fixed and floating exchange regimes would result in an outward shift of the LM curve. The shift of the LM curve would lower the interest rate (i) and raise output (y). The decrease in (i) would cause capital outflow which then has the tendency to cause a balance of payment deficit depending on the degree of capital mobility.

BOP = BOT – net capital account - Δ reserves = 0

The balance of payments (BOP) is the sum of the trade balance (BOT) and the capital account. Under BOP, it is assumed that the current account and the capital account add up to zero (0) since monetary authorities cannot interfere in the foreign exchange market, and as such there is no alteration in international reserves.

From equation (3), the balance of payments involves not only imports and exports but rather capital movements with the capital flows being dependent on the rate of interest differentials

among nations. The difference in the interest rate between the two economies determines the amount of inflow or outflow of capital. With the assumption of perfect capital mobility, the only way capital (K) can remain finite is when the domestic interest rate equals the world interest rate. However, the condition that the balance of payment is in equilibrium is also premised on the stock of international reserves.

$$B = Xr - rm\ (y,i,r) + K\ (i) = 0 \qquad (3)$$

In the case of the introduction of the exchange rate into the various equations:

$$y = x\ (r) + d\ (y,i,\ r\ )\ where\ \frac{dx}{dr} > 0,\ and\ \frac{\partial d}{\partial r} > 0, \quad (4)$$

Thus, a depreciation or rise in the exchange rate (r) will raise the net exports and would cause a rightward shift of the IS and Bp curves.

Figure 2. Graphical reprersentation of the IS-LM-BP
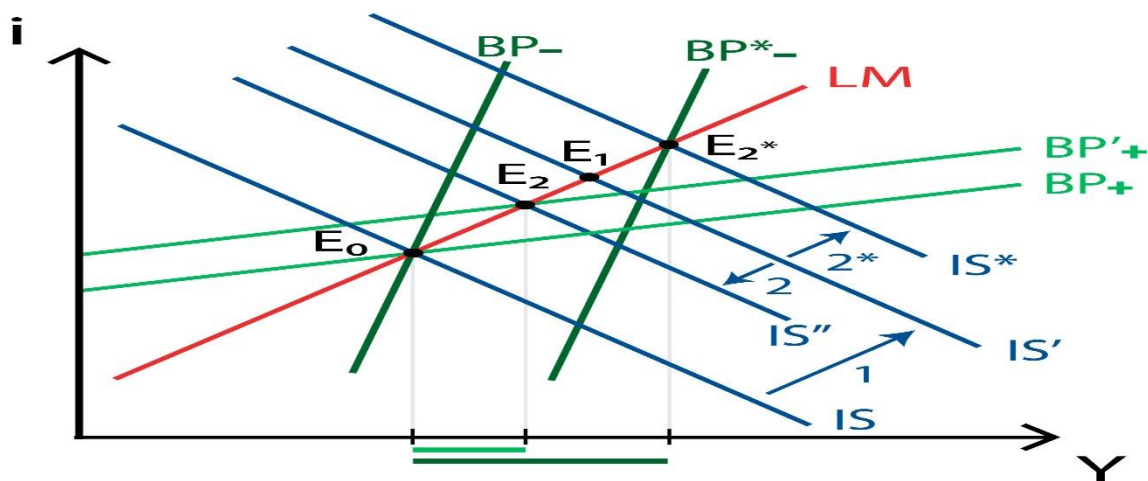
$$x\ (r) - rm\ (y,i,r) + K\ (i) = 0\ ,\ where\ \frac{\partial m}{\partial r} < 0$$

From figure 2, expressing r as a function of y, i, on the basis of the Jacobian of B(y,i,r) with respect to r being different from zero. This leads to:

$$Br = xr - m\ -\ rm_r = m\ (\frac{x}{rm}\ \cap x + \cap m - 1) \neq 0 \quad (5)$$

We obtain the differentiable function, r = r (y,i)

By the implicit functions theorem: $\frac{\partial r}{\partial y} = -\frac{By}{Br} = \frac{rmy}{Br} \cdot \frac{\partial r}{\partial i} = -\frac{Bi}{Br} = \frac{rmi - Ki}{Br}$

30

From here, $\frac{\partial r}{\partial y} > or < 0$ according as Br > or < 0, namely according as the critical elasticities condition is satisfied. Similarly, $\frac{\partial r}{\partial i} >$ or < 0 according as Br > or < 0.

Two important features distinguish this model from others, thus money stocks do not play a direct role, however monetary policy indirectly affect exchange rate through adjustment to the inflation and interest rate. Also, in the short-run, the differences in the interest rate determine the rate of change in the exchange rate. Therefore, we proceed to test the validity of this feature in the SVAR matrix in chapter 5 to ascertain the relationship between interest rates and exchange rates.

3.3 Conventional Monetary Policy and Non-Conventional Monetary Policy

Monetary policy tools have been used to achieve a specific short-term interest rate target or target a specific exchange rate of the domestic currency relative to the foreign currency. The policy framework of monetary policy has been inflation targeting to achieve low and stable inflation. The Central bank may resort to the use of the short-term interest rate in affecting the economy. However, in "The General Theory of Employment, Interest and Money, 1936", Keynesian and Monetarist Economist disagreed on the appropriateness and primacy of monetary policy in solving economic problems. The monetarist is of the view that monetary policy influences the level of economic activity by adjusting the amount of money in circulation which then affect the money stock and alters the Central banks economic growth prospects. The debate between Keynesians and the monetarists has not only been limited to the potency of monetary policy in the economy, but however revolved around how the income velocity of money in circulation (V) and the quantity of national output (Q) are affected by the changes in the money supply (M) in the quantity theory of money equation (MV=PQ).

Given the credibility of interest rates in anchoring the economy to stability, Ait-Sahalia, Andritzky, Jobst, Nowak, and Tamirisa (2012) posit that interest rate decisions remains a key policy tool during times of financial crisis. The monetary policy decisions may take the form of interest rate channel to transmit its impulses to the stock market. By this, the interest rate is the dominant channel that influences other macroeconomic variables. A change in the policy rate which is the rate at which the Central bank lends to the banking systems affects directly money-market interest rates. A change in the money market rate indirectly affects lending and deposit rates set by the financial institution. Joyce et al. (2012) affirm that conventional monetary policy

operates in the economy by altering the rates on short-term instruments through the buying and selling of securities which then influence the amount of reserves held by banks. Conventional monetary policy operates by enhancing the reduction in rates on short-dated instruments which then reinforces a lower interest rate expectation for longer term financial instruments. The reduction in rates on long-term instruments contributes to a decline in the borrowing cost which then bolsters asset prices. The low interest rates encourage consumer and business spending and thus spur economic growth[12].   In line with the traditional Keynesian view of the transmission mechanism through interest rate channel, a change in the interest rate affects the present value of a firm's future net cash flow which relates inversely with stock prices. The traditional Keynesian IS/LM model shows that an expansionary (loose) monetary policy has the result of lowering the real interest rate (r). A decline in the cost of borrowing raises investment (I), and thereby increases aggregate demand which further spirals growth in output.   In relation to the expectations theory of the term structure of interest rates, the long-term interest rate which is the average of short-dated instruments indicates that a low real interest rate (r) would result in a slid in rates on long-dated instruments (Mishkin, 1996).

The central bank may adjust the macroeconomic conditions in the domestic market through the exchange rate. Mishkin (1996), Bryant, Hooper, and Mann (1993) and Taylor (1993) documented how monetary policy decisions affects the domestic economy through the exchange rate channel by which: an expansionary monetary policy causes a fall in real interest rate, and a a fall in real interest rates results in a reduction in domestic dollar deposits as it becomes unattractive compared with foreign denominated currencies deposits, resulting in a weakening of the dollar. However, the lower value of the domestic currency could reinforce the possibility for the Marshall-Lerner's condition to be met and could spike aggregate output. The Marshall-Lerner condition provides reasons that in the event of the depreciaton of the local currency, the balance of trade could improve if the quantity effect as a result of exports exceed the cost effect as a result of imports.

While the conventional monetary policy, operating through the interest and exchange rate channel to achieve a low and stable inflation in the economy, it does not identify and deal with asset market bubbles (Joyce et al., 2012). Thus, at the time when the short-term policy rate was near the zero lower-bound, the conventional means by which the decline in the target rate to influence the prices and yields of financial assets became unlikely (Bernanke & Reinhart, 2004).

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[12] Federal Reserve (01-03-2011) Semiannual Monetary Policy Report to the Congress.
https://www.federalreserve.gov/newsevents/testimony/bernanke20110301a.htm / Accessed on 10-05-18

Therefore, the Central bank has resorted to policy strategies since the beginning of the financial crisis in 2007 to realize inflation targets as well as maintain stability in the economy. Joyce et al. (2012) assert that the disruptions of the reliable relationship between the official and the market interest rates at the time of the financial bubbles in the US resulted in the disruption of the financial system which then gave rise to the questioning of the solvency of most banks and investors. The major disruption in the global financial system therefore led central banks around the world to consider other forms of policy interventions.

Non-conventional monetary policy spanned from negative interest rates as was the case in Denmark in July 2012[13], to a change in inflation targets. During the global phase of the crisis that struck the United States and spilled-over to the rest of the world, most economies became concerned about designing an appropriate policy to address the weaknesses in the financial system. Policy priorities among monetary authorities during the crisis were hinged on stimulating global financial market confidence, preventing further systematic collapse of the banking sector, and stimulating domestic market demand (Ait-Sahalia et al., 2012). They posit that, the global crisis from September 2008 to March 2009 gave rise to frequent and diverse policy interventions such as: fiscal policies, quantitative and credit easing, interest rate cuts, liquidity support, liability guarantees and recapitalization-among economies.

In quantitative easing, the Central bank bought government securities from the public while credit-easing involved purchases of private sector assets by the central bank to improve access to credit. Because of the global economic crunch, most Central banks coordinated and implemented interest rate cuts. Interest rate cuts resulted in a significant decline in the difference between the London Interbank Offered Rates (LIBOR) and the Overnight Indexed Swap (OIS) spread. The LIBOR is the average rate charged by banks for lending to another bank in the short-term for an unsecured loan while the OIS represented the key interest rate used by the Central bank when banks want to swap interest obligations with counterparty. The higher the LIBOR-OIS spread, the higher the level of credit risk which then could tarnish the possibilities of increased financial system liquidity as well as increased liquidity among banks. The difference in the LIBOR and the OIS according to Ait-Sahalia et al. (2012) represented the level of financial distress in the economy.

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[13] Danmark National bank (Q3 2012 Monetary Review) Negative Interest Rate. https://www.nationalbanken.dk/en/publications/Documents/2012/10/MON3Q_P1_2012_Negative%20Interest%20Rates.pdf /Accessed 12-05-18

Joyce et al. (2012) specifically emphasize that QE has featured prominently as the most high-profiled form of non-conventional monetary policy. The Bank of Japan first used QE after an asset price crush in 1990 to rescue the domestic economy from a deflationary trap. Money authorities of the USA, the UK and the euro-area have all followed Japan in the implementations of QE and other forms of non-conventional policies. Gertler and Karadi (2011) explains that the effect of the central bank using non-conventional monetary policy are used to expand its credit intermediation to offset disruptions to private financial intermediations. During the financial crisis, the Federal Reserve provided support to the weak balance sheets of banks and other financial institutions through its increased purchases of private assets.

The unconventional monetary policy tools were utilized in the United States during the financial crisis in 2007/2008 to mitigate the looming effects of the downturn on the private sector. Following the deterioration in financial and real activity in the USA due to the collapse of Lehman Brothers in 2007, the Federal Reserve expanded the ease at which financial institutions could access credit by lending in high grade capital markets. The Federal Reserve extended its increased asset purchases program to include non-bank entities such as securities firms since the US financial system looked more complex with much dependence on intermediation outside the banking system.

The Federal Reserve in a bid to enhance price stability as well as spur employment resorted to two types of unconventional policies: forward guidance about the likely future path of the federal funds rate, and announcements of a large-scale asset purchases (LSAP) program (Neely, 2015). The intention of the policies by the Federal Reserve was to make it easier and cheaper to assess credit especially for mortgage purposes to bolster economic activities through reductions on medium-long-term interest rates. The Central bank's asset purchases turned up with positive results in the areas of employment reports, real output etc. John Williams, the President of the Federal Reserve Bank of San Francisco, indicated that the bank's asset purchases of $600 billion during the crisis contributed to the decline in the US jobless rate by 1.5 percent. Real output in 2012 was estimated to be 3 percent higher with the pursuit of the first and second tranche of QE programs.

d'Amico, English, López-Salido, and Nelson (2012) document that the LSAP program operated in November 2008 when the Federal Reserve made its announcement of purchases on agency debt and other mortgage backed-securities. In March 2009, the monetary authorities announced an increase in purchases of $1.25 trillion of agency backed mortgage-backed-securities (MBS)

and furthered to $200 billion in agency backed securities with additional plans to secure $300 billion worth of long-term securities. The Federal Reserve's purchases of MBS were a form of credit easing by which the Central bank aimed to restore normality to the financial system through creation of additional credit channels to boost liquidity. The government in a bid to shore up investors optimism about the financial market as well as motivate them to allocate their investments away from riskless assets to riskier assets resorted to increased bond-buying program. The lower yields on the government bonds induced private borrowings which provided support to investments, consumption and demand.

3.4 Capital flows, exchange rates and international capital markets

Unlike in the 1980 where the US dominated the global financial market and accounted for about 50 percent of the world's stock markets with about 98 percent of the funds invested domestically (Tesar & Werner, 1995), the abandonment of fixed exchange rates and thereafter reductions in transaction cost fueled the diversification of US investments into overseas markets. Capital inflows could be categorized as direct foreign investment where these flows reflect a long-term commitment on behalf of the investor in the host country or portfolio investment where it captures transactions in debts and equity securities. Other types of flow could also be identified where it involves trade credit, both short and long, and other official bilateral and multilateral loans (Edwards, 1998).

In the globalization of financial markets, foreign capital flows play a crucial role in the efficient movement of resources for developmental projects. The amount of capital inflow into a specific country is dependent on the rate of economic growth, legal institutional structure reforms within the financial sector, and the rate of macroeconomic stabilization within the confines of the domestic economy. Structural reforms such as a currency regime change from a fixed exchange system to a floating exchange system, and the implementation of an inflation-target has opened most countries to international capital flows.

Errunza and Miller (2000), Bekaert and Harvey (2000) and Henry (2000) show that the amount of foreign portfolio capital flow that follows key liberalization events contributes to the performance of stock market returns in an economy. Stock market liberalization represents a decision by a government of a country to allow foreigners to participate in trades on the country's stock market. They analyzed the impact of liberalization events on stock market returns and found that the liberalization of the capital markets resulted in increases in stock

returns and a decline in the cost of equity. The standard international asset pricing models (IAPM's) indicate that stock market liberalization may result in the equity cost of capital for the liberalizing country and may therefore allow for a process of risk sharing between international and local investors unlike before the times of financial liberalization where stock trades were undertaken predominantly at the local levels (Errunza & Losq, 1985) and (Stulz, 1999). The level of financial liberalization around the world has resulted in the growth of foreign private investment.

In the theory of portfolio investment as postulated by Hymer (1976), the resulting effect of reductions in borrowing cost influences foreign investors to direct foreign portfolio investments to areas of higher interest rates. However, in line with the law of one price, foreign portfolio investments would move freely into economies until there's no interest rate differential among countries.

In deciding the level of foreign investments, consideration is given to the level of risk which is represented with the level of uncertainty regarding the flow of foreign private investment to an economy. Kodongo and Ojah (2012) asserts in their study of the nexus between foreign exchange rates and international portfolio flows among several African countries, that uncertainties inform investors to invest in a specific location for short-term and withdraw funds on uncertain conditions. It could be inferred that uncertainties during the financial crisis led most sub-Saharan African countries to be faced with large balance of payments gaps as financial flows to the region reduced. Kaendera, Dixit, and Ltaifa (2009) studied the impact of the global crisis on the currencies of most sub-Saharan African countries. In their study, the currencies of Ghana, Nigeria, Kenya, Uganda and Zambia depreciated by about 20 percent within June 2008 to March 2009 against the US dollar.

In the determination of portfolio investment destinations, the exchange and interest rates of the recipient economy are considered. Ltaifa, Kaendera, and Dixit (2009) and Kodongo and Ojah (2012) analyzed the relationship between exchange rate, capital flows and stock prices. The exchange rate is the measure of a unit of a foreign currency in terms of the home currency. The exchange rate serves as the common medium by which value of goods, services and assets in different currencies are priced (Sangany & Ong'any, 2015). In an open economy, the real effective exchange rate is key to trade among economies within integrated international goods and services market such that an appreciation of the real exchange rate can lead to an increase in the inflow of funds, which could affect the economy. On the other hand, higher stock returns in

the home market compared with the foreign market could result in a depreciation of the home currency. Thus, there exist an inverse relationship between capital flows and exchange rates. Osei (2012) found a negative correlation between the effective exchange rate and the capital flows to Ghana. This is because, increase in capital inflows increase the amount of foreign currency supply which therefore provides support to the Ghana Cedi. The appreciation of the Ghana Cedi provides support to relaxing the inflationary pressures in the economy as most Ghanaians demand for foreign currency to undertake imports.

 The evolution of exchange rates in sub-Saharan Africa during the financial crisis were premised on external factors through the transmission of the crisis on financial market activities , policy choices and structural factors (Kaendera et al., 2009). The choice of exchange rate regime called for different policy choices to be implemented during the onset of the financial crisis. The policy mixes that were adopted in the sub-region during the crisis were instrumental to the direction of the exchange rate. However, policy intervention by the Central bank of Nigeria in 2008 to minimize the rate of depreciation of the managed float currency (Naira) failed to actualize despite the increase in trade and capital flows to the local economy. According to Kaendera et al. (2009), restrictions on external transactions and ;payments including acquisition of stakes in most banks, and the repatriation of FDI proceeds provided some level of stability to the Ghana Cedi during the period of the crisis. The underdevelopment of the financial sector in Africa due to smaller stock market capitalizations, continuous dependent on exportation of raw commodities which fueled fall in demand for exports, and increased capital inflows contributed to the weakened performance of the currencies in the region.

3.5 Empirical studies of relationship between monetary policy, inflation, exchange rates and stock markets performance

This division of the research tends to focus on the relationship that exists among macroeconomic variables and answer the question whether monetary policy and its related variables can have any effect on stock markets. This aims to exhibit the perceived relationship and causalities among the various macroeconomic variable findings in research and explain the differing opinions around them. Empirical evidence on the macroeconomic effects of monetary policy on aggregate activities like inflation, exchange rate, interest rate, money supply, GDP growth rate are examined. Past research investigated the impact of monetary policy on some economic

indicators; however, its empirical analysis with reference to its relationship during the QE has rarely been carried out in Sub-Saharan Africa and in Ghana more recently.

3.5.1 Interaction between Inflation and Stock Market

Monetary policy transcends to affect macroeconomic variables and ultimately inflation through the activities of the financial markets. In the study of the impact of inflationary pressures on stock markets, the amount of money supply which explains the total amount of money in circulation in the economy plays critical role in determining inflation rates. The amount of money supply may serve as an illusion for the rate of inflation, where changes in it are prominent in the quantity theory of money proposition. Bomfim (2003) and Smales (2012) argue that the direction of monetary policy owing to money supply changes can affect stock returns. Tobin (1969) asserts that the amount of money growth does matter in relation to the performance of stock market. Thus, in periods of high inflation due to excessive money supply, the monetary authority's decision to implement contractionary monetary policy is expected to result in a hike in the short-term interest rate. Thus, a rise in the cost of borrowing might invariably crowd out private investments as the cost of doing business increases, and this could lead to declines in investments and economic activities of companies that are listed on the stock market.

The real effect of inflation on stock market is caused by money illusion (Bekaert and Engstrom, 2010) where expectations of future rises in inflation results in the increases on yields of bonds, which further leads to an underpricing by equity investors owing to wrongful discounting of real cash flows on the basis of nominal rates. In their study on the US using VAR to estimate quarterly data from the 4th quarter of 1968 to 2007, they posit that in an instance where money illusion affect stock prices, the inflation serves as a stabilizer against stock price distortions and mis-pricings while the Federal Reserve's inflation policy does not have any impact on stocks in times where money illusion does not affect stocks.

Fisher (1930) also hypothesizes that equity stakes in a company may serve as a hedge against inflation, through its claims against the real assets of the invested company. Thus, holders of stocks could sell off their equity stakes in a company for real assets at the announcement of an expected inflation rate. Thus, predictable adjustment in the rate of inflation provides the impetus for the re-orienting of financial assets. This therefore alludes to the positive relationship between inflation and stock markets. Thus, in times of high inflation, investors are compensated for the decline in the real value of financial stocks in the economy, through corresponding increases in the nominal price of stocks. Thus, prices of stocks rise proportionately in nominal terms with

inflation. Using cointegration techniques on a sample of macroeconomic variables of Central and Eastern European countries from 1998-2007, Horobet and Dumitrescu (2009) complemented the findings of a positive relationship between stock prices and inflation. In their findings, an increase in the consumer price index results in a corresponding increase in the stock market index. In the Ghanaian context, we expect an inverse relationship between inflation and stock prices. Inflation inversely affects corporate earnings which are reflections of the prevailing stock prices. During periods of inflationary pressures in Ghana, the Bank of Ghana typically institutes contractionary monetary policy which results in hikes in interest rates. The high interest rates make it lucrative for Ghanaians to save while it becomes costly to borrow funds. The high borrowing cost may deride business investments which therefore could affect its growth prospect and thence, its stock price.

Also, the common feature of information asymmetries with regards to the financial markets give details on how a spontaneous rise in inflation negatively affects the credit market and in the long-run impact real economic activities. The Efficient Market Hypothesis (EMH) which emphasizes that all stock prices fully reflect all available public information, Davidson and Froyen (1982) and Fama (1991) supports the view that there is the need for monetary policy decisions to incorporate the possibilities of volatilities in stock prices as large swings on the capital market could have an impact on the economy.

Humpe and Macmillan (2009) using a cointegration framework to analyse the long-run relationship between industrial production, the CPI, money supply, the long-dated intrest rate and the price of stocks for the US and Japan found varied results in their study. They found that inflation rates in the US significantly negatively correlate with stock returns, but insignificantly positively correlate with money supply. Mishkin (2001b) complements this and finds that stock returns vary inversely with inflation rates. He argues that the cost of living during high inflationary times becomes expensive and this motivates a shift in resources from investment on the stock market onto consumables. This invariably culminates in a decline in the number of trades on the exchange and could result in bearish performance on the capital market. Parrado (2001) in his studies of the effects of the foreign and domestic monetary policy in the Chilean economy using a structural VAR approach found similar results by which a domestic monetary contraction generated a fall in monetary aggregates. This is because a contractionary domestic monetary policy would then cause the domestic interest rate to rise and as the rate rises, the amount of money in circulation then declines gradually.

Adam and Tweneboah (2008) used the Johansen's multivariate cointegration techniques to analyze data on macroeconomic variables in Ghana from 1991 to 2006. They report that inflation and exchange rate play a critical role in the movement of stock prices in the short-run, and in the long run inflation significantly affect stock markets positively. However, the influence of inflation on the performance of the stock market is premised not only on local factors but rather international conditions such as the larger flow of "hot money" by G-4 countries during their pursuits of QE policy.

3.5.2 Interaction between exchange rate and stock market

One of the significant interactions among the relationships between monetary policy and the performance of stock markets relate at the macro-level. Changes in the policy rate indirectly affect other macro-economic variables such as the exchange rate and inflation, which are widely embedded in financial decision making. This is because movement of the interest rate reflects the changes in the exchange rate. Parrado (2001) identifies in his studies on Chile using an SVAR approach that, an unexpected rise in the Chilean monetary policy rate would cause the the peso to rise against the US dollar. The appreciation is due to the fact that higher domestic interest rates made it profitable for foreign investors to divert their funds to the Chilean economy. The global economic meltdown in 2007 which had a hard hit on stocks and currencies around the world resulted in several empirical studies on the relationship between stocks and exchange rates (Ehrmann, Fratzscher, & Rigobon, 2011; Granger, Huangb, & Yang, 2000; Jongen, Muller, & Verschoor, 2012). Major stock indices during the 2008 to 2009 recorded drops as investor's pessimism about the financial markets and concerns on declines in accessing credit loomed-large. The exchange rate at this time exhibited unusual trends with the US dollar strengthening against the Canadian dollar (CAD), Norwegian Krone (NOK), New Zealand dollar (NZD), Swedish Krone (SEK), South African Rand (ZAR) etc. (Kohler, 2010). The fluctuations among major currencies gave rise to identifying the cause of run on exchange rates.

The theoretical basis for the explanation of the relationship between exchange rates and stock markets are premised on the "flow and stock oriented" models of exchange rates. Dornbusch and Fischer (1980) postulated that a nation's current account or balance of trade is influenced by its purchasing power parity. Adjustments in the purchasing-power parity affects the output of a nation which then affect the performance of a firm and invariably is reflected in the price of the stock of the firm. On this model, stock prices are affected by currency adjustments. This, however, conflicts with the Mundell-Fleming model which introduced capital mobility and

viewed the exchange rate to achieve a level where the goods and money market are in equilibrium, with money demand equating money supply at the world interest rate and corresponding income level.

Price of stocks relate positively with the earnings of firms. In times of higher stock prices, the total earnings of the firm increase accordingly and decline during bear seasons. Therefore, there is a need for the inclusion of foreign exchange risk in the pricing of stocks. This shows that stock prices dramatically adjust to exchange rate changes. In explaining the linkages between the exchange rate and stock prices, the stock-oriented approach suggests for the utilization of stock prices to explain and predict exchange rates movements. However, Aggarwal and Harper (2010) and Carrieri, Errunza, and Majerbi (2006) identified the flow-oriented approach by which causality runs from exchange rate to stock prices.

Under flow-oriented approach, companies with subsidiaries located on foreign lands are susceptible to foreign exchange risk due to transaction, translation and economic exposures, as well as the exposure due to import of substitutes (Jongen et al., 2012; Kolari, Moorman, & Sorescu, 2008). Foreign exchange risk is key in determining the share price of an investment. Aggarwal and Harper (2010) in their studies on the US for the period January 1990 through December 2003 using the Fama-French market models allude that fluctuations on the foreign exchange may affect the quantity of imports as well as the competitiveness of the domestic enterprises. In the case of depreciation of the domestic currency, the price of the locally produced goods can compete on the international market, as the good becomes cheaper thereby stimulating increased exports. Thus, the degree of harm of the exchange rate to the revenue of the export-oriented enterprise is premised on the elasticity of demand for the local company. If the price elasticity of the demand for the local firms export produce is less than one, in times of the depreciation of the exchange rate, this could reinforce a lower price. However, the increased demand because of the lower price would not be able to compensate for the lower revenue that accrues from the sale of the firms produce, and this could reinforce a lower stock price. Meanwhile, greater than the price elasticity would lead to an increase in the demand for the firms produce and this could lead the stock price to also rise. This shows that the exchange rates significantly impact stock prices.

Abdalla and Murinde (1997) conducted studies in emerging economies such as India, Korea, Philippines, Pakistan on monthly data for the period January 1985 to July 1994 and identified runs of causality from exchange rate to stock prices. Thus, they report that India, Korea and

Pakistan follow the traditional approach where changes in the exchange rates significantly impacts stock performance. Similarly, Murinde and Poshakwale (2004) studied the relationship between exchange rate and stock prices in emerging European nations. They estimated a bivariate VAR model using daily data for the period 2 January1995 to 31 December 1998 (before the Euro-crisis) and 1 January 1999 to 31 December 2003 (after the Euro-crisis). They found unidirectional causality from exchange rate to stock prices in Poland, Czech Republic, and Hungary for the pre and after-Euro crisis. Alagidede, Panagiotidis, and Zhang (2011) employed the Hiemstra-Jones test to examine the linearity and non-linear causality between exchange rate and stock markets for Canada, Switzerland, UK, Japan and Australia for the period January 1992 to December 2005. They complemented the granger causality from exchange rate to stock markets for Canada, Switzerland and the UK. Fowowe (2015) in his study on Nigeria and South Africa report divergent results for the relationship between stock prices and exchange rates. He documents that, there is causality runs from exchange rates to domestic stock prices in Nigeria, while there exists no causality for that in the case of South Africa. Using multi-variate causality tests, he finds that the London Stock Exchange drives both the Nigerian and South African stock markets.

Contrary to the traditional approach which views runs of causality from exchange rate to stock prices, Branson (1981) and Gavin (1989) view the capital account or trade balance positions to be influenced by exchange rate movements. Thus, market developments could impact the stock market which could affect the wealth and liquidity status, and invariably impact on the exchange rate. Thus, exchange rates could influence the evaluation of stock prices. However, only unanticipated changes in exchange rate could have any effect on stock prices since the forecasted changes are already factored in the pricing of stocks. Significant stock market developments which results in bullish stock trends would tend to increase the wealth of the investors that use the local currency. An increase in the wealth of the local investors would influence the increase in the demand for money and these further fuels a hike in the interest cost. Higher interest rates accompanied with a lower level of risk would motivate the flow of capital from more risky settings to less risky economies. It could be inferred that at the advent of the global economic crunch, increased investors pessimism about the global economy resulted in the drift of investment in US domestic assets to assets denominated in foreign currencies. The shift in investment destinations invariably influences a decline in the demand for money, which therefore instigates capital outflows from the affected nation and this could result in the depreciation of the currency.

Although, there exists theoretical foundation to explain the relationship between exchange rate and stock prices, Ehrmann et al. (2011) and Granger et al. (2000) among others do not find any relationship between the two indicators for some selected economies. For instance, Granger et al. (2000) do not find any relationship for Japan and Indonesia. A similar result is found by Ehrmann et al. (2011) in their study of the financial transmission between bonds, money and equity markets and exchange rates between the US and the euro-area. In their paper, they found that asset prices react strongly to shocks of other domestic assets, and that international spillovers within and across different assets impact on the asset market. Gavin (1989) concludes that both the exchange rate and stock prices are influenced by several related factors, and as such there exist no relationship between the two indicators.

However, stock market movements are not only due to exchange rate adjustments but can be the result of monetary policy decisions which are crucial in determining exchange rates and stock price movements. Monetary policy decisions play a crucial role in the movements of exchange rates and how they translate to changes in stock prices. Kim (2014) showed that contractionary monetary policy varies positively with the exchange rate. This is consistent with Gould and Kamin (2000) who in their studies on South Korea found that, an increase in the policy rate significantly strengthens the (Korean Won), while it relates inversely with the stock market due to a decrease in capital inflows from investors. Kearns and Manners (2006) in their study on Australia, Canada, New Zealand and the UK by different time periods found that, the impact of monetary policy on the exchange rate is very instantaneous and as such all monetary policy decisions will have the same effect on exchange rates. By this, they indicated that a tightening of monetary policy rate by 25 basis points would result in an appreciation of the exchange rate by 0.35 percent. Thus, monetary policy shock impacts significantly on exchange rates, an argument consistent with Gould and Kamin (2000).

In small open economies, international trade occupies a larger contribution to the share of the national income. Thus, the level of trade openness in the economy may determine the impact of the domestic monetary policy shocks on the domestic asset prices, and the effect the monetary policy shock would also have on the exchange rate. Kim (2014) in his studies of the effect of monetary policy on the Korean won found that foreign investors participation played a critical role in the relationship between monetary policy and exchange rate. Thus, in times of a contractionary monetary policy which increases interest rates, the amount of capital inflows into the bond market also increases which invariably leads to the appreciation of the domestic currency. However, moments of monetary tightening's in Korea are followed up with

withdrawals of funds from the stock markets. This therefore leads to a decline in capital inflows. Kim and Ruoy (2001) and Lee and Ryou (2006) convey in their studies of a simple timing between the Korean Won and the interest rate (which is a proxy for the monetary policy rate) and found an inverse relationship between them. That is, a hike in interest rate corresponds with a weakened exchange rate.

Furman, Stiglitz, Bosworth, and Radelet (1998) challenged these interpretations and contended that tightened monetary policy especially during financial crisis has untoward circumstance against the exchange rate. In the case of a further depreciation of the currency during the crisis, the cost of borrowing might be so high and could contribute to macroeconomic instabilities in the economy. Also, with foreign investors reducing their investments in the nation due to "international bank run", Gould and Kamin (2000) indicated that, it could result in loss of policy credibility which could hamper the possibility for the local debtors to rollover their maturing external obligations. In addition, contractionary monetary policy may heighten the debt burden for firms, as high non-performing loans (NPL) makes the financial sector very vulnerable and in effect could launch the economy into a high external debt, which could fuel increased investor's pessimism and result in a negative effect on the local stock market.

Glick and Leduc (2013) studied using high frequency intraday data to assess the value of the US dollar following monetary policy decisions by the Federal Reserve, and found that both the conventional and un-conventional monetary policy surprises significantly depreciated the US dollar. They estimated that at the end of 2008, a one standard deviation easing in unconventional monetary policy resulted in a depreciation of the US dollar by 40 basis points within an hour. This confirms the findings of Parrado (2001) that in the case of a contractionary foreign monetary policy that increases the interest rate, there is a tendency for the persistent depreciation of the exchange rate though for a short-time.

3.5.3 Interaction between Monetary Policy and Stock Market Performance

This section reviews the interactions that exist between the policy rate and stock returns both at the macro and micro levels. The stock market has an enviable role to play in the efficient allocation of resources to the various sectors of the economy. Therefore, innovations in monetary policy decisions which reflect economic developments on the stock market give a headlight to monetary authorities on the appropriate feedback to be implemented to impact the future course of macroeconomic variables (Chatziantoniou, Duffy, & Filis, 2013; Mishkin, 2001b).

The effect of monetary policy on stock markets could either be analyzed from the interest rate perspective or from the money supply channel. Kovanen (2011) in his study on the interes rate pass-through effect in Ghana noted that, in deep and liquid financial markets, the interest rate is used as an effective tool for monetary policy. The author emphasizes that the policy rate which is the ultimate lending rate by the Central bank is reflected in the treasury bill and interbank bill rates. He found out that the wholesale market interest rate which is the widely used rate and responds positively to a shock on the policy rate within a period of a month with a lag. This confirms the findings of Ghartey (2005) who identified a contemporaneous impact of monetary policy on the short-medium term treasury bill rates in Ghana.

At the perspective of interest rates, the exchange rate is crux to the explanation of stock prices in that during periods of high interest rates, the local currency appreciates compared with the foreign currency. The domestic currency appreciates as investors move their funds from countries with lower interest rates to countries with higher interest rates given a same level of risk. The increased inflow of funds would result in an increase in the supply of the foreign currency and a corresponding rise in the demand for the local currency by investors. An appreciation of the domestic exchange rate could in the long-run reinforce less foreign inflows to undertake investments. The strengthened domestic currency could have a dire consequence on the competitiveness of the nation, which invariably leads to a reduction in production, and eventually culminates in a lower asset price. Addo and Sunzuoye (2013) provide evidence of a negative relationship between Treasury bill and interest rate and stock prices in their studies on the joint impact of interest and Treasury bill rate on the Ghana stock market for the period January 1995 to December 2011 using Johansen's multivariate co-integration model and a vector error correction model. Adam and Tweneboah (2008) in their analysis of macro-economic factors and its linkages with stock markets identified a long-run relationship between them. They indicated that using the impulse response functions (IRF) and the forecast error variance decomposition (FEVD) that the rate of interest and the inflation rate should be considered in the pricing of stock prices in Ghana.

Central banks conduct and formulate monetary policy decisions with support of auxiliary functions such as the development of the money market through direct or indirect monetary policy to breathe stability to the macro-economy (Ncube, 2005) . Monetary policy works through the transmission mechanism to affect other macro-economic variables such as the stock markets, exchange rates etc. The transmission mechanism propagates the real economy indirectly through

the credit channel which functions with the interest rate channel. Hsing (2013) specifically emphasize the relevance of monetary and fiscal policies on stock market performance in Poland and finds an inverse relationship between the monetary policy rate and Poland's stock market index. This is because the stock market index which serves as a proxy for stock performance reacts endogenously to monetary policy rate. The policy rate may affect stock market activities through changes in the amount of money supply. This could further fuel a revaluation of portfolios by investors as a change in money supply would re-orient the market interest rate which has the capacity to affect the value of wealth of investors. Thus, monetary policy may impact on stock markets through the Q-theory of investment that is linked to Tobin (1969). According to the author "A General Equilibrium Approach to Monetary Theory", demand for investments can be explained by the ratio of the market value of a firm's capital stock to its replacement cost and a firm will invest until the ratio between the stock market valuation of its existing capital assets and current replacement (of same capital assets) is equal to one. Thus, a higher market interest rate will lead to a lower valuation of stocks. The traditional Keynesian approach to Tobin Q's theory postulates an inverse relationship between stock prices and interest-bearing instruments assuming the case where there exist two assets (stocks and bonds) in the investment universe.

Rigobon and Sack (2004) state that, holding all other factors constant, a contractionary monetary policy decision which results in a hike in interest rates, is associated with low stock prices, given the higher discount rate for the expected stream of dividends. Li, İşcan, and Xu (2010) used a structural VAR models with short-run restrictions to study the impact of trade and financial openness on the transmission of monetary policy shocks to stock for Canada and the USA. They identified a slight change in stock prices in response to contractionary monetary policy in the case of Canada, whereas the response of stocks to monetary policy shocks is large and prolonged in the case of the USA. The impact of contractionary monetary policy on the economy is premised on the Central banks control of the amount of money available to both consumers and firms through its relationships with banks with the sole aim of mopping up excess liquidity in the economy.

In sharp contrast, Kenourgios and Samitas (2011) in their findings on the relationship between stock markets and the domestic interest rate (r) for Czech Republic, Hungary, Slovakia and Poland identified the effectiveness of domestic industrial production on affecting stock market returns than the domestic interest rate (r). Bernanke and Kuttner (2005), studying the response of

stock markets to interest rates using daily data, consider how the impact differs depending on the changes to the profile of anticipated future monetary policy. Kearns and Manners (2006) conclude that since the monetary policy change is exogenous to the exchange rate, an unanticipated tightening of 25 basis points leads to a rapid appreciation of around 0.35 percent.

A growing body of empirical research has investigated the effect of monetary policy on the real economy, example Horobet and Dumitrescu (2009), Humpe and Macmillan (2009) and Ioannidis and Kontonikas (2008). The relevance of monetary policy transmission to stock prices depends on trade and financial market openness (Li et al., 2010). Therefore, the level of change in the stock market because of monetary policy decisions does not remain uniform across economies but varies depending on the level of trade and financial market openness. They found that relatively small open economies operate in international financial markets and as such tend to take the world interest rate as it is, with limited or no variabilities to suit its local economy.

Given the above considerations and the fact that Ghana is a small open economy compared with the United States of America, there is therefore a critical role that the domestic and the foreign interest rate play to affect the domestic stock market performance. Further, we proceed to set-up the economic variables for the estimation in chapter 4.

CHAPTER FOUR

DATA AND METHODOLOGY

4.1 Introduction

This research seeks to investigate the effect of Ghana's monetary policy rate on the Ghana Stock Exchange. In this chapter, the dataset used, and the methodology employed in analyzing the research are explained.

4.2 Data and description of the variables

The empirical analysis utilizes macroeconomic variables for which complete monthly secondary data are available from January 2000 to December 2017. Within this sample period, Ghana underwent numerous structural changes ranging from changes in domestic monetary policy strategies, redenomination of the Ghana cedi, and the financial crisis in the USA which might have directly or indirectly influenced the quantity of foreign capital flows from developed economies to emerging and developing markets. These economic and financial developments influenced the quantity and value of trades on the Ghana Stock Exchange (GSE).

The model uses seven variables to describe the macroeconomic relationships which have a bearing on the GSE. These include: The Government of Ghana 91-day T-bill rate (r), the Ghana Cedi-US dollar exchange rate exchange rate (E), the inflation rate (P), the real money supply (M2+), the Ghana stock exchange Composite Index (GSE-CI), the real GDP growth rate (GDP) and the US 3-month-Treasury bill rate (FR). Of the variables used in the model, the real GDP growth rate and the inflation rate characterize the state of the Ghanaian economy, while the US 3-month T-bill rate reflects changes in international financial conditions that influence the Ghanaian economy. The 91-day T-bill rate, the real money supply and the exchange rate reflect policy variables.

The Ghana Stock Exchange monthly stock indices data were obtained from the Ghana stock exchange website (www.gse.com.gh). In the study, the GSE-CI and the Ghana Stock Exchange All Share Index (GSE-ASI) were identified as proxies for measuring the Ghana stock market valuation. The macroeconomic variables used in the study included the monetary policy rate for which the 91-day T-bill rate is used as a proxy, while the monetary policy rate of the US was represented by the 3-months T-bill rate. The other variables included in the model are the inflation rate, the exchange rate, the amount of money supply, and the real GDP growth rate. The

data on the exchange rate and inflation rate were obtained from Thomson Reuters DataStream, while data on the amount of money supply was obtained from the Bank of Ghana website (www.bog.gov.gh). Annual data on real GDP growth rate were obtained from the Federal Reserve website https://fred.stlouisfed.org for the period 2000-2006, while quarterly GDP growth rate data were obtained from the Ghana Statistical Services website (www.statsghana.gov.gh) from 2007-2017.

The variables chosen for this research is similar to those used by Parrado (2001).The choice of the variables of interest is due to the linkages between them. One of the prominent factors that drive stock market activities are the prevailing market interest rate and the value of the domestic country's currency compared with the foreign currency. As per economic theory, capital is expected to move from countries with lower interest rates to countries with higher interest rates given a similar level of risk. Adjustments in interest rates could influence the value of a company's stock and hence its stock returns. Thus, there exists an inverse relationship between interest-bearing investments and investments on the stock market. Thus, investors in a bid to climb on higher profits would direct their investments away from the stock market when interest rates are high. The increased inflow of capital will lead to excess supply of funds, which could dampen the rate of interest in the long-run.

Data for the domestic currency against the US dollar is used as a measure of the exchange rate. The US dollar is computed into quantities in the Ghana cedi per the monthly average rate that prevails on the market. The appreciation or depreciation of the value of the Ghana cedi is denoted by the fall or rise of the exchange rate, respectively. The GSE-CI used is the monthly average of the main benchmark index on the Ghana stock market. The M2+ is a proxy for money supply rather than M3 and M3+ which include foreign currency deposits, and as such might pose a challenge for the domestic monetary authorities to have control on. Data for real GDP growth rate was difficult to be obtained monthly. Therefore, the annual data for real GDP growth rate from 2000 to 2006 as obtained from the Federal Reserve Bank of St. Louis is divided by twelve (12) and sequentially adjusted for inflation to get monthly data. From 2007 to 2017, the quarterly GDP growth rate released by the Ghana Statistical Services is extrapolated to get monthly data. The quarterly GDP growth rate is divided by four and the results accounted for by the monthly CPI to get the real GDP growth rate. All the variables except the foreign interest rate and the domestic interest rate are transformed into natural logarithmic form.

The study is conducted in two steps with the first step encompassing all the duration of time of the study (Jan 2000-Dec 2017) together with all the variables as defined in the model. The first step seeks to answer the first research question. To answer question two, robustness checks are conducted by limiting the duration of the study to the time of the quantitative easing (2007-2009) to analyze how it impacted the GSE-CI in step 2.

4.3 The methodology

The study seeks to estimate the effect of the domestic and foreign monetary policy decisions on the Ghana Stock Market performance. In this case it is of paramount interest to understand the variables that affect and are affected by both the monetary policy rates and the Ghana Stock Exchange indices.A structural vector autoregressive (SVAR) methodology is utilized to analyze and estimate the dynamic effects of variables over time and analyze the effect of shocks based on economic theory. It is used in the analysis of the monetary transmission mechanism. SVAR is considered for this research because it focuses on the role that shocks play in the dynamics of the model based on economic theory (Sims, 1986) unlike the traditional VAR model that include lags of all the variables to assume stationary.

4.3.1 The VAR model

In this section, a description is provided on the endogenous variables, exogenous variables and the lags that are used in the model. The standard VAR model is expressed in the following form

$$y_t = BX_t + B_i y_{t-1} + u_{it} \qquad (1)$$

where y_t is a vector of the endogenous variables, B_i represent the coefficient matrices of the endogenous variables, X_t is a vector of the exogenous variable, while y_{t-1} indicates the vector of the lagged endogenous variables and u_{it} is the vector of independent multivariate normal disturbances. The coefficients of y_t and B are of utmost priority in the model. However, it is not feasible to directly estimate the parameters in equation (1) without identifying restrictions. This is because, the model specified in equation (1) only has the lag of the endogenous variables and may turn to contemporaneously correlate among the errors. The vector of the endogenous variables (y_t) is a function of: real interest rate (r), log of real inflation rate (lnP), log of real GDP growth rate (lnGDP), log of real exchange rate (lnE), log of money supply growth (lnM2+) and the log of the Ghana Stock Exchange Composite-Index (lnGSE).

In the model, the foreign interest rate is represented by the US 3-months treasury- bill rate. This leads to $X_t = f(FR)$. We then proceed to test the significance of the foreign interest rate (FR) to identify whether it has any predictive power on the results of the estimation.

In the running of the VAR model, the exogenous variable is included in the dynamic forecast as an endogenous variable. The operationalized model as specified in equation (1) is specified with each of the endogenous variables and the exogenous variable in a matrix form.

Based on the likelihood ratio test, we determine whether to restrict the model by excluding the exogenous variables or unrestricted the model by failing to exclude the exogenous variables. In excluding the exogenous variable, we assign a zero coefficient for the variable. However, since the exclusion of the exogenous variable (foreign interest rate) could result in biases in the identification of the shocks to the domestic economy, we thereby include all potential variables that directly and indirectly influence the domestic monetary policy. Thus, since the inclusion of the foreign interest rate represents the model of the open economy, it is included in the model formulation.

This leads to the equation : $y_t = f(FR, lnGDP, lnP, r, M2+, E$ and $GSE)$ (2)
with GDP, inflation (P), monetary aggregate (M2+), the exchange rate (E) and the Ghana Stock Exchange Composite-Index (GSE) being represented in logarithmic forms. In matrix form, equation (2) is represented as:

$$
\begin{bmatrix} FR \\ \ln GDP \\ \ln P \\ r \\ \ln M2+ \\ \ln E \\ \ln GSE \end{bmatrix} = \begin{bmatrix} V_{FR} \\ V_{\ln GDP} \\ V_{\ln P} \\ V_r \\ V_{\ln M2+} \\ V_{\ln E} \\ V_{\ln GSE} \end{bmatrix} + \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & b_{77} \end{bmatrix} \begin{bmatrix} FR_{t-1} \\ \ln GDP_{t-1} \\ \ln P_{t-1} \\ r \\ M2+_{t-1} \\ \ln E_{t-1} \\ \ln GSE_{t-1} \end{bmatrix} + \begin{bmatrix} U_{FRt} \\ U_{\ln GDPt} \\ U_{\ln Pt} \\ U_{rt} \\ U_{\ln M2+t} \\ U_{\ln Et} \\ U_{\ln GSEt} \end{bmatrix} \quad (3)
$$

Following (Cushman & Zha, 1997) where the combination of the endogenous and exogenous variables assume an m x 1 vector of observations and the b_i's are m x m matrix polynomial and U_t is an m x 1 vector of structural disturbances. The model containing the variables is shown in the following system of equations:

$$FR_t = V_{FR} + b_{11}FR_{t-1} + U_{FRt} \qquad (3.1)$$

$$lnGDP_t = V_{lnGDP} + b_{22} \, lnGDP_{t-1} + U_{lnGDPt} \qquad (3.2)$$

$$lnP_t = V_{lnP} + B_{33}lnP_{t-1} + U_{lnPt} \qquad (3.3)$$

$$r_t = V_r + B_{44}r_{t-1} + U_{rt} \qquad (3.4)$$

$$lnM2+_t = V_{lnM2+} + B_{55}lnM2+_{t-1} + U_{lnM2+t} \qquad (3.5)$$

$$lnE_t = V_{lnE} + B_{66}lnE_{t-1} + U_{Etn} \qquad (3.6)$$

$$lnGSE_t = V_{lnGSE} + B_{77}lnGSE_{t-1} + U_{lnGSEt} \qquad (3.7)$$

From the equation (3.1 to 3.7), the dimension of B_{11} is n_1 x n_1, B_{22} is n_2 x n_2, B_{33} is n_3 x n_3, B_{44} is n_4 x n_4, B_{55} is n_5 x n_5, B_{66} is n_6 x n_6 and B_{77} is n_7 x n_7. U_{FRT} is m_1 x 1, U_{lnGDPt} is m_2 x 1 where m_1 + m_2 = m. U_{lnGSEt} is represented by m_7 x 1. The diagonals are represented with one's to show the contemporaneous relationship between the endogenous variables and the coefficient elements of the matrix, while the off-diagonals are represented by zero's. However, the one's on the diagonals do not appear in the equations (3.1 to 3.7 listed above).

$E[\varepsilon(t)\varepsilon(t)^1 | y(t-s), s >0] = 1$, where $E[\varepsilon(t) | y(t-s), s >0] = 0$. The covariance of the matrix is zero because the structural shocks are totally independent. The zero (0) in equation (3) is as a result of the imposition of a restriction on the contemporaneous relations among the endogenous variables of the structural model to equate the number of parameters of the reduced form Cushman and Zha (1997). The block-exogeneity restriction b_{12} to $b_{17} = 0$ implies that the second block GDP$_t$ does not enter the first block FR$_t$ for lagged values of the variables in the structural form (3). Therefore, imposing $b_{21} = 0$, then we imply that FR$_t$ is only affected with a lag by itself.

Following Sims (1992), we consider all the variables that are used in the model as endogenously determined within a VAR system depending on the lagged values of the variables used in the system. Then, we proceed to add a structure to the VAR by imposing restrictions based on economic theory. According to Sims (1992), the covariance matrix needs to be divided where Ω = PP^1 with the choice of the P matrix determining the structure of the economic model, and thus influencing the results of the analysis.

A VAR model is usd to analyze the interactions among the macroeconomic variables because of its flexibility in summarizing its interactions without the imposition of restrictions on unrealistic exogenous assumptions. In analyzing the VAR model, seven variables namely: the domestic interest rate, the foreign interest rate, inflation, money supply growth, real GDP growth rate, the exchange rate and the GSE-Composite Index are factored primarily to explain whether monetary policy shocks explain stock market performance. However, since exchange rates are affected by the inflow or outflow of funds to or from an economy, we included the foreign interest rate in the VAR analysis. Since VAR models requires the imposition of an ordering restriction could influence the results of the analysis.

4.3.2 Model Specification

Due to the difficulty of the reduced form VAR in equation 3 to indicate the structure of the economy, we then identify structural representation to derive orthogonal shocks in order to conduct policy analysis. Therefore, we obtain a model where the error terms are serially uncorrelated and independent of each other.

The vector of endogenous variables (y_t) contains the variables of interest and consider the system of equations,

$$Ay_t = BX_t + B_i y_{t-1} + \ldots + B_p y_{t-p} + D^{1/2} u_t \quad (5)$$

Where A = n x 1 vector of constants,

B_i = n x n matrix of coefficients, and

u_t = n x 1 vector of white noise innovations

From equation (5), the B_i are matrices of parameters, u_t is serially uncorrelated and independent of each other, $D^{1/2}$ is a diagonal square root matrix containing the standard deviations of the structural shocks (y_t) and $E(u_t u^1_t)$ =I.

If the $D^{1/2}$ is not diagonal, then it is assumed that the error terms of the matrix can be contemporaneously correlated. However, it is expected that the innovations in the error terms will be uncorrelated with their own lagged values and the variables at the right-hand side in equation (5).

Because equation (5) assumes contemporaneous relationships among the variables, we therefore cannot estimate the effect of a structural shock of one variable on the other using OLS. Equation (5) violates the assumption of no autocorrelation. In that regard, we define a structural mix by which the residuals of each of the variables are not correlated with the other variables. Therefore, the reduced form of the SVAR, a standard VAR model is derived by multiplying both sides of equation (5) by A^{-1} with the assumption that it exists and solving for y_t in terms of y_{t-1} and u_t.

$$A^{-1}Ay_t = A^{-1}B_0 + A^{-1}B_1 y_{t-1} + A^{-1}u_t \quad (6)$$

With $A^{-1}A = I$, and $A^{-1}B_0$ representing G_0 while $A^{-1}B_1 y_{t-1}$ representing G_1, we get equation (7)

$$y_t = G_0 + G_1 y_{t-1} + e_t \quad (7)$$

From equation (7), we get the reduced form of VAR where the vector y depends on the lags of itself and the forecast error (e). The matrix in equation (4) relates the structural shocks u_t to the forecast errors (e) of the reduced form. Thus, $e_t = A^{-1}u_t$.

In a more compact way, equation (7) could be expressed in lag operator notation as,

$$A(L)y_t = G_0 + u_t \quad\quad\quad (8)$$

$$A(L) = I_2 - A_1 L \quad (9)$$

Where $A(L) = I-A_1-\ldots\ldots-A_p$, $A_i= B_0^{-1}B_i$, $u_t = B_0^{-1}D^{1/2}\varepsilon_t$, and the covariance matrix of the error terms is $E(u_t u^1{}_t) = B_0^{-1}DB^{-1}{}_0 \equiv \Omega$. Given the reduced form in equation (7), we then estimate the parameters in the structural equation by imposing restrictions on the elements of the matrix A. Given that,

$$B^{-1} = \frac{1}{\Delta}\begin{bmatrix} 1 & -b12 \\ -b21 & 1 \end{bmatrix}, \Delta = det\ (B) = 1-b_{12}b_{21}$$

We have from equation (7),

$$G_0 = A^{-1}B_0 = \frac{1}{\Delta}\begin{bmatrix} B_{10} & -b_{12}B_{20} \\ B_{20} & -b_{21}B_{10} \end{bmatrix} = \begin{bmatrix} G_{10} \\ G_{20} \end{bmatrix},$$

$$G_1 = A^{-1}B_1 y_{t-1} = \frac{1}{\Delta}\begin{bmatrix} B_{11}-b_{12}B_{21} & B_{12}-b_{12}B_{22} \\ B_{21}-b_{21}B_{11} & B_{22}-b_{21}B_{12} \end{bmatrix} = \begin{bmatrix} G_{11} & G_{12} \\ G_{22} & G_{21} \end{bmatrix},$$

$$\varepsilon_t = A^{-1}u_t = \frac{1}{\Delta}\begin{bmatrix} u_{1t}-b_{12}u_{2t} \\ u_{2t}-b_{21}u_{1t} \end{bmatrix} = \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$$

4.3.3 SVAR Identification

The structural vector autoregressive (SVAR) approach is used to determine the effects of the domestic and foreign monetary policy shocks on the Ghana Stock Exchange. The methodology implied in the research relies on the official release of interest rate and how it interrelates with other macroeconomic variables at specific times during monetary shocks. Under SVAR, there is an imposition of restrictions on the response variables on each other based on the underlying VAR model. The model based on the Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hannan-Quinn information criterion, the Schwartz Bayesian Criterion (SBC) and the Likelihood Ratio (LR) statistic obtained one and three optimal lags respectivelyTherefore, the model used one optimal lag for the sample. In the model, since we incorporate a foreign rate variable (FR) into a VAR as a determined variable, there is the possibility for the variable not to depend on its own lags but rather the lags of the domestic variables. Leamer (1985) explained a variable to be exogenous if the conditional distribution of one of the variables (y given x) does not change given the modifications that generates the other variable (x). Therefore, a block exogeneity test is applied to minimize the number of parameters that might be needed to identify the monetary reaction function of the Ghanaian economy from the standpoint of a small open economy. The test according to Parrado (2001) would help to identify if the exclusion of variables together with its lags in a VAR could help the model to obtain sound statistical inferences. Thus, the model for the study follows the one used by Parrado (2001) with the SVAR

estimations performed with the natural logarithm for the GDP growth rate, inflation, money supply growth, exchange rate and the Ghana Stock Exchange Index.

4.3.3.1 Model Specification

To provide some empirical insight into the effects of domestic and foreign monetary policy on the Ghana Stock Exchange, we begin with a general specification with the reduced form, expressed as equation (2):

$$y_t = \beta \ (L) \ y_t + u_t \qquad\qquad (10)$$

where y_t = f(FR,GDP,P,r,M2+,E,GSE)

y_t is an n x 1 vector of observations, β (L) is a matrix polynomial in the lagged operator L, and $E[u_t u^1_t] = \Sigma$ as the variance-covariance matrix. The variance-covariance matric depict that there are as many structural shocks as there are variables in the model.

Due to the risky nature of making structural inferences from unrestricted VAR, which takes the shape of a reduced form, the possibility of measuring the true structural effects of a policy change is estimated by a structural VAR. In this case, the Ghanaian economy can be explained by the structural dynamic system of equations. The structural system exhibits the assumption of a linear, stochastic dynamic form (omitting the constant and the deterministic terms) where:

$$G \ (L) \ y(_t) = \varepsilon \ (_t) \quad (11)$$

Equation (11) assumes a recursive SVAR by which a specific ordering is used to estimate the effects of monetary policy shocks on the stock market performance. Some studies (Sims, 1992) adopts this recursive approach to estimate a VAR to trace the effects of a shock to monetary policy in the USA. From equation (11), y_t is an n x1 vector of observations while G (L) is an (n x n) matrix polynomial in the lagged operator L with non-negative powers, and e_t is an n x 1vector of structural disturbances.

The assumption concerning this model is that $\varepsilon_{(t)}$ is not serially correlated and E $[\varepsilon_t \varepsilon^1_t] = \Lambda$, and Λ constitutes a diagonal matrix where the elements on the diagonal are the structural shock variances. Also, there is the assumption of normality of the variances of all the structural shocks to unity. The orthogonality assumption ensures that the errors are mutually uncorrelated with past variables being forecast or with other variables that are contained in the model. The by Bernanke (1986); Cushman and Zha (1997) ;Blanchard and Perroti (2002). While they assumed a

recursive VAR by which restriction on the contemporaneous and lagged matrices of coefficients improves estimation results, they suggest allowing the non-recursive structures while they restrict the structural VAR. The minimum number of restrictions imposed is dependent on the differences between the number of known and unknown elements with (n) being the number of variables in the VAR.dependence of the Ghanaian interest rate on the foreign variables invalidates the conditions for the recursive structure in contemporaneous variables as captured in the model. Plausible exclusion restrictions contained in each structural equation would produce recursive contemporaneous structure which will be easy to interpret. The study specifies an explicit monetary policy function following similar approach used in literature Cushman and Zha (1997).

The structural VAR models which restrict contemporaneous structural parameters follow similar studies by Bernanke (1986), Blanchard and Perroti (1992), Cushman and Zha (1997). While they assumed a recursive VAR by which restriction on the contemporaneous and lagged matrices of coefficients improves estimation results, they suggest allowing the non-recursive structures while they restrict the structural VAR. The minimum number of restrictions imposed is dependent on the differences between the number of known and unknown elements with (n) being the number of variables in the VAR.

Thus, the variable G_0 is the contemporaneous coefficient matrix captured in the structural form, $G(L)$, while $G_{-0}(L)$ represent the coefficient matrix in $G(L)$ that excludes contemporaneous coefficient G_0 is defined by,

$$G (L) = G_0 + G_{-0} (L) \quad (12)$$

Under the structural and reduced form equations, the final structure of the equation is fulfilled by (A and B matrices) as shown below:

$$\beta(L) y_t = - G_0^{-1}G_{-0}(L)y_t, \quad (13)$$

$$u_t = G_0^{-1}\varepsilon_t \quad (14)$$

It then follows that, $\quad E [u_t u^1_t] = \Sigma = (G_0^{-1}) \Lambda (G^{-1})^1 \quad (15)$

where ε_t consist of the vector of the reduced VAR disturbances and U_t is made up of the vector of the traditional VAR disturbances. Using the sample covariance matrix estimate of Σ, the free parameters in G_0 and Λ are minimized through a maximum likelihood effect. From equation (14), $(G_0^{-1}) \Lambda (G^{-1})^1$ has an n x (n+1) free parameters to be estimated. G_0 has n^2 free parameters

while Λ has (n) parameters to be estimated. The model adopted from Parrado (2001) assumes an n x (n+1)/2 restrictions since Σ consist of the same number of parameters. However, normalizing each of the n diagonal elements of G_0 to 1 would require a minimum of n x (n-1)/2 restrictions based on theoretical assumptions. The matrix A consist of the contemporaneous interactions among the variables considered in the model while matrix B is the diagonal matrix under which the variances of the reduced VAR disturbances are normalized. The model is exactly identified when G_0 is considered to be a lower triangular on the basis of the Cholesky factorization (Parrado, 2001).

4.4 Identifying monetary policy shocks to stock markets

The vector of the model consists of the following economic variables [Fr, GDP, P, r, M2+, E and GSE]. Following the restrictions on the contemporaneous matrix of the structural parameters, as per Parrado (2001). The disciplining role of monetary policy is captured in the following:

$$
\begin{bmatrix}
\varepsilon_{FR} \\
\varepsilon_{\ln GDP} \\
\varepsilon_{\ln P} \\
\varepsilon_{r} \\
\varepsilon_{\ln M2+} \\
\varepsilon_{\ln E} \\
\varepsilon_{\ln GSE}
\end{bmatrix}
=
\begin{bmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 \\
a_{21} & 1 & 0 & 0 & 0 & 0 & 0 \\
a_{31} & a_{32} & 1 & 0 & 0 & 0 & 0 \\
a_{41} & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & a_{53} & 0 & 1 & 0 & 0 \\
0 & a_{62} & 0 & a_{64} & 0 & 1 & 0 \\
a_{71} & a_{72} & a_{73} & a_{74} & a_{75} & a_{76} & 1
\end{bmatrix}
\begin{bmatrix}
u_{FR} \\
u_{\ln GDP} \\
u_{\ln P} \\
u_{r} \\
u_{\ln M2+} \\
u_{\ln E} \\
u_{\ln GSE}
\end{bmatrix}
\qquad (14)
$$

where ε_{FR}, $\varepsilon_{\ln GDP}$, $\varepsilon_{\ln P}$, ε_{r}, $\varepsilon_{\ln M2+}$, $\varepsilon_{\ln E}$ and $\varepsilon_{\ln GSE}$ make up the structural disturbances – foreign monetary policy shocks, output shocks, domestic inflationary shocks, domestic interest rate shock, money supply shocks, exchange rate shocks and stock market shocks, respectively. Concurrently, u_{r*}, u_{GDP}, $u_{\ln P}$, u_{r}, $u_{\ln M2+}$, $u_{\ln E+}$ and $u_{\ln GSE}$ represent the reduced-form residuals that come from the unexpected changes of the foreign interest rate, output, price, domestic interest rate, money supply, exchange rate and stock markets.

Expansion of equation (14) leads to:

$$\varepsilon_{FR} = a_{11}\, u_{FR} + 0 + 0 + 0 + 0 + 0 + 0 \qquad (14.1)$$

$$\varepsilon_{\ln GDP} = a_{21} + a_{22}\, u_{\ln GDP} + 0 + 0 + 0 + 0 + 0 \qquad (14.2)$$

$$\varepsilon_{\ln P} = a_{31} + a_{32} + a_{33}\, u_{\ln P} + 0 + 0 + 0 + 0 \qquad (14.3)$$

$$\varepsilon_{r} = a_{41} + 0 + 0 + a_{44}\, u_{r} + 0 + 0 + 0 \qquad (14.4)$$

$$\varepsilon_{lnM2+} = 0 + 0 + a_{53} + 0 + a_{55} u_{lnM2+} + 0 + 0 \qquad (14.5)$$

$$\varepsilon_{lnE} = 0 + a_{62} + 0 + a_{64} + 0 + a_{66} u_{lnE} + 0 \qquad (14.6)$$

$$\varepsilon_{lnGSE} = a_{71} + a_{72} + a_{73} + a_{74} + a_{75} + a_{76} + a_{77} u_{lnGSE} \qquad (14.7)$$

The system has not imposed any restrictions to solve for the parameters of the structural model. Each of the reduced form shocks represents a weighted average of the selected disturbances. The weights assigned to each of the shocks are represented by the a_{xy}. The matrix in equation (14) relates the forecast errors and the structural errors. The equations are analyzed below,

The first equation relates to the foreign interest rate which is the most exogenous variable and as such does not respond contemporaneously to the variables specified in the model but rather is affected only by a shock to itself. Due to its exogenous characteristic, the foreign interest rate is considered the first in the matrix system. In the case of the foreign interest rate, it is assumed that the Federal Reserve of the USA only hike rates in relation to inflationary pressures in the economy. Therefore, adjustments to the federal funds rate are unlikely to affect the output as well as the price level of the Ghanaian economy.

The second and third equations features the real GDP growth rate and the domestic real inflation rate which according to Vinayagathasan (2013) proxies the goods market equilibrium of the domestic economy. Based on the matrix, we assume that both the output and the price are contemporaneously not affected by the domestic interest rate, the money supply, the exchange rate and the Ghana Stock Exchange Index. However, output depends contemporaneously only on the foreign interest rate. The price level responds contemporaneously to changes in the foreign interest rate and the output level. This however is inconsistent with the Mundell-Fleming framework as it suggests output to vary largely in response to monetary policy shocks and in the presence of a flexible exchange rate regime (Parrado, 2001).

The fourth and fifth equations feature the domestic interest rate and the growth of money supply which are featured in the money-market equilibrium. It is assumed that the Bank of Ghana adjust the amount of money supply to affect the level of prevailing interest rate in the Ghanaian economy. Thus, the domestic interest rate which features in equation (4) of the matrix is contemporaneously affected by the foreign interest rate. The growth of money supply in circulation in the Ghanaian economy is contemporaneously affected by the price

level. Thus, changes in the rate of inflation are expected to contemporaneously affect the amount of money supply.

Equation (6) allows for changes in output (GDP) and the domestic interest rate to contemporaneously affect the exchange rate. Vinayagathasan (2013) explains that the exchange rate represented the financial market equilibrium. In line with Cushman and Zha (1997), the exchange rate represented a forward-looking asset price and as such tended to influence a number of domestic variables implicitly.

The model assumes that the Ghana Stock Exchange Composite Index responds contemporaneously to changes in the foreign interest rate, the changes in GDP, changes in inflation due to its effect on the real interest rate as an alternative instrument to investment on the stock market, changes in money supply, changes in interest rate and changes in the exchange rate as well as lags of all variables. It could be termed as the monetary policy reaction function.

According to Parrado (2001), the structural shocks are made up of:

   i.   Money market: money supply and money demand variables
   ii. Domestic goods market: output and the price levels variables
   iii. Exogenous shocks: the foreign interest rate; and
   iv. Arbitrage condition: the real exchange rate variable

4.5 Robustness checks for step 2

One potential issue that pertains to the estimated SVAR structural coefficients for step 1 is the size of the variables. Hausman, Auffhammer, and Berck (2012) note that smaller structural systems generally perform better than larger systems. With the robustness checks, we estimate a sparser model by testing for the impact of the US interest rate on the domestic economy during the quantitative easing by varying the time that was initially considered in the model to 2007-2009. The model contains only the foreign interest rate (FR), the domestic interest rate (r) and the log of Ghana Stock Exchange index (lnGSE). The corresponding matrices A and B with their restrictions are presented below:

$$
A = \begin{bmatrix} 1 & 0 & 0 \\ a_{21} & 1 & 0 \\ a_{31} & 1 & 0 \end{bmatrix} \quad
B = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}
$$

Additionally, we use the log for the GSE-Composite Index. The various identification restriction have been imposed to ensure that the restrictions produce varied impulse response functions among the variables. The monetary policy function has been changed by excluding data on GDP, inflation, money supply and exchange rate but has been balanced to cater for omitted variable biases. The GDP has been omitted from the model because data are not available on monthly basis. With the informational assumption, the inflation rate and the money supply growth (P, M2+) have been omitted because they are all assumed to affect the domestic interest rate function. Also, the exchange rate (E) has contemporaneously been omitted due to the objective of the study to analyze the interaction of the US interest rate with the Ghanaian interest rate on the Ghana stock market rather than unexpected changes in the exchange rate.

4.6 Estimation Techniques

This research adopts a structural vector autoregressive (SVAR) model. In the use of the SVAR, several econometric challenges may come up from estimating the equations:

i. Under the reduced form of the VAR, the rejection of the imposition of an economic restriction on the data, and the possibility for the residuals not to be orthogonal may violate the fundamental structural shock assumption.

ii. The choice of the specification and the identifying assumption might affect the results of the SVAR. Therefore, unit root tests and the Johansen cointegraton test would be conducted for the structural identification.

iii. The measurement of endogenous variables is not attainable for instance, when monetary policy reacts with the movement of other variables. The endogeneity problem can be solved by identifying purely exogenous movements of shocks and how the economy responds to them through the *impulse response functions (IRF) and the forecast error variance decomposition (FEVD).* By this, we expect to use SVAR to isolate the exogenous shocks and undertake a measurement of the impact of the shock on the variables that are considered in the model.

iv. From the matrix in equation (14), the diagonal elements are E $[U_t^2]$ while E $[U_t U_t^1]$ are the off-diagonal elements. There is an imposition of a restriction on the diagonal terms to 1. The diagonal terms reflect the changes in the parameters on itself.

Unlike the Cholesky decomposition approach which consists of orthogonalize reduced form residuals, Σ. Cushman and Zha (1997) explains that the Cholesky decomposition is simply a case of numerous identification schemes. It involves a Wald causal chain and precludes simultaneous linkages that might exist among economic variables. This has the effect to constrain the G (L) matrix to be triangular. In the case of structural identification, the monetary policy shock may inter-relate with other economic variables both at the domestic and international fronts.

In chapter 5, we proceed to provide results of the contemporaneous coefficients and interpret the effects of monetary policy on stock markets by analyzing the variables data considered for the model formulation.

CHAPTER FIVE

EMPIRICAL RESULTS AND DISCUSSSION

5.1 Estimation Results

This section is divided into 4 subsections. The first section (section 5.1) presents an overview of the test for stationarity and optimal lags. Section 5.2 presents the results of the Johansen cointegration rank test while section 5.3 lists the results of the contemporaneous coefficients that were used in the model. The response of the Ghana Stock Exchange to monetary policy shocks is showed in section 5.4. The analysis of the robustness checks to determine the impact of the US quantitative easing during the 2008/2009 financial crisis is explained in section 5.5.

5.2 Estimation results of the Unit root test and optimal lags

The first process in identifying the effect of the monetary policy is to identify that the data to be used in the research are time invariant and as such do not result in the variation of the mean and the variance. Thus, the series should be stationary. Table 2 presents the unit root test for all the variables that were considered in the model. In the analysis, we tested for the null hypothesis of non-stationarity at levels examined against the alternative of the standard test for stationarity using the Augmented Dickey-Fuller (ADF). The acceptance of the null hypothesis requires the need to take the first difference to obtain stationarity I (1). Under the ADF test, it is assumed that there should be no correlation among the residuals when considering the appropriate number of lags to be used in testing for unit roots. Parrado (2001) suggests for the inclusion of unit roots test and granger causality test for each of the variables in the system.

Table 2. **Test for Unit roots (January 2000 –December 2017)**

Variable	Level		Log		1st Difference		Log 1st difference	
	Test-stat	p-value	Test-stat	p-value	Test-stat	p-value	Test-stat	p-value
FR	-2.399	0.1421	-1.495	0.5362	-4.738	0.0001**	-12.454	0.0000**
GDP	-5.316	0.0000 **	-7.202	0.0000**	-11.409	0.0000**	-13.911	0.0000**
P	-2.459	0.1257	-1.986	0.2929	-5.867	0.0000**	-8.571	0.0000**
M2	-2.373	0.1494	-2.494	0.1169	-9.112	0.0000**	-9.218	0.0000**
r	-2.171	0.2168	-2.232	0.1948	-6.088	0.0000**	-5.817	0.0000**
E	1.971	0.9986	-0.408	0.9088	-6.721	0.0000**	-5.722	0.0000**
GSE	-1.863	0.3499	-1.917	0.3240	-7.304	0.0000**	-7.842	0.0000**

Note: Augmented Dickey-Fuller unit root test for the variables in the model using lag of 2
** Estimated variable is significant at the 5% level (p-value)

Where FR, GDP, P, M2, r, E and GSE represent the logarithmic values of the foreign interest rate, the real GDP growth rate, the inflation rate, the growth of money supply, the domestic interest rate, the exchange rate and the Ghana Stock Exchange Composite Index respectively.

From the computation in table 2 which presents the unit roots test for the variables, the ADF test for unit roots at levels rejected the null hypothesis of the presence of unit roots for all the variables except the GDP. This showed that from the unit roots test at levels, only GDP was stationary at the 5 percent significance level. Since the other variables had problems of unit roots, we proceeded by testing for stationarity in logarithmic terms. Here, GDP remained the only stationary economic variable. Subsequent modifications such as the first difference and the first difference of the logarithmic term however results in the stationarity of all the variables. This shows that the variables such as the FR, GDP, P, r, M2+, E and the GSE are integrated at order one, I (1) at first difference and logarithmic first difference. In subsequent test, the foreign interest rate (FR) and the domestic interest rate (r) are used for estimations in their level forms. The rate of inflation (P), the money supply growth (M2+), the exchange rate (E) and the Ghana Stock Exchange Composite Index (GSE) are also specified in their logarithmic terms. Taylor (1993) argued that the monetary policy reaction function of the US operates through the interest rate channel through adjustments in inflation, output, as well as other relevant economic

variables. Therefore, subsequent tests to answer the second research question are conducted using the FR and the r at levels.

The choice of the optimal lag length according to Vinayagathasan (2013) is crucial in estimating the causal relationship that exists among economic variables. The number of lags is chosen to avoid autocorrelation, maintain the largest degree of freedom to allow for the number of lags to be reflected in the response on the variables based on theory[14]. Therefore, formal tests are conducted on statistical adequacy grounds to identify the number of lags that should go into the model. Based on the lag selection criteria, the FPE, AIC, HQIC and the SBIC each indicated one lag as the optimal lag, while the likelihood ratio statistics indicated the use of 3 lags. Therefore, the SVAR is computed by using one lag to estimate the parameters while 3 lags are used for capturing the dynamic responses of the model through the impulse response function (IRF) and the forecast error variance decomposition (FEVD).

5.3 Cointegration test

Table 3, provides information on the validity of the long-run equilibrium relationship among the economic variables. The long-run association among the variables is also estimated by running the Johansen's test of cointegration. The Johansen's reduced rank methodology was employed to test the validity of the long-run equilibrium relationship. Based on the computed test in Table 3, the trace statistic showed the existence of one cointegrating vector at the 5 percent significance level (Johansen, 1995). From the cointegration test, the trace statistic (λ_{trace}) shows that at a rank (r) of zero, the result of 151.021 exceeds the 5 percent critical value of 124.24. Therefore, we reject the null hypothesis of no cointegration among the variables in the equation. Furthermore, at the rank of ($r \leq 1$), the λ_{trace} statistic value of 99.03 is greater than the 5 percent critical value of 94.15 and hence we reject the null hypothesis that there is the existence of only one cointegration vectors. However, at $r \leq 2$, the λ_{trace} statistic figure of 52.35 is less than the 5 percent critical value of 68.52 and therefore we fail to reject the null hypothesis that there are only 2 cointegrating vectors. Therefore, we have only one cointegrating vector in the model. Since the series are cointegrated, it shows that there exists long-run relationship among variables and as such shocks in the short-run may affect the individual series and converge with time in the long run.

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[14] Bank of Israel (Research) A Structural VAR Model for Estimating the Link between Monetary Policy and Home Prices in Israel. http://www.boi.org.il/en/Research/Pages/dp201709e.aspx /Accessed 20-07-2018

Table 3. **Johansen's Cointegration Rank Test**

Series:

Null Hypotheses	Trace Statistic	Critical value (5%)
r = 0**	151.02	124.24
r ≤ 1**	99.03	94.15
r ≤ 2	52.35	68.52
r ≤ 3	29.47	47.21
r ≤ 4	13.33	29.68
r ≤ 5	3.93	15.41
r ≤ 6	0.16	3.76

r represents the number of co-integrating vector. * denotes significance of the test statistic at the 5% level. Trace test indicate 2 co-integrating equations at the 5% level.

5.4 Results for the contemporaneous coefficients

The results in table 4, presents an estimation of the short-run contemporaneous relationships for the structural models within a specific period under the order of variables: the foreign interest rate, the GDP growth rate, the inflation rate, the domestic interest rate, the money supply growth rate, the exchange rate and the GSE-Composite Index. We assumed the contemporaneous matrix as presented in chapter 4 to exhibit the Cholesky structure. In that regard, the Cholesky estimation has been conducted in the same order as the variables presented in the structural matrix in chapter 4.

In table 4, the estimated contemporaneous coefficients of the SVAR, their standard errors and identification restrictions are presented. To test the validity of the short-run contemporaneous relationship among the variables, we imposed theoretical constraints on the matrix A. In the matrix A which captures the lower triangular decomposition of the variance-covariance matrix of the estimated VAR shocks, the required coefficient to be used in identifying the monetary policy functions are restricted to zero. Furthermore, the likelihood-ratio test is also conducted to ascertain the validity of the imposition of the restrictions (Effiong, 2014).

Table 4. **Estimated contemporaneous coefficients of SVAR for question 1**

Restriction	Estimate	Restriction	Estimate
a_{21}	0.1701 (0.69)	a_{53}	0.0097 (0.09)
a_{31}	-0.0484 (-1.28)	a_{73}	-0.0098 (-0.09)
a_{41}	0.1883 (0.28)	a_{64}	-0.0045** (-3.48)
a_{71}	0.0438 (0.69)	a_{74}	-0.0013 (-0.20)
a_{32}	-0.00329 (-0.32)	a_{75}	-0.0361 (-0.52)
a_{62}	0.00093 (0.26)	a_{76}	0.0933 (0.28)
a_{72}	0.0296 (1.69)		

Notes: Numbers in parenthesis are z-values. ** $p < 0.05$

From the results in table 4, the coefficients of the variables and its relationship with the endogenous variables as reflected in the system are based on the historical relationships among them. From the table above, the estimated coefficient of the contemporaneous relationship between the foreign interest rate and the domestic GDP growth rate does not match theoretical sign expectations and is also statistically insignificant. This is because, there exist an inverse relationship between the foreign interest rate and the domestic real GDP growth rate.That is, in line with the Mundell-Fleming model, a contractionary monetary policy in the foreign economy could cause the appreciation of the local currency due to the increased foreign exchange flows into the economy. The increased foreign exchange reserves would then increase the reserve requirments of the domestic economywhich then increases the capacity of the domestic economy to undertake imports in instances that the economy depends on imports. The increased demand for imports is expected to contribute to a raise in the national output.

From the table above, the estimation results of the short-run relationship between the domestic inflation with the foreign interest rate does not also match theoretical expectations and is statistically insignificant. The estimated coefficient for (r X FR) the foreign interest rate is positive but statistically insignificant. The insignificance of the foreign interest rate does not imply that the monetary policy committee of the Bank of Ghana is not concerned about the interest rate conditions in the US. The positive coefficient moves in line with the Mundell-Flemming model by which an increase in the foreign interest rate (US) would cause the domestic

economy (Ghana) to correspondingly hike its interest rate to attract investors. The reason is that foreign investors' decision to invest on the local stock market is motivated by the rate of returns as well as the economic and political nature of the country. In that case, foreign investors would like to be compensated with a premium on their investments for assuming additional level of risk especially when investing in unstable economic and political destinations. From the table above, the foreign interest rate does not also enter the Ghana Stock Exchange reaction function significantly and the positive coefficient sign does not satisfy theoretical assumptions. This is because there exist an inverse relationship between the foreign interest rate and the domestic stock market activities.

The contemporaneous relationship between the inflation rate and the real GDP growth rate does not match theoretical expectations and is statistically insignificant. This is because there exist a positive relationship between the two variables where a positive shock to GDP is expected to cause a corresponding rise in the rate of inflation. However, the positive coefficient for the GDP growth rate relationship with the GSE-CI is consistent with theoretical expectations and that a rise in the GDP growth rate would invariably lead to an increase in the GSE-CI.

Also, the coefficient on interest rate in the equation of the Ghana Stock Exchange (GSE) is negative but is also statistically insignificant at the 5 percent level. The negative coefficient of the interest rate suggests that a positive shock to the domestic interest rate would cause the GSE-CI to decline. The sign of the coefficient is consistent with the findings of Rigobon and Sack (2004) in their study of the response of asset prices to monetary policy in the US. The coefficient is insignificant but this does not imply that the domestic interest rate does not cause variations in the performance of the Ghana Stock Exchange Composite-Index.

However, the contemporaneous interest elasticity of the exchange rate is statistically significant at the 5 percent level. Thus, in the exchange rate transmission mechanism, the contemporaneous interaction of the exchange rate and the domestic interest rate enter significantly at the 5 percent level and the home interest elasticity is negative. This suggests that there exists an inverse relationship between the domestic interest rate and exchange rate. In that regard, a fall in the domestic interest rate will result in a rise in the exchange rate (US dollar /Ghana Cedi). This supports the findings of Cushman and Zha (1997) that monetary policy shocks in a small open economy with flexible exchange rate works around the interest and exchange rate effects. Hence, monetary policy decisions in Ghana indirectly affect the exchange rate through adjustments to the interest rate. That is, as the rate of interest in the domestic market declines compared with

that of the foreign interest rate, it would result in the outflow of capital which thereby would then result in a rise of the exchange rate.

The significance of the interest rate in explaining the exchange rate dynamics show that the interest rate is very crucial in explaining the short-run movements in exchange rates. This is consistent with the findings of Effiong (2014) who found interest rate differentials in Nigeria to significantly impact on the exchange rate movements. Due to the insignificance of the contemporaneous relationships between the foreign interest rate, the GDP growth rate, the inflation rate, the domestic interest rate, the money supply growth rate and the exchange rate with the GSE-CI, we then focus on estimating the dynamic responses of the GSE-CI to the monetary policy shocks using IRF and FEVD to have clearer insights on the contemporaneous relationships among the endogenous variables.

5.5 Response of the Ghana Stock Exchange Composite-Index to monetary policy shocks

Under this section, the estimated impulse response function is done to explain the dynamic responses of the GSE-CI to the various domestic and the foreign structural shocks that have been captured in the SVAR system. The impulse response functions in Figure 4 traces the response of the GSE to foreign interest rate shocks, output shocks, domestic inflation shocks, domestic interest rate shocks, money supply shocks and exchange rate shocks. However, in line with the Mundell-Fleming model by which the foreign interest rate, the domestic interest rate and the exchange rate are key to the model formulation, only those variables would be explained. The IRF are conducted over an 8-month period with the upper and lower bands indicating one standard deviation shocks for each of the economic variables.

5.5.1 Responses of the rate of change in GSE-CI to foreign interest rate shocks

Figure 1 presents the Ghana stock market's response to a standard deviation shock to the foreign interest rate. In the model with the foreign interest rate as a policy tool, a positive FR shock reduce the value of the GSE-CI. Based on the monetary transmission mechanism which operates through interest and exchange rate to affect the asset markets, a positive shock which implies an increase to the foreign interest rate (FR) is expected to result in a decline in the outflow of funds from the foreign country. This is because a contractionary foreign monetary policy decision which results in an increase in the foreign interest rate for a given expected inflation rate would make investments in the foreign destination lucrative and as such will lead to a decline in the

outflow of capital. A reduction in capital flows from foreign to the domestic economy would appreciate the local currency value , slow capital inflows and lower market valuations.

From the figure 3 below, between period 0 and 1, the GSE initially decreases and assumes a negative shock. The response function declines further to period 2 and attain a precipitous fall until period 4. From period 4, the GSE achieves a stable state but declines further from period 6 to period 8. Therefore, the response of GSE to a 1 standard deviation shock to FR is a decrease in the short and long-run. However, a positive shock to the foreign interest rate does not significantly impact the Ghana stock market; and this is a rather surprising outcome since the Mundell-Fleming model under a small open economy with capital mobility postulates free movement of capital from lower interest yielding destinations to higher interest return destination given similar level of risk. However, due to the inverse relationship between interest rates and stock market instruments, it is assumed that shocks to the foreign interest rate would rather have an effect on the domestic interest rate directly rather than on the GSE-CI.

*Figure 3. Response of the rate of change in GSE-CI to foreign interest rate shocks*
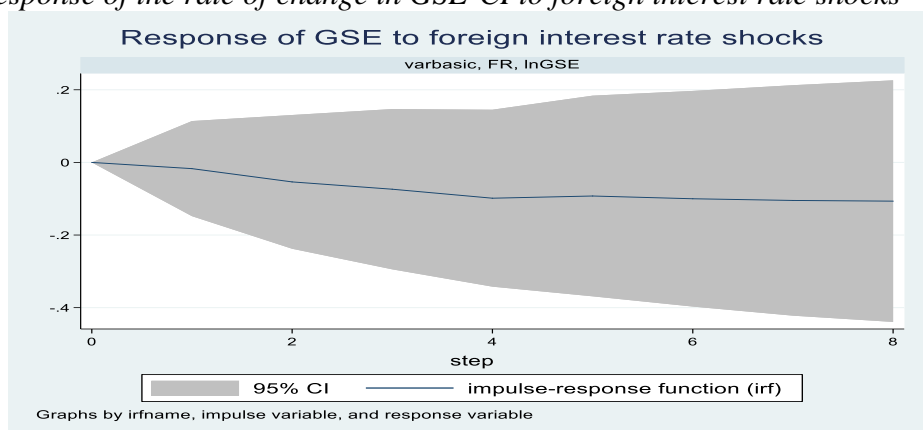
5.5.2 Responses of the Ghana Stock Exchange Composite Index to Output shocks

In the presentation of the response of Ghana Stock Exchange to output shocks, as evident in the contemporaneous interactions between the foreign interest rate and GDP in appendix 1, a rise in the foreign interest rate would lead to a fall in the output. From the imposition of the contemporaneous restriction $a_{31} = -0.0484$, the GDP increases, and the price shocks decline though not statistically significant.

From figure 4, a positive shock to the real GDP growth rate would cause the GSE to decline from period 0 to 1 and a further decline from period 1 to 2. The GSE begins to rise from period 2 and is positive up to period 3. Afterwards, the GSE stabilizes from period 3 up to period 4 and

then decreases to period 6. However, GDP achieves a stable state from period 6 to 7 by a minimal increase from period 7 to period 8 but still stays in the negative territory. This shows that the response of GSE to a positive standard deviation shock to output is a decline in the short and long-run. However, the output shocks do not generate a statistically significant effect regarding the GSE-CI.

Figure 4. Response of the GSE-CI to output shocks
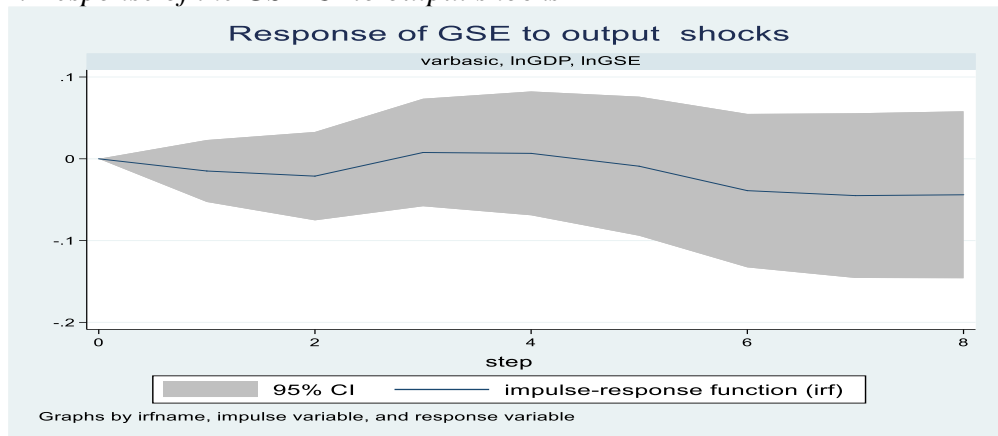
5.5.3 Response of the Ghana Stock Exchange Composite Index to a 1 standard deviation shock of the domestic interest rate

Movements in the domestic interest rate due to monetary policy decisions also affect the exchange rate. This is due to the fact that an increase in the domestic interest rate which according to Parrado (2001) is an indication that the fundamentals of the domestic economy has improved would cause assets denominated in the local currency to be attractive to both foreign and local investors and could then reinforce foreign currency inflows. The increased foreign currency could then provide support to the stock market.

From figure 5, the rate of change of the Ghana Stock Exchange Composite Index to a monetary policy shock through the workings of the interest rate was stable from period 0 to period 1. The GSE then witnesses a negative shock to record declines from period 1 to period 3 and then stabilizes from period to period 4. Afterwards, there is a decline in GSE from period 4 to period 6 until there is a slight rise in GSE from period 6 to period 8. From the graph it could be inferred that the shock dies out after period 6 but still remains within the negative band. Thus, the response of GSE to interest rate shocks is a decline in the short and long-run. The response of the GSE to a domestic interest rate positive shock is in line with the findings of Adam and Tweneboah (2008) who in their studies on Ghana identified a shock to the log of the t-bill rate to lead to a decline on the log of Databank Stock Index(LDSI).

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Figure 5 Responses of the Ghana Stock Exchange Composite Index to a 1 standard deviation
*shock of the domestic interest rate.*
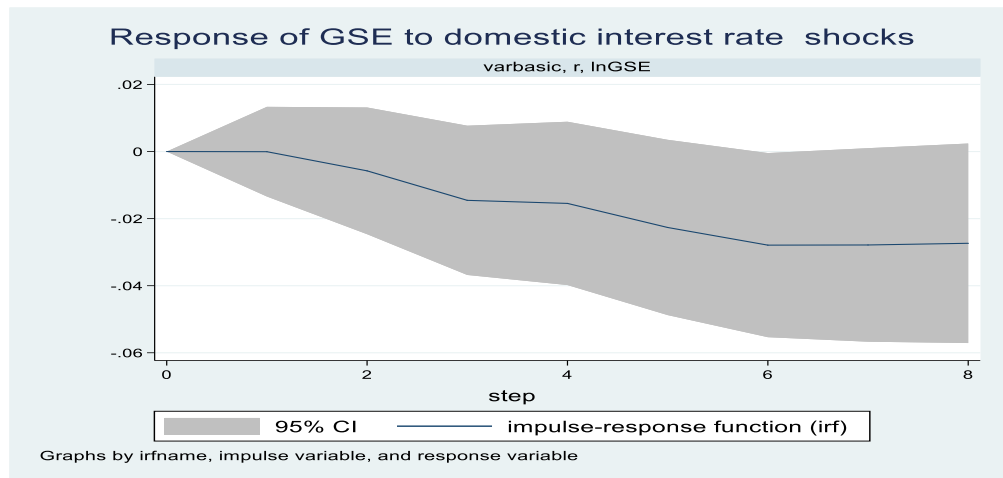
5.5.4 Responses of the Ghana Stock Exchange Composite Index to the exchange rate shocks

Changes in the domestic and foreign interest rate due to monetary policy decisions also affect the exchange rate (Parrado, 2001). This is because a negative shock to the domestic interest rate which is associated with a decline in interest rates would lead to a rise in the value of the US dollar against the Ghana cedi. This is because most foreign and local investors would prefer to undertake their investments in dollar-denominated assets compared with that of the cedi-denominated asset. Thus, the lower domestic interest rate would result in a low supply of dollars to the domestic economy and this could culminate in a decline in the value of the Ghana Cedi.

An exchange rate shock as evident from figure 6. which invariably leads to a depreciation of the local currency (US$/GH₵) would also reinforce a decline in GSE from period 0 to period 1. The GSE rebounds to an exchange rate shock by increases in the GSE from period 1 to period 3. The 1 standard deviation shock to the exchange rate causes the GSE to stabilize from period 3 to period 4 and decline constantly until the 6th period. Afterwards, it declines slightly up to period 8 and stays within the negative band. Thus, the response of GSE to a standard deviation shock to exchange rate is a decline in the short and long run. This is consistent with the findings of Kim (2014) who identified negative relationship between the exchange rate and stock markets in Korea during monetary tightening periods.

Figure 6. Response of the Ghana Stock Exchange Composite Index to exchange rate shocks
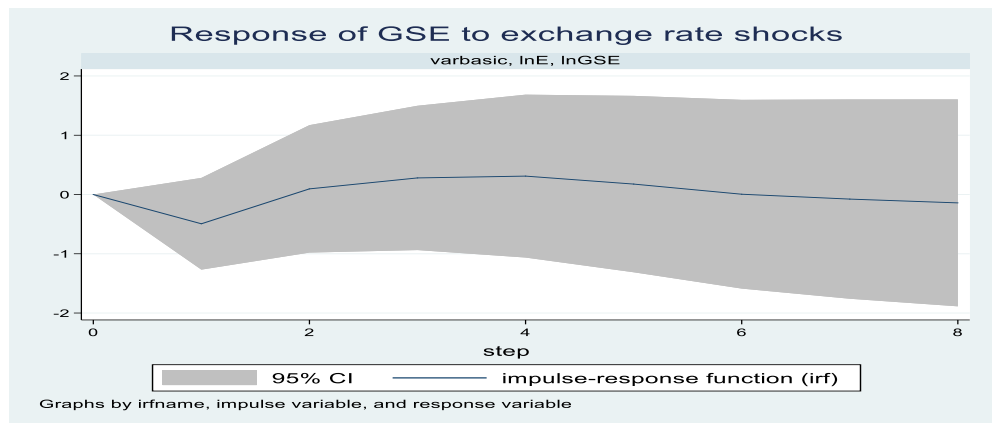
5.6 Forecast error variance decomposition (FEVD) for step 1

The variance decomposition is an econometric tool that enables the interpretation of a VAR model by analyzing the various proportions of shocks to the variable in question and to other endogenous variables that are accounted for by the examined variable. The appendix 7 provides the details of the variance of the Ghana Stock exchange to its own shock as well as shocks to the endogenous variables.

Table 5. Forecast Error Variance Decomposition for the Ghana Stock Exchange Composite-Index in step 1

Period	Foreign Interest rate shock	Output shock	Inflation shock	Domestic interest rate shock	Money supply growth shock	Exchange rate shock	Shocks to the rate change in GSE
1	0.001	0.012	0.000	0.000	0.000	0.000	0.985
2	0.003	0.013	0.003	0.000	0.015	0.007	0.957
3	0.007	0.013	0.009	0.000	0.010	0.006	0.952
4	0.009	0.012	0.018	0.001	0.008	0.006	0.944
5	0.010	0.011	0.028	0.004	0.008	0.006	0.932
6	0.010	0.010	0.038	0.007	0.008	0.006	0.920
7	0.009	0.0009	0.047	0.011	0.009	0.007	0.905
8	0.009	0.0008	0.055	0.016	0.010	0.008	0.892

The forecast error variance decomposition (FEVD) tells us the percentage of the forecasting error for a variable due to a specific shock in a specific period. Under FEVD, the shocks are orthogonalized.

To answer the first research question, shocks to foreign interest rate explain 0.1 percent of the one step ahead forecast error in the GSE-CI for the first period. The impulse of GDP account for 1.2 percent variation in the GSE while the shock to the GSE (own shock) account for 98.5 percent shock in GSE within the same period. Shocks to inflation, the domestic interest rate, money supply and the exchange rate explain very insignificant part of the variation to GSE in the first period.

In period 2, innovation to foreign interest rate and inflation account for 0.3 percent of the variation in GSE. The output and the money supply shocks can explain 1.3 percent and 1.5 percent respectively of the fluctuations in GSE. Shocks to the exchange rate can cause 0.7 percent of the variations in GSE while GSE accounts for 95.7 percent of the variation in GSE (own shock).

In period 3, shock to the foreign interest rate, inflation and exchange rate can cause 0.7 percent, 0.9 percent and 0.6 percent of the variation of shocks to the GSE respectively. Also, innovations to GDP and money supply growth account for 1.3 percent and 1.0 percent of the fluctuations to the GSE.

In period 4, the foreign interest shock contributes 0.9 percent to the variation in GSE. The domestic interest rate and the exchange rate cause a 0.10 percent and 0.8 percent fluctuation to the GSE. The GSE contributes to 94.4 percent of the errors in GSE.

Much of the forecast error continues to come from variation in the GSE which accounts for 93.2 percent variation in the GSE in the 5th period. The innovation to the foreign interest rate, output and inflation accounts for 1.0 percent, 1.1 percent and 2.8 percent respectively of the variations to GSE.

In the long-run, that is period 6, impulse to foreign interest rate, output, inflation and the domestic interest rate can cause 1 percent, 1 percent, 3.8 percent and 0.7 percent variations in the GSE respectively. Also, shocks to money supply and exchange rates contributes 0.8 percent and 0.6 percent of the error while the GSE explain 92 percent of the forecast error with GSE.

An impulse to the foreign interest rate can account for 0.9 percent fluctuation in GDP in the 8th horizon. Innovations to inflation, the domestic interest rate and the money supply growth explains about 5.5 percent, 1.6 percent and 1 percent respectively to variations in the GSE-CI. The largest contributor to the forecast error is again the GSE which accounts for 89.2 percent variation in the GSE.

For the FEVD, the largest contributor to the forecast error is the GSE which, on average, accounted for shocks more than 90 percent at each period. Shocks to the domestic interest rate has within the horizon contributed small percentage of the variation to the GSE. A check from the table 2 shows that as the horizon increases, the components of the shocks that results from GSE (own shock) decreases.

5.7 Robustness Checks for step 2

Based on the imposition of the restrictions as was described in the modelling section, robustness checks were conducted with the inclusion of the foreign interest rate, the domestic interest rate and the log of the GSE-CI in the model specification to estimate the response of the GSE-CI to both domestic and foreign monetary policy decisions.

5.7.1 Impulse response functions for robustness checks -step 2

From the robustness checks in appendix 8, the response of the Ghana Stock Exchange to foreign interest rate is consistent with the Mundell-Fleming theory as well as the findings of the study in question 1 for the short-run. This is because, a shock to the foreign interest rate causes the GSE to decrease precipitously from period 0 to period 5. The GSE then gets to a stable state at period 5 and then begins to rise from period 6 to period 8 but remains within the negative bands. Thus, the response of GSE to a standard deviation shock to the FR is a decrease in the short and long-run. Thus, a positive shock to the US interest rate would result in a decline of the GSE-CI in the short-run as well as in the long-run.

From figure 7, the Ghana Stock Exchange composite index declined significantly in the long-run following a positive domestic interest rate shocks. This follows a-priori that there exists an inverse relationship between stock markets and interest-bearing investments. From the impulse response function of GSE to a shock in (r), it is inferred that the Ghana Stock Exchange Composite-Index increases slightly because of a positive shock from period 0 to period 1. It then attains a steady state level at period 2 and thereafter witnesses a gradual decline up to period 8. Thus, in the short run, GSE will have a positive response to shocks to domestic interest rate but decreases in the long-run. In general, the results of the robustness checks with respect to the domestic interest rate shocks on GSE conflicts with the findings from the SVAR equation in step 1 for the short-run but is consistent in the long-run.

5.7.2 Forecast Error Variance Decomposition for the Ghana Stock Exchange Composite-Index to shocks in step 2

With respect to the second research question, shocks to foreign interest rate explains 4.9 percent of the of the one step ahead forecast error in the GSE-CI for the first period. The impulse of the domestic interest rate (r) accounts for 1.0 percent variation in the GSE while the shock to the GSE (own shock) account for 95.0 percent shock in GSE within the same period.

In period 2, innovation to foreign interest rate account for 9 percent of the variation in GSE. The domestic interest rate shock can explain 1.0 percent of the fluctuations in GSE. Shocks to the GSE can cause 90.0 percent of the variations in GSE (own shock).

In the short-run, that is period 3, shock to the foreign and the domestic interest rate can cause 13.2 percent and 3.1 percent of the variation of shocks to the GSE respectively. Also, innovations to the GSE account for 84.0 percent of the fluctuations to the GSE.

In period 4, the foreign interest shock contributes 17.2 percent to the variation in GSE. The domestic interest rate causes 5.90 percent fluctuation to the GSE. The GSE contributes to 76.8 percent of the errors in GSE.

Much of the forecast error continues to come from variation in the GSE which accounts for 70.2 percent of the variation in the GSE in the 5th period. The impulses of the foreign interest rate and the domestic interest rate accounts for 20.8 percent and 9.0 percent respectively of the variations to GSE.

In the long-run, that is period 6, impulse to the foreign interest rate and the domestic interest rate can cause 23.9 percent and 12.0 percent variations in the GSE-CI respectively. Also, shocks to the GSE explains 64.1 percent of the forecast error with GSE.

An impulse to the foreign interest rate can account for 28.5 percent fluctuation in GDP in the 8th period. Innovations to the domestic interest rate explains about 17.6 percent of the variations in the GSE-CI. The largest contributor to the forecast error is again the GSE which accounts for 53.9 percent of the variations in the GSE (own shock).

It should be noted that based on the SVAR results from the step 1 and step 2, the findings seem to show that the Ghana Stock Exchange Composite Index responds less to monetary policy shocks. Also, it could be inferred that the foreign monetary policy transmission does not directly impact the Ghana Stock Exchange.

Table 6. Forecast Error Variance Decomposition for the Ghana Stock Exchange Composite-
Index in step 2.

Period	Foreign Interest rate shock	Domestic interest rate shock	Shocks to the rate of change in GSE
1	0.049	0.010	0.950
2	0.090	0.010	0.900
3	0.132	0.031	0.840
4	0.172	0.059	0.768
5	0.208	0.090	0.702
6	0.239	0.120	0.641
7	0.265	0.149	0.586
8	0.285	0.176	0.539

*The forecast error variance decomposition (FEVD) tells us the percentage of the forecasting error for a variable
due to a specific shock in a specific period. Under FEVD, the shocks are orthogonalized.*

CHAPTER SIX

DISCUSSION AND CONCLUSION

6.1 Discussion

The response of the Ghana Stock Exchange to the domestic and foreign monetary policy decisions was analysed using a variety of data sources. Monetary policy decisions both domestic and foreign play crucial role in the functioning of the global economy. However, just like any other macroeconomic variable, it interacts with the interest rate, the exchange rate, inflation, real GDP etc. to impact on the local economy. In understanding the effect of monetary policy decisions on the Ghanaian economy, variables such as real GDP growth rate, the real inflation rate, the real interest rate, the money supply growth, the real exchange rate and the Ghana Stock Exchange Composite Index were included as endogenous variables, while the US interest rate was used in the analysis as the exogenous variable. The foreign interest rate was included to help us identify the impact of the exogenous variable on the Ghanaian economy. This research sought to test the reaction of the Ghana Stock Exchange to domestic and foreign monetary policy decisions for the period January 2000 to December 2017.

A structural vector autoregression model is developed to analyze the contemporaneous relations among the variables, impulse response and the forecast error variance decomposition (FEVD) of the variables in the model. In the study, the structural matrix chosen for the analysis mimicked the standard Cholesky matrix but with modifications on the contemporaneous effect of the domestic interest rate on the exchange rate. The structural vector autoregression provides better description of the dynamic responses of economic variables to independent shocks.

In the study, we sought to determine whether foreign monetary policy interacts with the domestic monetary policy in the event of QE to impact on the performance of the Ghana Stock Exchange. Due to this, we run a robustness checks on the foreign interest rate and how it relates with the domestic interest rates during the quantitative easing (QE) period from 2007 to 2009. The empirical results from numerous studies showed different responses of the asset market to an expansionary monetary policy as was the case in the US during QE. Studies by Kim (2014) suggest that an expansionary foreign monetary policy which results in a rise in the foreign interest rate and a fall in the domestic interest rates may result in a decrease in the exchange rate (appreciation of the domestic currency) while a contractionary foreign monetary policy stance may result in the depreciation of the local currency.

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As a method to examine the responses of the Ghana Stock Exchange Composite- Index to monetary policy shocks, the Augmented Dickey-Fuller test (ADF) for unit roots was first conducted to identify the stationarity of the variables at levels, logarithmic, first difference and logarithmic differences. The ADF test showed stationarity for real GDP at levels and at logarithmic form. Subsequent modifications to the variables such as first differences and the difference of logarithmic form showed stationarity for all the variables. The research was further conducted by testing for the long-run dynamic relationship between the monetary policy functons and the GSE-CI using the Johansen's test of cointegration. The results showed the presence of one cointegrating vector in the model. We analyzed the contemporaneous relationships among the variables by estimating the effect of structural shocks such as foreign monetary shocks, domestic output shocks, domestic inflationary shocks, domestic interest rate shocks, monetary aggregate shocks, exchange rate shocks and the stock market shocks to the Ghana Stock Exchange. In analyzing the response of the GSE-CI to monetary policy shocks, the Impulse Response Functions (IRF) and the Forecast Error Variance Decomposition (FEVD) were explored to explain them.

Empirical results show that a contractionary domestic monetary policy decision results in a fall in the performance of the foreign stock market. From the IRF, it was identified that a shock to the foreign interest rate under step 1 would lead to a reduction in the GSE indices in the short and long-run. This is because foreign investments return higher rates compared with that of the domestic investments during tight monetary policy. The IRF results of the GSE to foreign interest shocks is consistent with the finding of Hymer (1976), who identified that foreign investors are drawn to direct their foreign portfolio investments to areas of higher interest rates and as such a contractionary monetary policy which results in a hike in the policy rate will invariably make foreign investors consider the destinations of these high rates for investments.

The model conducted with the exchange rate as a policy tool provided significant results with the domestic interest rate compared to that of the foreign interest rate as a channel for impacting the Ghana Stock Exchange. From the study, our empirical findings suggest that the domestic interest rate plays crucial role in explaining the monetary policy transmission of exchange rate to the capital markets. Thus, a shock to the domestic interest rate has the capacity to reorient the exchange rate of the Ghanaian economy due to the increased inflows of funds. Our findings indicated that a positive shock to the interest rate would significantly affect the exchange rate. This is consistent with the findings of Parrado (2001) that the variations in interest rates caused by monetary policy also affect the exchange rate.The results of the contemporaneous relationship

between the interest rate and the exchange rate is consistent with standard theory such as the Uncovered Interest Parity (UIP). However, the contemporaneous relation of the exchange rate and the GSE-CI was not statistically significant at the 5 percent level.

Using IRF, a positive shock to the domestic interest rate will cause a rise in the exchange rate in the short and long run periods. Regarding the exchange rates, the estimation results from the impulse response functions shows that the exchange rate adjusts to shocks on the domestic interest rate to affect the Ghana Stock Exchange performance. Thus, the exchange rate was found to play significant role in explaining the volatility surrounding the GSE-CI. This is statistically significant. That is, a shock to the exchange rate would result in a fall in the GSE-CI in the short-run and long-run. This is consistent with the findings of Kim (2014) who identified negative relationship between the exchange rate and stock markets in Korea during monetary tightening periods.

In step 2 which constrains the duration of study to (January 2007-December 2009), a contractionary foreign monetary policy which results in the rise in the US treasury bill rate leads to a precipitous fall in the GSE-CI from the first period to the 6th period. In the long-run, a contractionary foreign monetary policy stance would cause the GSE-CI to correspondingly rise. The response of the GSE-CI in the long-run to a foreign monetary policy shock is inconsistent with the Mundell-Fleming model which assumes capital to flow from low-interest rate economy to high-interest rate country in an economy where there is free mobility of capital. This finding is consistent with the results of Parrado (2001) who identified the shocks to the foreign interest rate to have no major influence on the Chilean economy.

The domestic interest rate under the IRF of scenario 2 follows a-priori as there exist an inverse relationship between interest bearing investments and stock markets. It could be inferred that a domestic monetary policy shock would result in a corresponding decline in the performance of the GSE-CI. This supports the findings of Hsing (2013) that there exist an inverse relationship between monetary policy rate and Poland's stock market performance.

In the research, we used the forecast error variance decomposition to analyze the percentage of the shock to the GSE that are accounted for by the monetary policy functions. Throughout the studies in the case of step 1, the monetary policy shocks were on their own not a dominant factor in explaining the variations in the GSE-CI. In the short run, in period 4, the monetary policy functions led by the inflation and output shocks caused 1.8 percent and 1.2 percent variations in the GSE respectively while own shock (the GSE) explained 94.4 percent of the variations in

GSE. The innovations to the foreign and the domestic interest rate in the 8th period rose marginally to 0.9 percent and 0.1 percent to cause the fluctuations to the GSE. From the FEVD results in step 1, the monetary policy shocks namely the foreign interest shock, the domestic interest shock, the output shock, the exchange rate and money supply shock contributed marginally to the variations in the GSE-CI. This is consistent with the findings of Parrado (2001) who in similar work identified the monetary policy innovations to explain a smaller percentage of the fluctuations to the Chilean output, price level and exchange rate. However, FEVD estimations from step 2 in period 4 showed that innovations to the foreign and domestic interest rates caused the GSE to vary by 17.2 percent and 5.9 percent within the short-run. This showed that the components of the shock to the GSE that were explained by the foreign interest rate and the domestic interest rate at step 2 compared favorably to that of the impulses in step 1.

In the long run at period 8 for step 1, the foreign and the domestic interest rate shocks accounted for 0.9 percent and 1.6 percent of the variations in the GSE-CI while the own shock, the shocks to GSE still accounted for a greater portion (89.2 percent) of the variations to the GSE. In the case of step 2, shocks to the foreign and domestic interest rates accounted for 28.5 percent and 17.6 percent of the forecast error in GSE. This showed that during the QE period (2007-2009), the monetary policy functions contributed significantly to the GSE-CI variations.

Due to the potential problem of identifying the clear-cut impact of the foreign interest rate on the GSE-CI due to many parameters in the initial SVAR model, we reduced the number of parameters in the estimation for the second research question to the foreign interest rate, the domestic interest rate and the GSE-CI. Though the findings for the question 2 remained unchanged from the question 1, a larger portion of the variance in the GSE-CI occurred under the second section than the first.

One issue identified in the research was the availability of data for the GDP growth rate for the period of the research. In Ghana, real GDP data were difficult to be obtained on monthly basis. Therefore, the research resorted to use annual data from 2000-2006 and quarterly data from 2007-2017 by which the data were sequentially adjusted to get monthly data. Though the research was conducted with an incomplete data on GDP growth rate, the data accessed was sufficient and therefore was able to serve the purpose of the research. Another issue encountered in the research bordered on the methodology used in conducting the research. The estimation results from several studies carried in other countries differ due to the differences in the variables as well as the modifications to the specification of the model for the research. Therefore, the

results of the study should be treated with caution due to the following reasons: Firstly, a larger portion of the variation in the GSE-CI were explained by its own shock while it could be that other relevant variables such as the FDI data, the world oil price and fiscal policy could have played significant role in its volatility. Also, the strength of the VAR system depends on its ability to relate the dynamic relations between the macroeconomic variables rather than specifying only the variables that are related to stock markets.

According to the results obtained in this research, they do not differ from other study findings and as such the findings of the research are credible and could be used for informational purposes by policy planners, investment bankers, economist and the Bank of Ghana. The research questions of the study were answered.

6.2 Conclusion

Basing the conclusion of the study on the results, this study shows that the Ghana Stock Exchange Composite-Index responds to monetary policy shocks. Based on the Mundell-Fleming model, the study illustrated how macroeconomic variables interrelate to affect the Ghana Stock Exchange Composite-Index. The usefulness of the model also lies in identifying the various shocks such as the foreign interest rate, the GDP growth rate, the inflation rate, the domestic interest rate, the money supply growth rate and the exchange rate that influence GSE-CI.

Empirical findings from the SVAR results to identify how the Ghana Stock Exchange Composite Index responds to domestic monetary policy shocks revealed that the domestic interest rate plays crucial role in explaining the monetary policy transmission of exchange rate to the capital markets. Thus, a shock to the domestic interest rate has the capacity to reorient the exchange rate of the Ghanaian economy due to the increased inflows of funds. In conclusion, based on the SVAR results from the question 1 it could be inferred that a a positive shock to the domestic interst rate would lead to the inflow of funds from the foreign economy into the domestic economy. As anticipated by both policymakers and economists, the increased inflow of capital would then increase the domestic economy's foreign exchange reserves and then provide support to the local currency. Thus, domestic interest rate shocks through its operations with the exchange rates will significantly impact on the performance of the Ghana Stock Exchange. From the estimated contemporaneous coefficient for the main SVAR equation, we found that a positive shock to the domestic interest rate which casues the interest rate to rise holding other factors constant would cause the GSE-CI to decline in the short and long term but is statistically insignificant at the 5 percent significance level. This is consistent with the findings of Addo and

Sunzuoye (2008), who identified a statistically insignificant negative relationship between the interest and treasury bill rates and stock prices in Ghana. Thus, the negative relationship between the domestic interest rate and the GSE-CI is in-line with theoretical assumptions, but the domestic interest rate has weak predictive power on the movements in the GSE-CI. However, based on the estimation results for the contemporaneous relationship between the domestic interest rate and the exchange rate, we found a statistically significant negative relationship between the domestic interest rate and the exchange rate. The results of the contemporaneous relationship between the domestic interest rate and the exchange rate is consistent with the traditional theoretical analysis of interest-exchange rate relationship.

Similarly, the variance decomposition estimates for question 1 also showed that the domestic interest rate and the exchange rate both explains less than 2 percent of the variation in the GSE-CI. The findings however conflicts the results of (Adam & Tweneboah, 2008) who in their studies on the relationship between stock markets and macroeconomic factors using IRF and FEVD identified the interest rate variable to be important in the determination of stock prices in Ghana as it accounted for 68.0 percent of the variation in the Databank Stock Index(DSI) which was used as a proxy for the GSE-CI. The empirical results of the main SVAR brings us to another research question of the response of the GSE-CI to the interaction between the domestic and the foreign interest rate during QE from 2007 to 2009. The FEVD test results for question 2 shows that during the period 2007-2009, the percentage of the variation of the GSE-CI due to shocks to the foreign interest rate and the domestic interest rate increased. As can be shown in table 6, the percentage of the variation in the GSE-CI due to foreign and domestic interest rate based on the variance decomposition was 28.5 percent and 17.6 percent. This confirms the findings of
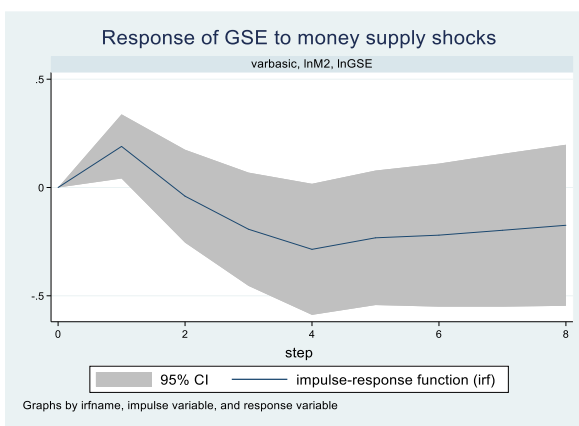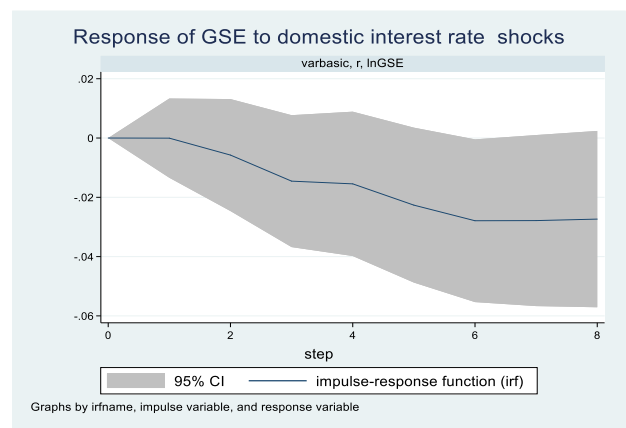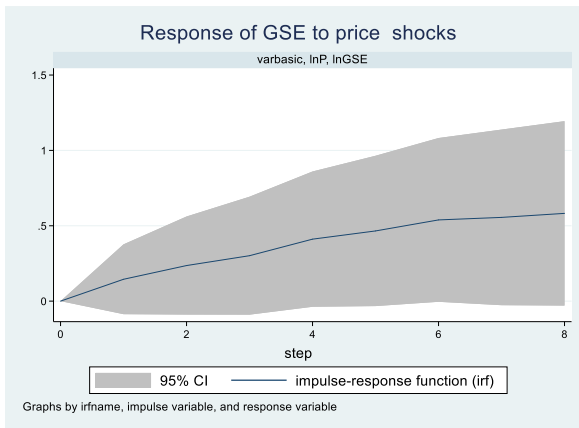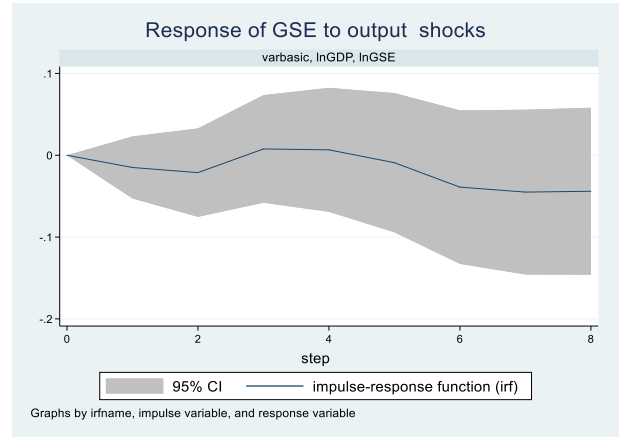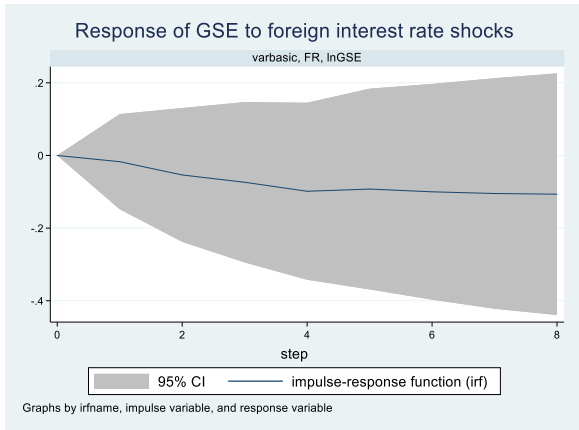
Based on the results, there is justification for prudent fiscal and monetary strategies to be in place to support the local currency from weakening against its major trading partners. In light of this, there is the need for a moderately tight monetary policy so as to make investments in Ghana cedi lucrative for foreign investors which invariably would contribute to the supply of foreign currency. However, the possibility for the effective functioning of the exchange and interst rate in impacting the Ghanaian economy rests on the discipline of monetary authorities.
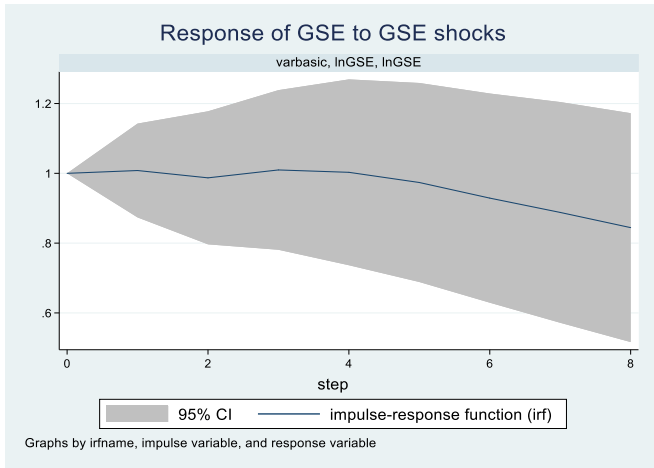
Due to the higher percentage of the variability in GSE-CI from the foreign and domestic interest rate shocks in step 2, policy makers need to have a keen eye on the foreign interest rate so as to accordingly implement domestic policy measures.

Fiscal policy variables that are embedded in the Mundell-Fleming model could be included in future studies to measure the response of the Ghana Stock Exchange Composite Index to macro-economic shocks.

Appendices:

Appendix 1. Impulse Response Functions of the Ghana Stock Exchange to structural shocks in step 1


Response of GSE to foreign interest rate shocks

Response of GSE to output shocks

Response of GSE to price shocks

Response of GSE to domestic interest rate shocks

Response of GSE to money supply shocks

Response of GSE to exchange rate shocks

Response of GSE to GSE shocks
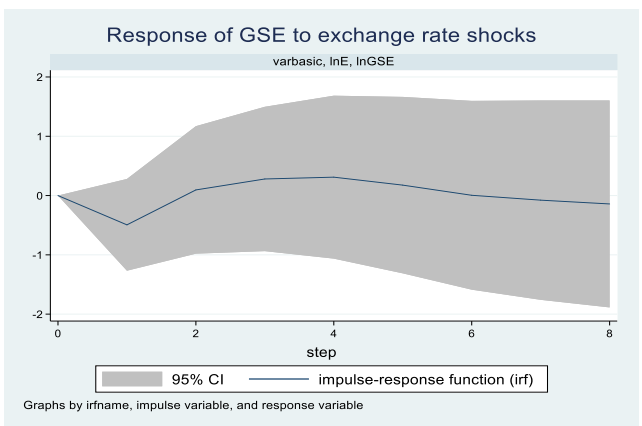
Appendix 2. Dynamic Response of log of GSE-Composite Index to macro-economic shocks

Source: Author's computation

Appendix3. Dynamic responses for the model in step 1with its contemporaneous coefficients.

Shock to foreign interest rate

Shock to log of real inflation (lnP)

Shock to domestic interest rate (r)

Shock to the foreign interest rate

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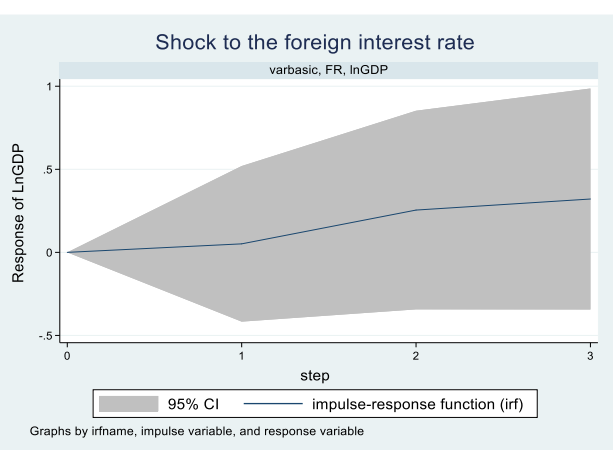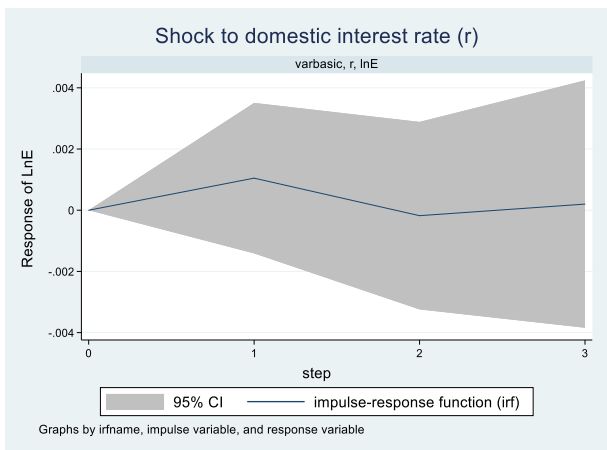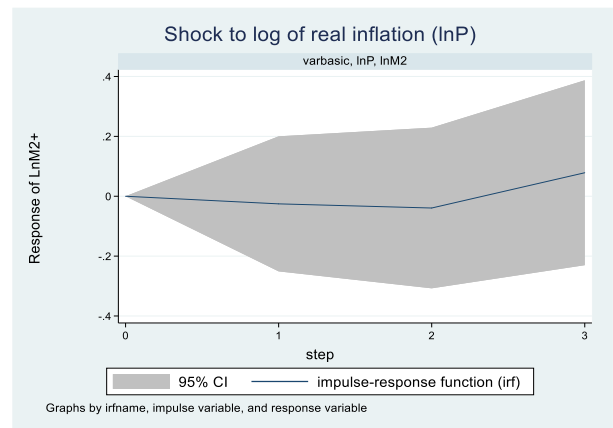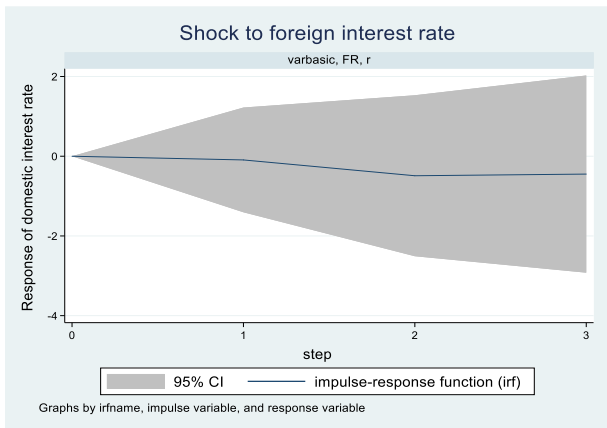
Appendix 4. Impulse Response Functions for the VAR in step 1

Graphs by irfname, impulse variable, and response variable
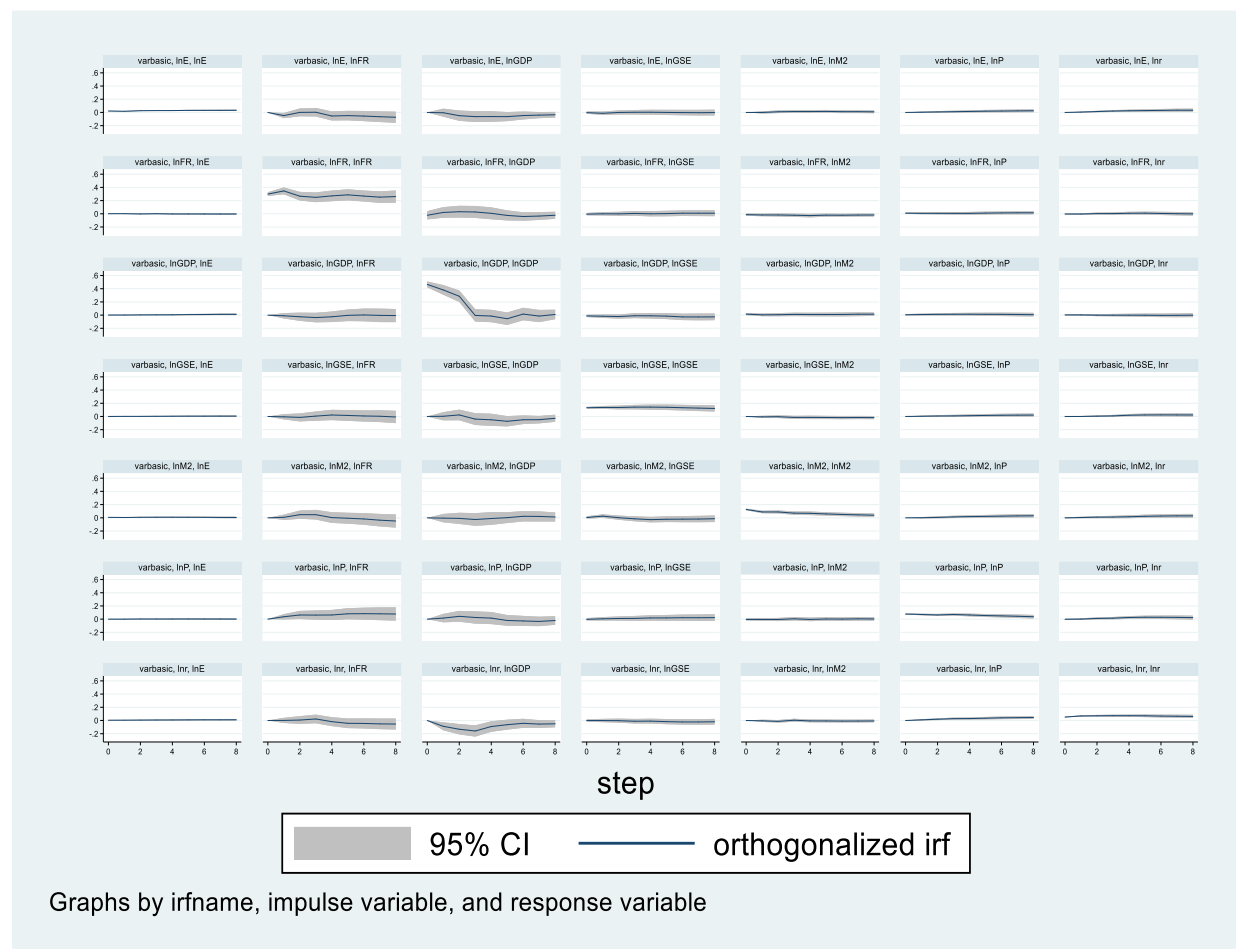
Appendix 5. Estimated contemporaneous coefficients of SVAR for step 2

Restriction	Estimate
a_{21}	-0.7818 (0.68)
a_{31}	0.0504 (0.44)
a_{32}	-0.0012 (0.01)

Notes: Numbers in parenthesis are z-values. ** $p < 0.05$

Appendix 6. Step 2. Robustness Checks
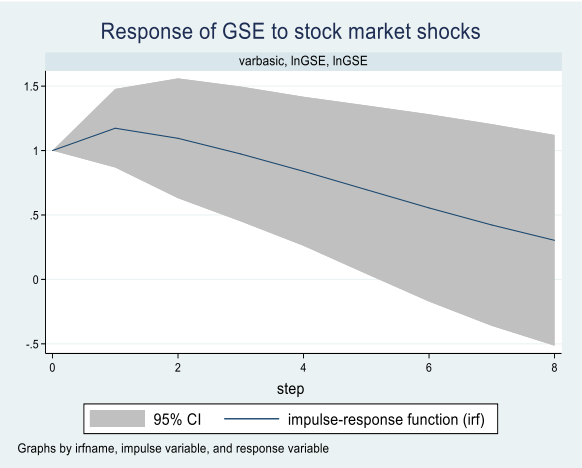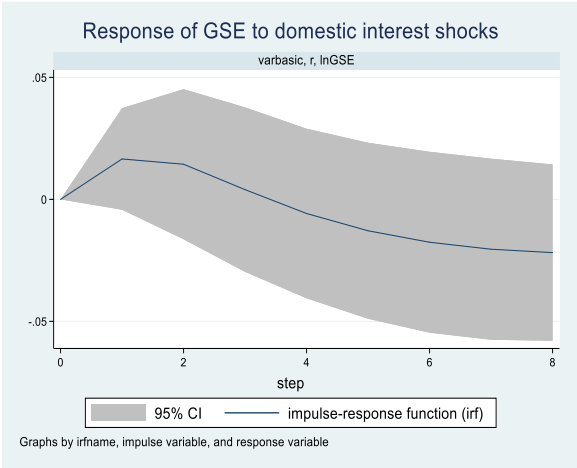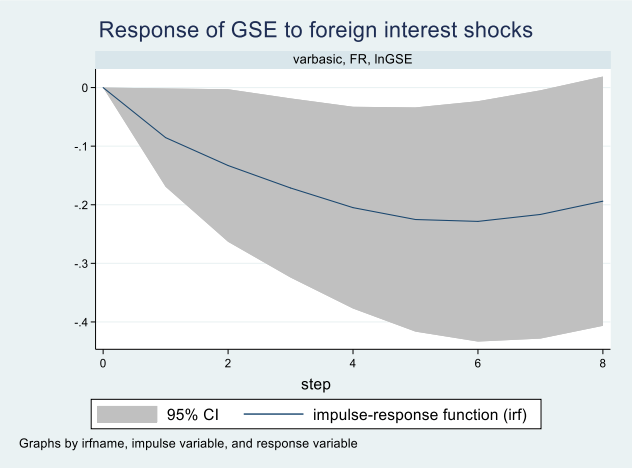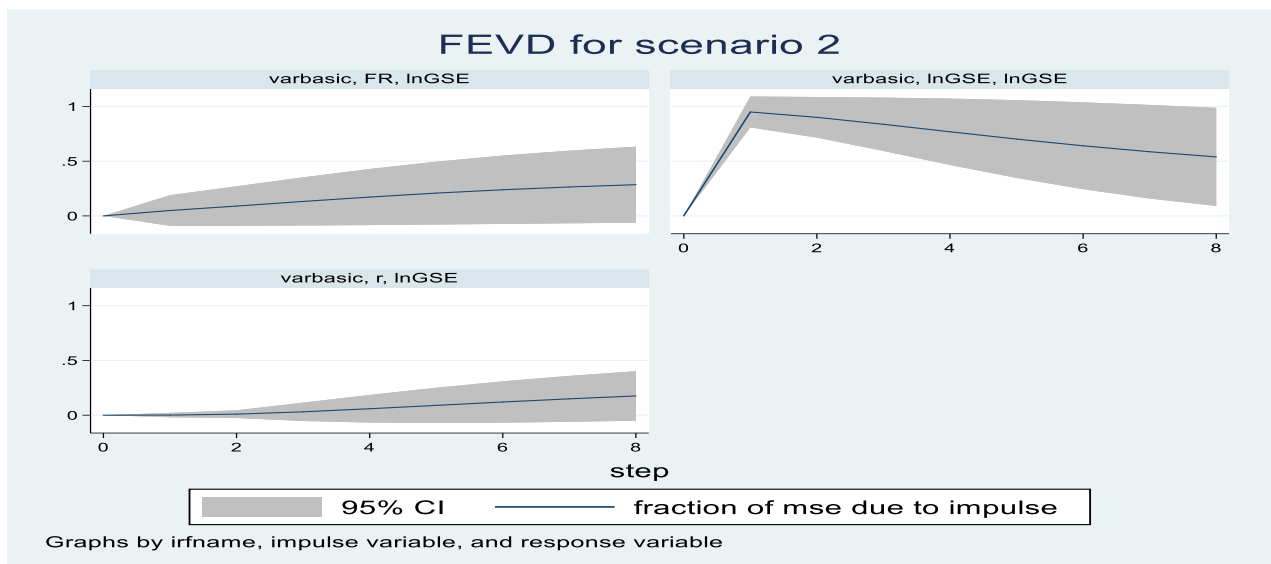

Appendix 6. Robustness checks impulse response functions for step 2

Appendix 7. Graphical representation of the forecast error variance decomposition (FEVD) for step 1
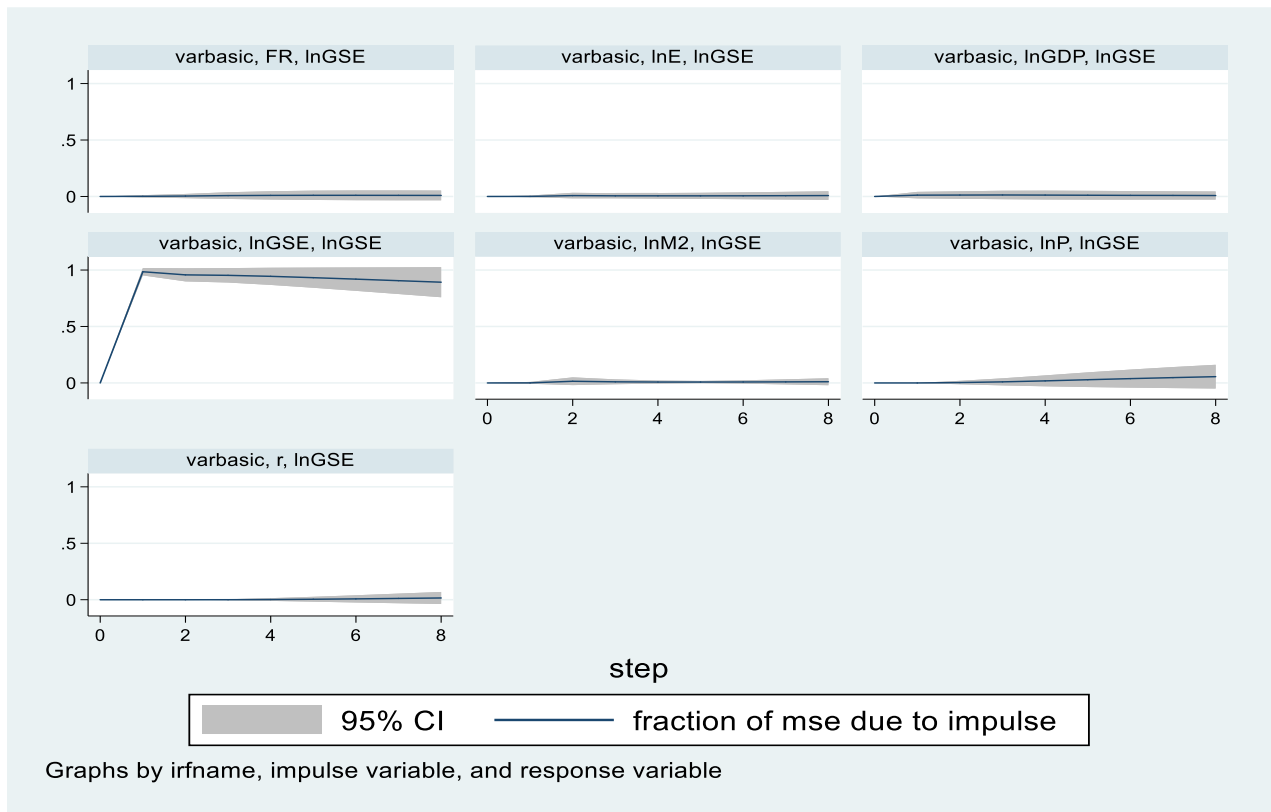
Appendix 8. Graphical representation of the forecast error variance decomposition (FEVD) for step 2.

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