"Determinants of behavior of inflation rate in Nigeria"

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**BUSINESS PERSPECTIVES**

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# DETERMINANTS OF BEHAVIOR OF INFLATION RATE IN NIGERIA

## Abstract

Inflation is an important macroeconomic issue that has continued to dominate discussions at major economic fora over time. Governments all over the world are concerned about its rising trend because of its pervasive effect on economic performance. One intriguing fact about inflation is that it is both the cause and effect of certain policy actions of government. Several studies have been conducted on the effect of inflation on economic activities in developing and developed nations, but studies on its cause, particularly in developing nations, are scant. This paper aims at identifying major factors that cause inflation in Nigeria. Based on the autoregressive distributed lag (ARDL) estimation method, the study shows empirical support for significant impact of external debt, exchange rate, fiscal deficits, money supply and economic growth on inflation. It further shows previous period or lagged inflation rate as a significant determinant of current inflation rate. However, the study produced no evidence of significant long-run impact of interest rate on the rate of inflation in Nigeria. The study recommends economic reforms that target foreign exchange inflow through increased export trade, as well as a paradigm shift away from deficit budgeting. There is also a need for infrastructural and institutional reforms to eliminate or, at least, minimize the impact of structural inequity on output prices.

## INTRODUCTION

Though a frequently used term among discussants on issues of macroeconomic importance, the nature and causes of inflation remain largely debatable. However, there appears a near convergence of opinion among economists that inflation refers to sustained increase in general price level. By implication, this expression indicates that inflation does not refer to a one-off increase in price but to a continuous one. It also indicates that for a price increase to qualify as inflationary, it should not be an isolated case or an increase in a single item or selected items but must operate at the aggregate level, cutting across sectors of the economy.

A major implication of an inflationary condition is the erosion of purchasing power of the national currency and subsequently a reduction in the economic well-being of citizens, particularly those on fixed income. It lowers the quality of life through its impact on the purchasing power of economic agents, perpetuates poverty and impedes economic growth. Inflation also makes budgetary process and planning a difficult activity for economic agents. It impedes the capacity of an economy to produce, especially if businesses are constrained to divert resources to other uses, thereby hampering investment and impeding the process of growth (Orubu, 2009).

There have been divergent opinions on the cause(s) of inflation in an economy, but the divergence becomes even more pronounced when the comparison is between developed and developing economies. For instance, while monetary growth is often acknowledged as a major influencer of inflation in developed nations, inflation is not strictly considered as the result of increase in monetary aggregates in developing economies (Totonchi, 2011). It is imperative to note that full employment of resources is characteristic of developed economies and at this economic condition, increase in output is either zero or near zero, implying that growth in money supply translates to a rise in the price of available output as the increased money supply merely confers enhanced purchasing power on citizens. On the other hand, in developing economies, owing to massive under or unemployment of resources, an increase in money supply partly adds to prices and partly raises the level of output as more resources get engaged in production. These economies are also characterized by structural imbalances, which contribute partly to price increases, thereby fueling inflationary pressure.

Over the years, several scholars have examined the impact of inflation on various segments of the economy both in developing and developed nations. Such studies include Modebe and Ezeaku (2016), Okoye, Modebe, Erin, and Evbuomwan (2017), Olokoyo, Osabuohien, and Salami (2009), Adeleye, Osabuohien, Bowale, Matthew, and Oduntan (2017). However, studies on its cause, particularly in developing nations, are rather scant. To contribute to the body of literature in this area, this paper sets out to identify major causes of inflation in Nigeria using the econometric technique of autoregressive distributed lag (ARDL).

## 1. THEORETICAL ISSUES

Opinions are divided on the real cause(s) of inflation even among economists. While some view inflation as driven by monetary factors, others argue that inflation is production-driven. For instance, the classical theorists contend that inflation is the result of excessive growth in money supply. They argue that aggregate price level is affected by changes in monetary demand and supply conditions. Hence, movements in monetary conditions lead to changes in general price level. The classical theory, perhaps, enjoys more empirical support than any other economic theory aside from the basic law of demand and supply (Ireland, 2014).

Monetary economists, on the other hand, tried to establish a correlation between inflation, money supply and output. It was Milton Friedman, a modern quantity theorist, who argued that inflation is always associated with monetary factors. He argued that inflation is often the result of a more rapid expansion in money supply over an increase in output. To the monetarists, 'only money matters', thus they consider monetary policy a more potent instrument of economic stabilization than fiscal policy. Advocates of monetary policy contend that price level is always a direct result of movements in monetary aggregates. They however-er argue that money supply does not affect output level in the short-run, because resources are fully employed.

Another dimension to the argument was forward by the Keynesian economists who argue that inflation is driven by demand factors rather than money supply. They contend that inflation is the result of excess of aggregate demand (consumption + investment + government spending) over aggregate supply when production facilities are fully utilized. The wider the gap between them, the more severe is the impact of inflation. At full employment level, the production capacity of the economy is at its maximum, thus consumer demand for products precedes supply, thereby heralding the incipience of inflation.

Advocates of Keynesian theory contend that firms raise wages to motivate their workers to higher productivity. They also raise prices to compensate for the increased wage bill in order not to compromize the firms' profit policy. Keynesian economists argue that the resultant increase in wages and prices places a demand on the monetary authorities to increase the level of currency in circulation to support the new level of productivity. Thus, money supply is merely raised in response to higher price level engendered by increased wage bill and the sustenance of corporate profit.

Hence, while classical economists consider changing money supply as a causal factor in inflation, Keynesian economists view inflation as the driver of changing money supply.

Another important theory put forward by two renowned economists, Myrdal and Straiten, explained inflation with developing economies in focus. They argue that existence of structural imbalance in economic, political and social systems accounts for disproportionate response of output to increase in investment spending and money supply. They further contend that savings in these economies are often inadequate to finance planned level of investment, thereby prompting the use of deficit finance. The economists identify low agricultural output, resource, foreign exchange, and infrastructural constraints as major obstacles to output response to rising demand following an increase in money supply. They contend that low agricultural output, budget constraint, scarcity of foreign exchange, and infrastructural challenges are major obstacles to output growth in developing economies and that in the light of these challenges, an increase in money supply produces a less proportionate increase in output, thereby pushing up the price level. The proponents therefore posit that aggregate demand-supply inflation model cannot appropriately explain inflation in developing economies.

## 2. LITERATURE REVIEW

Several scholars have over time conducted researches aimed at identifying causes of inflation to be able to recommend policy frameworks that will aid relevant institutions, like the monetary (the central bank) and the fiscal (the government) authorities in controlling inflation so that it does not become an impediment to growth and development process. The works of some of these scholars are reviewed in this section.

Moser (1995) investigated major drivers of inflation in Nigeria. The study which assumed money market equilibrium conditions was based on the estimation technique of error correction mechanism. The result shows that inflation in Nigeria is largely explained by expansionary monetary policies driven by expansionary fiscal policies. It fur-

ther shows that currency depreciation or devaluation and agro-climatic conditions are equally important factors. The results confirm that inflationary condition in Nigeria is largely the result of expansionary fiscal policies, which drive the expansion of monetary variables.

In another Nigerian study, Iya and Aminu (2014) analyzed the causes of inflation using the econometric technique of the ordinary least squares. The regression result shows government spending, interest rate, money supply and exchange rate as important determinants. It further shows that while interest rate and money supply positively affect inflation, the effect of government spending and exchange rate on inflation is negative.

Mohamadu and Philip (2003) investigated the link among inflation, exchange rate and increase in money supply in the Ghanaian economy. The study adopted the error correction mechanism. Evidence from the study supports a positive association between inflation and money supply. Oyejide (1972) studied the relationship between debt financing, capital formation and inflation rate. Following from the outcome of the study, the author concludes that rate of growth of price inflation may be reduced through less emphasis on deficit financing, an indication that financing of fiscal deficits fuels inflationary pressure.

Hossain and Islam (2013) used the technique of ordinary least squares to determine the causes of inflation in Bangladesh. The result shows that lagged interest rate (one lag) and money supply significantly affect the trend of inflation rate. The study by Lim and Papi (1997) analyzed causes inflation in Turkey. The study adopted the framework of a multi-sector macroeconomic model and covered the period 1970–1995. The result indicates that monetary factors like exchange rate and money supply play significant roles in Turkish inflation. It also shows evidence that inertial factors are important quantitative determinants.

Alexander, Andow, and Danpone (2015) investigated the predictors of inflation in Nigeria using the vector autoregression (VAR) technique. Data for the period 1986–2011 were analyzed in the study. The study shows that fiscal deficits, exchange rate, domestic imports, money supply, interest rate, and

agricultural production are significant predictors of inflation in Nigeria. It also shows that inflation rate in the previous year influences inflation rate in later years. An earlier study by Bakare (2011), which also investigated causes of inflation in Nigeria, presents further evidence that money supply fuels inflationary pressure in Nigeria.

Okoye, Evbuomwan, Modebe, and Ezeji (2016) examined the link between macroeconomic performance and government fiscal deficits in Nigeria using annual data over the period 1981–2014. Granger causality and vector error correction estimation techniques were used in analyzing the data. The Granger causality estimate shows evidence of causal impact of fiscal deficits on inflation. The result indicates that as government raises the level of deficit spending, the rate of inflation increases. It validates the finding of earlier studies like Oyejide (1972), Alexander, Andow, and Danpone (2015), Khandan and Husseini (2016), etc.

The study on capital market development and economic growth in Nigeria conducted by Okoye, Modebe, Taiwo, and Okorie (2016) adopted the estimation technique of Granger causality to determine the nexus between inflation and growth. The Granger causality estimate shows uni-directional causation from GDP growth rate to inflation. The result indicates that GDP growth affects inflation. The result of this study further confirms the finding in Odusola and Akinlo (2001), Laryea and Sumaila (2001), Leheyda (2005), etc.

Inimole and Enoma (2011) used the autoregressive distributed lag (ARDL) to study how inflation is affected by exchange rate depreciation in the Nigerian economy. The study identified money supply, depreciation of exchange rate, and real output as significant drivers of inflation in the country. An earlier study by Fakiyesi (1996) based on the estimation technique of ARDL also showed that monetary growth, exchange rate depreciation, real GDP growth, rainfall, and level of anticipated inflation significantly affect inflation in Nigeria.

The study by Odusola and Akinlo (2001) also produced evidence that output growth and exchange rate, to a significant extent, influence price level in Nigeria. The study used the estimation technique of vector auto-regression (VAR) and presents fur-

ther empirical support for significant influence of exchange rate on inflation. El-Sakka and Ghali (2005) used augmented VAR technique to identify causes of inflation in Egypt. The result indicates that structural reforms that target productivity improvements, reduction of budget deficit and reduced public debt obligations are critical for inflation control.

Metwally and Al-Sowaidi (2004) also conducted a study on inflation in Egypt. The study which covered the period 1986–2002 focused on identifying the nature and causes of inflation. Model estimation was based on the simultaneous equation method. It shows that demand and cost factors are major determinants of inflation. Leheyda (2005) used the error correction method to examine the causes of inflation in Ukraine. The study identified exchange rate, wages, money supply and GDP growth as short-run determinants. It also showed that influences from purchasing power parity, money demand and profit margin affect price level over the long run.

Khandan and Husseini (2016) used a system of simultaneous equations, incorporating several variables based on extant theories of inflation, to identify core drivers of inflation in Iran. The result of the study shows money supply as a key causal component of inflation. The study further reveals that financing of budget deficits through increased money supply indirectly raises the general price level.

Oppong, Abruquah, Agyeiwaa, Owusu, Quaye, and Ashalley (2015) conducted a study on inflation in Ghana. The study was based on monthly data covering a period of 18 months (January 2000 to December 2014). The result indicates that price of crude oil, exchange rate, and electioneering spill-over quaternary effects (for each post-election year covered by the study, only first quarter was considered for this variable) are core influencers of inflation in Ghana.

The study by Loungani and Swagel (2001) focused on exchange rate policy and inflation in developing economies. Using annual data for fifty-three (53) developing nations over the period 1964–1998, the study shows that increase in monetary aggregates and exchange rate changes are major infla-

tion determinants in nations with variable exchange rate policy, while for those that adopt fixed exchange rate policy, inertial factors dominate the inflation process.

Laryea and Sumaila (2001) adopted various econometric techniques to identify factors that cause inflation in Tanzania. The study adopted quarterly data for 1992Q1-1998Q4. Evidence from the study indicates that in the short term, output and monetary policy affect inflation, while parallel exchange rate, output and monetary factors dominantly contribute to long-run inflation trend in Tanzania.

Another Tanzanian study by Mbongo, Mutasa and Msigwa (2014) investigated how money supply affects inflation using the techniques of ordinary least squares, vector auto-regression and vector error correction mechanism. Result of the ordinary least squares and vector error correction mechanism tests show that inflation is significantly caused by exchange rate and money supply.

However, Ayubu (2013) studied the interaction between monetary policy dynamics and inflation in Tanzania. The study specifically examined the extent to which money supply, output, international oil price and exchange rate movements explain inflation trend in Tanzania. Econometric techniques of the impulse response function based on structural vector auto-regression, as well as vector error correction mechanism were used in analyzing quarterly data from 1993 to 2011. The result of the study suggests that inflation responds more to output than monetary factors in Tanzania.

In analyzing the nexus between unemployment and money wage rate changes in the UK, Phillips (1958) showed that inflation and unemployment are negatively related, an indication that economic policies aimed at maintaining low rate of inflation produces an increase in unemployment rate. This result has however been criticized as unsustainable, particularly in the long run. However, Nitzan (1990) contends that the negative association between inflation and unemployment should not be ignored. Thus, though Phillips' study has been attacked by macroeconomists, the importance of the study is so fundamental that the criticisms rather than nullify it only seek to modify it.

An important observation from the above review is that several factors play significant roles in the inflationary process across the globe and this has obvious implications for macroeconomic management. For instance, a policy that targets reduction of inflation rate through adoption of a contractionary monetary policy leads to a reduction in economic activity and thereby raises the level of unemployment. Similarly, an import-dependent country like Nigeria wishing to reduce inflation through arbitrary fixation of exchange rate in favor of the domestic currency may achieve the goal of procuring cheap imports, but at the expense of the patronage of foreign trade partners for locally produced goods due high export costs. In other words, control of inflation requires a trade-off to achieve macroeconomic stability.

# 3. SCOPE AND METHODOLOGY

The study was designed to identify major influencers of inflation in Nigeria. It covered the period 1981–2016. Different issues of the Statistical Bulletin (publication of the Central Bank of Nigeria) provided data for this research. The study adopted the ex-post facto research design, because it offers considerable degree of convenience in the use of historical data to explain economic phenomena. Being an event study, the methodology developed by Campbell and Mackinlay (1977) was adopted. The regression estimates were obtained using the econometric technique of the autoregressive distributed lag (ARDL), since the variables are integrated of order 0 and 1. To enhance the robustness of the result, the series was tested for unit root, normality, serial correlation, heteroskedasticity and stability. Estimations were based on 5 per cent significance level.

## 3.1. Model specification

The model adopted in this study is an extension of that used by Hussain and Islam (2013) to investigate factors that cause inflation in Bangladesh. The model in Hussain and Islam (2013) is presented below:

$$INF = \beta_0 + \beta_1 IR + \beta_2 M2 + $$
$$+ \beta_3 NER + \beta_4 FD + \varepsilon_{it}, \tag{1}$$

where $INF$ – inflation rate, $IR$ – interest rate, $NER$ – nominal exchange rate, $FD$ – fiscal deficits, $\beta_0, ..., \beta_4$ – parameters to be estimated, $\varepsilon_{it}$ – stochastic variable or error term.

The above model was extended by introducing output growth rate ($GDPR$) and external debt ($EXD$). The extended model is presented below:

$$INF = f\left(EXD, EXR, GDPR, IR, FD, M2\right). \quad (2)$$

This economic relationship is explicitly presented as:

$$INF = \beta_0 + \beta_1 EXD + \beta_2 EXR + \beta_3 GDPR + \\ +\beta_4 IR + \beta_5 FD + \beta_6 M2 + \varepsilon_{it}, \quad (3)$$

where $INF$ – inflation rate, $EXD$ – external debt, measured as ratio of external debt to GDP, $EXR$ – nominal exchange rate, $GDPR$ – GDP growth rate, $IR$ – interest rate, $FD$ – fiscal deficits, $M2$ – broad money supply, $\beta_0, ..., \beta_6$ – parameters to be estimated, $\varepsilon_{it}$ – stochastic variable or error term.

## 3.2. Theoretical justification for the model

The structural theory of inflation provides a theoretical link between the dependent variable (inflation) and external debt, fiscal deficits and money supply. According to the theory, existence of structural imbalance in the economic, social and political systems in a developing economy creates a mis-match between output and money supply. Developing economies are characterized by underemployment of resources (idle capacity), which according to classical theory ($MV = PQ$) are exploited when money supply ($M$) is increased to bring the model to equality. However, owing to structural defects, rate of output ($Q$) growth in developing economies does not match rate of monetary growth, leading to inflation. In line with the structural theory of inflation, external debt acquisition ($EXD$), financing of fiscal deficits ($FD$) and broad money supply ($M2$) correlate positively with inflation ($INF$) owing to less proportionate response of output. This implies that the rate of inflation is increased when these variables increase.

The link between exchange rate and inflation rate is also explained by the structuralists who argue that non-competitiveness of developing countries' exports creates foreign exchange constraints, which impair their capacity to import essential production inputs, leading to sluggish output growth. They further argue that even when these economies adopt currency devaluation to enhance foreign exchange inflow through increased export, the prices of imported inputs rise simultaneously, thereby fueling inflationary pressure. Note that developing economies export primary products and import industrial, processed and semi-processed products.

The nexus between economic growth and inflation, according to Svirgir and Milos (2017), is complex and could be positive, negative, or even neutral. However, following the work of Phillips (1958), a negative association is established between inflation rate and unemployment rate, an indication that economic policies aimed at reducing unemployment raise the rate of inflation. Increased employment therefore leads to output growth.

Like exchange rate, interest rate is a price variable. High interest rates on loans raise the cost of production, which manifests as high prices of output, leading to cost-push inflation.

# 4. DISCUSSION OF RESULTS

The results of the unit root and autoregressive distributed lag (ARDL) tests, as well as diagnostic tests (presented in Appendix), are discussed below.

## 4.1. Unit root test

Since the study was based on time series data, the ADF unit root test was conducted to determine the statistical properties of the data. The result presented in Table 1 (see Appendix) shows that only fiscal deficits ($FD$) was stationary at level. However, when the non-stationary variables ($IFR$, $EXD$, $EXR$, $IR$, $M2$ and $GDPR$) were differenced, they show stationary trend at first difference. At first difference, therefore, the null hypothesis of existence of unit root was rejected for all the variables.

## 4.2. Autoregressive distributed lag (ARDL) test

Following evidence that the variables exhibit different order of integration, the autoregressive

distributed lag (ARDL) method was adopted in estimating the parameters of the model. The model estimates the long-run impact of the explanatory variables on inflation rate. The result of the test (shown in Table 2 (see Appendix)) indicates significant positive effect of the level of inflation in the previous year or period (lag 1) on inflation rate in the current period. The result also shows that increase in fiscal deficits (*FD*) has a significant direct effect on inflation rate. For exchange rate (*EXR*), the result shows strong negative effect on inflation rate in the first lagged period, but in the second lag, the impact became significantly positive. With regard to money supply (*M*2), the study produced evidence that an increase in money supply significantly raised the inflation rate in lag 1 and lag 2 periods. However, in the third lag, the impact was strongly negative. Evidence of strong positive impact of fiscal deficits, exchange rate and money supply on inflation rate presented in this study lends support to the findings of earlier studies. For instance, the finding that inflation is significantly driven by fiscal deficits is consistent with Oyejide (1972), Alexander et al. (2015), Okoye et al. (2016a), Khandan and Husseini (2016).

On a similar note, evidence that inflation responds significantly and positively to exchange rate confirms the result of studies by Moser (1995), Lim and Papi (1997), Alexander et al. (2015), Inimole and Enoma (2011), Fakiyesi (1996), Odusola and Akinlo (2001), Leheyda (2005), Oppong et al. (2015). These studies lend support for the cost-push theory of inflation, which maintains that inflation derives from high cost of production.

Also, the significant positive impact of money supply presented in the study aligns with the outcome of several studies reviewed in this work (see for example studies by Iya & Aminu, 2014; Mohamadu & Philip, 2003; Alexander et al., 2015; Bakare, 2011; Inimole & Enoma, 2011; Leheyda, 2005; Khandan & Husseini, 2016). These studies also support the classical theory of inflation, which posits that increased money supply fuels inflationary pressure.

Further findings from the study indicate that economic growth is negatively linked to inflation rate, an indication that as more output is produced, demand pressure reduces thereby lowering price.

Finally, the result of the study indicates that within the scope of our study, interest rate has no significant long-run impact on inflation rate.

The respective $R^2$ and adjusted $R^2$ values of 97.75 per cent and 92.42 per cent indicate that the independent variables strongly explain the phenomenon under investigation. The *F*-statistic shows a high level of goodness of fit for the estimated model, while the Durbin-Watson (D-W) statistic (1.9137) shows no serial autocorrelation in the model.

## 4.3. Bounds test

Evidence of long-run or co-integrating relationship between inflation rate and the explanatory variables was established in the study using the *F*-bounds test. From the result (presented in Table 3 (see Appendix)), the *T*-statistic value of 10.31, which is greater than the lower (2.88) and upper (3.99) bound values at 1 per cent level of significance implies stability of the model over the long run.

## 4.4. Error correction model (ECM)

The error correction model (ECM) shows the short-run impact of the explanatory variables on inflation rate, as well as the speed at which the model adjusts to equilibrium after a shock. The ECM result (see Table 4 in Appendix) indicates that 58.75 per cent of disequilibrium arising from previous period's shock reverts to long-run equilibrium in the current period.

With regard to the short-run impact of the explanatory variables, the result shows significant impact of all the variables on inflation rate, either in their differenced lag or current values.

## 4.5. Diagnostic tests

Diagnostic tests conducted include Breusch-Godfrey serial correlation test (Table 5 (see Appendix)), Breusch-Pagan-Godfrey heteroskedasticity test (Table 6 (see Appendix)), Jarque-Bera test for normality (Figure 1 (see Appendix)), as well as Cumulative sum (CUSUM) and Cumulative sum (CUSUM) of squares for stability (Figures 2 and 3 (see Appendix)).

The results presented in Tables 5 and 6 (see Appendix) indicate acceptance of the null hypothesis of no serial correlation and heteroskedasticity (non-constant variance), because the Prob. (*F*-statistic) and Prob. (Chi2) > 0.05. Also, non-acceptance of Jarque-Bera statistic ($P > 0.05$) implies acceptance of the null hypothesis of normal distribution for our series. Finally, since the series lie between the lower and upper bounds (Figures 2 and 3 (see Appendix)), the assumption of structural stability is met. The upper and lower bounds are represented by the broken lines in the respective figures.

## SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

The study shows empirical support for significant impact of external debt, exchange rate, fiscal deficits, money supply and economic growth on inflation. The result further indicates that while current fiscal deficits and GDP growth rate strongly affect current inflation rate, it is rather lagged values of external debt, exchange rate, and money supply that show significant influence on current inflation rate. It was also observed that previous period's or lagged inflation rate is a significant determinant of current period's inflation rate. However, the study produced no evidence of significant long-run impact of interest rate on rate of inflation in Nigeria.

Following from the above result, the study concludes that inflation is significantly driven by external borrowings, exchange rate, fiscal deficit, money supply and output growth. It is therefore recommended that (i) government should aim at achieving low exchange rate regime (possibly exchange rate appreciation) in order to lower the cost of domestic production, (ii) there should be paradigm shift from deficit financing of government budgetary operations to maintenance of, at least, balanced budgets, (iii) the monetary authorities should put in place strict regulatory controls over expansion of monetary aggregates so as to ensure productive deployment of financial resources.

## ACKNOWLEDGMENT

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# APPENDIX

**Table 1.** Unit root test using the ADF test statistics

| Variables | ADF test stat* level | Critical value** 5% | ADF test stat* 1ˢᵗ diff. | Critical value* 5% | Order of integration |
|---|---|---|---|---|---|
| IFR | −2.939813 | −2.948404 | −5.941402 | −2.951125 | I(1) |
| EXD | −1.423367 | −2.948404 | −4.390913 | −2.951125 | I(1) |
| EXR | −1.357722 | −2.954021 | −3.197646 | −2.960411 | I(1) |
| FD | −3.200487 | −2.948404 | −7.206587 | −2.951125 | I(0) |
| IR | −2.926116 | −2.948404 | −6.600553 | −2.954021 | I(1) |
| M2 | −0.605802 | −2.948404 | −5.258884 | −2.951125 | I(1) |
| GDPR | −2.821629 | −2.954021 | −7.206587 | −2.960411 | I(1) |

*Note:* * Critical value at 1 per cent, ** critical value at 5 per cent.

**Table 2.** ARDL results

Dependent variable: inflation
Method: ARDL
Selected model: ARDL(1, 0, 2, 3, 3, 3, 1)

| Variable | Coefficient | Std. error | t-statistic | Prob.* |
|---|---|---|---|---|
| IFR(−1) | 0.412456 | 0.169727 | 2.430112 | 0.0412 |
| FD | 6.217555 | 1.288045 | 4.827125 | 0.0013 |
| EXD | 0.269471 | 0.261205 | 1.031648 | 0.3324 |
| EXD(−1) | −0.137321 | 0.302990 | −0.453221 | 0.6624 |
| EXD(−2) | 0.684431 | 0.222671 | 3.073735 | 0.0153 |
| EXR | −0.055041 | 0.110047 | −0.500159 | 0.6304 |
| EXR(−1) | −0.519823 | 0.213699 | −2.432504 | 0.0410 |
| EXR(−2) | 0.466570 | 0.192873 | 2.419048 | 0.0419 |
| EXR(−3) | 0.160229 | 0.116104 | 1.380039 | 0.2049 |
| M2 | −2.296617 | 1.059375 | −2.167897 | 0.0620 |
| M2(−1) | 4.653023 | 1.622707 | 2.867444 | 0.0209 |
| M2(−2) | 4.571907 | 1.318322 | 3.467975 | 0.0085 |
| M2(−3) | −5.739274 | 0.967373 | −5.932847 | 0.0003 |
| IR | 0.656212 | 0.754398 | 0.869848 | 0.4097 |
| IR(−1) | 0.384055 | 0.581958 | 0.659936 | 0.5278 |
| IR(−2) | −0.260063 | 0.775343 | −0.335416 | 0.7459 |
| IR(−3) | −0.958035 | 0.535198 | −1.790057 | 0.1112 |
| GDPR | −2.853489 | 0.707678 | −4.032185 | 0.0038 |
| GDPR(−1) | −1.121993 | 0.748637 | −1.498715 | 0.1723 |
| C | 9.928751 | 17.52833 | 0.566440 | 0.5866 |
| R-squared | 0.977529 | F-statistic | 18.31657 | 0.000131 |
| Adjusted R-squared | 0.92416 | Durbin-Watson | 1.913705 | − |

**Table 3.** Bound testing result

| F-bounds test | | Null hypothesis: no levels relationship | | |
|---|---|---|---|---|
| Test statistic | Value | Significance | I(0) Asymptotic: n = 1000 | I(1) |
| F-statistic | 10.30645 | 10% | 1.99 | 2.94 |
| K | 6 | 5% | 2.27 | 3.28 |
| | | 2.5% | 2.55 | 3.61 |
| | | 1% | 2.88 | 3.99 |

**Table 4.** ARDL error correction regression

Dependent variable: D(INF)
Selected Model: ARDL(1, 0, 2, 3, 3, 3, 1)

| Variable | Coefficient | Std. error | t-statistic | Prob. |
|---|---|---|---|---|
| D(EXD) | 0.269471 | 0.110181 | 2.445706 | 0.0402 |
| D(EXD(–1)) | –0.684431 | 0.119335 | –5.735382 | 0.0004 |
| D(EXR) | –0.055041 | 0.057740 | –0.953267 | 0.3684 |
| D(EXR(–1)) | –0.626798 | 0.076145 | –8.231687 | 0.0000 |
| D(EXR(–2)) | –0.160229 | 0.067329 | –2.379779 | 0.0446 |
| D(M2) | –2.296617 | 0.602391 | –3.812499 | 0.0051 |
| D(M2(–1)) | 1.167366 | 0.654643 | 1.783211 | 0.1124 |
| D(M2(–2)) | 5.739274 | 0.550939 | 10.41726 | 0.0000 |
| D(IR) | 0.656212 | 0.243486 | 2.695072 | 0.0273 |
| D(IR(–1)) | 1.218098 | 0.268179 | 4.542112 | 0.0019 |
| D(IR(–2)) | 0.958035 | 0.232079 | 4.128065 | 0.0033 |
| D(GDPR) | –2.853489 | 0.328472 | –8.687161 | 0.0000 |
| Coint Eq(–1)* | –0.587544 | 0.047254 | –12.43369 | 0.0000 |
| R-squared | 0.966298 | | | |
| Adjusted R-squared | 0.939337 | | | |
| Durbin-watson stat | 1.913705 | | | |

**Table 5.** Breusch-Godfrey serial correlation LM test
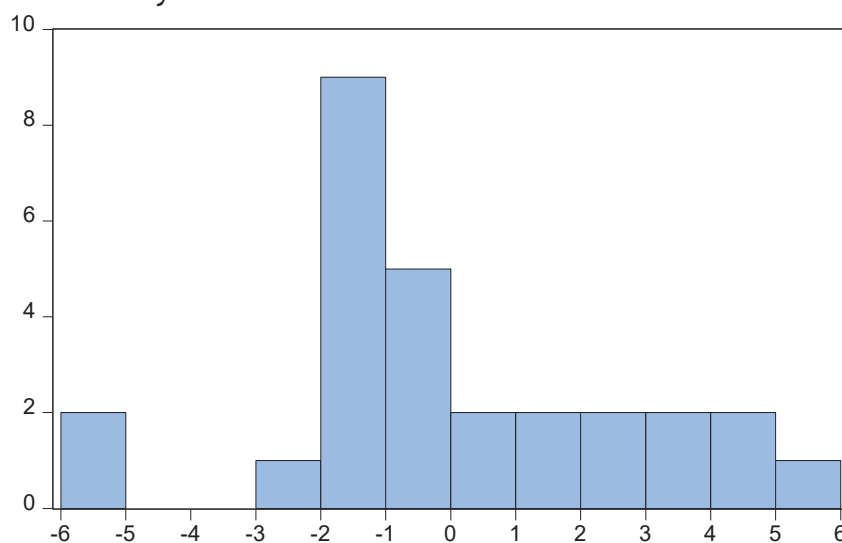
| | | | |
|---|---|---|---|
| F-statistic | 0.008673 | Prob. F(1,7) | 0.9284 |
| Obs*R-squared | 0.034650 | Prob. Chi-Square(1) | 0.8523 |

**Table 6.** Heteroskedasticity test: Breusch-Pagan-Godfrey

| | | | |
|---|---|---|---|
| F-statistic | 1.293190 | Prob. F(19,8) | 0.3694 |
| Obs*R-squared | 21.12263 | Prob. Chi-Square(19) | 0.3301 |
| Scaled explained SS | 1.584657 | Prob. Chi-Square(19) | 1.0000 |



*Normality test*

| | |
|---|---|
| Series: Residuals | |
| Sample 1989 2016 | |
| Observations 28 | |
| Mean | -2.99e-14 |
| Median | -0.411081 |
| Maximum | 5.700792 |
| Minimum | -5.858967 |
| Std. Dev. | 2.756841 |
| Skewness | 0.115061 |
| Kurtosis | 2.838033 |
| Jarque-Bera | 0.092387 |
| Probability | 0.954857e |

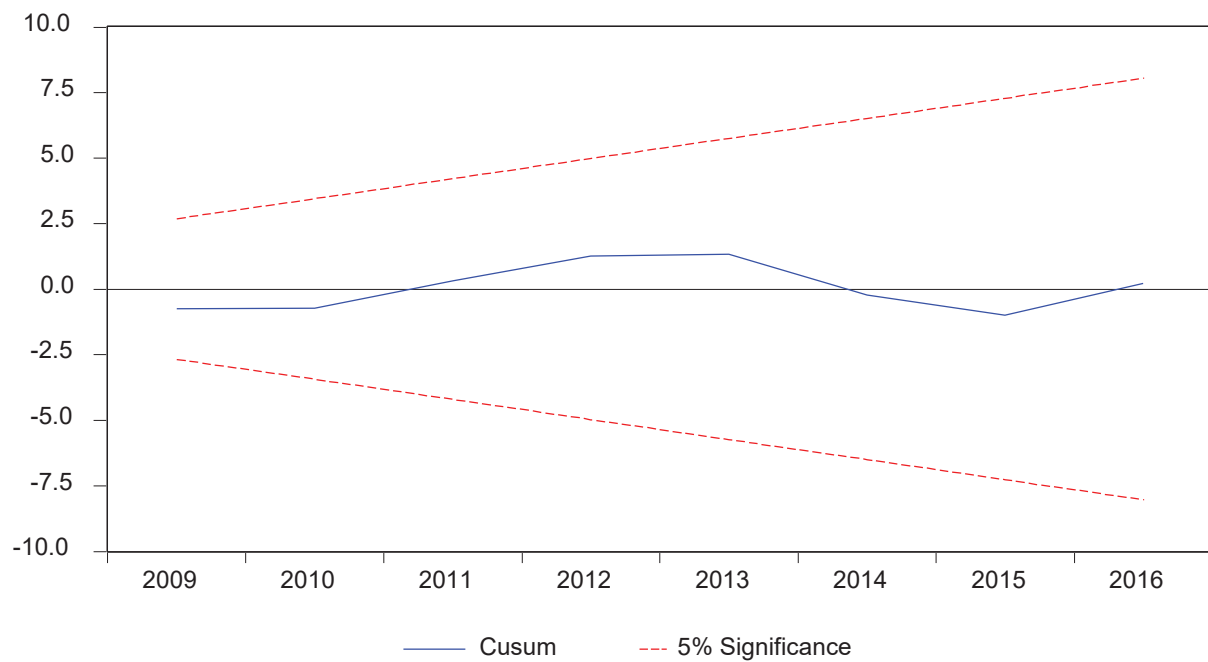**Figure 1.** Jarque-Bera normality test

## *Stability tests*



**Figure 2.** Cumulative sum of residuals: the broken lines represent the critical bounds
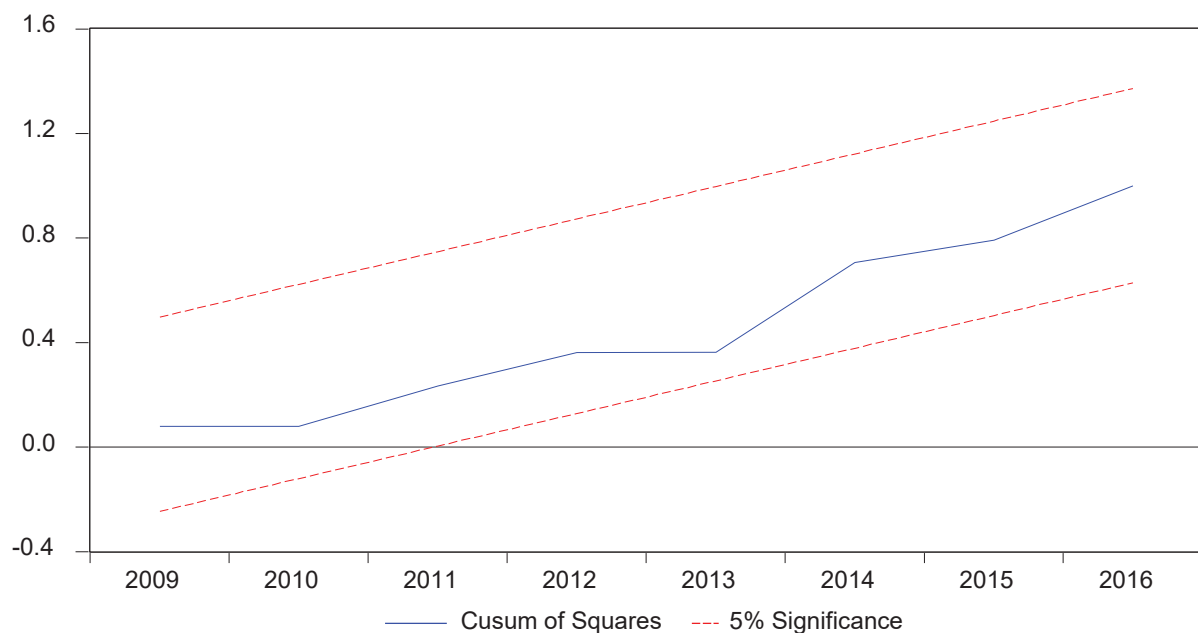at 5% level of significance



**Figure 3.** Cumulative sum of residual squared: the broken lines represent
the critical bounds at 5% level of significance