NEXUS OF MONETARY POLICY ON ECONOMIC GROWTH: A STUDY OF GHANA

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ABSTRACT

The role of monetary policy instruments has not been explored by most researchers in Ghana; hence this study investigates the impact of monetary policy instruments on economic growth using time series data from 1990 to 2019. In testing for stationarity, augmented Dickey–Fuller and Phillips–Perron unit root tests were employed; Johansen cointegration and error correction mechanism were used in estimating the long- and short-run dynamic of the variables. The results obtained from the estimation revealed a positive and significant impact of money supply and exchange rate on economic growth for both long and short run. Moreover, monetary policy rate, interest rate, and inflation significantly affected growth rate negatively. The results also indicated a bidirectional causal linkage between money supply and growth rate. There was, however, a unidirectional relationship between interest rate and growth, between inflation and growth, and between monetary policy rate and growth in the long run. The study recommends that monetary policy authorities and the Bank of Ghana (BoG) introduce structural reforms and policies that will help create a favorable climate for both domestic and foreign investment. Again, BoG should keep interest rates, policy rates, and inflation in check to prevent shrinking of economic activities, since these have a direct influence on growth.

Contribution/Originality: The study contributes to the existing literature on monetary policy and economic growth by considering interest rates, monetary policy rates, and exchange rates in the Ghanaian context. The study checked causal relationships among monetary policy variables and economic growth, which most studies have ignored.

1. INTRODUCTION

The nexus of monetary policy and output has been crucial in the area of monetary economics. Most economists show dissent oregarding the impact of monetary policy on economic growth, whereas others are of the notion that major determinants of economic growth depend on variation in the volume of money in circulation, and countries that monitor the aggregate supply of money barely encounter variation in their economic activities (Fridman, 1968; Rasheed, 2011). Ghana's economy has gone through various phases since independence. The bulk of macroeconomic policy began to take shape after 2001, and has somewhat upgraded its scope and is subjected to minor policy

deviation and reversal from stipulated policies (Aryeetey & Kanbur, 2017). The primary focus of policy is to create a stable macroeconomic environment for economic expansion. The Ghanaian economy has been faced with challenges over the years and, in the minds of many, periodic changes in macroeconomic and monetary policy have raised the question as to whether monetary policy is having the desirable economic impact. Economists' views on this question vary, with most strongly believing that monetary policy exerts pressure on economic activities and arguing that unexpected changes in the money supply affect general growth and development (Suhaibu, Harvey, & Amidu, 2017). An increase in money supply leads to an increase in economic growth through increase in stock prices for most businesses (Laopodis, 2013). For a country to experience economic growth its central bank must increase its money supply and this can be accomplished through monetary policy regulation.

Interest rates, policy rates, inflation, and exchange rates have been the major monetary policy tools commonly used by most monetarists in regulating the flow of money in an economy. Monetary authorities increase the aggregate supply of money by lowering these three rates, and during this period investment spending increases, because firms can borrow at a lower rate to expand production which, in turn, increases their revenue and profitability. Regarding individuals, a decrease in interest rate discourages people from saving thereby increasing their rate of consumption. As consumption increases, there is the spillover effect on economic growth as aggregate demand for goods and services increases. However, as aggregate demand for goods and services increases due to an increase in money supply, there is a high proclivity for prices levels to rise. Authorities' counter inflation by withdrawing money from the system through raising interest rates, which encourages individuals to save more than they consume and also deters businesses from borrowing due to the high costs. This fall in consumption and business spending leads to shrinking of the economy. In controlling economic activities in Ghana, regulatory authorities use the three rates, money supply, cash reserve ratio, open market operations, and inflation rate as market intervention.

Although increase in money supply enhances economic activities, it is also likely to escalate inflation if not well regulated by policymakers and central banks. Secondly, countries that adopt monetary policy tools to govern their domestic market have other market interventions to enhance growth compared with fiscal policy tools. Lastly, building a free market through monetary policy helps countries strengthen their domestic market against internal and external shocks that may arise.

The study contributes to the literature as follows: first, previous studies considered money supply, inflation, and lending rate as monetary policy tools in regulating economic growth in Ghana. Hence this study introduces interest rates, exchange rates, and monetary policy rates as determinants of growth rate in that country. Since Ghana imports more than it exports, fluctuations in exchange rate consequently impact domestic currency and hence growth rate. Second, prior explorations on the nexus between monetary policy and economic growth failed to unearth the causal connection amid the variables of concern. However, according to Musah et al. (2021), the existence of a long-run equilibrium connection between variables does not guarantee causation amidst them. To help fill this gap, Engle and Granger (1987) were employed to investigate the causality between variables.

This study is important because its findings will aid policymakers in developing suitable monetary policies to improve economic growth in Ghana. Again, it will assist authorities in developing, coordinating, and enforcing policies linked to the nation's macroeconomic goals.

Finally, the study is relevant because it contributes to cumulative knowledge on the relationship between monetary policy and economic growth in Ghana. This will act as a resource material for future researchers who may want to carry out studies in this area. The focus of this study is to ascertain the nexus of monetary policy on economic growth. The remainder of the paper is structured as follows: section two describes monetary reforms in Ghana since 1957 and related literature reviews; section three provides the methodology, section four shows the results and discussion, and section five contains the conclusions.

2. LITERATURE REVIEW

2.1. Monetary Policy Reforms in Ghana

Monetary policy contributes significantly to economic stability and development by improving the performance of businesses across the globe. Vincent (1979) puts monetary policy as a formulated construct that ensures that the money supply in an economy is equitable to support sustainable and desirable growth. Saunders and Schumacher (2000) define monetary policy as a process where a country controls its money availability, supply, and interest rate through its monetary authority, and through central bank to achieve the set short- and long-term goals which yield stability and economic growth. The prime objective of monetary policy is to attain price stability in an economy, and BoG has focused on lowering inflation to achieve a stable price that will help boost its economic activities (Bank of Ghana, 2003).

In achieving suitable pricing, BoG has gone through legislative adjustments since its establishment in 1957 under Ord. No. 34. Its basic function was to redeem and issue banknotes and coins, to keep and use reserves, and to influence the credit situation with a view to managing monetary stability in the country. Act 182 of 1963 replaced Ord. No. 34. In 1965 Act 182 was amended and was repealed by Act 282. Again, PNDCL 291 in 1992 subsequently replaced that of Act 282, and Act 621 of 2002 was used after Act 282. The recent law under which BoG operates is amended Act 621 of 2016 (Bank of Ghana, 2020).

The inflation-targeting policy has been in use since 2002 and is geared toward stabilizing price and exchange rate with low inflation (Sowa & Abradu-Otoo, 2007). The inflation-targeting policy has been used by many countries after having been used by the central bank of New Zealand in the 1990s. Ghana and South Africa are two subSaharan countries that have adopted this policy framework (Archer, 2000; McDermott & Williams, 2018). However, after the adoption of inflation-targeting policy, the Central Bank of Ghana has been trying to come up with policies which will help boost growth of economic activities in the country.

2.2. Monetary Policy and Economic Growth

Economic growth is one of the most-watched indicators by both domestic and international bodies due to its impact on businesses. Economic growth in simple terms means an increase in national output that is attained through aggregate demand (government spending, investments, consumer spending, export, and import) and aggregate supply (efficiency of the economy, productivity, and labor productivity). Expansion in economic growth tends to create profit for most firms and employment, which is a result of the increase in productivity and economic efficiency, leading to rising in stock prices (Mugableh, 2019). Economic efficiency attracts both domestic and foreign investors to countries that serve as a platform for massive investment.

However, economic growth is affected by policy implementations from monetary regulatory authorities, which either shrink or expand productivity and efficiency (Nouri & Samimi, 2011). Normally, expansionary is experienced when monetary authorities decide to increase economic activities in a country via increasing the money supply through lowering interest rate, policy rate, inflation, and exchange rate (Davoodi, Dixit, & Pinter, 2013). This reduction in the cost of borrowing allows firms to borrow at a lower rate, which automatically increases investment spending, performance, and general output of the economy. During this period most firms can expand their production lines and size, as well as products, and this helps to reduce the unemployment rate in the country (Bondarchuk & Raboshuk, 2020). Conversely, contractionary is implemented when there is instability in the general price level and, to counteract inflation, monetary authorities reduce the aggregate demand of money by increasing interest rate, policy rate, and exchange rate which, in turn, increases the cost of borrowing and dissuades firms from borrowing to expand their production, which can result in a spillover effect on the economy. However, due to the increase in interest rate, individuals prefer to save more than to spend, and thus money is extracted from the economy.

Figures 1 to 4 show trends in policy rate, interest rate, inflation, and exchange rate, respectively (1990–2019)
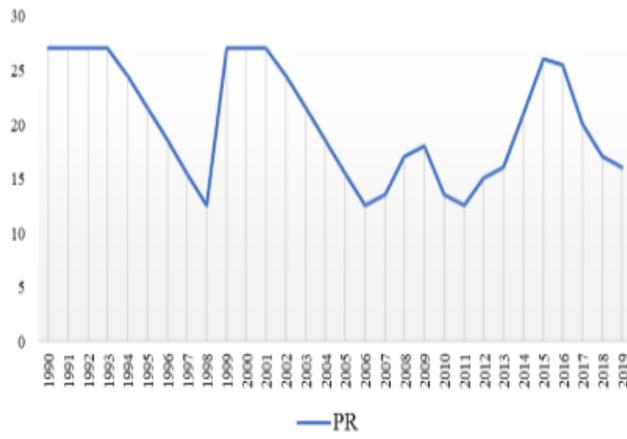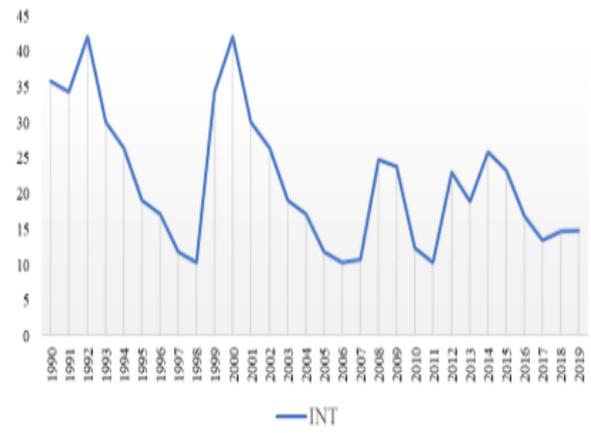
Figure-1. Policy rate.
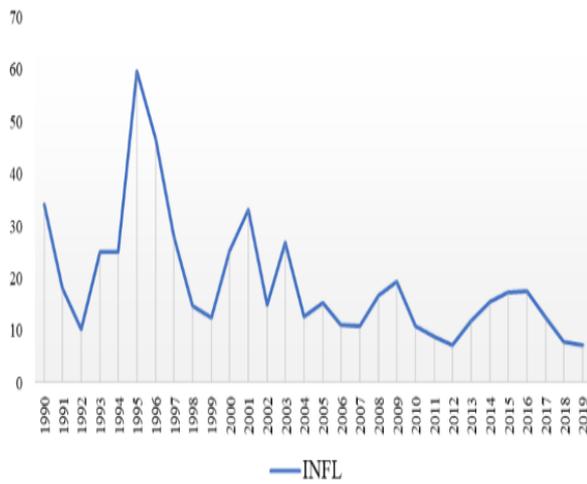

Figure-2. Interest rate.
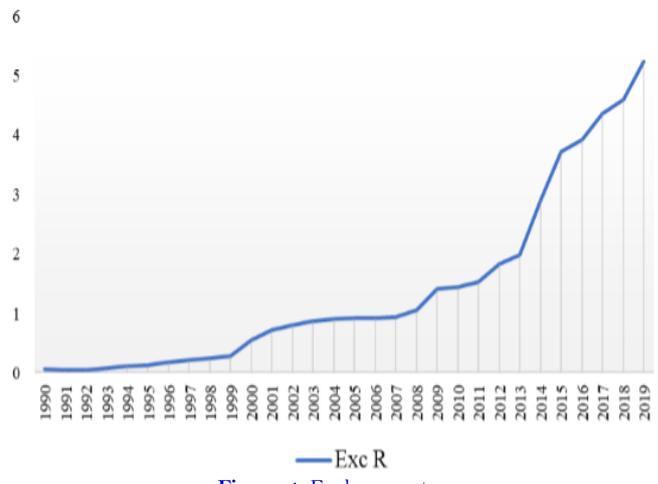

Figure-3. Inflation.

Figure-4. Exchange rate.

Figures 1-4 confirm the reason that Ghana opted for an inflation-targeting policy as a framework for its monetary regulations although, after the adoption, the country has not been able to reduce inflation. Again, the interest rate has been rising; the lowest recorded within the period under study was in 2011, with a percentage of 10.3.
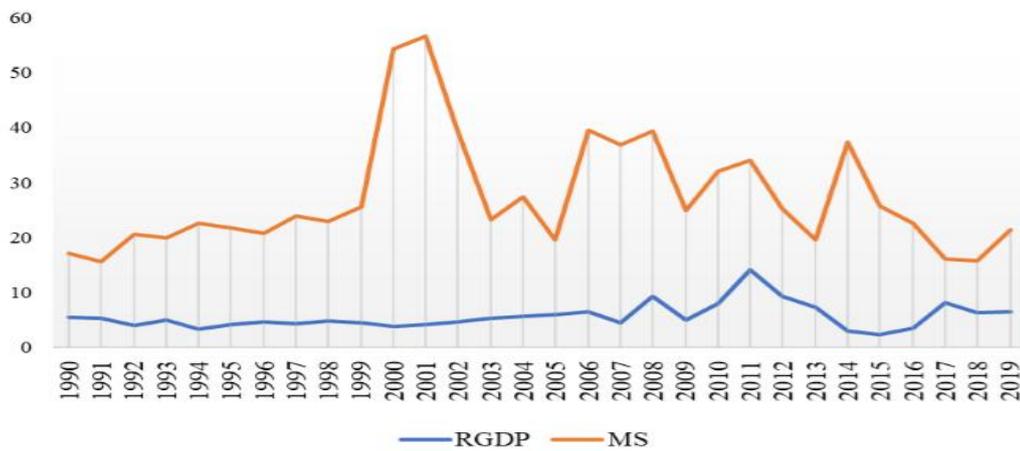

Figure-5. Money supply and real GDP (1990–2019).

From Figure 5 it will be seen that the levels of money supply going into the economy do not correspond to output. The country attained its highest economic growth in 2011 with a percentage of 14, which is the year the country recorded its lowest interest rate; it was then followed by 2008 and 2017 with a growth rate of 9.15 and

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8.14%, respectively. Ghana has not experienced continuous economic growth – a clear indication that monetary policy fluctuations have a direct impact on the economic growth of the country.

2.3. Theoretical Perspectives

This study is based on two theories – Keynesian economic and modern monetary.

Keynesian theory argues that economic activities or growth are not impacted by money supply, and the theory explicitly outlines the weak correlation between monetary and economic sectors. Khabo (2002) found an indirect link between monetary policy and output that supports the theory. Keynesians are of the view that portfolio imbalance caused through transmission mechanism does not increase interest rate (Precious & Makhetha-Kosi, 2014), in that disequilibrium in the money market caused by a shortage in money supply can be offset when consumers tender their financial assets such as bonds at a lower price and, due to the negative relationship between bond price and interest rate, interest rate increases rather than decreases. This leads to a liquidity trap where money supply becomes insensitive to low interest rate changes. Monetary authorities are not able to stimulate the economy by their policies, but rather investors prefer to hold on to money instead of investing because of the low rate of returns. Keynesians believe that fiscal policy conveys changes in economic growth rather than monetary policy.

On the contrary, monetarists think money supply is the driving force of economic activities and growth. They advocate a direct linkage of monetary policy and growth in the sense that disequilibrium caused by a shortage in money supply triggers the second phase of transmission mechanism, where a high interest rate negatively influences aggregate demand and thereby decreasing economic growth (Twinoburyo & Odhiambo, 2018). The liquidity trap as used by Keynesians is illustrated by the IS downward sloping curve and LM curve. Monetarists refute the idea of the liquidity trap and posit that the LM curve is downward sloping rather than horizontal, as suggested by Keynesians, and also assume that changes in the level of economic growth can be influenced by changes in the LM curve (the relation between interest rate and income level which rises in money markets), and thus making monetary policy efficient in bringing about changes in growth rate (Ajisafe & Folorunso, 2002; Mankiw, 2002; Precious & Makhetha-Kosi, 2014).

2.4. Related Empirical Review

Several studies have examined the impact of monetary policy on growth rate, and various results have been yielded. Precious and Makhetha-Kosi (2014) in their research aimed to empirically examine the impact of monetary policy on South Africa's economic growth, using ADF and PP unit root tests and ECM on a dataset from 2000 to 2010. The study revealed a long-run relationship among money supply, repo rate, inflation, and exchange rate. Again, money supply and exchange rate showed insignificant impact on economic growth but inflation showed otherwise. Furthermore, the findings of Onyeiwu (2012) on the effect of monetary policy and economic growth on the Nigerian economy, using data from 1981 to 2008, revealed that monetary policy proxied as money supply exerted a positive influence on growth.

Nouri and Samimi (2011) investigated the effect of monetary policy on growth in Iran's economy from 1974 to 2008. The outcomes unveiled a positive and significant relationship between money supply and Iran's economy. (Fasanya, Onakoya, & Agboluaje, 2013) empirically examined the effect of monetary policy on output in Nigerian's economy, using time series data from 1975 to 2010. They established a strong and significant impact of instrument of monetary policy on output. The study proxied monetary policy as inflation, external reserve, and exchange rate. In addition, based on the findings drawn from autoregression distributed lag (ARDL) and vector error correction (VEC) model estimations, Mugableh (2019) concluded that interest rate and money supply positively and significantly influence economic growth in both the short and long run. Also, there was a bidirectional causality found between monetary policy and economic growth. Contrastingly, Cyrus (2014) explored the influence of

monetary and fiscal policy shocks on Kenya's output, and the results revealed an insignificant influence of monetary policy on growth; the findings of Kamaan (2014) support this finding. Also, Lashkary and Kashani (2011) examined the effect of monetary factors on the economic growth of Iran's output from the period 1959–2008, and discovered an insignificant relationship between monetary policy proxied as money supply and economic growth.

Monetarists argue that variations in monetary policy affect economic growth, while Keynesians are of the opinion that monetary policy has no significant influence on growth rate. However, the literature is uncertain about the nexus of monetary policy on growth. In the Ghanaian context, findings drawn by Abille and Mpuure (2020) from the ARDL model for the period 1983–2017 revealed that money supply has a significant positive or negative impact on growth rate in Ghana in the long run and short run, respectively, while inflation significantly affects economic growth negatively in both the long and short run. On the contrary, the lending rate insignificantly affected growth rate. Again, Havi and Enu (2014) measured the significance of monetary and fiscal policies on the Ghanaian economy for the period of 1980–2012 and found that monetary policy proxied as money supply exerted a positive and significant impact on Ghana's economy.

In conclusion, the varying results presented in the literature above show that there is general disagreement based on the existence of diverging views on the pros and cons of monetary policy tools being an influencing component on economic growth. This study seeks to determine whether monetary policy influences Ghana's economy, by introducing monetary policy rate and exchange rate as monetary policy tools to influence growth rate. Hence this study expands the existing literature by studying the relationship of monetary policy rate and exchange rate with economic growth in the Ghanaian context. The study hypothesized that:

H_1: *Money supply has a significant positive impact on economic growth.*

H_2: *Interest rate has a negative and significant effect on growth rate.*

H_3: *Policy rate has negative impact on growth rate.*

H_4: *Inflation has a negative effect on growth.*

H_5: *Exchange rate has a significant negative influence on economic growth.*

3. DATA AND METHODOLOGY

3.1. Data and Definition of Variables

This study is centred on Ghana's economy and, due to data availability and to achieve consistency among the variables, the study considered the period 1990–2019. The key variables for this research are economic growth (as dependent variable), money supply, interest rate, inflation (as independent variables). Nevertheless, to avoid the possibility of omitting bias variables, this research added two explanatory variables: exchange rate and monetary policy rate. Economic growth proxied as real GDP growth (annual %) served as a regressor, while money supply measured as broad money growth (annual %), interest rate as 91-day treasury bill interest rate equivalent (annual %), policy rate as monetary policy rate (annual %), inflation as consumer price index (annual %), and exchange rate as official exchange rate (LCU per USD, period average) served as regressands. The time series data were extracted from BoG and World Development Indicators (WDI).

3.2. Model Specification

The model specifies the endogenous variable RGDP as a function of interest rate, policy rate, money supply, inflation, and exchange rate. The study employs an econometric model in ascertaining the nexus of monetary policy on growth rate in Ghana's economy. The IS-LM function serves as the basis for formulating the empirical model for short- and long-run dynamics. Hence, following McCallum (1991), the following model is presented:

$$RGDP = f(INT, PR, MS, INFL, EXC) \tag{1}$$

where RGDP, INT, PR, MS, INFL, and EXC represent real gross domestic product, interest rate, monetary policy rate, money supply, consumer price index, and exchange rate, respectively. Equation 1 was then linearized as

$$RGDP_t = \beta_0 + \beta_1 INT_t + \beta_2 PR_t + \beta_3 MS_t + \beta_4 INFL_t + \beta_5 EXC_t + \mu_t \qquad (2)$$

where $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ are the parameters for the explanatory variables and t represents the time dimension.

Finally, μ_t is the error term. To help reduce the issue of heteroskedasticity, the natural logarithm was taken for all series. The log-linear transformation of Equation 2 therefore becomes

$$LogRGDP_t = \beta_0 + \beta_1 LogINT_t + \beta_2 LogPR_t + \beta_3 LogMS_t + \beta_4 LogINFL_t + \beta_5 LogEXC_t$$
$$+ \mu_t \qquad (3)$$

Equation 3 was then inserted in a Johansen model as

$$\Delta logRGDP_t = \beta_0 + \sum_{i=1}^{k-1} \beta_i \Delta LogPR_{t-i} + \sum_{j=1}^{k-1} \beta_j \Delta LogINT_{t-j} + \sum_{m=1}^{k-1} \beta_m \Delta LogMS_{t-m}$$
$$+ \sum_{n=1}^{k-1} \beta_n \Delta LogINFL_{t-n} + \sum_{p=1}^{k-1} \beta \Delta LogEXC_{t-p} + \lambda_i ECT_{t-1} + \mu_{1t} \qquad (4)$$

where LogRGDP, LogPR, LogINT, LogMS, LogINFL, and LogEXC are the natural log of real gross domestic product, interest rate, monetary policy rate, money supply, consumer price index, and exchange rate, respectively;

$k-1$ is the lag length reduced by 1, $\beta_i, \beta_j, \beta_m, \beta_n, \beta_p$ are the short-run dynamic coefficients of the model's

adjustment to long-run equilibrium, λ_i is the speed of adjustment, and ECT_{t-1} is the error correction term.
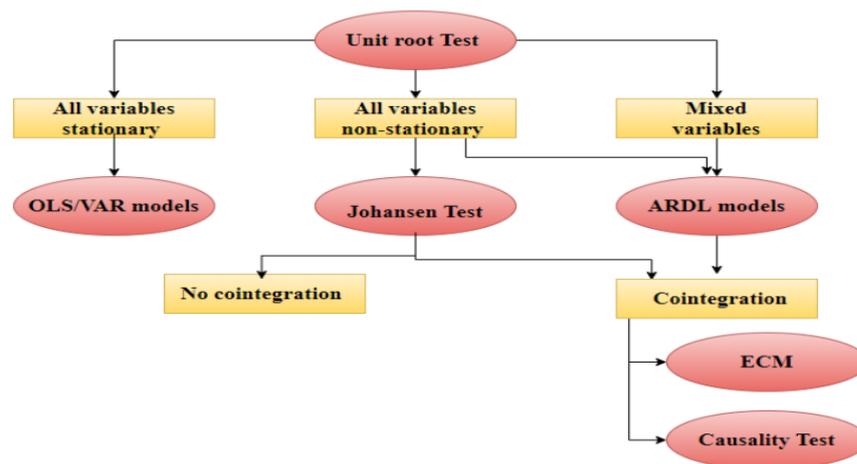
Figure-6. Analytical procedure.

3.3. Analytical Procedure

Avoiding spurious regression, the study started by testing for stationary of the time series data collected; the possible outcomes determine which model to employ in estimating the relationship between monetary policy tools and economic growth. First, if the results show stationary levels, either the OLS or VAR model is suitable for estimating the relationship. Secondly, if variables are stationary after the first difference, then, Johansen

cointegration is preferred over OLS and VAR. Lastly, if the unit root test is a mixture of levels and first difference, then the ARDL model is best in determining the long- and short-run relationship between the variables used, as shown in Figure 6.

4. RESULTS AND DISCUSSION

4.1. Descriptive Statistic

The study made use of time series data from 1990 to 2019, and Table 1 gives descriptive statistics and a correlational matrix of regressor and explanatory variables. In terms of mean, MS recorded the highest value followed by INT, PR, INFL, RGDP, and EXC in that order. Again, EXC recorded the lowest standard deviation, signifying that it is the least volatile among the variables studied, whereas MS is the most volatile with the highest standard deviation. Furthermore, all variable distributions are positively skewed and, except for PR and EXC, RGDP, MS, INT, and INFL are heavily dense at the tail ends of the distribution since K>3. The correlational matrix showed a positive relationship between growth and money supply, indicating that as RGDP rises, so do MS and EXC in the same proportion and vice visa. However, RDGP showed a negative correlation with INT, PR, and INFL, implying that increase in INT, PR, and INFL reduces growth rate.

Table-1. Descriptive statistics and correlation matrix.

	LogRGDP	LogPR	LogMS	LogINT	LogINFL	LogEXC
Mean	6.0000	19.2619	30.2183	20.1004	14.8971	1.9394
Median	5.6000	18.0000	25.5740	18.8000	12.6245	1.4049
Maximum	14.0471	27.0000	56.5342	41.9900	32.9054	5.2173
Minimum	2.1782	12.5000	15.7609	10.1900	7.1263	0.2666
Std. Dev.	2.6984	5.1176	11.3156	8.4874	6.6703	1.5157
Skewness	1.2270	0.3335	0.8714	0.8672	1.1866	0.9494
Kurtosis	4.8125	1.7080	3.0819	3.25301	3.9336	2.4491
Jarque–Bera	8.1447	1.8499	2.6637	2.6885	5.6911	3.4204
Probability	0.0170**	0.965	0.0039***	0.006***	0.0581*	0.1808
Sum	126.0019	404.5000	634.5847	422.1100	312.8399	40.7278
Sum Sq. Dev.	145.6281	523.8095	2560.864	1440.748	889.8831	45.9506
Observations	21	21	21	21	21	21
Correlation matrix						
RGDP	1.0000					
PR	-0.6690	1.0000				
MS	0.1615	0.2751	1.0000			
INT	-0.4424	0.7642	0.5074	1.0000		
INFL	-0.4837	0.6582	0.5337	0.5631	1.0000	
EXC	0.0183	-0.0282	-0.5473	-0.3229	-0.3619	1.0000

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

4.2. Unit Root Test

To establish the robustness of the study results, augmented Dickey–Fuller (1981) (ADF) and Phillips–Perron (1988) (PP) unit root tests were employed to test the stationary of variables. ADF and PP test the null hypothesis of the presence of a unit root or otherwise (i.e. $\beta = 0$ or $\rho = 1$). To reject the null hypothesis, the absolute value of the computed test statistics should be less than the critical values. The study considered critical values at 5%. As seen from Table 2, the results obtained from ADF and PP tests for both levels and first difference for LogRGDP, LogPR, LogINT, LogMS, LogINFL, and LogEXC were not stationary, but all variables became stationary at first difference, satisfying the condition for Johansen cointegration and the error correction model (VECM).

4.3. Cointegration Analysis and Result Interpretation

After estimating the stationarity of the variables, a cointegration test was carried out to ascertain the existence of equilibrium or long-run relationship among them. Other techniques are available to determine cointegration, but

this study employed Johansen maximum likelihood based on the unit root test estimated above and its covetable properties (Wassell & Saunders, 2000). From Table 3 a lag of 1 was used as optimum lag for the variables and SIC was used in choosing the optimal lag for the VAR test.

Table-2. Unit root result at levels and first difference.

Variable	Levels				First Difference			
	ADF Test		PP Test		ADP Test		PP Test	
	Value	Prob	Value	Prob	Value	Prob	Value	Prob
LogRGDP	-3.0723	0.9721	-3.0875	0.8142	-6.4010	0.0000***	-7.3155	0.0000***
LogINT	-3.0145	0.2645	-2.3313	0.5369	-4.4396	0.0000***	-4.1886	0.0000***
LogPR	-2.0395	0.1387	-2.0785	0.3580	-4.1773	0.0002***	-4.9105	0.0000***
LogMS	-2.9414	0.4106	-2.7281	0.6262	-5.5388	0.0001***	-6.6197	0.0000***
LogINFL	-2.5645	0.1875	-2.4246	0.1216	-5.8724	0.0007***	-5.8608	0.0000***
LogEXC	-2.6112	0.2479	-3.604	0.0057***	-3.9788	0.0109**	-3.8821	0.0000***

Note ***, ** indicate 1%, 5% level of significance, respectively.

Table-3. VAR lag order selection criteria.

lag	LL	LR	P	FPE	AIC	HQIC	SIC
0	-49.9468			1.77e-06	3.7819	3.8691	4.0673
1	67.2507	171.296*	0.000	7.08e-09*	2.1299	0.9954*	0.1947*
2	-107.819	43.4663	0.000	7.60e-09	1.8036*	1.1927	1.5812

Note: *Indicates lag order selected by criterion. LR: sequential modified LR test statistic (each test at 5% level). FPE: final prediction error. AIC: Akaike information criterion. HQ: Hannan–Quinn information criterion. SIC: Schwarz information criterion.

4.4. Johansen–Juselius Cointegration Test Results

Trace and maximum eigenvalue tests were used in determining the number of cointegrating vectors. The inference of restricted constant and no deterministic trend was used for variables, as described by the Pantula principal test. The null hypothesis states that there is no cointegration and the hypothesis is rejected when the trace statistic is greater than 5% critical value. Table 4 shows the result of trace and maximum eigenvalue test values of cointegration.

Table-4. Johansen–Juselius cointegration test results.

Hypothesized no. of CE(s)	Eigenvalue	Trace statistic	5% Critical value	Eigenvalue	Max statistic	5% Critical value
None*	0.86423	129.9175	95.7537	0.8642	55.9111	40.0776
At most 1	0.6793	74.0064	75.8189*	0.6793	31.8453	33.8769*
At most 2	0.5785	42.1611	47.8561	0.5785	24.1929	27.5843
At most 3	0.2781	17.9681	29.7971	0.2782	9.1266	21.1316
At most 4	0.2259	8.8416	15.4947	0.2259	7.1705	14.2646
At most 5	0.0579	1.6711	3.8415	0.0579	1.6711	3.8414

Note: Trace test and maximum eigenvalue test indicates 1 cointegrating equation at the 0.05 level. * Denotes rejection of the hypothesis at the 0.05 level.

From Table 4 above, the null hypothesis of no cointegration is rejected since the trace statistic of 129.9174 is greater than the 5% critical value of 95.7537. However, we agreed with the null hypothesis of no cointegration in at most one, meaning that there is a maximum of one cointegrating equation on the model since the trace statistic of 74.0064 is less than the 0.05 critical value of 75.8189. The maximum eigenvalue test showed similar results to the trace statistic – 55.9111 is greater than the 5% critical value 40.0776 – which led to rejection of the null hypothesis. Nonetheless, the alternative hypothesis was rejected since the maximum eigenvalue of 31.8453 was less than the 5% critical value of 33.8769. Hence, the study concluded that both trace and maximum eigenvalue tests have at most one cointegrating model.

4.5. Long-Run Model Based on Normalized Cointegrating Coefficient

Due to the existence of cointegration vectors, the normalized cointegration was estimated to measure or determine movement from long-run equilibrium. Table 5 shows the normalized long-run cointegration coefficients of monetary policy on economic growth.

Table-5. Long-run model based on normalized cointegration coefficients.

Variables	Dependent variable: RGDP		
	Coefficient	Std. err.	t-Statistic
Constant	-18.9823		
LOGPR	-0.9976***	0.0784	-12.724
LOGMS	0.4462***	0.0672	6.6399
LOGINT	-0.7010***	0.0603	-11.6252
LOGINFL	-0.8662***	0.0573	-15.1169
LOGEXC	0.6753***	0.0861	7.8432

Note *** indicates 1% level of significance.

From Table 5, taking all independent variables as constant or zero, in the long run economic growth will decrease autonomously by 18.8923 units. Except for exchange rate (EXC), money supply (MS), interest rate (INT), monetary policy rate (PR), and inflation (INFL) had the presumed sign as hypothesized by the study. PR, INT, MS, INFL, and EXC are all statistically significant at the 1% level. MS and EXC have a positive influence on RGDP in the long run. As MS and EXC increase by 1%, economic growth increases by 0.4462 and 0.6753%, respectively, meaning that MS and EXC predict movement or changes in the Ghanaian economy in the long run. However, the estimated results showed a negative and significant impact of INT, PR, and INFL on RGDP in that a percentage increase in INT, PR, and INFL in the long run decreases economic growth by 0.7010, 0.9976 and 0.8662%, respectively.

4.6. Short-Run Analysis: An Error-Correction Model

The error correction model is used to determine the rate at which the dependent variable adapts to changes imposed by the independent variables, which is the speed of adjustment. The focus of this analysis is to determine whether short-run dynamics affect long-run equilibrium estimates. Having ECM negative shows that there is feedback from the short-run mechanism, which aids in correcting disequilibrium in the short run.

Table-6. Results of short-run relationship model of the variables

Variables	Coefficient	Std. err.	t-Statistic
ECT_{t-1}	-0.5046***	0.2306	-2.1882
D(LOGPR)	-0.5515***	0.0708	-7.7895
D(LOGINT)	-0.8716***	0.2167	-4.0221
D(LOGMS)	0.2030***	0.0833	2.4369
D(LOGINFL)	-0.5798***	0.0935	-6.2011
D(LOGEXC)	0.3204	0.2037	1.5729
R^2	0.6229		
Adj R^2	0.5426		
F-statistic	0.009		
Loglikehood	140. 9804		

Note *** indicates 1% level of significance.

From Table 6 the adjustment term of -0.5046 is statistically significant with a t-value of 2.1882, suggesting that the previous year's errors or deviations from long-run equilibrium are corrected for within the current year at a convergence speed of 50.46%. The short-run dynamic coefficients of PR, INT, and INFL are -0.5515, -0.8716, and -0.5798, respectively, meaning that PR, INT, and INFL inversely influence RGDP. Again, MS and EXC positively impacted growth rate, which depicts the same movement as in the long run. The overall dynamic estimated model

for this study is satisfactory with an f-statistic of 0.009, in that the joint effect of endogenous variables of monetary policy is high (R^2= 0.6229). This means that 62.29% of the deviations in growth rate are jointly explained by variations in monetary policy, and hence the study concludes that monetary policy can effectively influence economic growth in Ghana.

4.7. Wald Test

The Wald test results are shown in Table 7 below, strengthening the findings of the VECM estimates. According to the Wald test, money supply, interest rate, inflation, and exchange rate are statistically significant, confirming the existence of a short-run causal relationship among these variables.

Table-7. Wald test results

Exogenous variables	Dependent variable: LOGGDP	
	F-statistics	P-value
LOGPR	1.1631	0.1367
LOGMS	4.2997	0.0489**
LOGINT	3.8717	0.0631*
LOGINFL	2.7420	0.0921*
LOGEXC	3.2893	0.0745*

Note *, ** denote rejection of the null hypothesis at 1%, 5% significance levels, respectively.

4.8. Granger Causality Test

The Granger causality approach analyzes the structure of causal relations among variables, and such knowledge is needed for formulating suitable policies. The null hypothesis states H_0: no Granger causality in both the short and long run. The null hypothesis is rejected when $P < 0.05$. From the results in Table 8, there is a bidirectional causal relationship between MS and RDGP. A blockage in MS will upset RGDP and any disturbance in RGDP will affect MS, and thus an increase in MS increases aggregate demand for goods and services, thus increasing productivity. This affirms the feedback hypothesis between RGDP and MS. However, a unidirectional causal relationship is observed stemming from INT, INFL, and EXC to RGDP, inferring that any variations in INT, INFL, and EXC will affect economic activities.

Table-8. Granger causality test results.

Null hypothesis	Causality	Probability
LOGGDP $\nRightarrow$ LOGPR	LOGGDP $\neq$ LOGPR	0.257
LOGPR $\nRightarrow$ LOGGDP	LOGPR $\rightarrow$ LOGGDP	0.195
LOGGDP $\nRightarrow$ LOGMS	LOGGDP $\rightarrow$ LOGMS	0.049**
LOGMS $\nRightarrow$ LOGGDP	LOGMS $\rightarrow$ LOGGDP	0.000***
LOGGDP $\nRightarrow$ LOGINT	LOGGDP $\neq$ LOGINT	0.176
LOGINT $\nRightarrow$ LOGGDP	LOGINT $\rightarrow$ LOGGDP	0.038**
LOGGDP $\nRightarrow$ LOGINFL	LOGGDP $\neq$ LOGINFL	0.882
LOGINFL $\nRightarrow$ LOGGDP	LOGINFL$\rightarrow$ LOGGDP	0.000***
LOGGDP $\nRightarrow$ LOGEXC	LOGGDP $\neq$LOGEXC	0.255
LOGEXC $\nRightarrow$ LOGGDP	LOGEXC $\neq$ LOGGDP	0.098*

Note: *, **, *** denote rejection of the null hypothesis at 1%, 5%, and 10% significance levels, respectively.

4.9. Diagnostic Checks for VECMs

Diagnostic checks are important because they validate evaluation of parameters outcome estimated by the model, and aid in elimination of residual unbiasedness. This study tested normality using the Jarque–Bera test, and serial correlation and heteroskedasticity tests were also carried out.

Table-9. Diagnostic tests used.

Variable	Chi2	Prob > Chi2
Jarque–Bera	7.776	0.80239
Serial correlation LM test	0.3166	0.4113
Heteroskedasticity test	0.5437	0.6568

Table 9, presented above, shows that the errors of dependent and independent variables, and the overall model errors, are normally distributed and that there is no heteroskedasticity among residuals. Again, the null hypothesis of no autocorrelation is accepted since the *P*-value is greater than 5%.

4.10. Discussion of Results

From the long- and short-run estimations, an increase in MS should have automatically increased RDGP according to the literature, yet this was not the case in Ghana – rather, a decrease in RGDP. The explanation is that an increase in MS leads to a rise in the general price level (inflation) which tends to influence RGDP negatively due to the negative relationship between them. Ghana's greatest challenge is high inflation; after adoption of an inflation-targeting policy framework in 2002, the country has not been able to attain single-digit inflation and increase in MS has not been seen in the growth rate as inflation keeps rising. Although MS had a significant impact on RGDP, its degree of linkage is weak compared with INT, PR, and INFL in both the long and short run.

The positive coefficient of EXC implies that the depreciation of Ghana's currency (the cedi) reduces the price of exported goods, hence increasing the total number of exports significantly. Net exports and imports influence the value of Ghana's cedi and exchange rates. If Ghana exported more commodities than it imported, its currency would be in higher demand and its exchange rate would rise alongside other foreign currencies. Due to a rise in exports, other foreign currencies are needed more than the domestic cedi, which leads to devaluation of the Ghana cedi. In the case of capital goods and material imports, an increase in their import prices would not only directly lift the price level but, because they are used as substitutes in the manufacture of other goods, a rise in their import prices would also drive up the cost of production of these other goods, resulting in cost-push inflation.

Moreover, depreciation reduces the cost of exports, making them more competitive in global markets. This raises product exports while decreasing production and the availability of products in the Ghanaian market, which tends to raise domestic prices. Furthermore, as the costs of imported products increase, consumers in the country chose to substitute costly imported goods with locally manufactured goods. Unfortunately, since imported goods exceed exported goods, total net export and import are always negative and, instead of RGDP rising with the exchange rate, it rather declines with RGDP. According to the IMF executive board meeting held on 12 December 2019, it was recommended that boosting export competitiveness, growing economic diversification, and accelerating productivity growth, according to the directors, would be essential to maintain recent development gains. Improving the market climate and encouraging digitalization will also help unlock doors to economic growth. The findings of this study are consistent with studies that proxied money supply and exchange rate as monetary policy, and confirm that monetary policy is vital for economic growth (i.e. Amarasekara, 2007; Fasanya et al., 2013; Havi & Enu, 2014), but are contradictory to the results of Precious and Makhetha-Kosi (2014), who found that money supply and exchange had no significant effect on growth rate in South Africa.

Again, high inflation in Ghana can be attributed to the expansionary monetary policy that the government embraced as a strategy to boost economic growth and development. Nevertheless, the expansionary led to an

increase from 33.98% in 1990 to 59.46% in 1995. During economic crisis recessions in the 2000s, the country hit its third-highest inflation rate of 32.91%, although this was the year that it recorded the highest MS of 56.53% of annual growth. Finally, the negative coefficient of INT and PR means that as these parameters increase, investment spending is often affected because most industries are unable to borrow to support and expand operations. Again, due to the increase in interest rate, individuals prefer to save and this withdraws money or decreases money supply in the economy, and hence economic activities shrink, which lowers productivity in general. This supports the findings of Ganev, Krisztina, Krzysztof, and Prsemyslaw (2002); Starr (2005); Folawewo and Osinubi (2006); Ivrendi and Yildirim (2013); Mukhtarov, Selcuk, and Mammadov (2016); Hasanov and Omay (2011), but not those of Mallik and Chowdhury (2001). The hypotheses H_2, H_3, H_4 set by this study are therefore confirmed.

5. CONCLUSION AND POLICY IMPLICATIONS

For stability in economic activities and growth, monetary policy plays a vital role and this study sought to explore the impact of monetary policy on output in the Ghanaian economy. The findings revealed that adjustment in interest rate, monetary policy rate, exchange rate, money supply, and inflation have both long- and short-run significant impacts on economic growth. Interest rate, monetary policy rate, and inflation significantly affected economic growth negatively in both the long and short run. On the contrary, money supply and exchange rate showed a positive impact on growth in both the long and short run. Granger causality indicated a bidirectional relationship between money supply and economic growth and a unidirectional flow from interest rate, inflation, and exchange rate to growth rate.

This study recommends that monetary policy authorities and BoG should introduce structural reforms and policies that will create a favorable climate for both domestic and foreign investment, since aggregate money supply has the proclivity to influence growth rate and excessive supply leads to inflation. Again, BoG should keep interest rate, policy rate, and inflation in check to prevent shrinkage of economic activities. Furthermore, the government should help boost the growth rate by intensifying financial development and also increasing its fiscal expenditure and FDI. The study suggests that further studies be carried out in this area considering repurchase agreements (REPOs), open market operations (OMOs), and cash reserve ratio (CRR) from the Ghanaian perspective.

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