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INFLATION DYNAMICS AND POLICY MIX IN GHANA

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Abstract

Research background: Ghana was the second African country to adopt the inflation-targeting framework in 2007. The country faced persistently high levels of inflation, exceeding 100 percent in the early 1980s. Since the adoption of the inflation targeting regime, the inflation rate has decreased and remains below 20 percent.
Purpose: Given the importance of the policy mix in achieving price stability and economic growth in any economy, this study examines which policy mix is more effective in determining the inflation dynamics in Ghana.
Research methodology: Annual data from 1980 to 2021 and the autoregressive distributed lag (ARDL) were used, firstly on individual monetary and fiscal policy models and then jointly on the policy mix model.
Results: Results show that fiscal policy is effective and significant in determining inflation dynamics in Ghana in the long run, while monetary policy is ineffective, less dominant, and statistically insignificant. Monetary policy is effective and significant in the short run. Based on the findings of the study, policy recommendations include giving more attention to the possible coordination of fiscal and monetary policies than has been previously given.
Novelty: The study's originality is in examining if the monetary or fiscal policy (policy mix) effectively regulates the inflation rate in Ghana; the inflation target and the exchange rate as external shocks were included, amongst others and estimating the separate and combined models for the policy mix.

Keywords: ARDL, monetary policy, fiscal policy, inflation, Ghana

JEL classification: C01, C32, E52, E62, F62

Introduction

The primary objective of any central bank, including the Bank of Ghana (BoG), is the maintenance of price stability in the general price levels. As per the mandate of the Bank, it is required to support the general economic policy of the government in stimulating economic growth and development, while promoting and maintaining financial stability. This, therefore, zooms in on the importance and the interactions of monetary and fiscal policy (policy mix) in fostering price stability. Fiscal policy is used by the government to achieve various macroeconomic objectives, such as economic growth and price stability, among other objectives (Isaac, Samwel, 2012). Fiscal policy involves increasing or decreasing taxation and/or government spending. Although it is normally stated that monetary policy cannot operate in isolation from fiscal policy, and vice versa, in achieving price stability and the economic growth of any economy, it is important to observe whether this applies to Ghana.

Seeing the extent to which the BoG will go to ensure that the target is achieved jointly with the government, this study seeks to investigate how the inflation rate responds to changes in the repo rates and government spending. The novelty of this study is investigating which of the two policies, monetary or fiscal policy, separately and jointly cause inflation to change significantly. This is because while previous studies observed the different determinants of inflation in Ghana, others separated the causes of inflation into monetary and structural factors (Ocran, 2007; Adu, Marbuah, 2011; Harvey, Cushing, 2014; Bleaney *et al.*, 2020). This is the first study that examines whether monetary or fiscal policy separately affects the inflation dynamics in Ghana and jointly tests the effects of this policy mix on inflation, in the short run and the long run. Furthermore, the current study used different and more advanced econometric techniques of the autoregressive distributed lag (ARDL), over previous studies thus examining which of the two economic policies is more effective in controlling the inflation rate. The hypotheses tested are explained in the method section.

Knowing the importance of price stability and in its quest to reduce the inflation rate to low single-digit levels, the BoG officially adopted an inflation targeting (IT) framework, in 2007; yet, its inflation rate of over 30 percent, in August 2022, is high compared to its set target. Both the government and the BoG fixed the target at 8 percent, with a symmetric band of 2 percent, while the Bank uses its policy tools to achieve the set target. The inclusion of inflation targeting, which was not done previously is also a significant contribution to the study. Furthermore, Ghana has followed the flexible exchange rate system since 1983 and this regime does not insulate an economy from external shock. Since the country is currently

experiencing challenges in managing inflation due to external shocks and the development of monetary policy models that will effectively reduce exogenous inflationary pressures, this study therefore considers the inclusion of exchange rate as well as the interaction of both monetary and fiscal policy in order to examine their effects on the inflation dynamics in Ghana. The main monetary policy tool used by the Bank is the monetary policy rate (MPR), with four sets of instruments employed to support it, namely the repurchase agreements (repos), reserve requirements, term deposits, and open market operations (OMO) instruments. The following section outlines the stylized facts on the inflation and policy mix in Ghana, followed by the theoretical foundations and the empirical reviews of previous studies. The next section provides the methodology of the study, followed by the analysis of the results. The last section concludes the study and provides some policy recommendations.

1. Stylized facts on inflation and policy mix in Ghana

The IT regime has been in place since 2007 and the inflation rate has remained high, with an average of 11.6 percent from 2007 to 2020. Historical records show that pre-1983 depicted generally high inflation periods. A new policy introduced between 1983 and 1986, which included the management of fiscal deficit and improving government finances, was formed as part of the economic recovery programme (ERP) (Dordunoo, Nyanteng, 1997; Fosu, 2001; Adom *et al.*, 2015). Hence, monetary authorities need to know the factors to use to lower inflation to be within the target. The government should also strive to reduce the budget deficit and spending to have sustained and favourable inflation (Fosu, 2001).

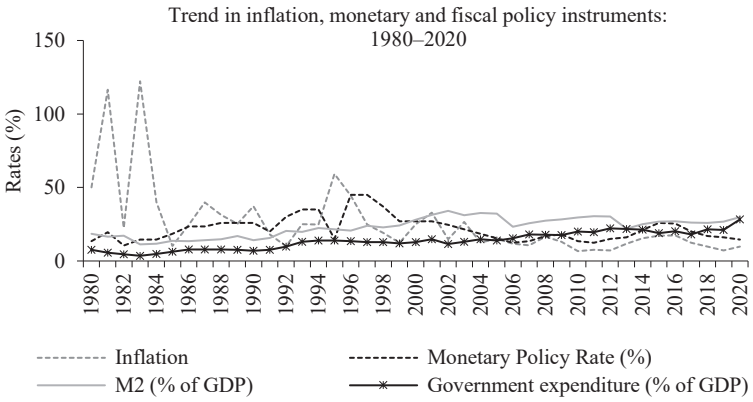


Figure 1. Inflation, monetary and fiscal policy instruments

Source: own elaboration.

Figure 1 shows the trend in inflation, monetary policy, and fiscal policy instruments from 1980 to 2020. Although there is no clear relationship among these variables, the figure shows that inflation was very high pre-1983, over 100 percent in some years. It fell and remained below 40 percent after 1983 until 1995 when it increased to over 50 percent. However, during the IT regime, inflation was 10.7 percent, and it declined to a low of 7 percent in 2012. Meanwhile, during these periods money supply as a share of GDP gradually increased from 1983 to 2005 and remained steady below 30 percent. The monetary policy rate was fluctuating and increased from 13.5 percent in 1980 to 35 percent in 1994, after which it oscillated, but remained below 30 percent after 1998.

While the monetary policy rate exhibited a somewhat inverse relationship with the inflation rate in some periods, from 1980 to 2004, this relationship became unclear afterward. On the other hand, the ratio of government spending to GDP generally increased steadily during the period. It showed an upward trajectory of 3.5 percent in 1983, to over 7 percent in 1986, during the ERP period. It continued to increase to over 28 percent in 2020. Once again, there is no clear correlation between the fiscal variable and the inflation rate during the period observed.

2. Theoretical underpinnings and review of related literature

This section explains the theoretical foundations of the different schools of thought about the determinants of inflation; followed by a review of previous empirical studies in the research area.

The monetarists' school of thought argue that when too much money chases too few goods, it will lead to inflation dynamics. They believe that inflation is "always and everywhere a monetary phenomenon" (Friedman, 1966). Also, they conclude that monetary aggregates are the only variables that can determine inflation. Meanwhile, fiscalists believe that fiscal variables, such as government expenditure, debts, and taxes are responsible for the inflation rate changes. The standard monetarists further argue that a central bank can achieve price stability if it is committed to its goal; however, the proponents of the fiscal paradigm disagree. The fiscalists argue that monetary policy alone will not be sufficient to achieve price stability, but also an equally appropriate fiscal policy (Woodford, 1994; McCallum, 1998; Cochrane, 2000).

Several studies investigated the determinants of changes in inflation in various economies, including Ghana, and different variables emerged as determinants. Diouf (2007) tested the monetarist and structuralist theories of inflation to investigate the determinants of inflation

in Mali. Using quarterly data from 1979Q1 to 2006Q1 and adopting a single-equation model of the error-correction mechanism, the results showed that inflation in Mali is driven by real income, exchange rates and deposit rates in the short run. In examining the causes of inflation in Nigeria, Imimole & Enoma (2011) found that money supply, real output, and exchange rate are the major determinants. Their study adopted autoregressive distributed lag and annual data from 1986 to 2008.

Furthermore, Kabundi (2012) examined the main drivers of inflation in Uganda, using monthly data over the period of January 1999 to October 2011 and adopted a single-equation error correction model. They found that all the variables, inflation inertia, monetary aggregates have lasting and significant effects on inflation. A study on South Africa, the first African country that adopted inflation targeting, conducted by Akinboade *et al.* (2002) examined the determinants of inflation based on the monetarist and the structuralist approaches. The study used quarterly data from 1970Q1 to 2000Q2 and adopted the structural vector autoregressive and impulse response functions approaches. They found the dominance of structural factors, while monetary factors show limited effect in determining inflation. Meanwhile, Adusei (2013) found the presence of both the structuralist and the monetarist schools of thought in explaining the South African inflation dynamics, using annual time series data, spanning a period from 1965 to 2006 and adopting fully modified ordinary least squares and Granger causality test techniques.

Ocran (2007) found that inflation dynamics are caused by both the structural and monetary factors in Ghana, where money growth, interest rates and exchange rates are significant in the short run, with exchange rate affecting inflation in the long run. Adu and Marbuah (2011) used the autoregressive distributed lag bounds tests to cointegration and an error correction technique to examine the determinants of inflation in Ghana, using annual data from 1960 to 2009. They found that output is most significant in determining inflation in Ghana in the long run.

Meanwhile, Kovanen (2011) tested the role of money in determining inflation in Ghana and found that it is weak, while the exchange rate and output gap significantly determine inflation changes. The study used quarterly data from 1990Q1 to 2009Q4 and adopted a generalised method of moments. As much as money is an important part of monetary policy, the Ghanaian monetary authorities use the interest rate in implementing monetary policy, in the context of the inflation target framework.

Bleaney *et al.* (2020) examined whether the persistent increase in inflation in Ghana has been fuelled by monetary policy conduct. Using monthly data, from November 2002 to May 2017, their study adopted the ordinary least squares technique and tested the response of inflation

expectations to changes in lagged inflation, policy rate, output gap, and fiscal balance. Their results show that there is weak fiscal dominance, which affects inflation expectations. They concluded that the continuous increase in the inflation rate, under formal inflation targeting, is not triggered by monetary policy conduct.

Although the current study is close to the one by Adu and Marbuah (2011), their study used fiscal deficit while the current study used government spending and included a dummy to capture the inflation target regime. The current study first observes the reaction of inflation rate to the policy mix variables separately and later combined these variables, which was not done in any previous study.

3. Methodology

3.1. Model specification and data sources

This study uses the repo rate as the monetary policy rate instrument. The choice of variables was guided by the theoretical foundations explained above. Although the study by Kovanen (2011) found that money is weak in determining inflation in Ghana, and a preliminary graphical analysis in this study confirms this; the study proceeds to observe the effect of money supply following the monetarist theory. Also, it cannot be assumed that changes in money supply are insignificant in determining inflation, especially in a developing country such as Ghana, with less developed financial systems. Though the post-Keynesian theory shows that the shocks in the real variables, such as fiscal policy, will automatically lead to an increase in money supply, which might bring about the problem of autocorrelation in the model, the autoregressive distributed lag technique adopted in the study caters for such problems. Based on the above reasons, the study proceeds to first observe the monetarist and fiscalist theories separately, equations 1a and 1b, before merging the two models, equation 1.

Therefore, the monetary policy model is:

$$\underset{}{CPI} = f\underset{-}{(MPR}, \underset{+}{EXR}, \underset{\pm}{MS}, \underset{\pm}{GDPg}, \underset{-}{D_IT}) \tag{1a}$$

The fiscal policy model is:

$$\underset{}{CPI} = f\underset{\pm}{(GDPg}, \underset{+}{GE}, \underset{-}{D_IT}) \tag{1b}$$

The combined model is:

$$\underset{}{CPI} = f\underset{-}{(MPR}, \underset{+}{EXR}, \underset{\pm}{MS}, \underset{\pm}{GDPg}, \underset{+}{GE}, \underset{-}{D_IT})$$

$$D_IT = \begin{cases} 1 & \text{Inflation targeting period from 2007} \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

The dependent variable is the consumer price index (CPI), representing inflation rate. This shows the year-on-year changes in the prices of the average consumer basket; the inflation rate that is targeted by the Bank of Ghana. To satisfy the objectives of the study, the monetary policy variables considered are the monetary policy rate, exchange rate, and money supply. The fiscal policy variable is government expenditure; tax revenue values are missing in many periods. The monetary policy rate, MPR, is expressed in percentages and it is the interest rate that the Bank of Ghana uses in its monetary policy to regulate inflation rate.

The bilateral official exchange rate, EXR, is the exchange rate that matches the local currency units (Ghanaian cedi) relative to the US dollar. The money supply is the broad money, MS, which is the sum of currency outside banks, time and savings deposits and foreign currency deposits, banks, traveller's cheques, and other securities. The growth rate of the real gross domestic product, GDPg, is the increase in total output produced in the country measured at constant local currency unit. GE is government spending, which is the total expenditure of the general government.

The economic theory hypothesises that the exchange rate and government spending would show a positive relationship with inflation rate; the monetary policy rate and the dummy variable are expected to be negatively related to inflation rate. Money supply and output growth can be positive or negative. An increase in the monetary policy rate is seen as a deflationary policy action; thus, the monetary policy rate is expected to negatively impact inflation. While the real exchange rate shows how much of goods and services in the domestic economy can be exchanged for goods and services in a foreign country, the nominal exchange rate indicates how much of a local currency can be exchanged for a unit of foreign currency. Thus, the increase in the nominal exchange rate translates to a depreciation of the domestic currency and vice versa, while an increase in the real exchange rate will instantly lead to an increase in net imports. In addition, an increase in exchange rate causes a decline in the price of exports, foreigners will demand more of the country's less expensive exports, meaning an increase in exports, and net imports. This leads to an increase in aggregate demand, and the inflation rate increases. The opposite holds for a decline in the exchange rate leading to a fall in inflation. Moreover, a positive relationship is expected between exchange and inflation rates.

The effect of the money supply on inflation rate can be either positive or negative. If the money supply grows faster than the rate at which an economy grows, an increase in

the inflation rate will ensue, thus depicting a positive relationship. But, if economic growth matches money supply growth, or an economy has room to grow, then a negative effect will be realised. So, the quantity theory of money postulates a direct relationship between money supply and inflation, as it assumes that the increases that occur in the amount of money go into spending and no variations in the velocity of money in circulation. On the other hand, Keynesians and monetarists opposed the theory of a direct effect of money supply on inflation, arguing that inflation is also indirectly affected by money supply, whereby the impact of money supply causes inflation to rise faster than the money stock itself.

According to the Classical school of thought, a negative relationship exists between inflation and output growth, such that high output growth is needed to have a low inflation rate, and vice versa (Gokal, Hanif, 2004). However, following the Keynesian Phillips curve trade-off, an economy will have to sacrifice some amount of output growth to reduce inflation rate; thus, a positive relationship is expected (Hodge, 2006). The study, therefore, expects a positive or negative effect of output growth on the inflation rate, following the Classical theory or the Keynesian Phillips curve trade-off approach. Since real GDP is adjusted for inflation, the study uses nominal GDP growth.

The dummy variable, D_IT, captures the period of inflation targeting regime and an inverse relationship is expected between it and inflation. Although a new policy, the "Economic Recovery Programme", was introduced between 1983 and 1986, it was not long enough to capture its effect using the dummy variable. Data on the consumer price index, exchange rate, money supply, GDP growth, and government expenditure was obtained from the 2022 World Development Indicator (WDI) database. The monetary policy rate was sourced from the Bank of Ghana database. Annual data from 1980 to 2021 was used due to the unavailability of quarterly data on real GDP and government spending.

Equation 1 is used to explain the rest of the econometric technique. The formula shows that CPI and government spending are transformed into logarithms, money supply growth and growth rate of gross domestic products are used, while the monetary policy and exchange rates are at levels. These transformations allow for all the variables to be measured at the same level while avoiding outliers. The following model, from equation 1 is therefore estimated:

$$\log CPI_t = \alpha_0 + \alpha_1 MPR_t + \alpha_2 EXR_t + \alpha_3 MSg_t + \propto_4 GDPg_t + \alpha_5 \log GE_t + \alpha_6 D_IT_t \qquad (2)$$

3.2. Estimation techniques

According to Johansen and Juselius (1990) and Hjalmarsson snd Osterholm (2007), economic time series normally depict non-stationary processes. To avoid spurious results and determine the applicable techniques, the augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) stationarity tests are used. Cointegration is obtained using the popular ARDL bounds test to the cointegration approach, developed by Pesaran *et al.* (2001). The cointegration test will be employed to observe whether the variables move together in the long run. The merits of using this cointegration test above others include that the regressors can have a mixed order of integration. Thus, the technique can be used whether the regressors have a combination of I(0) and I(1) or purely I(1), but they cannot be I(2). But, the dependent variable has to be integrated of order one. This technique is also applicable in the presence of endogeneity of the independent variables, which is common in autoregressive models (Pesaran *et al*., 2001; Odhiambo, 2015).

The error-correction model of the ARDL-ECM technique will be used to obtain the short-run and long-run effects of each of the variables, and the inflation rate short-run adjustment back to equilibrium. The emphasis will be on the effectiveness of monetary and fiscal policy variables, and the dummy variable on the inflation rate of Ghana.-

Thus, the conditional ARDL model for the combined policy mix and inflation dynamics following from equation 2 is:

$$\begin{aligned}\Delta \log CPI_t = {} & \gamma_0 + \sum_{i=1}^{n} \alpha_0 \Delta \log CPI_{t-i} + \sum_{i=0}^{n} \alpha_1 \Delta MPR_{t-i} + \sum_{i=0}^{n} \alpha_2 \Delta EXR_{t-i} + \\ & + \sum_{i=0}^{n} \alpha_3 \Delta MSg_{t-i} + \sum_{i=0}^{n} \alpha_4 GDPg_{t-i} + \sum_{i=0}^{n} \alpha_5 \Delta \log GE_{t-i} + \sum_{i=0}^{n} \alpha_6 \Delta D_{IT_{t-i}} \\ & + \beta_0 \log CPI_{t-1} + \beta_1 MPR_{t-1} + \beta_2 EXR_{t-1} + \beta_3 MSg_{t-1} + \beta_4 GDPg_{t-1} + \\ & + \beta_5 \log GE_{t-1} + \beta_6 D_{IT_{t-1}} + \varepsilon_t \end{aligned} \tag{3}$$

where:

Δ – the first difference,

$\alpha_0, \ldots, \alpha_6$ – the short-run coefficients,

$\beta_0, \ldots, \beta_6$ – the long-run coefficients,

γ_0 – the intersect,

ε_t – the error term.

Cointegration is tested among the variables using the F-test, and the following null and alternative hypotheses:

$$\begin{aligned} H_0&: \beta_0 = \beta_1 = \ldots = \beta_6 = 0 \text{ (no cointegration)} \\ H_1&: \beta_0 \neq \beta_1 \neq \ldots \neq \beta_6 \neq 0 \text{ (cointegration)} \end{aligned} \tag{4}$$

The existence of cointegration will be confirmed if the null hypothesis of "no cointegration" is rejected, given that the computed F-statistic exceeds the upper bound. The null hypothesis cannot be rejected if the F-statistic lies below the lower bound; thus, indicating no cointegration. But, there will be an inconclusive decision on the cointegration if the computed F-statistic lies between the upper and the lower bounds at a chosen level of significance.

If cointegration exists, equation 3 will be estimated using the standard OLS, and the long-run and short-run coefficients, as well as the speed of adjustment of the inflation rate back to the long-run equilibrium will be obtained. By re-parameterising equation 3 above, the short-run and long-run unrestricted error correction model of the dynamic linear ARDL regression model is:

$$\begin{aligned} \Delta \log CPI_t = {} & \gamma_0 + \sum_{i=1}^{n} \alpha_0 \Delta \log CPI_{t-i} + \sum_{i=0}^{n} \alpha_1 \Delta MPR_{t-i} + \sum_{i=0}^{n} \alpha_2 \Delta EXR_{t-i} + \\ & + \sum_{i=0}^{n} \alpha_3 \Delta MSg_{t-i} + \sum_{i=0}^{n} \alpha_4 GDPg_{t-i} + \sum_{i=0}^{n} \alpha_5 \Delta \log GE_{t-i} + \sum_{i=0}^{n} \alpha_6 \Delta D_{IT_{t-i}} \\ & + \beta_0 \log CPI_{t-1} + \beta_1 MPR_{t-1} + \beta_2 EXR_{t-1} + \beta_3 MSg_{t-1} + \beta_4 GDPg_{t-1} + \\ & + \beta_5 \log GE_{t-1} + \delta ECT_{t-1} + \varepsilon_t \end{aligned} \tag{5}$$

Equation 5 gives the long-run and short-run coefficients from the ARDL-UECM model, where the effectiveness of each of the economic policies to inflation rate will be established. In so doing, the study will conclude whether the monetarist or fiscalist school of thought applies to Ghana.

The coefficient of the one-period lag error correction term, δ, is the short run speed of adjustment back to the long-run equilibrium. It shows how the inflation rate gradually returns to its long-run equilibrium path after deviating from it. The coefficient should be negative, less than one and statistically significant.

4. Results

The descriptive analysis presented below in Table 1 shows that all the explanatory variables exhibit lower average and maximum than the measure of inflation, CPI. On average,

the price of a basket of goods and services was about 72%, while the government spent a very low and insignificant percent, money supply increased by 35% and the economy grew annually by 4.6% over the period considered. The maximum growth of the economy was a massive 14%, with money supply growth at over 56% and the monetary policy rate at 45%.

While the skewness shows the spread of a normal distribution, a normal kurtosis, which shows the height of a normal distribution should have a value of between –2 and +2 to be considered acceptable values for normal distribution. These go hand-in-hand with the Jarque-Bera probability. The statistics shows that only money supply is normally distributed, and all the variables have higher peaks since they have positive values, as shown by the kurtosis statistic. The symmetrical skewness value of between –0.5 and +0.5 shows that only money supply growth and gross domestic product growth variables are close to the symmetry while positively and negatively skewed respectively.

Table 1. Descriptive Statistics

Statistics	CPI	MPR	EXR	MSG	GDPG	GS
Mean	71.76388	21.67857	1.266771	34.96347	4.519786	5.52E+09
Median	23.19499	19.75000	0.630612	35.41472	4.819693	3.23E+08
Maximum	336.4929	45.00000	5.805700	56.53422	14.04712	4.57E+10
Minimum	0.052615	10.50000	0.000275	13.30136	–6.923650	478400.0
Std. Dev.	96.60194	8.455638	1.730043	12.87382	3.584323	1.01E+10
Skewness	1.376749	1.117043	1.450584	0.085112	–0.880445	2.253958
Kurtosis	3.706661	3.827913	3.810067	1.773202	5.840959	7.982291
Jarque-Bera	14.14196	9.934019	15.87772	2.684516	19.55062	79.00293
Probability	0.000849	0.006964	0.000357	0.261255	0.000057	0.000000
Sum	3,014.083	910.5000	53.20437	1,468.466	189.8310	2.32E+11
Sum Sq. Dev.	382,609.4	2,931.411	122.7150	6,795.146	526.7423	4.17E+21
Observations	42	42	42	42	42	42

Source: analysis by the author.

Given the inability of the descriptive analysis in providing estimated values, the following explains the econometric results that were obtained. The stationarity tests results show that all the variables are I(1), except the money supply growth (Table 2). It shows that these variables become stationary after the first difference at the 1 percent level of significance.

Table 2. Stationarity test results

Variables	ADF Test		PP Test		Integration order
	levels	1st difference	levels	1st difference	
logCPI	–2.835	–7.540***	–2.835	–14.172***	I(1)
MPR	–3.041	–8.043***	–2.946	–18.175***	I(1)
EXR	1.125	–4.631***	0.928	–4.632***	I(1)
MSg	–5.743***	NA	8.769***	NA	I(0)
GDPg	–3.771**	–7.513***	–3.437*	–19.483***	I(1)
logGE	–1.598	–6.477***	–1.532	–6.518***	I(1)

Test critical values: ADF [1% –4.199; 5% –3.524; 10% –3.193]; PP [1% –4.205; 5% –3.527; 10% –3.195].
***1%, **5%, *10%.

Source: analysis by the author.

Given that all the variables are integrated of a mix of order zero, I(0) and order one, I(1), with the dependent variable being integrated of order one, I(1), we proceed to observe whether these variables move together in the long run, using the ARDL-bounds testing approach to cointegration. The optimal lag length is determined before the cointegration test. The selected maximum lag length using the Akaike information criterion (AIC) is 1 for both the monetary and fiscal models separately, and 3 for the combined model, resulting from the number of regressors in the models.

Table 3. Cointegration test results: combined model

Test statistic	Value	K
F-statistic	37.146***	6
Critical value bounds		
Significance levels	I(0) Bound	I(1) Bound
10%	1.99	2.94
5%	2.27	3.28
2.5%	2.55	3.61
1%	2.88	3.99

Null hypothesis: No long run relationships exist; *** 1%.
K is the number of explanatory variables.

Source: analysis by the author.

Thus, the optimal ARDL model selected for the Ghana inflation rate equation for the monetary and fiscal models are ARDL(1, 0, 0, 0, 1, 0) and ARDL(1, 0, 1, 0,), respectively, and ARDL(1, 3, 0, 1, 1, 0, 1) for the combined model. The next step is to check whether cointegration exists among the variables. The cointegration test results, in Table 3, are based on "Case II:

Restricted constant and no trend" of Pesaran *et al*. (2001), for the combined equation, chosen by the E-views software used. These results depict that the null hypothesis of 'no cointegration' is rejected, since the F-statistic obtained exceeds the upper bound at all levels of significance. Thus, there exists a long-run relationship between inflation rate and the regressors. The individual models for monetary and fiscal variables also showed that cointegration exists.

The study proceeds to the ARDL-ECM model, to establish the effectiveness of each of the economic policies to inflation rate. From the individual models of monetarist and fiscalist theories shown in Tables 4 and 5, the results show the effectiveness of government spending in determining inflation dynamics in Ghana over the monetary variables. The fiscal variable has the expected positive sign, economically significant, and statistically significant at all levels. The results show that, in the long run, a percentage increase in government spending will cause inflation rate to increase by 0.69 percent (Table 5).

Table 4. Monetary policy ARDL-ECM results

Variable	Coef	Std. error	t-Statistic
MPR	0.027	0.136	0.197
EXR	.	1.619	–0.426
MSG	0.125	0.174	0.720
GDPG	–1.327	1.539	–0.863
D_IT	2.924	4.310	0.679
C	14.714	14.218	1.035
ECT_{t-1}	–0.019***	0.001	–14.129
Adj R-squared: 54%			

*** 1%; Dependent variable: logCPI.

Source: analysis by the author.

Table 5. Fiscal policy ARDL-ECM results

Variable	Coef	Std. error	t-Statistic
logGE	0.691***	0.059	11.628
GDPG	–0.094*	0.049	–1.905
D_IT	–0.374	0.296	–1.266
C	–9.471***	1.459	–6.490
ECT_{t-1}	–0.207***	0.014	–14.911
Adj R-squared: 58%			

***1%; *10%; Dependent variable: logCPI.

Source: analysis by the author.

On the other hand, in Table 4, the monetary instrument, MPR, has the wrong sign and all the monetary variables are statistically insignificant at all levels. The exchange rate depicts a wrong negative sign, while money supply growth shows a positive relationship with inflation rate. The dummy variable for inflation targeting also has the wrong positive sign. The insignificance of all the monetary variables shows that monetary policy is ineffective in changing inflation levels in Ghana. In each individual model, the short run adjustments back to equilibrium are highly statistically significant, less than one and have a negative sign.

The long and short run results and the coefficient of ECT_{t-1} for the combined equation are shown in Table 6. This supports the findings of the individual models, where the fiscal variable is found to be highly economically and statistically significant and effective in determining the changes in inflation rate in the long run, while the monetary variables are ineffective. The ARDL-ECM result of the combined model confirms the dominance of the fiscal policy. Suffice to say that, in the short run, the monetary policy rate and the money supply growth variables have the expected negative sign – the former variable is statistically significant over the two-period lag, while the latter is statistically insignificant. The exchange rate variable was dropped by the system from the specific model in the short run, as it was found to be insignificant.

Also, the money supply growth variable has conflicting signs in the short run and long run, but statistically insignificant in both instances. Although exchange rate is statistically significant in the long run, it has a wrong negative sign, instead of the expected positive relationship. As shown in the individual models, the dummy variable capturing the effect of the adoption of inflation targeting is statistically insignificant both in the short run and the long run, although it carries the expected negative sign in the short run. The results show that inflation targeting does not contribute to stabilising inflation rate during the period observed, as it shows a positive and insignificant relationship with inflation rate in the long run. While inflation rate is high since the adoption of inflation targeting, there is an indication of a decline in the levels of the inflation rate between pre-IT and during IT adoption observed from data. The results, however, show that the inflation targeting framework is insignificant in causing a decline in the inflation rate since inflation is still high.

Based on the results discussed above, no wonder the inflation rate has remained high since the country adopted inflation targeting over a decade ago (15 years). The country is battling to keep the inflation rate within a single digit, despite that being the reason for the adoption of inflation targeting. The monetary policy instrument chosen to combat high inflation is found to be ineffective in the long run, although it is effective and statistically significant in the short

run (Table 6). Meanwhile, given a percentage increase in government spending, the inflation rate will increase by 0.77 percent in the long run. This shows that increased government spending contributes significantly to Ghanaian inflation.

Table 6. ARDL-ECM results

Variable	Coef.	Std. error	t-Statistic
Long-run coefficients			
MPR_{t-1}	–0.0002	0.014	–0.012
EXR_{t-1}	–0.341***	0.126	–2.700
MSG_{t-1}	0.010	0.011	0.939
$GDPG_{t-1}$	–0.222**	0.086	–2.574
$logGE_{t-1}$	–0.766***	0.065	11.731
D_IT	0.537	0.481	1.116
C	–10.466***	1.502	–6.968
Short-run coefficients and ECT			
ECT_{t-1}	–0.194***	0.0099	–19.503
ΔMPR_t	–0.004*	0.0019	–1.905
ΔMPR_{t-1}	–0.006***	0.002	–3.238
ΔMPR_{t-2}	–0.005***	0.002	–2.779
ΔMSG_t	–0.0005	0.0009	–0.575
$\Delta GDPG_t$	–0.0227***	0.004	–5.611
D_IT	–0.076	0.075	–1.021
Adj R-squared: 74%			

***1%, **5%, *10%; Dependent variable: logCPI.

Source: analysis by the author.

Real economic growth shows an inverse relationship with the inflation rate, and it is also statistically significant in the short and long run, implying that economic growth should be improved in order to reduce inflation rate. It has a higher effect on the inflation rate in the long run, where a percentage increase in economic growth will decrease the inflation rate by 0.22 percent in the long run, compared to a decline of 0.023 in the short run. This supports the findings of Adu and Marbuah (2011) that output is significant in determining the inflation rate in the long run. The results show that the inflation rate in Ghana is responsive to changes in fiscal policy, while monetary policy is ineffective. Although, in the short run, the monetary policy rate is deflationary by having an inverse relationship as per the apriori expectation, it has a highly insignificant effect in the long run.

Bleaney *et al.* (2020) found some weak fiscal dominance. Thus, the current study supports the study by Bleaney *et al.* (2020), where inflation dynamics in Ghana are caused by fiscal factors, as they concluded that the continuous increase in the inflation rate, under the adoption of the formal inflation targeting framework, is not triggered by monetary policy conduct, but because of increased fiscal activities. Studies by Kovanen (2011) and Harvey and Cushing (2014) found the exchange rate to be a significant determinant of the inflation rate in Ghana, whereas in the current study, the exchange rate was found to be economically insignificant in the long run. The error correction term is negative, less than one, and also highly statistically significant at all levels, as expected. The negative sign shows that the system returned to its long-run equilibrium path in the current year, from the previous year's disequilibrium at the rate of over 19 percent.

The cointegration graph in Figure 2 shows that the model is appropriate, as the graph reverts to equilibrium, around zero. All the models passed the battery of the diagnostic tests, Table 7, and the stability tests shown by the CUSUM and CUSUM of squares, Figure 3.

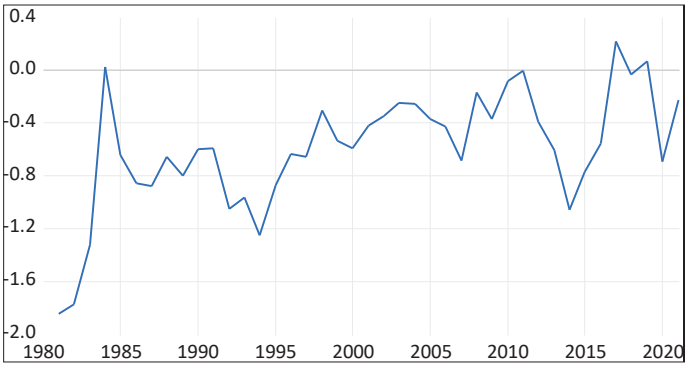


Figure 2. Cointegration graph for the inflation rate model

Source: analysis by the author.

Table 7. Diagnostic test results

Test	Null hypothesis	Probability
Normality test: Jarque-Bera	Error term is normally distributed	4.269 (0.118)
Serial correlation LM tests: Breusch-Godfrey	No serial correlation	0.991 (0.387)
Heteroskedasticity test: Breusch-Pagan-Godfrey	Homoskedasticity	0.881 (0.582)
Ramsey RESET test: Functional form	Stable model	1.313 (0.263)

Source: analysis by the author.

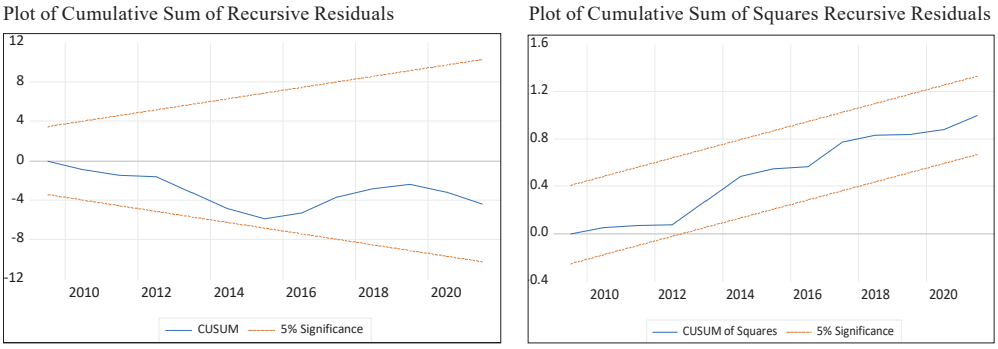


Figure 3. Stability test: CUSUM and CUSUMQ

Source: analysis by the author.

Conclusions and policy recommendations

This study investigated the policy mix (monetary or fiscal policy) and inflation dynamics interactions in Ghana, using annual data from 1980 to 2021, with adopting the autoregressive distributed lag. The objective of the study was to examine which of the policy mix is effective in determining the inflation dynamics in Ghana. This study departs from prior studies that examined the determinants of inflation or compared the structural and monetary factors in the inflation dynamic. This study also examined how inflation will respond separately to changes in monetary and fiscal policy instruments, before observing the joint effects of these policy instruments on inflation rate.

The results showed the significance and effectiveness of the fiscal policy variable, government spending, over the monetary policy instrument in the long run, while the monetary policy instrument was effective and statistically significant in the short run. Furthermore, the study captured the effect of the period of the adoption of an inflation targeting regime, using a dummy variable. The results further confirmed that the inflation targeting variable did not appear to affect the inflation rate statistically or significantly over the period observed, both in the short and the long run. Although, there was a decline in the level of the inflation rate in Ghana since the adoption of inflation targeting, this cannot be attributed to the use of monetary instruments. Meanwhile, fiscal policy was found to be highly economically and statistically significant in the long run, thus confirming the case of government spending being inflationary. Hence, for the economy to effectively battle inflation, it should use the monetary policy instrument to achieve a low inflation rate in the short run and work on the fiscal policy variables, through government spending, for long run price stability.

In conclusion, importantly monetary authorities should strongly consider a more focused coordination and application of fiscal and monetary policies, as a macroeconomic policy tool. This brings to light the fact that the adoption of inflation targeting is not working for Ghana. Thus, the stance of the monetarist school of thought that to successfully control the inflation rate and achieve effective price stability, the appropriate policy mix should be chosen, while monetary authorities carry on with the transparency practice. This will thus assure consumers and businesses alike of their sovereignty in conducting efficient and effective monetary policy in Ghana, since monetary policy is effective in the short run.

Although, the monetary policy contribution to the inflation rate is insignificant and ineffective in the long run while fiscal policy is highly effective and significant, it is advisable that fiscal authorities manage their spending, so that it does not have damaging effects on inflation and, consequently, on the economy. Given the high contribution of real GDP to the inflation dynamics, policies such as the economic recovery programme that will improve economic growth, should continually be amended.

An area of further research could be to observe other monetary policy instruments and deviate from the traditional linear relationship between inflation and its determinants, to obtain the maximum level of monetary policy instruments beyond which it helps curb inflation in Ghana. As it is, the increased interest rate is not assisting in lowering the inflation rate to single-digit levels. Other continued studies could investigate the effects of additional external shocks on the inflation dynamics in Ghana as well as the development of effective monetary policy models that will reduce the inflationary shocks.

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