

**Analysis of the Effect of Price and Money Supply on Economic Growth in
Ghana: Vector Error Correction Model Approach**

By

SAEED, Abdul-Razak Abass

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

MASTER OF PUBLIC POLICY

2022

**Analysis of the Effect of Price and Money Supply on Economic Growth in
Ghana: Vector Error Correction Model Approach**

By

SAEED, Abdul-Razak Abass

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

MASTER OF PUBLIC POLICY

2022

Professor Cho, Dongchul

**Analysis of the Effect of Price and Money Supply on Economic Growth in
Ghana: Vector Error Correction Model Approach**

By

SAEED, Abdul-Razak Abass

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

MASTER OF PUBLIC POLICY

Committee in charge:

Professor Cho, Dongchul, Supervisor

Dongchul Cho

Professor Lee, Jinsoo

Lee Jinsoo

Professor Sohn, Wook

Wook Sohn

Approval as of May, 2022

ABSTRACT

Economies all over the world aim to achieve high growth rate of output and stability in the general price level. But the tradeoff between output growth and inflation makes it imperative for Central Banks to conduct monetary policy. The study, therefore, aims to analyze the effect of price and money supply on GDP growth in Ghana using a forty-year time series data from 1980 to 2020. The empirical work used Vector Error Correction Model (VECM), cumulative impulse response function in VAR model and causality checks techniques to assess short-run and long-run relationship among price level, broad money supply, interest rate and GDP. Analysis of VECM short-run estimates revealed broad supply of money significantly affects GDP. The results further indicate that past year income and price level have negative and statistically significant effects on current year output. However, long-run estimates of the co-integrating vector shows that supply of money does not have statistically significant effect on GDP. This result is corroborated by the outcome of the cumulative orthogonal impulse response function. Furthermore, with -0.215 as the coefficient of the error correction model, a disequilibrium to GDP caused by shocks to the exogenous variables in the short-run are corrected at an adjustment speed of 21.5% in the long-run. Moreover, the study robustly concludes on bidirectional relationship between inflation and money supply. As a policy recommendation, this study proposes that the Bank of Ghana pays critical attention to the monetary policy rate since it is the channel through which the central bank targets inflation in order to achieve price stability and sustained output growth.

TABLE OF CONTENTS

ABSTRACT.....	i
TABLE OF CONTENTS.....	ii
LIST OF TABLES.....	iv
LIST OF FIGURES.....	v
CHAPTER ONE.....	1
INTRODUCTION.....	1
1.1 Monetary Policy Committee (MPC) and Inflation Targeting.....	1
1.2 Background of Study.....	3
1.3 Problem Statement.....	4
1.4 Purpose of Study.....	5
1.5 Research Questions.....	5
1.6 Importance of the Study.....	6
1.7 Structure of the Study.....	6
CHAPTER TWO.....	7
LITERATURE REVIEW.....	7
2.1 Theoretical Framework.....	7
2.2 Empirical Framework.....	8
2.2.1 Economic Growth and Inflation.....	8
2.2.2 Economic Growth and Money Supply.....	9
2.2.3 Economic Growth and Interest Rate.....	10
2.2.4 Causal Relationship among Output Growth, Money Supply and Inflation Rate.....	11
CHAPTER THREE.....	12
METHODOLOGY.....	12
3.1 Data Source and Variables.....	12
3.2 Econometric Specification and Estimation Procedure.....	12
CHAPTER FOUR.....	16
PRESENTATION AND ANALYSIS OF EMPIRICAL RESULTS.....	16
4.1 Analysis of Short-run Estimates.....	17
4.2 Analysis of Long-run Estimates.....	19

4.3 Analysis of Impulse Response Experiments.....	20
4.4 Analysis of Results of Causality Checks	22
4.4.1 Summary of Causality Checks Results	25
4.5 Diagnostics Test.....	26
CHAPTER FIVE	28
CONCLUSION AND POLICY RECOMMENDATIONS	28
5.2 Policy Implications and Recommendations.....	28
5.3 Areas for Further Studies	29
REFERENCES	30

LIST OF TABLES

Table 1:Phillips-Perron and Augmented Dickey Fuller Test.....	16
Table 2:Optimal Lag Test	16
Table 3:Outcome of Johansen Co-integration test.....	17
Table 4:VECM Short-run Estimation Results	18
Table 5:Long-run estimates	20
Table 6:Results of VAR estimation	22
Table 7:Results of Granger Causality Wald test.....	23
Table 9:Autocorrelation	26
Table 10:Normality Test.....	26

LIST OF FIGURES

Figure 1: Inflation vs. GDP.....	2
Figure 2: Broad Money Supply vs. GDP	3
Figure 3: Cumulative Orthogonal Impulse Response Function in VAR.....	21
Figure 4: Roots of the Companion Matrix.....	27

CHAPTER ONE

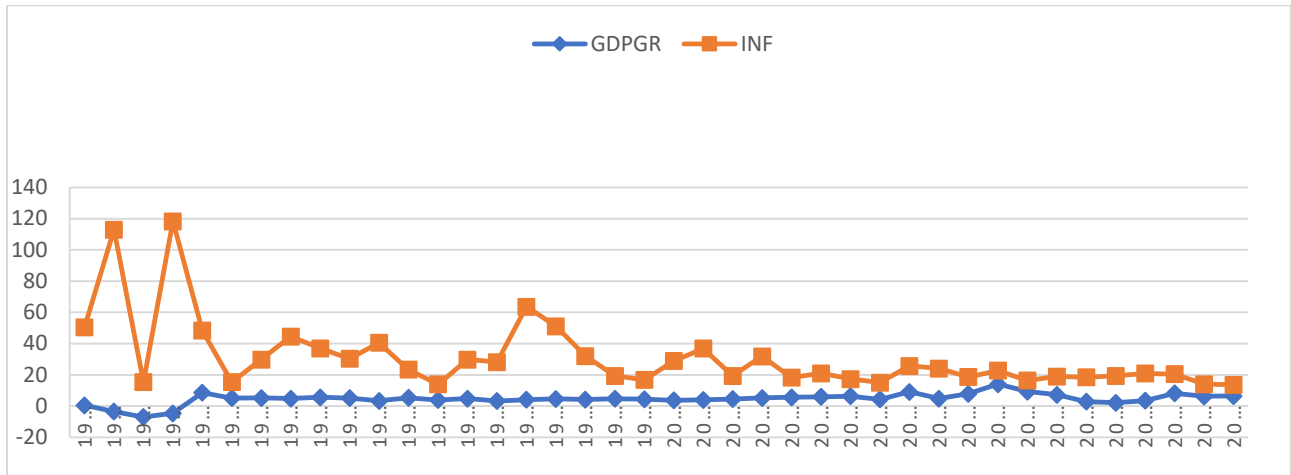
INTRODUCTION

1.1 Monetary Policy Committee (MPC) and Inflation Targeting

Economies all over the world aim to achieve high growth rate of output and stability in the general price level. But macroeconomic theories have proposed that the quest for economic growth invariably causes inflationary pressure (Mankiw, 2016). The tradeoff between output growth and inflation makes it imperative for Central Banks to conduct monetary policy.

Like any other country, the conduct of monetary policy in Ghana is the sole mandate of the Bank of Ghana. The MPC of the Bank of Ghana formulates monetary policy to ensure price stability through inflation targeting. Adopted in 2007, inflation targeting is the setting of inflation rate as a target so that monetary policy rate is adjusted regularly with the goal of achieving the target rate. Specifically, the monetary policy rate is the rate at which the Bank of Ghana lends to universal banks. The MPC used the policy rate to control the amount of money in circulation and cost of borrowing geared toward price stabilization and increasing output level. For instance, in March 2020, the Bank of Ghana reduced the policy rate by 150 basis point from 16% to 14.5%, the lowest rate since 2012. The unexpected laxity in monetary policy occurred following reduced inflationary pressure and increased fears of possible economic downturn due to the Covid-19 pandemic (Focus Economics, 2020). Thus, the interest rate was reduced to stimulate demand and increase production with the aim of increasing growth rate of output.

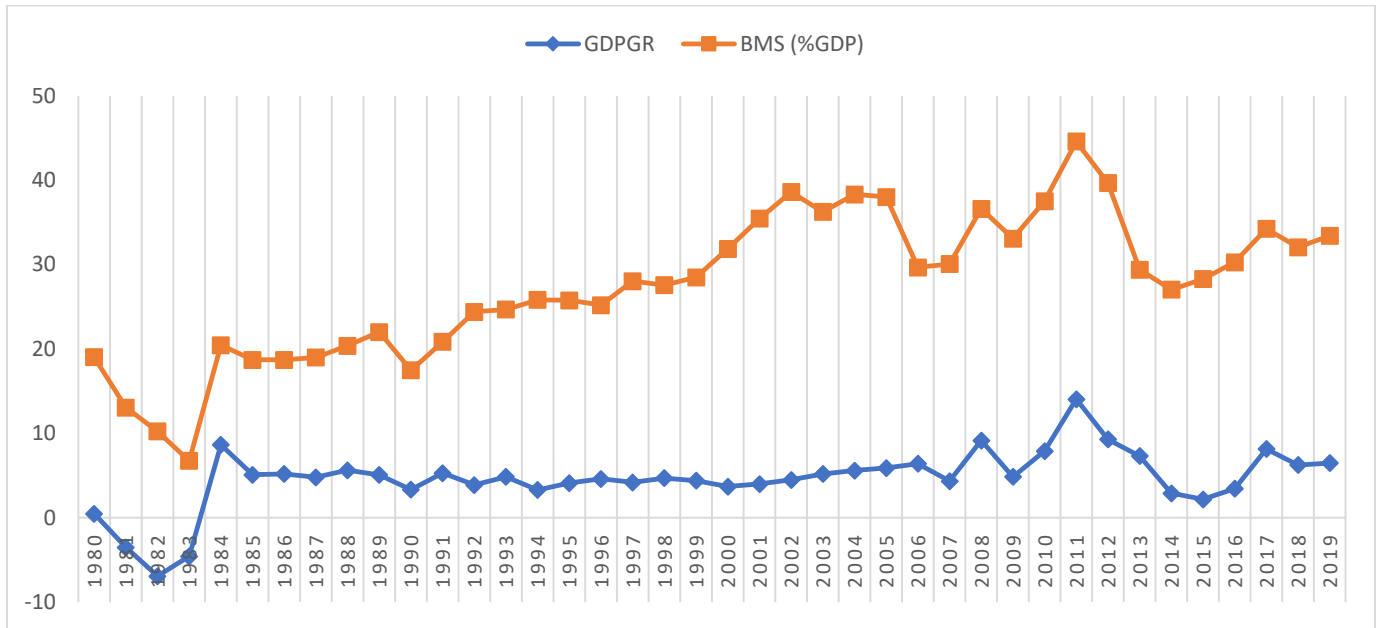
Figure 1: Inflation vs. GDP



Source: computed using data from World Bank

The graphs in figure 1 and figure 2 explain trend of inflation and GDP as well as trend of broad money supply (M2+) and GDP for the period under study, 1980-2019. Figure 1 explains trends of inflation with GDP growth for the period under study. From 1980 to 2019, a long-term trend in terms of inverse relationship between inflation and output growth could be observed. Inflation threatens the economy in the long run as it reduces the real monetary value and discourages investment. Also, it is presented in figure two that growth rate of output and money supply move in the same direction for the period under study. This trend is not unexpected as laxity in monetary policy puts downward pressure on interest rate, boosts investment and aggregate demand, and eventually increases output level.

Figure 2: Broad Money Supply vs. GDP



Source: computed using data from World Bank

1.2 Background of Study

The study of the effect of macroeconomic variables like money supply and inflation rate on economic growth has gained tremendous attention from both researchers and policy makers alike. One common objective of economies all over the world is to achieve low inflationary pressure and high growth rate of output. However, as posited by the Keynesian model, Okun's Law and Phillips Curve imply that in the short run, inflation and output move in the same direction when the aggregate supply (AS) curve slopes upward (Mankiw, 2016). Thus, policy makers are faced with trade-offs between attaining high GDP growth and low level of prices. To illustrate further, policies rolled out by managers of economies aiming to attain growth rate of output invariably result in inflationary pressure. Also, the asset model approach argues that because of short run rigidity in prices, an expansionary monetary policy tends to reduce cost of lending, increase investment, and eventually increases output. On the contrary, due to long run movement in prices, the classicals economists posit that, laxity in monetary policy increases price proportionally, which tends to increase nominal interest rate without affecting real output (Krugman, et al, 2018). Therefore, in line with the theoretical frameworks as presented above,

money supply and rate of inflation are not expected to have significant impact on output growth in the long run.

Like the theoretical frameworks discussed above, empirical papers in relation to the linkage between inflation, economic growth and money supply have revealed mixed results (Saymeh & Orabi, 2013; Agalega & Antwi, 2013; Bhat & Laskar, 2016; Enu et al, 2013; Dingela & Khobai,2017). For instance, Dingela & Khobai (2017) found that inflation rate does not have significant association with output growth in South Africa. This finding is supported by a similar study in Ghana (Agalega & Antwi, 2013). On the contrary, a research paper by Saymeh & Orabi, (2013) on the effect of GDP, cost of lending and inflation on real GDP growth in Jordan presents that price level is important in determining real output. This result has been backed by Agalega & Antwi (2013) and Enu et al (2013) in Ghana as well as Bhat & Laskar (2016) in India. Moreover, whilst a study by Majumder (2016) in Bangladesh shows money supply had insignificant effect on economic growth; money supply was found to have statistically significant effect on economic growth in Nigeria (Gatawa et al 2017), Ghana (Ahiakpor, & Akapare, 2014) and South Africa (Dingela & Khobai, 2017).

Furthermore, a study conducted on how macroeconomic variables affect GDP in Ghana presents that interest rate relates negatively with output, significant at 1% level (Agalega & Acheampong,2013). Similarly, Bhat & Laskar, (2016) examined the nexus between cost of credit, inflation rate and GDP in India and revealed rate of interest to have indirect and significant relationship with GDP. On the other hand, the results of the empirical work of Khobai and Dingela (2017) on the effect of macroeconomic variables on output in South Africa contrasted with the findings presented by Agalega & Acheampong (2013) and Bhat & Laskar, (2016) in relation to growth rate of out and cost of credit. Their study revealed that interest rate affects growth rate of the South African economy.

1.3 Problem Statement

As presented in section 1.1, several extant literature has studied the short run (Gatawa et al, 2017; Andinuur,2013; Agalega & Acheampong, 2013; Ahiakpor, & Akapare,2014; Dingela, & Khobai,2017) and the long run (Majumder, 2016; Gatawa et al, 2017; Andinuur,2013; Agalega & Acheampong, 2013; Ahiakpor, & Akapare,2014; Dingela & Khobai,2017) effects of price level and money supply on output and have revealed mixed findings. This has therefore necessitated further studies to be

carried out on the linkage between money supply, general rise in price level and economic growth, especially in Ghana.

Furthermore, for policy makers not to make wrong monetary policy prescriptions due to incorrect diagnostics of domestic economy (Njimanted et al., 2016), knowledge of interactive relationship among the macroeconomics variables under consideration is important. For instance, knowing the impact of money supply on output and the interactive linkage between the former and the latter will help monetary authorities to predict with precision the amount of growth attainable for a given level of money supply, interest rate and inflation (Albatel, 2000).

According to studies conducted in Jordan (Saymeh & Orabi, 2013) and Ghana (Ocansey, 2020), there is bidirectional causation between economic growth and interest rate and between money supply and economic growth, respectively. However, whereas an empirical work by Gatawa et al. (2017) in Nigeria presents GDP growth to unidirectionally cause money supply, a similar study in Sudan (Ahmed et al., 2011) shows no interactive relationship between real GDP and money supply.

Therefore, inference can be made from the foregone findings that the directional association between interest rate, inflation rate, output growth and supply of money have been contradictory. A possible reason for this phenomenon could be lack of robustness in the various methodologies used for these studies. Almost all the papers reviewed used one-way causality checks in their analysis, which makes inevitable to obtain inconsistent results. Therefore, to fill this gap, the current study will make use of three techniques to check for causality. The empirical work will also seek to investigate how disturbances to inflation and money supply affects economic growth by conducting impulse response experiment.

1.4 Purpose of Study

- i. to analyze the relationship between economic growth, inflation and money supply.
- ii. to investigate if economic growth responds to shocks to inflation and money supply.
- iii. to determine the causal linkage between economic growth, inflation and money supply

1.5 Research Questions

Based on the afore-mentioned objectives, the following research questions will be answered:

- I. Is there associations among output, money supply and price level?
- II. Does output growth respond to shocks to inflation and money supply?
- III. What is the causal linkage between economic growth, inflation and money supply?

1.6 Importance of the Study

Outcome of this paper will be important to policy makers, including the BOG in their conduct of monetary policy. The study will help the MPC to determine the right quantum of money needed to achieve target growth in GDP and inflation rate given the level of policy rate. Also, this paper will serve as a reference material for researchers and students.

1.7 Structure of the Study

The remainder of the study is structured as follows. Second chapter reviews related literature to find empirical and theoretical support for the relationships among the macroeconomic variables under study. Model design and specification are presented in the third chapter. Chapter four then discusses the outcome of statistical computations. The paper finally ends with summary, conclusion, and recommendations in Chapter five.

CHAPTER TWO

LITERATURE REVIEW

2.1 Theoretical Framework

One common goal of developed and developing economies all over the world is the achievement of sustained growth rate of GDP. Because economic growth depends on many factors, attaining such a goal has not been easy for policy makers. But economic indicators like as money supply and rate of growth in general price level have often been relied upon by managers of economies in gauging economic growth (Barro, 1995). For instance, central banks use monetary policy rate to control money supply and cost of lending in order to achieve price stability and sustainable output growth.

However, as posited by the Keynesian model, Okun's Law and Phillips Curve imply that when short-run aggregate supply (AS) curve moves upward, price level and output relate together (Mankiw, 2016). It means that as output increases price level goes up and as output decreases price level falls. This presents a clear case of policy conflict for policy makers, as they would have tradeoff between output growth and rising price level in the short run. On the contrary, the quantity theory ($MV=PY$) predicts a long run negative relationship between price level and output. Given velocity of money and money supply, an increase in the level of prices causes real money balance to fall. To keep the money market in equilibrium, interest rate rises, causing aggregate demand and output to fall (Mankiw, 2016).

Moreover, the asset model approach argues that because price is fixed in the short run, increased money supply reduces interest rate, boosts investment and aggregate demand, and eventually increases output level. Hence, monetarists predict short-run direct association between money supply and output. However, the classical economists' postulate that laxity in monetary policy increases price level proportionally, and consequently increases nominal interest rate without affecting real output (Krugman, et al., 2018). Moreover, the equilibrium condition of the Keynesian model $\frac{M^S}{P} = L(R, Y)$ indicates a long run propositional adjustment of price to changes in money supply so that real money balance $L(R, Y)$ does not change. This supports the claim by the classical economists that "money is a veil". It means in the long-run, money supply only fuels inflation without affecting real variables. Therefore, in line with the theoretical frameworks

presented so far, money supply, rate of interest and inflation are not expected to be important in impacting output growth in the long-run.

2.2 Empirical Framework

Several empirical works have studied the short run (Gatawa et al, 2017; Andinuur,2013; Agalega & Acheampong, 2013; Ahiakpor, & Akapare,2014; Dingela, & Khobai,2017) and long run (Majumder, 2016; Gatawa et al, 2017; Andinuur,2013; Agalega & Acheampong, 2013; Ahiakpor, & Akapare,2014; Dingela & Khobai,2017) effects of interest rate, inflation, and money supply on economic growth. Also, there have been mixed findings in terms of causal relationships among these variables (Saymeh & Orabi, 2013; Gatawa et al., 2017; Andinuur,2013; Ocansey, 2020; Ahmed et al., 2011; Amankwah & Atta Sarfo, 2019). Therefore, this section is divided into four subsections with the first subsection devoted to the association between price and output growth. While the second subsection analyzes the linkage between cost of lending and GDP growth, the nexus between growth rate of output and broad money supply is assessed in subsection three. The final subsection then discusses the causal linkages among these variables.

2.2.1 Economic Growth and Inflation

As discussed in Section two, economic theories have predicted direct and indirect association between inflation and output growth. To examine the theoretical propositions, related literature has been reviewed to investigate the effect of persistent rise in the general price level on growth rate of GDP. For instance, Orabi and Saymeh (2013) analyzed impacts of inflation, rate of interest and GDP on growth rate of real output in Jordan using regression analysis, cointegration test and the pair wise granger causality test. They reported that inflation rate had statistically significant positive effect on economic growth, *ceteris paribus*. Similar results were revealed from the works of Agalega & Acheampong (2013) in Ghana and Bhat & Laskar, (2016) in India. On the contrary, empirical work on the linkage between GDP and price level in Ghana using the OLS model reveals that inflation has a negative effect on economic growth, significant at 5% level (Enu et al.,2013).

Furthermore, empirical studies have also been conducted to assess short-run and long-run effect of inflation on output growth. For example, in South Africa, a study on the dynamic effect of selected macroeconomic variables on economic growth was conducted using autoregressive

distributed lag and error correction model. The study revealed that unlike in the short run, inflation was statistically significant in impacting GDP growth in the long-term (Dingela, & Khobai, 2017). Also, Ahiakpor, & Akapare (2014) employed VECM and granger causality test to investigate the nexus between inflation and growth of output in Ghana. They presented that price level has indirect and significant impact on GDP. Similarly, Gatawa et al. (2017) assessed how B2+ and rate of inflation impact output growth in Nigeria using VAR model. They found that inflation rate has statistically significant negative relationship with growth rate of output in the short and long run. These findings have been confirmed in Ghana by Andinur, (2013), whose research work reveals inflation to be negative and significant in affecting output growth. On the contrary, analysis of the impact of the long run and short run effect inflation, interest rate and government consumption expenditure on GDP growth in Ghana was carried out using VECM and cointegration test. The study concluded that economic growth was positively significant in affecting inflation rate (Agalega & Acheampong, 2013).

2.2.2 Economic Growth and Money Supply

In relation to output growth and money supply, macroeconomic theorists have posited that money supply has directly affects output in the short time-frame, and has no long run impact. Furthermore, monetarists have argued that monetary policy increases inflation proportionally with no effect on output. Therefore, to investigate this theory, Isiaka et al., (2011) undertook an empirical work in Nigeria on the linkage between GDP growth rate and broad money supply and reported an insignificant and positive connection between money supply and GDP in the long time-frame. Similarly, Majumder (2016) analyzed impact of macroeconomic indicators on output in Bangladesh. The paper concluded that broad money supply has no effect on output in the long-term. However, empirical work on the effects of selected macroeconomic indicators on GDP growth reported that broad money supply significantly and indirectly affects economic growth in Nigeria (Amassona *et al.*, 2011). This finding was supported by Omotor, (2010), who employed the VAR model to study the effect of money supply on output growth in Nigeria and concluded on long-term effect of money supply on level of output.

Further, to make comparative analysis of short run estimates against long run estimates, Khobai & Dingela (2017) investigated the effect of M3 on output using the ARDL and EC model. They presented that the quantum of broad money supply (M3) is important in

determining GDP in South Africa. Similarly, in Ghana, a paper on the link among output growth and selected macroeconomic variables and revealed that, all other things being equal, money supply (M2) has significant and positive association with GDP growth in the short run and in the long run (Ahiakpor, & Akapare,2014). However, Gatawa et al. (2017) studied the effects of price level and supply of money on output growth in the Nigeria economy and reported B2+ has direct and indirect association with economic growth.

2.2.3 Economic Growth and Interest Rate

Central banks used monetary policy rate to control quantity of money supply to achieve economic growth and stable price level. Increased supply of loanable fund, lowers cost of credit, raises investment and aggregate demand and thus, increasing output. To test this theory, Agalega & Acheampong (2013) conducted a study on how macroeconomic variables impact GDP in Ghana. The study discovered that cost of credit relates negatively to output, significant at 1% level. Similarly, Bhat & Laskar, (2016) assessed the nexus between rate of interest, inflation rate and GDP and found rate of interest to have an indirect and significant relationship with GDP in India. Moreover, in a thorough study, Ahiakpor, & Akapare, (2014) employed the VECM statistical techniques to assess the link among some macroeconomic indicators and economic growth in Ghana. Results of the Johansen cointegration test indicate long run relationship among price, supply of money, interest rate and real output. With -0.1825 as the coefficient of the error correction term, it means that a 18.25% of disequilibrium created by shocks in the short-run will return to equilibrium in the long-run. The study further revealed interest rate to have an indirect and significant long run linkage with economic growth. On the other hand, the results of the empirical work by Khobai and Dingela (2017) on the effect of macroeconomic variables on output growth in South Africa contrasted with the findings presented so far in this section. Their study revealed that interest rate inversely and insignificantly affects economic growth in South Africa.

Furthermore, Agalega & Acheampong,(2013) compared the effects of policy rate, government expenditure and general price level on output growth in Ghana, using the vector error correction model and cointegration test. The results revealed that policy rate significantly affects output indirectly in the short-term and directly in the long-term. Also, study on the effect of inflation, broad supply of money and interest rate on growth rate of output in Nigeria by

Gatawa et al.,(2017) present that cost of credit indirectly affect output in a short time-frame. The study further reveals interest rate to be indirectly important in affecting GDP in the long-term, thus contrasting the long-run results of Agalega & Acheampong (2013).

2.2.4 Causal Relationship among Output Growth, Money Supply and Inflation Rate

For policy makers not to make wrong monetary policy prescriptions because of wrong diagnostics of domestic economy (Njimanted et al., 2016), causal linkage among macroeconomic variables is important. Therefore, considerable studies have been conducted on the directional association among output, interest rate and price level (Saymeh & Orabi, 2013; Gatawa et al 2017; Andinuur,2013; Ocansey, 2020; Ahmed et al., 2011; Amankwah & Atta Sarfo, 2019).

For instance, studies have revealed a bidirectional causation between output growth and rate of interest in Jordan (Saymeh & Orabi, 2013) and between money supply and economic growth in Ghana (Ocansey, 2020). However, whereas an empirical work by Gatawa et al (2017) in Nigeria presents that GDP growth unidirectionally causes money supply, a similar study in Sudan (Ahmed et al., 2011) shows no interactive connection between broad money supply and real output. Moreover, a research work carried out on the impact of inflation and money supply on economic growth in Nigeria reveals that inflation, interest rate and money supply do not cause output (Gatawa et al.,2017).

CHAPTER THREE

METHODOLOGY

3.1 Data Source and Variables

To carry out the empirical analysis, yearly time-series data from 1980 to 2020 will be used. The source of data include the Bank of Ghana, International Financial Statistics and the World Bank. The period chosen gives dataset 40 observations which is enough to be used in conducting time-series analysis.

Several variables have been reported to affect economic growth. For the purpose of this study money supply, output, price and interest rate proxied by the monetary policy rate are used. The monetary policy rate (MPR) measures the rate at which the Bank of Ghana lends to financial institutions. Price level is represented by the consumer price index (which measures average prices of goods and services within a given time period). Also, while the paper measures economic growth with GDP, broad money supply was used to represent money supply. It is worth noting that the policy rate, inflation and M3 constitute key monetary variables used by the BOG in conduct of monetary policy. Thus, this paper seeks to analyze how shocks to these variables affect short-run and long-run output using quantity theory of money approach.

3.2 Econometric Specification and Estimation Procedure

According to Monetarists, price is sorely determined by money supply. Therefore, when quantity of money changes, price level changes in equal proportion. Thus, as propounded by Irvin Fisher, the original quantity theory of money is stated as

$$MV = PQ \dots\dots\dots 1$$

Where V = number of times money used in carrying out transaction, M = stock of money, P= price and Q stands for volume of transaction within a given period. Equation one is modified with Y replacing Q. Y represent commodities exchanged for money. Thus, equation one becomes

$$MV = PY \dots\dots\dots 2$$

Taking a log form of equation 2 yields:

$$\log(M) + \log(V) = \log(P) + \log(Y) \dots \dots \dots 3$$

Hence, the log of money supply, general price level and output will be used to address all the research questions.

In using time series data to carry out empirical analysis, conducting a test of stationarity is important in order to avoid spurious results. Time-series variables are stationary if their statistical properties are constant with time (Gujarati and Porter, 2009). Equation (1) shows how the unit root is modeled, with $\beta_0, \beta_1, \beta_2$ and α_i being parameters to be computed and μ_t the error term assumed normally distributed. For robustness, Augmented Dickey-Fuller (ADF) and Phillip Perron tests are carried out.

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 t + \sum_{i=1}^n \alpha_i \Delta Y_{t-1} + \mu_t \dots \dots \dots (1)$$

After confirming that the series are stationary, the study continues to assess the effect of macroeconomic variables on output growth. Different statistical techniques have been employed to accomplish this. Based on theoretical propositions and following the empirical works of Gatawa et al., (2017), Agalega & Acheampong (2013) and Ahiakpor, & Akapare, (2014); the current study employed Vector Error Correction Model (VECM) to answer the first research question. Once the variables from the data have long-run association through the use of the Johansen cointegrating test, VECM contains parameters which allows for short-run and long-run analysis to be undertaken. It is a restricted form of VAR with no exogenous variables. The VECM specification is stated in equation (2) to (5):

$$\begin{aligned} \Delta(\ln GDP)_t = & \gamma + \sum_{i=1}^{n-1} \theta_i \Delta(\ln GDP)_{t-i} + \sum_{j=1}^{n-1} \beta_j \Delta(\ln B2)_{t-j} + \sum_{k=1}^{n-1} \delta_k \Delta(\ln P)_{t-k} \\ & + \sum_{l=1}^{n-1} \sigma_l \Delta(\ln INT)_{t-l} + \omega_1 ECT_{t-1} + \mu_{1t} \dots \dots \dots (1) \end{aligned}$$

$$\begin{aligned}\Delta(\ln B2)_t = & \gamma^m + \sum_{i=1}^{n-1} \theta_i \Delta(\ln GDP)_{t-i} + \sum_{j=1}^{n-1} \beta_j \Delta(\ln B2)_{t-j} + \sum_{k=1}^{n-1} \delta_k \Delta(\ln P)_{t-k} \\ & + \sum_{l=1}^{n-1} \sigma_l \Delta(\ln INT)_{t-l} + \omega_2 ECT_{t-1} + \mu_{2t} \dots \dots \dots (2)\end{aligned}$$

$$\begin{aligned}\Delta(\ln P)_t = & \gamma^n + \sum_{i=1}^{n-1} \theta_i \Delta(\ln GDP)_{t-i} + \sum_{j=1}^{n-1} \beta_j \Delta(\ln B2)_{t-j} + \sum_{k=1}^{n-1} \delta_k \Delta(\ln P)_{t-k} \\ & + \sum_{l=1}^{n-1} \sigma_l \Delta(\ln INT)_{t-l} + \omega_3 ECT_{t-1} + \mu_{3t} \dots \dots \dots (3)\end{aligned}$$

$$\begin{aligned}\Delta(\ln INT)_t = & \gamma^q + \sum_{i=1}^{n-1} \theta_i \Delta(\ln GDP)_{t-i} + \sum_{j=1}^{n-1} \beta_j \Delta(\ln B2)_{t-j} + \sum_{k=1}^{n-1} \delta_k \Delta(\ln P)_{t-k} \\ & + \sum_{l=1}^{n-1} \sigma_l \Delta(\ln INT)_{t-l} + \omega_4 ECT_{t-1} + \mu_{4t} \dots \dots \dots (4)\end{aligned}$$

The variables are defined as:

lnGDP = log of GDP measured by output

lnB2 = log of stock of money measured by broad money supply

lnP = log of price measured by consumer price index

lnINT = log of interest rate measured by monetary policy rate

With VECM, the lag length is reduced by one. The endogenous variable is a function of its lagged values and that of other variables.

$\theta_i, \beta_j, \delta_k, \sigma_l$ = short-run parameters

μ_{it} = stochastic error term also known as shocks.

ETC_{T-1} equals the error correction term which contains long-term information about the variables under-study. Also, the coefficient of the error correction term ω_i carries negative sign and determines the extent to which the endogenous variable returns to equilibrium following shocks to exogenous variables.

To further analyze the response of endogenous variable after changes to itself as well as the exogenous variables, the impulse response function (IRF) is estimated. Apart from helping to explain the extent to which disturbances to a variable are passed to other variables within the system, the IRF also tracks the effect of shocks to one of the innovations on current and future values of the endogenous variable (Gujarati and Porter, 2009). Thus, the impulse response function helps to answer the second research question.

Finally, causality techniques will be employed to check for causality among variables under-study and to help address the third research question. As a departure from the empirical studies reviewed so far, the current work will use three different techniques to test for causality among the variables. This is to ensure robustness of results. Further, in order to have justification for results from the VECM and VAR analysis, some post-estimation diagnostics test will be carried out. Most especially, test for stability, normality and serial autocorrelation will be conducted.

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF EMPIRICAL RESULTS

Table 1:Phillips-Perron and Augmented Dickey Fuller Test

Variable	ADF Test		PP Test		Integration Result
	constant without trend	constant with trend	constant without trend	constant with trend	
lnGDP	-3.234**	3.295*	-5.510***	-5.601***	I(1)
lnB2	-3.223**	5.001***	-4.401***	-5.715***	I(1)
lnINF	-5.304***	5.180***	-10.240***	-10.073***	I(1)
lnINT	-3.077**	3.266*	-7.271***	-7.280*	I(1)

All figures are test statistics with *** p<0.01, ** p<0.05, * p<0.1

Source: Computed from Stata 17

The interpretation and analysis of results begin with examination of characteristics of time series data. To test for stationarity, both the Augmented Dickey Fuller test and the Phillips-Perron test were used. The series contained unit root after applying the ADF and PP test at levels. Thus, the non-stationary series were differenced, and the techniques reapplied. As shown in table 1, the null hypothesis of non-stationarity was rejected for all the variables. Therefore, all the variables were stationary at the first order. With the series integrated of order one, there is theoretical backing for application of VAR and VEC model.

Table 2:Optimal Lag Test

Lag	LogL	LR	FPE	AIC	HQ	SC
0	12.5557		7.3e-06*	-0.47532	-.413906*	-.299369*
1	25.7923	26.473	8.60E-06	-0.32179	-0.01474	0.55794
2	44.6151	37.646	7.60E-06	-0.47861	0.074076	1.1049
3	54.6028	19.976	0.000012	-0.1446	0.653729	2.1427
4	77.5444	45.883*	9.60E-06	-.530245*	0.513726	2.46085

* Optimal lag length

Source: computed from Stata 17

Following confirmation of stationarity in the series, the study proceeded to check for maximum lags to be used. Hence, optimum lag length test was undertaken and the results shown in table 2. It can be seen that the HQ, SC and FPE criteria selected zero lag while the AIC and LR criteria selected an optimal lag of 4. Since the AIC criterion has the lowest value, an optimum lag of four was used in this study.

Table 3: Outcome of Johansen Co-integration test

Null Hypothesis (Number of CEs)	Eigen Value	Trace Statistic	Critical Value (5%)	Max Statistics	Critical Value (5%)
Zero	19.952605	62.2046*	47.21	27.2052*	27.07
At most 1	33.555213	34.9994*	29.68	17.7848	20.97
At most 2	42.447621	17.2146*	15.41	12.3351	14.07
At most 3	48.615188	4.8795*	3.76	4.8795*	3.76

* p<0.1

Source: computed from Stata 17

With optimum lag determined, the empirical work went on to examine long-run nexus among the variables using the Johansen co-integration test as displayed in table 3. From the trace statistics and max eigen value, null hypothesis of no long-run linkage among the variables is rejected at 5% level of significant. Hence, both techniques have indicated at least one co-integrating vector.

4.1 Analysis of Short-run Estimates

As exhibited in table 4, in the short-term, there is an indirect association between GDP and its first lag (LD.lnGDP), significant at 1% level. This means that within the period under study, past year output has significant negative effect on current year GDP. The inference to be made from this result could be that income from past year economic growth was not properly reinvested or distributed within the Ghanaian economy. This result conforms to the findings of Gatawa et al. (2017) as well as Henri and Henri (2011).

Table 4: VECM Short-run Estimation Results

System Equations				
	(1)	(2)	(3)	(4)
VARIABLES	lnGDP	lnB2	lnINF	lnlNT
L._ce1	-0.215** (0.0921)	0.0285 (0.0485)	2.020*** (0.399)	0.104 (0.0727)
LD.lnGDP	-0.507*** (0.175)	-0.0363 (0.0920)	-1.748** (0.757)	0.0779 (0.138)
LD.lnB2	0.0577 (0.357)	-0.432** (0.188)	0.309 (1.549)	1.500*** (0.282)
L2D.lnB2	0.608 (0.425)	-0.403* (0.224)	-0.834 (1.844)	-0.234 (0.336)
LD.lnINF	-0.204** (0.0908)	0.0447 (0.0479)	0.847** (0.394)	0.0816 (0.0717)
L2D.lnINF	-0.118* (0.0641)	0.0184 (0.0338)	0.191 (0.278)	0.000462 (0.0506)
LD.lnlNT	-0.0432 (0.207)	0.000532 (0.109)	-0.592 (0.897)	-0.530*** (0.163)
L2D.lnlNT	-0.0652 (0.185)	0.0336 (0.0976)	-0.138 (0.803)	-0.0967 (0.146)
Constant	0.00763 (0.0324)	-0.00649 (0.0171)	0.00147 (0.140)	-0.0110 (0.0256)
Observations	37	37	37	37

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: computed from Stata 17

Moreover, first and second lag of the rate of inflation were found to have indirect connection with output growth which is statistically significant. The inverse effect of inflation on

GDP could be ascribed to law of demand which emphasizes on the indirect relationship between price and output. Price of a commodity could suddenly rise due to factors such income, expectation, seasonality, etc. As a result, demand for that commodity could fall bringing about accumulation of inventories. Therefore, firms react by cutting back on production, leading to low output and growth. This outcome is in agreement with studies by Ahiakpor, & Akapare (2014), Enu et al. (2013) and Andinur, (2013) who conducted similar studies on the Ghanaian economy as well as Gatawa et al (2017) whose work focused on the Nigerian economy. However, this finding contrasts the Keynesian model which predicts that when the short-run AS curve slopes upward, price and output move together.

Further, the paper presented broad money supply to have positive effect on economic growth in the short run. Though statistically insignificant, the result agrees with the Keynesians model which posit short run positive linkage between supply of money and output level. Given the theories discussed so far, in the short-run, due to rigidity in prices, increased supply of money reduces interest rate, boosts investment and aggregate demand, and consequently increases output. This result concurs with that of Ahiakpor & Akapare (2014) who studied how laxity in monetary policy affects the Ghanaian economy and Dingela & Khobai(2017) whose empirical work focused on the effect of macroeconomic variables on growth rate of the South African economy. Moreover, interest rate was revealed to be related negatively with GDP in the short run. It is worth to note that when the monetary policy rate, set by the Bank of Ghana, increases, cost of borrowing goes up leading to reduction in investment and aggregate demand. This consequently affects output negatively.

Further analysis from results of the short-run coefficients in table 4 revealed that the coefficient for the error correction term is statistically significant and negative as well, lending support to existence of long-term association among variables under-study. Also, ECM coefficient of -0.215 implies a disequilibrium to GDP caused by shocks to the exogenous variables in the previous year are corrected at an adjustment speed of about 21.5%.

4.2 Analysis of Long-run Estimates

Table 5 presents estimate of long-run error correction model normalizing on GDP. The co-integration equation from the table revealed existence of direct and statistically insignificant nexus between output and supply of money. This finding confirms the classical economist's l

theory of money being a ‘veil’. They argue that in the long-run expansionary monetary policy increases price level proportionally, and consequently increases nominal interest rate without affecting output. Empirically, this result conforms with studies by Isiaka et al., (2011) and Majumder (2016) and contrasts with findings of Gatawa et al (2017).

Table 5: Long-run estimates

lnGDP	Constant	lnB2	lnINF	lnINT
1	-0.5172553	1.13258 (1.088733)	-1.232723*** (0.2360438)	0.875129 (0.7085945)

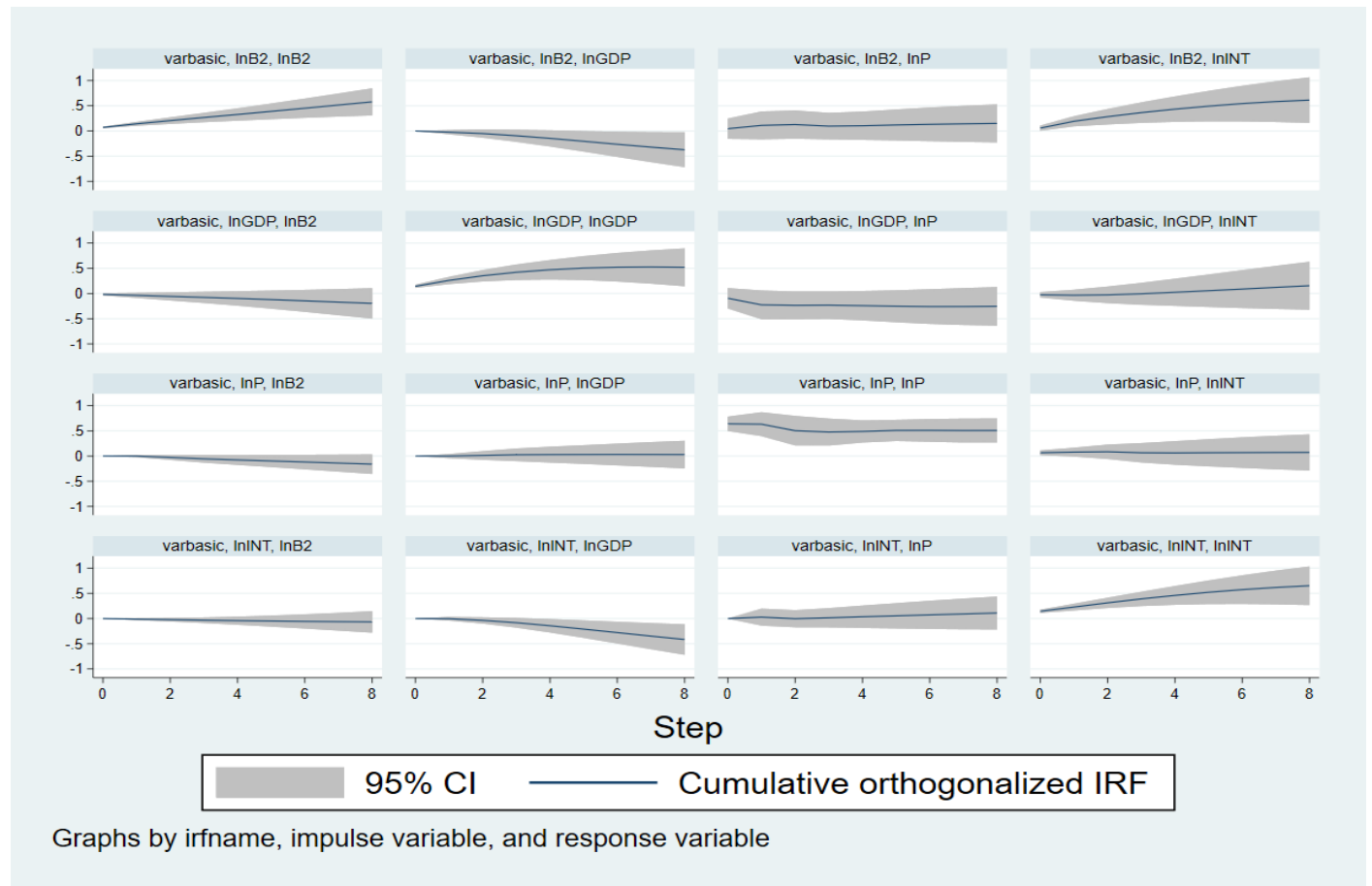
*** p<0.01, ** p<0.05, * p<0.1

Source: computed from Stata 17

Moreover, in the long-run, inflation is statistically significant in indirectly affecting growth rate of output. It is important to note that when inflation persist within an economy for a while, business confidence within the local economy is dampened as real value of money falls. Businesses will respond by cutting back on investment within the domestic economy. This move will reduce aggregate demand and output and consequently affects economic growth. Also, in line with prior expectation, interest rate does not significantly affect output in the long-term.

4.3 Analysis of Impulse Response Experiments

Figure 3: Cummulative Orthogonal Impulse Response Function in VAR



Source: computed from Stata 17

Figure 3 is a cumulative orthogonal response function (COIRF) and explains how GDP response to shocks in broad money supply, price level, interest rate and GDP itself.

The graph shows a significant response of GDP to shocks in broad money supply, interest rate and GDP itself. GDP responded to shocks in interest rate and money supply by gradually decreasing below its zero line and persisted over time. This is in line with economic theory given that disturbances to cost of capital negatively affects investment which eventually decreases aggregate demand and output. In the case of shocks to GDP itself, the response is more pronounced with a significant increase in GDP which persisted over the eight-year time frame. The impact of a shock to price is however insignificant with a slight increase in GDP which disappears with time. Albert insignificant, this outcome is in line with Keynesians short-run asset model which posits direct relationship between price and output.

Also, analyzing the effect on broad money supply of disturbances to macroeconomic variables under-study, the COIRF depicts money supply to have a significant response to shocks in itself. The effect became more pronounced within the eight years' time frame. However, the reaction of broad money supply to disturbances in interest rate, price and GDP tend to be insignificant.

Moreover, price level responded to shocks in interest rate, money supply, GDP and price itself after one year. The impact of the shock on price was not pronounced for all the variables. Except price level, a shock to all the variables under study brought about a significant reaction of interest rate.

4.4 Analysis of Results of Causality Checks

As a departure from empirical papers reviewed so far, this paper employed three econometric techniques to check for causality among the variables under study. The first method employed is the vector autoregressive model with estimation result presented in table 6.

Table 6: Results of VAR estimation

	(1)	(2)	(3)	(4)
VARIABLES	dlnGDP	dlnB2	dlnINF	dlnINT
L.dlnGDP	0.00697 (0.162)	0.0750 (0.0741)	-0.394 (0.527)	0.293** (0.121)
L2.dlnGDP	0.117 (0.161)	-0.0274 (0.0736)	-0.961* (0.523)	0.277** (0.120)
L3.dlnGDP	0.0584 (0.159)	0.00886 (0.0727)	-0.0245 (0.516)	-0.0261 (0.119)
L4.dlnGDP	-0.0572 (0.161)	-0.0447 (0.0734)	1.576*** (0.521)	-0.0931 (0.120)
L.dlnB2	-0.398 (0.313)	0.339** (0.143)	1.497 (1.016)	1.634*** (0.234)
L2.dlnB2	1.050** (0.483)	0.142 (0.221)	-4.812*** (1.567)	-1.301*** (0.361)
L3.dlnB2	-1.069** (0.511)	0.0820 (0.233)	8.258*** (1.658)	0.415 (0.382)
L4.dlnB2	0.280 (0.384)	0.112 (0.175)	-2.772** (1.246)	-0.372 (0.287)
L.dlnINF	0.0302 (0.0356)	-0.000616 (0.0163)	-0.766*** (0.115)	-0.0241 (0.0266)

L2.dlnINF	0.0596	-0.0395*	-0.715***	-0.0502
	(0.0457)	(0.0209)	(0.148)	(0.0342)
L3.dlnINF	0.0613	-0.0696***	-0.218	-0.0188
	(0.0584)	(0.0267)	(0.189)	(0.0436)
L4.dlnINF	0.0435	-0.0881***	-0.413**	-0.0846**
	(0.0526)	(0.0240)	(0.171)	(0.0393)
L.dlnlNT	-0.465**	-0.0832	3.559***	0.273
	(0.227)	(0.104)	(0.736)	(0.169)
L2.dlnlNT	0.0360	0.111	-2.283***	0.214
	(0.195)	(0.0891)	(0.633)	(0.146)
L3.dlnlNT	-0.0192	-0.0333	-0.943*	0.0706
	(0.172)	(0.0784)	(0.557)	(0.128)
L4.dlnlNT	-0.270*	0.0670	0.0185	0.145
	(0.156)	(0.0714)	(0.507)	(0.117)
Constant	0.127	0.0739	-0.825	-0.164
	(0.170)	(0.0778)	(0.553)	(0.127)
Observations	36	36	36	36

*** p<0.01, ** p<0.05, * p<0.1

Source: computed from Stata 17

According to the VAR output in table 6, first and second lag of broad money supply as well as first and fourth lag of interest have statistically significant causal effect on GDP. It implies that the occurrence of interest rate and broad money supply makes the occurrence of economic growth within the period under study more probable. Moreover, whereas the second, third and fourth lag of inflation have causal effects on broad money supply, 2nd, 3rd and 4th lag of broad money supply also have causal effect on inflation. Therefore, both inflation and money supply have causal effect on each other. This confirms the Keynesians and Classical school of thought. Moreover, digesting table 6 further, GDP and money supply have causal effect on interest rate. In other words, both variables are important in predicting inflation.

Table 7: Results of Granger Causality Wald test

Equation	Excluded	chi2	df	Prob > chi2
lnGDP	lnB2	7.0249	4	0.135
lnGDP	lnINF	2.3481	4	0.672
lnGDP	lnINT	7.7684	4	0.1
lnGDP	ALL	16.638	12	0.164
lnB2	lnGDP	1.5289	4	0.822
lnB2	lnINF	19.026***	4	0.001
lnB2	lnINT	4.342	4	0.362
lnB2	ALL	26.63	12	0.009
lnINF	lnGDP	11.982**	4	0.017
lnINF	lnB2	28.079***	4	0.000
lnINF	lnINT	31.179***	4	0.000
lnINF	ALL	52.412	12	0.000
lnINT	lnGDP	11.978**	4	0.018
lnINT	lnB2	55.369***	4	0.000
lnINT	lnINF	5.9098	4	0.206
lnINT	ALL	73.385	12	0.000

*** p<0.01, ** p<0.05, * p<0.1

Source: computed from Stata 17

Having confirmed the existence of causality among the variables under study using the VAR technique, the paper continued to deploy the second method of checking for causality by estimating the Granger causality Wald test in table 7.

From table 7, there is causality running from inflation to money supply and from money supply to inflation, confirming the Keynesians and Classical theories as well as the results obtained in the first method for checking causality. Moreover, whereas both GDP and broad

money supply granger cause interest rate, there is one-way causality running from interest rate to price level. These results again confirmed what was obtained in table 6.

Table 8: Wald Coefficient Test

Equation	Excluded	chi2	df	Prob > chi2
lnINF	lnB2	28.08***	4	0.0000
lnB2	lnINF	19.03***	4	0.0008
lnINF	lnINT	31.18***	4	0.0000
lnINT	lnGDP	11.98**	4	0.0175
lnINT	lnB2	55.37***	4	0.0000

*** p<0.01, ** p<0.05, * p<0.1

Source: computed from Stata 17

Also, it is interesting to note that, no explanatory variable causes GDP, meaning within the period under investigation expansionary money supply has not cause enough downward pressure on cost of investment to the extent of stimulating investment and boosting output. This outcome is confirmed by research findings of Gatawa et al. (2017).

The third method used to check for causality among variables under study is the Wald coefficient test as presented in table 8. According to the results, inflation and money supply bidirectionally caused each other. Also, as found in method 2, both economic growth and broad money have causal effect on interest rate. Further, interest rate was found to have causal effect on inflation.

4.4.1 Summary of Causality Checks Results

Digesting results of the three methods, the study robustly concludes on the existence of interactive relationship between inflation and supply of money. This implies that within the period covered for this research work, both variables have causal effects on each other. In other words, both variables are statistically significant in predicting each other. There is theoretical and empirical support for these results from the Keynesian and Classical models as well as Gatawa et al (2017) respectively.

Furthermore, the study also resolved that there exists one way causality from GDP to interest rate and one-way causality from supply of moeny to interest rate. The latter is not unexpected given that monetary policy will invariably affect interest rate in the money market. Lastly, the empirical work presents the existence of one-way causation moving from interest rate to inflation.

4.5 Diagnostics Test

Table 8: Autocorrelation

lag	chi2	df	p>chi2
1	9.9753	9	0.35249
2	8.8577	9	0.45051
3	5.8821	9	0.75165
4	4.6226	9	0.86589

Ho: No autocorrelation at lag order

To ensure robustness of results and to have confidence in the analysis undertaken so far, some diagnostic tests have been carried out. From table 9, the study fails to reject the null hypothesis of no autocorrelation at all lags. The paper proceeded to conduct normality test, and as displayed in table 10, outcome of normality test shows that all variables are normally distributed.

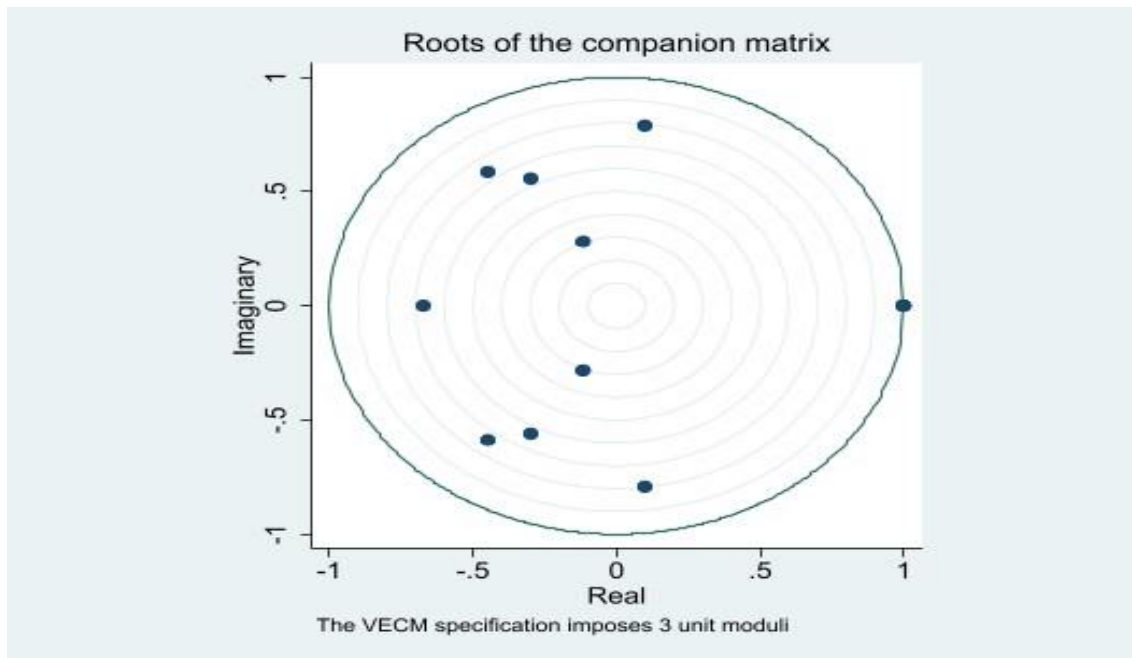
Table 9: Normality Test

Equation	chi2	df	P> chi2
D_dlnGDP	1.858	2	0.39491
D_dlnB2	1.968	2	0.37385
D_dlnINF	5.039	2	0.08049
D_dlnlNT	0.737	2	0.6918
ALL	9.602	8	0.29406

Ho: Normality

Finally, stability test was carried out and the outcome presented in figure 4. As can be seen from the roots of the companion matrix, there is stability within the model used in the study.

Figure 4: Roots of the Companion Matrix



CHAPTER FIVE

CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Conclusion

The paper examined the impact of price level and broad money supply on output growth using VECM. Results from the short-run parameters present that, broad money supply and price level respectively relates directly and indirectly with output growth, confirming the Keynesian model. Moreover, the paper further revealed past year output to negatively affect current year GDP, indicating that the past year income was not well managed within the period under study.

Also, long-run estimates of the co-integrating vector reveals money supply and inflation to respectively have a statistically insignificant direct and statistically significant negative connection with output. The former was corroborated by the cumulative orthogonal impulse response function. Further, the coefficient of the error correction model -0.215 implies that a disequilibrium to GDP caused by shocks to the exogenous variables in the previous year are corrected at an adjustment speed of about 21.5%.

The study also examined the causal relationship among the variables under study. Comparing results from the three techniques (vector autoregressive model, granger causality Wald test and Wald coefficient test), the study robustly concludes on the existence of interactive relationship between inflation and money supply. Moreover, the empirical work presents GDP and broad money supply to be the probabilistic cause of interest rate.

5.2 Policy Implications and Recommendations

One common objective of economies all over the world is the achievement of sustained growth rate of GDP. Because economic growth depends on many factors, attaining such a goal has not been easy for policy makers. Following results of this empirical work, it is explicit that supply of money is significant in determining price level and interest rate in Ghana. Since the monetary policy rate is the channel through which the central bank of Ghana targets inflation, a critical attention must be paid to the policy rate.

Also, the government of Ghana must effectively allocate income from past year economic growth in order to avoid situations where output in previous years negatively affects current and future GDP.

5.3 Areas for Further Studies

The current study focused more on Ghana's post economic recovery program era. Thus, a comparative empirical work on the effect of price level and broad money supply on real output growth before and after economic recovery program will help to know the effectiveness of monetary policy within the two eras. Further, given the effectiveness of fiscal policy in goods market, it is imperative for a comparative analysis between fiscal and monetary policy to be conducted in relation to economic growth.

REFERENCES

- Agalega, E., & Acheampong, P. (2013). The Impact of Inflation, Policy Rate and Government Consumption Expenditure on GDP Growth in Ghana: A Co-Integration Approach. *European Journal of Business and Management*, 5(15), 170-185.
- Agalega, E., & Antwi, S. (2013). The impact of macroeconomic variables on gross domestic product: empirical evidence from Ghana. *International Business Research*, 6(5), 108.
- Ahiakpor, F., & Akapare, I. A. (2014). Short-run and long-run inflation and economic growth nexus in Ghana. *Ghana Journal of Development Studies*, 11(2), 32-49
- Albatel, H. A. (2000).” The Relationship between Government Expenditure and Economic Growth in Saudi Arabia”. *Journal of King Saud University*, 2, 12, pp. 173-191.
- Ahmed, A. E. M., & Suliman, S. Z. (2011). The long-run relationship between money supply, real GDP, and price level: empirical evidence from Sudan. *Journal of Business Studies Quarterly*, 2(2), 68
- Amankwah, E., & Atta Sarfo, P. (2019). The causal linkages among money growth, inflation and interest rates in Ghana.
- Aminu, U. & Amono, A. Z. (2012). Effect of inflation on the growth and development of Nigerian economy: Empirical analysis. *International Journal of Business and Social Science*, 3(10): 183-191
- Andinuur, J. A. M. E. S. (2013). *Inflation, foreign direct investment and economic growth in Ghana* (Doctoral dissertation, University of Ghana).
- Bhat, S. A., & Laskar, M. R. (2016). Interest rate, inflation rate, and gross domestic product of India. *International Journal of Technical Research & Science*, 1(9), 284-288.
- Christian, R. K. Adedapo, A. , and William, O. (2010). An estimate of inflation threshold in the West Africa monetary zone (WAMZ): The Case of Ghana and Nigeria. *Journal of Monetary and Economic Integration*, 11(2), 159-201.
- Culpepper, T. M. (2013). *The Ghanaian economic recovery*. Naval Postgraduate School Monterey Ca.

- Dingela, S., & Khobai, H. (2017). Dynamic impact of money supply on economic growth in South Africa. An ARDL approach
- Enu, P., Attah-Obeng, P., & Hagan, E. (2013). The relationship between GDP growth rate and inflationary rate in Ghana: an elementary statistical approach. *Academic Research International*, 4(5), 310-318.
- Gatawa, N. M., Abdulgafar, A., & Olarinde, M. O. (2017). Impact of money supply and inflation on economic growth in Nigeria (1973-2013). *IOSR Journal of Economics and Finance (IOSR-JEF)*, 8(3), 26-37
- Focus Economics.(2020). Conduct of Monetary Policy:<https://www.focus-economics.com/countries/ghana/news/monetary-policy/bank-of-ghana-slashes-key-interest-rate-to-near-eight-year-low#:~:text=In%20an%20emergency%20meeting%20on,150%20basis%20points%20to%2014.50%25.&text=FocusEconomics%20panelists%20forecast%20the%20policy,%25%20and%202021%20at%2014.58%25>.
- Majumder, S. C. (2016). Inflation and its impacts on economic growth of Bangladesh. *American Journal of Marketing Research*, 2(1), 17-26
- Mankiw, N. Gregory. (2016). *Macroeconomics*. Ninth edition. New York, NY: Worth.
- Njimanted, F. G., Akume, D. & Mukete, E. M. (2016). The impact of key monetary variables on the economic growth of the CEMAC Zone. *Expert Journal of Economics*, 4(2), 54-67.
- Ocansey, T. F. (2020). Money Supply And Economic Growth: a Case In Ghana
- Omoke, P. C. (2010). Inflation and Economic Growth in Nigeria. *Journal of Sustainable Development*, 3(2), 159-166
- Osuala, A. T., Osuala, K. L. & Onyeike, S. C. (2013), Impact of inflation on economic, growth in Nigeria- a Causality Test. *Jorind*, 11(1), 206-216, June, 2013. ISSN 1596-8308. Retrieved from www.transcampus.org/journals and www.ajol.info/journals/jorind

Prasert, C., Kanchana, C., Chukiatt, C. & Monekeo, K. (2015). "Money supply influencing on Economic growth – wide phenomena of AEC open region". *Procedia Economics and Finance*, 24(2015), 108-115.

Saymeh, A. A. F., & Orabi, M. M. A. (2013). The effect of interest rate, inflation rate, GDP, on real economic growth rate in Jordan. *Asian Economic and Financial Review*, 3(3), 341.