Monetary Policy and Macroeconomic Trends In Developing Countries: Ghana

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1 Overview

In this research, we seek to examine the impact of monetary policy in Ghana on its output growth and inflation rate. Generally, we address whether monetary policy has an impact on prosperity and development in Ghana. We build our evaluations from historical economic data from the Central Bank of Ghana over the period 2001 - 2022, and use statistical methods to demonstrate how monetary stimulus is associated with economic growth in Ghana. First, uisng pooled OLS regresions, we demonstrate the correlations between monetary policy and several macroeconomic indicators. In what follows, the Vector Auto-Regression (VAR) model – a technique that is extensively used in modern dynamic economic analysis – provides us with the estimated effects of monetary policy on inflation rate and GDP growth. We find that shocks to the monetary policy rate result in persistent changes in GDP growth, while inflation increases only temporarily. These results are proven as significant after carrying out the relevant stationary checks and evaluating potential cointegration relationships. Using VAR, this research also estimates the impulse responses to monetary shocks, which gives valuable intuition on the drivers behind economic growth in Ghana.

2 Introduction

The tools of monetary policies that countries are able to use can be critical when regulating macroeconomic stability and growth. In expansionary times, these activities can spur investment, growth, and employment while reducing the risks of uncontrolled inflation. In times of crisis, they act as a valuable tool to increase aggregate demand and stimulate declining economies.

Despite periods of unprecedented growth, many countries in Africa have recently experienced economic slowdown compared to global averages. Many low-income countries in Africa lack access to international capital markets, so it is common for those countries to seek out fiscal or monetary stimulus through external means, such as foreign aid (Mangwanya, 2022). When they attempt to conduct these policies, economies face the risk of crowding out private spending and increasing debt. Also, due to the fiscal dominance effect where the massive scale of fiscal failure persistently cancels out the positive effects of monetary policy in a lot of developing countries, it is difficult to accurately measure the impact of monetary policy just by observing the data. (Bleaney et al., 2020). Therefore, it is of importance to take a deeper look at the resulting effects of monetary policies in African countries and observe whether the targets of economic growth and controlled inflation can be met.

In 2022, Ghana's GDP was $77.59B, seeing a 5.36% growth rate over FY 2021 (MacroTrends, 2022). This represents an increasing trend in GDP growth since the COVID-19 pandemic, during which growth was significantly slower at 0.51%. In 2022, transportation and storage, and information and communication comprised the largest component of Ghana's GDP, contributing 47.13 percent. Unemployment data signal that youth unemployment and underemployment for persons ages 15-35 were 12 percent and 50 percent respectively, resting slightly above the overall rates in Sub-Saharan Africa (The World Bank, 2022). These high rates do not take into account that

approximately 28% of Ghana's youth are discouraged workers , who do not factor into the employment statistics. Nonetheless, these preliminary data indicate that the primary sectors offering the greatest employment gains for Ghana are entrepreneurship, apprenticeship, construction, and agribusiness.

Ghana has experienced a conscious shift away from the use of direct control measures (e.g. setting credit or interest rate limits) and toward indirect interest-based monetary policy. Prior to this change, the country used to intervene directly through sectoral credit controls, a fixed exchange rate, and reserve requirements. Although this method was easy to implement, there were several inefficiencies associated with its ability to allocate resources efficiently, as the government began to channel resources to certain "priority sectors" of the economy (Quartey and Afful-Mensah, 2014).

In what follows, we will first provide an overview of the existing literature in dynamic macroeconomics, monetary policy research, and case studies of developing nations in Africa. We will then present a description of our data scraping and analysis methods, provide panel regressions and the Vector Auto-Regression (VAR) specification with impulse response functions. We review the results of our analyses and provide economic interpretations, then propose a quasi-experiment to further test the findings, with comparisons to other developing countries. Overall, we hope to uncover the contemporaneous relationships between these macroeconomic indicators as they relate to Ghana's current and previous monetary policy initiatives.

3 Literature Review

3.1 Causality in Macroeconomics

The immense challenge of identifying causal relationships in the macro economy has been a source of great research interest over the past century—with many of the fundamental questions remaining the same, such as the effect of monetary policy on economic outcomes. Nakamura and Steinsson (2018) discuss the challenge of finding opportunities for causal inference, noting the high dimensionality of macroeconomic data, and endogeneity of monetary and fiscal policy decisions. Policy affects the economy, while also responding to changes within it. Nakamura and Steinsson (2018) further provide a survey of possible techniques for identification, such as using discontinuities (Mussa, 1986), or attempting to control for confounding factors. The latter is the source of the majority of the vector auto-regression (VAR) literature, which is the method of this paper. Rudebusch (1998), Nakamura and Steinsson (2018) voice various concerns with monetary VARs, such as their reliance on assumptions of no reverse causality, and the large potential for OVB, as both monetary policy and the macro economy can react to factors not present in the VAR. While progress has been made in the VAR literature, with the use of external instruments by Gertler and Karadi (2015), it is important to remember the strong identifying assumptions of any VAR based monetary analysis when evaluating its potential for correctly identifying causal relationships. Still, VARs have been the source of many successful contributions to the literature on monetary policy, such as the work of Christiano et al. (2005), and remain a valuable tool when

properly assessed.

3.2 Monetary Policy in Ghana

The majority of academic discussions with regard to the monetary policy of Ghana revolves around its formal adoption of the Inflation Targeting (IT) framework[1] in May 2007. Bleaney et al. (2020) provide a detailed practicalities behind the IT framework as well as how it differs from the other countries that also have adopted the IT framework since its initiation in New Zealand in 1990. In an official working paper published by the Bank of Ghana, Bawumia et al. (2008) examine the supporting arguments and issues behind the choice of monetary policy regime toward the IT framework, concluding that the practical environment for the implementation of IT framework in Ghana remains similar to those of the other inflation-targeting countries. Considering that Ghana is a country where the inflation rates have been persistently high across multiple historical phases of monetary policy, the majority of studies has included inflation rate (either CPI or core inflation) as one of the major macroeconomic determinants within their models. By investigating whether or not the monetary policy in Ghana is responsible for its failing macroeconomic outcome, Bleaney et al. (2020) conclude that such policies are not directly related. Some other literature also focus on the unique characteristics in the adoption process of the IT framework in Ghana, specifically on the point that the pilot period existed only in Ghana from 2002 to 2007. Achiyaale et al. (2022), for example, separated the pilot period from the post-formal announcement period and concluded that the formal announcement of the IT framework had a significant negative impact on the inflation rate in Ghana.

3.3 Empirical Analysis on Macroeconomic Variables in Ghana

Among the relevant literature on this study, a handful of different econometric strategies have been employed to investigate the relationship between multiple macroeconomic determinants and monetary policy measures in Ghana. Achiyaale et al. (2022) used the General Autoregressive Conditional Heteroskedasticity (GARCH) model to examine the impact of inflation targeting announcement on inflation and inflation volatility in Ghana from 1985 to 2014. Its approach differed from most of the relevant model specifications since it included a set of dummy variables to indicate the different periods before and after the adoption of the IT framework. Agalega and Antwi (2013) employed multiple the linear regressions by pooling the original time series dataset from 1980 to 2010. They concluded that there exists a positive association between GDP, interest rate and inflation rate in Ghana. The result is at odds with the majority of literature, which concludes on a negative relationship between inflation level and GDP in Ghana (Enu et al., 2013).

The statistically significant results from the above set of research notwithstanding, Vector Autoregressive (VAR) model (Sims, 1980). has been the most popular choice as a multivariate mod-

[1] A conduct of monetary policy where a central bank (1) has price stability as its primary objective; (2) publicly announces a medium-term numerical target inflation and commits to it; and (3) uses the inflation forecast as an intermediate target. (Bleaney et al., 2020)

eling technique to investigate the dynamic behaviors of the macroeconomic variables in Ghana. Such an extensive use mostly builds on the researchers' realization of the complexity in the relationships among many of the financial variables and their serial correlations (Tetteh-Bator et al., 2018). Antwi et al. (2020) used VAR to examine the effect of macroeconomic variables (which includes M2, inflation rate and real GDP) on exchange rate from 2000 to 2019. They also used Granger Causality test and Cholesky decomposition for the better identification of VAR results. Similarly, Tetteh-Bator et al. (2018) used Johansen cointegration test via VAR model to examine the causality between real GDP, exchange rate , and Foreign Direct Investment (FDI). To verify the unilateral granger-causality between FDI and the other variables, Tetteh-Bator et al. (2018) employed the Granger Causality test after checking for the stationarity of variables using Augmented Dickey-Fuller (ADF) test. From Antwi et al. (2020) and Tetteh-Bator et al. (2018), we can note that the exchange rate of cedi has been considered as one of the most important metrics in Ghana's economy along with the inflation rates.

The dynamic impact of macroeconomic variables on GDP in Ghana or its growth, on the other hand, has been relatively less popular than other research agenda (Mohammed et al., 2016). Mohammed et al. (2016) investigated the effect of inflation on economic growth from 1980 to 2013 and found that inflation volatility has a significant negative effect on economic growth. As they only studied the unilateral impact on GDP, they used the Autoregressive Distributed Lag (ARDL) model, instead of VAR model, along with OLS estimation similar to Agalega and Antwi (2013). Kankpeyeng et al. (2021) studied the impact of inflation and other aggregate macroeconomic variables (e.g. government expenditure) on GDP growth in Ghana. They employed the modified specification of the VAR model of lag length 4, and controlled the stationarity issue (detected from ADF test) by adding a constant and the trend term into the model. The high inflation rate dummy was also included in their VAR model to evaluate the policy results from previous literature.

3.4 Contributions

As a contribution to the literature, this study incorporates the most recently updated source of data into its analysis ($2001 - 2022$). In light of the fact that Ghana is presently experiencing a pronounced level of inflation that has been unprecedented in most of the previous literature on this issue, this study can provide the most relevant insight on the relationship between macroeconomic variables in the 21^{st} century Ghana. Also, while a lot of previous studies used either quarterly data or quarterized annual data in their analysis, this study uses monthly measures so that we can leverage on the significance of high frequency analysis.

4 Methods

4.1 Data Description

The data we used for the initial linear regression data were scraped from the World Bank website (The World Bank, 2023). We used their publicly available data portal and selected the

relevant time series data, and then extracted the data from the resulting . The initial data were sampled annually, beginning in 1990 and ending in 2022. The data used for our VAR model were scraped from the Bank of Ghana website (Bank of Ghana, 2023), where we selected the relevant time series data and extracted the numbers from the resulting . The time series data were sampled monthly, starting in January 2001 and ending in December 2022.

4.2 Pooled OLS Regression

In this section, we examine the association between African monetary regimes and development. In Western countries, fiscal and monetary policy tools can be valuable tools to spur economic growth, elevate living standards, and fight back against recessions. Our aim is to understand whether monetary regimes in Ghana specifically act as fitting policies to accomplish these tasks. We test if there is an association between Ghana's monetary policy and GDP growth, per worker GDP, CPI, and labor force size. We find that monetary policy, as measured by broad money (M3 money supply) as a percentage of GDP, is significantly ($p < 0.05$) positively correlated with all but GDP growth.

For introductory purposes, we use linear regressions to get a sense of the correlations between the above variables. We observe that Trend graphs for each variable and the regressions specified here are available in the Appendix, Figure 1 and Figure 2. The results find that monetary policy rate is associated with higher GDP per worker, CPI, and Labor Force Size. The results also find greater coefficient instability when looking at GDP growth, indicated by low R^2 values. We posit that measurement errors, variability and instability of economic and political conditions in Subsaharan Africa may explain this result. Stimulus dynamics may be less clear in Africa due to weaker institutions and different patterns of economic stimulus flow. Seeing as year-to-year fluctuations in economic growth are not so strongly associated with monetary policy, we find it necessary to consider the other limitations a nation may have when conducting monetary policy. For example, a country's exchange rate regime seems to strongly influence the amount of monetary policy it can actually carry out ("Exchange Arrangements and Foreign Exchange Markets: Developments and Issues", International Monetary Fund, July 22, 2002). Future research may benefit from a study of these cyclical or political factors which could, more indirectly, be affecting countries' monetary stimulus decisions.

While these OLS regressions are helpful to illustrate the associations between monetary policy and several key indicators, they do not address interactions between these variables and do not rigorously test stationarity. We hope to add layers of depth to our understanding in the following sections using the results of our Vector Auto-Regression.

4.3 VAR Implementation

The Vector Auto-Regressive (VAR) model is useful when predicting the movement of multiple time series variables using a single model. As an extension of the univariate auto-regressive model, VAR utilizes k time series regressions, where the lagged values of all k series appear as regressors.

To regress a vector of time series variables on lagged vectors of those variables, one can follow a general form. Using a system of equations with lag order p and two variables X_t and Y_t such that $k = 2$, we have VAR(p):

$$\begin{aligned} Y_t &= \beta_{10} + \beta_{11} Y_{t-1} + ... + \beta_{1p} Y_{t-p} + \gamma_{11} X_{t-1} + ... + \gamma_{1p} X_{t-p} + \epsilon_{1t} \\ X_t &= \beta_{20} + \beta_{21} Y_{t-1} + ... + \beta_{2p} Y_{t-p} + \gamma_{21} X_{t-1} + ... + \gamma_{2p} X_{t-p} + \epsilon_{2t} \end{aligned} \tag{1}$$

where the βs and γs can be estimated using OLS on each equation. The assumptions for VAR are the standard time series assumptions applied to each of the equations, and will be listed in the following section.

The Vector Auto-Regression itself will require a few steps. First, we use the Augmented Dickey-Fuller Test in R to determine whether the linear transformation of our identified variables is stationary. If stationary is confirmed, we will build our matrix for contemporaneous correlations and run our VAR on the selected data from Ghana.

In VAR analysis, endogeneity poses a problem since this class of models assumes that the variables in usage are exogenous as well as stationary (i.e. the mean, variance, and auto-correlation structure remain constant over time). Stationarity is important to the VAR time series anlaysis because treating endogenous variables as independent can lead to spurious regressions and cointegration patterns. We overcome the non-stationarity problem by confirming the stationarity of our variables, so there is no need to explicitly introduce cointegration relationships that describe long-term equilibria of the system.

Sena et al. (2021) provides some valuable intuition regarding this approach. Even if variables are non-stationary and the multivariate time series are integrated such that $d > 1$ in $I(d)$, certain linear transformations of the time series may be stationary. The term $I(d)$ stands for "integrated of order d," which describes the amount of differencing required to make a time series stationary. For example, if a time series is I(1), it has a unit root and is non-stationary, but can be made stationary by taking the first difference of the series. In the context of this research, the time series happens to be I(0) after applying the Hodrick-Prescott Filter ($\lambda = 129,600$) so there is no need for differencing, and the variables are stationary. This is a particularly important property of time series analysis and forecasting because many statistical models, such as Autoregressive Integrated Moving Average (ARIMA), assume that underlying data are stationary. To provide more robustness to our results, the above tests allow us to confirm stationarity so that we can use past data to predict future data. In simplest terms, the property of stationarity confirms to us that the process of data generation and the central features of the data do not change over time.

4.3.1 Lag Length Determination

When implementing our Vector Auto-Regression (VAR) model, a critical step was to determine the appropriate lag length | for each variable, how many lagged terms should be identified in the auto-regressive process to check for serial correlation? Choosing an optimal lag length is essential in

order to ensure robustness of the model, and to mitigate omitted variable bias and overfitting of the model. Initially, we use an Augmented Dickey-Fuller (ADF) test on HP-filtered data, which gave the lag length of six. However, the matrix size constraint on our data suggests that we can only use a maximum lag length of three in our analysis. Including six lags would add eighteen variables to each equation in the system, which could potentially create a high dimensionality problem as well as significantly reduce the model accuracy. Considering that by default the programming language merely uses a rule-of-thumb approach in determining its optimal lag length, we reviewed multiple literature on this topic that employed the formal approaches by using information criteria (e.g. Schwartz Information Criterion) and found that the majority of them uses lag length 2. Although our lag length was constrained to two, we sought to limit the model's complexity while also capturing the main dynamics of our data. Ultimately, this model uncovers important relationships among GDP growth, inflation, and monetary policy. Future studies may benefit from more rigorous time series analysis and employing techniques to more effectively handle dimensionality issues.

5 Results and Interpretation

We use the following specification for a VAR(2) model with error correction, where Z_t is written as the 3x1 column vector of endogenous variables, α_t is the vector of constants, and β_1, β_2 are 3x3 coefficient matrices for the first and second lags of Z_t.

$$Z_t = \alpha_t + \beta_1 Z_{t-1} + \beta_2 Z_{t-2} + \epsilon_t \tag{2}$$

The VAR model generates a correlation matrix of residuals that is the estimate of the correlation matrix of the error term. This means that if the error for one variable is positive, it is more likely that the error for another variable is also positive. This relationship is stronger when the correlation value is closer to 1. When the value is negative, an analogous relationship holds for 2 variables, wherein if the error for a variable is positive, it is more likely that the error for another term is negative. The covariance and correlation matrices of residuals are attached below.

Table 1: Covariance Matrix of Residuals

	GDP Growth	**Monetary Policy Rate**	**Headline Inflation**
GDP Growth	39.64807	0.08041	-1.2107
Monetary Policy Rate	0.08041	0.36588	0.1529
Headline Inflation	-1.21069	0.15288	1.9278

In addition to these matrices, we include our regression estimates and coefficients for GDP Growth, Monetary Policy Rate, and Headline Inflation. Importantly, the VAR model generates a series of impulse response functions to see what one standard deviation shock in Money Supply Rate would do to other macro indicators. The dashed lines show a spread in relation to the confidence interval. These functions can be located in the Appendix, Table 3−5.

Table 2: Correlation Matrix of Residuals

	GDP Growth	Monetary Policy Rate	Headline Inflation
GDP Growth	1.00000	0.02111	-0.1385
Monetary Policy Rate	0.02111	1.00000	0.1820
Headline Inflation	-0.13848	0.18203	1.0000

In Figure 3, a one standard deviation positive shock in monetary policy rate will induce a small increase in GDP growth in the first period. The peak occurs during period 1. Then over periods 2-9, there is a consistent decrease in GDP. Generally, the initial shock spurs consumption, investment, and economic activity, thus leading to an increase in GDP over the first period. However, in the long run, we see a convergence back to zero level, or perhaps slightly below that level. In the lower pane of Figure 3, we see that a one standard deviation positive shock in monetary policy rate will induce an increase in inflation in the first several periods, understandably as increasing the money supply will spur inflation in the immediate future. By period 4, however, the inflation spike is already subsiding as inflation levels return towards a cyclic pattern centered around the initial point, showing that money supply shocks to inflation are very much temporary, with no real effects.

6 Experiment Proposal

In this section we present a quasi-experimental design to study certain components of our research question. In particular, our quasi-experiment aims to provide insights on how the Bank of Ghana's transition towards an IT policy framework has affected the relevant macroeconomic indicators discussed in our previous analysis (such as GDP growth and inflation). Note that for the purposes of simplicity and brevity we exemplify our model below using inflation as the outcome variable, although the same model can be estimated for other macroeconomic variables of interest for which data exists in monthly, year-on-year format (e.g. GDP). We propose a difference-in-differences (DiD) model over multiple time periods to estimate the effect of the IT framework (the "treatment") on the Ghanian economy in various years. This is not a fundamentally novel application of DiD - past research has considered inflation targeting as a treatment variable in the DiD specification to study the same research question in different economies (see Mishkin and Schmidt-Hebbel (2007), Ball and Sheridan (2003), and Kose et al. (2018)). However, it is certainly not the only quasi-experimental method to analyze the relationship between inflation targeting and inflation / GDP growth. For example, Lin and Ye (2009) uses propensity score matching with a panel dataset involving 52 developing countries to find a statistically significant effect of inflation targeting on inflation variability.

In May 2007, the Bank of Ghana formally announced its decision to transition to an IT monetary policy framework (Akosah et al., 2019). Thus, our DiD model treats May 2007 as the time of treatment. Units of time are given in years, regarded as 12 month periods before and after May

2007 (we would average monthly year-on-year inflation data over a 12 month period for each time period being considered). The Gambia, another West African economy, is our comparison country. Its central bank currently employs a Monetary Targeting (MT) policy (which is the same framework used by Ghana before IT) (Central Bank of The Gambia, 2023). We select The Gambia as our point of comparison in order to justify a parallel trends assumption (which would allow us to make inferences about average treatment effects, as explained below). Although parallel trends is a statement about a counterfactual reality (i.e. where Ghana does not adopt inflation targeting), we can consider observed pre-trends to justify such an assumption. Figure 4 displays monthly, year-on-year inflation rates for Ghana and The Gambia, in the period before and after Bank of Ghana adopts the IT framework. Observe that before 2007, pre-trends seem to be parallel, which supports our ability to make a parallel trends assumption.

The model is structured as follows:

$$Y_{it} = \alpha + \psi D_i + \sum_{t=2007}^{2011} \gamma_t Post_t + \sum_{t=2007}^{2011} \beta_t Post_t \cdot D_i + \epsilon_{it}$$

$\alpha, \psi, \gamma_t, \beta_t$ are coefficients to be estimated via OLS regression. $Post_t$ is an indicator variable for the 3 year time period $(t, t+3)$, for $t \in \{2007, 2008, 2009, 2010, 2011\}$. For example, $t = 2007$ represents the 3 year period from May 2007 to May 2010, $t = 2008$ represents May 2008 to May 2011 etc. Thus, Y_{it} is calculated as 3 year moving averages of year-on-year inflation from May in year t to May in $t+3$ for individual i, where $i \in \{\text{Ghana, The Gambia}\}$. The baseline time period is May 2004 to May 2007 - in this period, both Ghana and The Gambia are untreated, and for all subsequent periods Ghana is treated while The Gambia remains untreated. D_i is a treatment indicator variable which equals 1 if $i =$ Ghana and equals 0 if $i =$ The Gambia. Our design employs this multi-year, multi-period structure (similar to that of Kose et al. (2018)) in order to account for the fact that treatment effects may be delayed, in the sense that monetary policy may only begin to affect inflation rates several years after the IT framework is formally introduced.

We are primarily concerned with the coefficients β_t. For example, under the parallel trends assumption, an OLS estimate of β_{2008} would estimate the average effect of transitioning to IT monetary policy on Ghana's average inflation from May 2008 to May 2011. Note that our model is simply an extension of the canonical, 2 period and 2 group model:

$$Y_{it} = \alpha + \psi D_i + \gamma Post + \beta Post \cdot D_i + \epsilon_{it}$$

where D_i is an indicator for being treated in period 2, and $Post$ is an indicator for observations in period 2. Assuming that one group is treated in period 2 and both groups are untreated in period 1, and that we have parallel trends, standard economic literature tells us that estimating β with OLS gives an estimate of the average treatment effect on the treated (ATT). The same fundamental principle applies in our multi-period setting.

7 Conclusion

Overall, this research has provided insights into the dynamic relationships between monetary policy, economic growth, and inflation in Ghana. For VAR model creation, we first conducted a stationarity test to establish whether or not there were cointegration relationships between our predictor variables. These tests confirmed the data are individually stationary, and our subsequent tests demonstrated the inter-relationships between them. Our findings revealed the varying impacts of monetary policy adjustments on economic growth and inflation, and how these impacts can be both immediate and delayed. This understanding is crucial for policymakers, particularly for the Bank of Ghana, who face the challenge of crafting monetary policies that foster economic growth while keeping inflation in check. We hope that the results provide additional intuition regarding the use of policy for prosperity and growth in developing countries, more generally.

Looking forward, more detailed analysis that factors in additional macroeconomic variables such as fiscal policy indicators, unemployment rates, exchange rate regimes, and external trade balances could enrich this model. As we suggest in our experimental proposal, future research could also be extended to a panel VAR approach that would include other comparable developing economies. This might help in understanding whether the observed findings in Ghana are unique or shared by similar economies.

Appendix

Figure 1: Macroeconomic Trends in Ghana

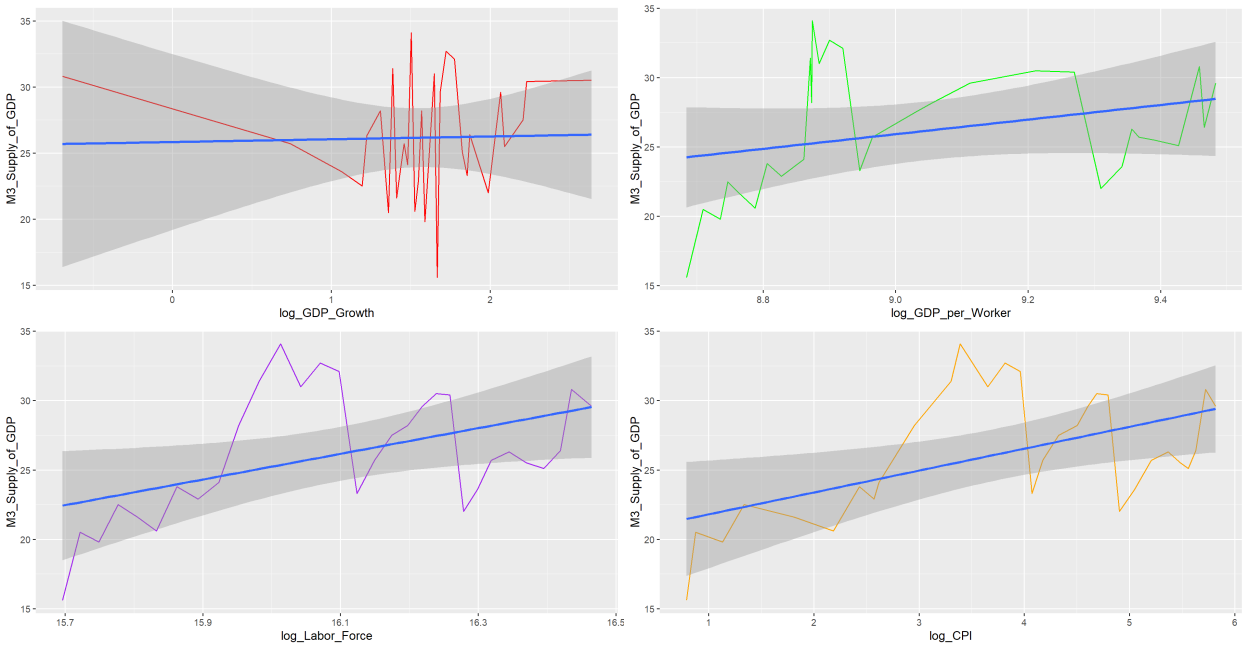

Figure 2: Correlations of Growth with Monetary Policy

Table 3: Estimates on Headline Inflation

	Estimate	Std. Error	t-value	p-value
GDP Growth (t-1)	0.001176	0.014542	0.081	0.9352
MPC Rate (t-1)	0.448859	0.145234	3.091	0.00222**
Headline Inflation (t-1)	1.177013	0.061178	19.239	< 0.0001***
GDP Growth (t-2)	-0.001904	0.014547	-0.131	0.89596
MPC Rate (t-2)	-0.409160	0.144811	-2.825	0.00509**
Headline Inflation (t-2)	-0.271367	0.060095	-4.516	< 0.0001***
Constant	0.0002	0.0864	0.00	0.9986

Note: All variables are HP-filtered; ***p<0.001; **p<0.01; *p<0.05

Table 4: Estimates on GDP Growth

	Estimate	Std. Error	t-value	p-value
GDP Growth (t-1)	0.7675	0.0629	12.19	< 0.0001***
MPC Rate (t-1)	0.5749	0.6284	0.915	0.3611
Headline Inflation (t-1)	-0.4490	0.2647	-1.696	0.0911
GDP Growth (t-2)	0.020	0.0629	0.321	0.7488
MPC Rate (t-2)	-0.7153	0.6265	-1.142	0.2547
Headline Inflation (t-2)	0.4304	0.2600	1.655	0.0991
Constant	0.0347	0.3897	0.089	0.9291

Note: All variables are HP-filtered; ***p<0.001; **p<0.01; *p<0.05

Table 5

Table 5: Estimates on Monetary Policy Rate

	Estimate	Std. Error	t-value	p-value
GDP Growth (t-1)	0.001176	0.014542	0.081	0.93562
MPC Rate (t-1)	0.448859	0.145234	3.091	0.00222**
Headline Inflation (t-1)	1.177013	0.061178	19.239	< 2e-16***
GDP Growth (t-2)	-0.001904	0.014547	-0.131	0.89596
MPC Rate (t-2)	-0.409160	0.144811	-2.825	0.00509**
Headline Inflation (t-2)	-0.271367	0.060095	-4.516	< 0.0001***
Constant	-0.034175	0.090085	-0.379	0.70473

Note: All variables are HP-filtered; ***p<0.001; **p<0.01; *p<0.05

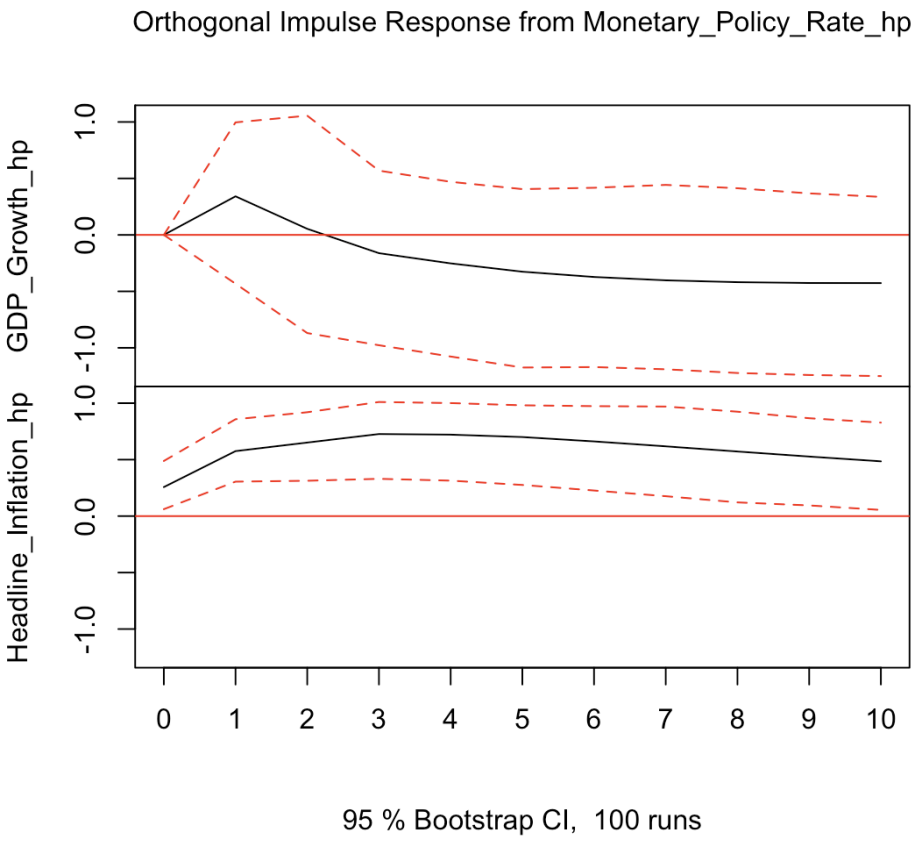

Figure 3: Ghana Impulse Response to Money Supply Shock

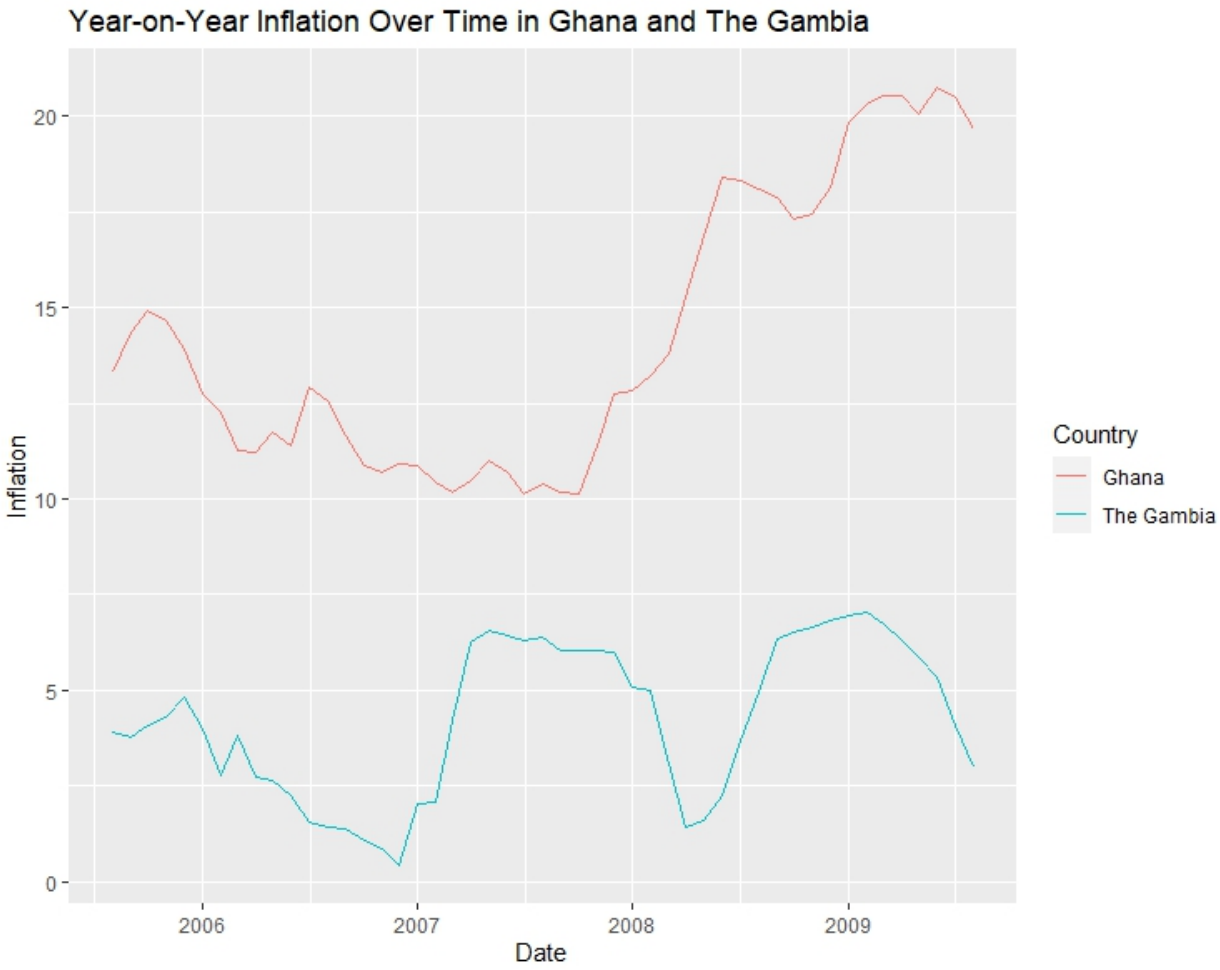

Figure 4: Year-on-Year Inflation in Ghana and The Gambia, August 2005 - August 2009

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