Public debt and inflation: empirical evidence from Ghana

Akingbade U. Aimola and Nicholas M. Odhiambo

Department of Economics, University of South Africa, Pretoria, South Africa

ABSTRACT

This paper investigates the impact of public debt on inflation in Ghana using annual data during the period 1983–2018. The study uses the Autoregressive Distributed Lag (ARDL) bounds testing approach to cointegration and an error correction model to examine this linkage. The cointegrating regression results reveal evidence of a stable long-run relationship between inflation and the explanatory variables in the presence of a structural break. The findings also show a positive and significant impact of public debt on inflation. These results were found to hold, irrespective of whether the regression was conducted in the short run or in the long run. The study confirms the presence of the inflationary effects of public debt in Ghana. The government should, therefore, be prudent when considering increases in public debt to minimize volatility in inflation and its associated risks to the economy.

1. Introduction

The control of inflation dynamics is vital to the monetary and fiscal policy objective. Given the significant role that public debt plays in fiscal deficit financing, the relationship between public debt and inflation has emerged as a topical issue in recent decades. Policymakers have started wondering whether the changing levels of public debt have an influence on inflation. Some central banks have adopted inflation-targeting policy largely on the basis that inflation is generally a monetarist’s phenomenon. However, some recent studies have found that this assumption is obsolete or unfounded. According to Sims (2013, 2014, 2016), persistent and growing fiscal deficit finance through government borrowings will eventually produce inflationary pressures, regardless of the policies followed by the Central Bank. Hence, debt-financed deficits will require effective coordination with the monetary authority to avoid high and unstable inflation rates that may be harmful to macroeconomic stability. More so, according to Aimola and Odhiambo (2018), the effectiveness of monetary policy in controlling inflation critically depends on its coordination with fiscal policy, suggesting that granting Central Bank autonomy in the hope that it will insulate an economy from having to accommodate imprudent fiscal policies, may not be successful at curbing inflation. The Fiscal Theory of the Price Level (FTPL), as embedded in the non-Ricardian policy shows that fiscal authority alone can dominantly influence inflation irrespective of monetary policy.

Available data on inflation for Ghana shows that between 1983 and 2018, the country recorded high inflation rates in excess of 25% (Bank of Ghana 2019; World Bank 2019). According to Masson, Savastano, and Sharma (1997), a country would be unable to rely on monetary policy alone to target a stable and reduced inflation rate once it experiences annual inflation rates in the range of 15–25% for several consecutive years. Hence, the relationship between public debt and inflation becomes even more important in a country such as Ghana as changes in public debt levels tend to be linked to rising fiscal deficits.

Although a number of studies have attempted to examine the relationship between public debt and inflation, very few studies have been conducted on African countries, and where studies have been done, a significant gap still exists. Not many studies have been conducted on the relationship between public debt and inflation in Ghana where public debt has played a vital role in the funding of fiscal deficits. In addition, time-series data were used in these studies, but no attempt has been made to address the issue of structural breaks given that Ghana’s economic history has registered some structural changes over time. According to Perron (1989), unaddressed breaks may invalidate statistical test inference. It is against this argument that the relationship between public debt and inflation in Ghana is...
investigated in this study. Hence, the primary aim of this study is to examine the impact of public debt on inflation in Ghana using the ARDL approach. Apart from contributing to the literature on public debt and inflation by using Ghana as a case study, to our knowledge, this might well be the first study of its kind to examine the dynamic relationship between public debt and inflation in Ghana using the ARDL approach to cointegration in the presence of structural breaks.

The rest of the paper is organized as follows: Section 2 presents trends in public debt and inflation in Ghana. Section 3 discusses the theoretical and empirical literature review. Section 4 presents the estimation technique and empirical analysis. Section 5 concludes the paper.

2. Public debt and inflation in Ghana

Ghana’s public debt stock has evolved in the last three decades. As a percentage of gross domestic product (GDP), this represents an increase from 26.88% in 1983 to 57.58% in 2018, with a minimum of 19.86% in 2006 and a maximum of 89.22% in 2000 (Bank of Ghana 2019). The ratio between 1983 and 2003, before external public debt relief in 2004, averaged 49.92% compared to a 40.84% between 2007 and 2018 after external public debt relief (Bank of Ghana 2019). These ratios are an indication that gains from debt relief that reduced this ratio to 19.86% in 2006 were short lived. Ghana, in 2004 and 2006, secured external public debt relief under the Highly Indebted Poor Countries (HIPC) initiative and the Multilateral Debt Relief Initiative (MDRI), respectively, reducing public debt to GDP ratio from 58.35% in 2003 to 45.02% in 2004 and from 37.20% in 2005 to 19.86% in 2006 (Bank of Ghana 2019). In spite of gains recorded in public debt ratios due to debt forgiveness, Ghana’s public debt stock levels have been on the increase, with contribution from both external and domestic public debt stock (Bank of Ghana 2019).

The structure of Ghana’s public debt stock can be broadly categorized into external and domestic public debt. Prior to debt relief in 2004, public debt was characterized by huge external borrowing by government in meeting its financing needs, which resulted in public debt stock that was largely dominated by external public debt stock (Fosu 2001). The composition of Ghana’s public debt stock stood at 49.78% for external public debt stock and 50.21% for domestic public debt stock as at end 2018 (Bank of Ghana 2019).

On domestic public debt stock, before the introduction of the Bank of Ghana bills in 1988 to take care of excess liquidity in the economy and to provide investment opportunities for banks, government could not borrow from the domestic market to support the budget and had to rely on the Bank of Ghana (BOG) to finance its deficit by printing money (African Forum and Network on Debt and Development (AFRODAD) 2013). This caused strong inflationary pressures in the economy and the deterioration of the financial sector (AFRODAD 2013). The introduction of the Bank of Ghana bills saw the emergence of 30-day bills to deal with the short end of the market and longer dated bills (182-day and 2-year) and the 3-year and 5-year bonds. These developments further enhanced the development of the domestic debt market with the issuance of various short-, medium- and long-term debt instruments. Thus, the need to finance fiscal deficits, the issuance of domestic debt instruments for the purposes of domestic debt management strategy and to refinance matured securities have all contributed to increase in domestic public debt stock and public debt stock in Ghana (AFRODAD 2013; Ghana Medium Term Debt Strategy (MTDS) 2016). Overall, growth in public debt stock for the study period was through fiscal excesses and the implementation of domestic public debt management strategy.

Inflation has been an issue of Ghana’s economy during the past few decades. Inflation experience during the study period in Ghana was mixed as the inflation hovered across single, double digit and even triple digit rates. Available data indicates that between 1983 and 2018 Ghana recorded several experiences of high inflation rate in excess of 25%, suggesting that it was unable to rely on monetary policy alone for a stable and reduced inflation rate (Masson, Savastano, and Sharma 1997; World Bank 2019; Bank of Ghana 2019). Inflation rate reached an all-time high of 122.8% in 1983 and an all-time low of 7.13% in 2012. Inflation rate in the 1980s averaged 48.2%; and 27.61% in the 1990s, compared to an average of 15.54% in the 2000s (World Bank 2019). For instance, in the 1980s, inflation was largely due to excessive demand pressures as a result of government’s expansionary fiscal operations (Sowa 1991). The huge fall within the same period was as a result of the implementation of the Economic Recovery Programme (ERP) that focused on reducing budget deficits and the reliance on bank financing of budget deficit (Sowa 1991). The high investment by government in the economy to stimulate economic growth showed more in the short and medium term demand increase than output increase, and thus increased inflationary pressures in the country. The high rate of inflation reflected demand pressures driven by fiscal expansion and money growth complimented by weak economic growth (Adom et al. 2015). This episode, which persisted into the 1990s, coincided with a period of expansionary fiscal deficit and money supply growth. Despite the prevalence of price controls between 1983 and 1991 for the study
period, inflation rate averaged 38.79%, compared to 19.12% between 1992 and 2018. The swing in changes continued through the 2000s, although changes within this period were relatively stable for the country with single digit rates recorded in 2011, 2012 and 2018 (World Bank 2019). Overall, major changes in inflation rate for the period under review can be attributed largely to excess domestic demand generated by expansionary fiscal and monetary policies of the government. Inflation rate stood at 9.84% as at end 2018 (World Bank 2019).

Figure 1 illustrates trends in public debt (% of GDP) and inflation rate for Ghana using annual data for the period from 1983 to 2018. A closer look at the graphical representations of public debt and inflation movements in Figure 1 do appear to suggest relationship between these variables. Trends show that peaks in public debt moved quite closely with inflation over the years.

3. Literature review

3.1. Theoretical literature

Inflation as widely known is a monetary phenomenon and its control lies within the purview of monetary authorities. According to Friedman (1968), an expansionary monetary policy will increase both real output and general price level in the short-run and only the price level will increase in the long-run. In recent times, studies have shown that inflation is not only a monetary problem but also of a fiscal concern, with fiscal variables influencing price stability. According to Sargent and Wallace (1981), Leeper (1991), and Woodford (1994, 1996, 2001) fiscal and monetary policy interaction is crucial in establishing links between public debt and inflation. Hence, the control of inflationary pressures in an economy does not depend alone on the control of money supply.

The theoretical arguments on the link between public debt and inflation are centered on the Ricardian and non-Ricardian strategy on price level determination. Oscar (2007) argues that when government policy is formulated in such a way that intertemporal budget constraint is satisfied for any price level, it is a Ricardian policy and a non-Ricardian policy when it satisfy only the equilibrium price level. Erdogdu (2002) also shows that the relationship between real value of government debt and price level can be Ricardian or non-Ricardian policy depending on the fulfillment of government budget constraint. It is Ricardian policy if government budget constraint is satisfied for all price levels with an endogenous determination of monetary and fiscal policy variables. Ricardian policies assume that the Ricardian Equivalence Theorem holds, suggesting that fiscal policy does not create any wealth effects. Ricardian equivalence according to Barro (1974, 1989) is based on monetarist view on inflation that government deficit or debt does not have significant impact on the determination of price level – implying that government bonds are not net wealth.
For the non-Ricardian policy, intertemporal government budget constraint is an equilibrium condition that is not satisfied for every price levels. Before the price level is determined, the level of surplus is set such that any threat to the solvency of budget constraint is met by market mechanism moving the price level (Erdogdu 2002). The non-Ricardian policies do not follow the Ricardian Equivalence Theorem’s assumption that fiscal policy does not create wealth effect. An increase in the value of government bonds affects the households’ lifetime budget set. Fiscal disturbances affect price level through wealth effect on private consumption demand (Woodford 1998). Under a non-Ricardian plan, price level is fundamentally a fiscal phenomenon, with monetary aggregates playing a marginal role (Oscar 2007).

The validity of the Ricardian policies has been questioned in the developing economies and for most periods in the developed economies, such that anti-inflationary policies followed by apex banks in these economies may not have been sufficient to guarantee price stability and thus requiring an appropriate mix of monetary and fiscal policies (Loyo 1999; Christiano and Fitzgerald 2000; Attiya, Umaima, and Abdul 2008). The FTPL, as embedded in the non-Ricardian policy, seems to have particular relevance for developing economies because they issue domestic currency debt and often lack the fiscal capacity to mobilize the necessary real tax revenues, giving rise to an ‘active’ fiscal authority, while the concerns for capital flows imply that monetary policy tends to be ‘passive’ (Beck-Friis and Willems 2017).

More so, because these economies are characterized by large public debt, Blanchard (2004) and Favero and Giavazzi (2004) suggest that an increase in interest rate in an economy with large public debt aimed at controlling inflation within the target range may increase the cost of debt service, debt level, default probability and country premium, which may trigger capital outflows and exchange rate depreciation that would affect inflation expectations and in the end inflation itself. Hence, according to Woodford (1995, 1998), the source of change in price level can be explain by FTPL through the positive wealth effect of government debt policy on private consumption demand or increase private spending.

Kwon, McFarlane, and Robinson (2006) argue that FTPL identifies the wealth effect of government debt as an additional channel of fiscal influence on inflation. The theory posits that increased government debt adds to household wealth and consequently to their demand for goods and services, leading to price pressures. The non-Ricardians in more recent time are of the view that under an active fiscal regime, changes in government debt will necessitate changes or fluctuations in inflation even if monetary policy is exogenous. Consequently, the determination of price level in an economy will require monetary and fiscal policy interactions (Marzieh 2015).

Expansionary fiscal policy in the Keynesian view or increased level of debt or a reduction in tax rates, according to Branson (1989), Elmendorf and Mankiw (1999) and Wickens (2008) would, in the short run, affect aggregate demand by increasing disposable income and generating positive wealth effects that may lead to price level pressures. Sargent and Wallace (1981), Leeper (1991), and Woodford (1994, 1996, 2001) in their studies have also shown that fiscal and monetary policy interaction is crucial in establishing relationship between public debt and inflation. Hence, the control of inflationary pressures in an economy does not depend alone on the control of money supply.

The FTPL shows that fiscal authority alone can dominantly influence inflation irrespective of monetary policy. According to Sims (2013, 2014, 2016) when governments want to pay off debt without increasing taxes and printing money, they pay off the old debt by issuing new debt. The effect of simply rolling over debt is not default, but inflation. Hence, persistent and growing borrowings by government would eventually produce inflation regardless of policies followed by the monetary authorities.

Finally, the relationship between public debt and inflation can either be direct or indirect according to Nastansky and Strohe (2015). It is direct when the central bank buys public bonds. On the other hand, it is indirect when the demand for public bonds is by the private sector. It may also be indirect through the banking sector’s demand for public bonds, and through inflation expectation of the economic agents owing to high levels of public debt.

In line with all of the above, we expect government debt through wealth effect to increase inflationary pressures. This hypothesis suggests that public debt management policy may have consequences on inflation. Against this theoretical background, the study will further review empirical studies on the link between public debt and inflation that have used different country dataset.

3.2. Empirical literature review

The effect of public debt on inflation has generated empirical studies with mixed results using ordinary least square (OLS) model, vector autoregressive (VAR) model, panel data model and vector error correction (VECM) model estimation techniques using data ranging from time series to cross-sectional and panel. Even though results from these studies differ depending on study countries and estimation methods, the majority
of the studies tilt more towards a positive association between public debt and inflation.

Available empirical literature surveyed for this study shows evidence supporting both positive and negative impact of public debt on inflation. Pioneering works on government debt and inflation was by Musgrave (1949) and Phelps (1973). The study by Musgrave (1949) opened up debate on the relationship between public debt and inflation. Although the study focused on the contribution of domestic public debt policy to economic stability and in particular to checking inflation, Musgrave pointed out that if, during some period, private holders of government securities endeavored to liquidate all or a major portion of their portfolios, and if fiscal authorities were the only buyers, the volume of bank credit would expand rapidly. Such an expansion would not in all probability have any direct connection with the legitimate needs of the economy and extremely powerful inflationary forces would be generated. Phelps (1973) argued on public finance approach to inflation that the central bank should be made the source of inflation for this study. The study will therefore proceed to investigate the impact of public debt on inflation in Ghana.

4. Estimation techniques and empirical analysis

4.1. Estimation techniques

The study employed the autoregressive distributed lag (ARDL) bounds testing approach by Pesaran, Shin, and Smith (2001) to examine the existence of a cointegration relationship among the variables used in this study. Our rationale for adopting this technique, among others, is the robust ability of the ARDL technique in analyzing short-run and long-run dynamic relationships in small sample sizes (Pesaran, Shin, and Smith 2001; Narayan and Smyth 2005; Odhiambo 2020a). Before estimating the cointegration relationship, a dummy variable (DUM) was introduced in the model based on Zivot-Andrews (2005) unit root test to represent a breakpoint in the series. Hence, the estimated ARDL specification is expressed as

$$\Delta \text{InINF}_t = \psi_0 + \sum_{i=1}^{n} \psi_{i1} \Delta \text{InINF}_{t-i} + \sum_{i=0}^{n} \psi_{i2} \Delta \text{InPD}_{t-i}$$
$$+ \sum_{i=0}^{n} \psi_{i3} \Delta \text{InMS}_{t-i} + \sum_{i=0}^{n} \psi_{i4} \Delta \text{InINT}_{t-i}$$
$$+ \sum_{i=0}^{n} \psi_{i5} \Delta \text{InGDPC}_{t-i} + \sum_{i=0}^{n} \psi_{i6} \Delta \text{InGFCF}_{t-i}$$
$$+ \psi_{7} \text{InINF}_{t-1} + \psi_{8} \text{InPD}_{t-1} + \psi_{9} \text{InMS}_{t-1}$$
$$+ \psi_{10} \text{InINT}_{t-1} + \psi_{11} \text{InGDPC}_{t-1}$$
$$+ \psi_{12} \text{InGFCF}_{t-1} + \psi_{13} \text{DUM95}_{t-1} + \omega_t,$$

where: INF = Inflation; PD = Public debt; MS = Money supply; INT = Interest rate; GDPC = Economic growth; GFCF = Private investment.
Table 1. Selected studies on the nature of relationship between public debt and inflation.

| Author(s) | Title | Methodology | Association |
|-----------|-------|-------------|-------------|
| **Positive Association** | | | |
| Bleaney (1996) | Inflation and public debt. | • Ordinary Least Square (OLS) | Positive (1973–1982) |
| Taghavi (2000) | Debt, growth and inflation in large European economies: A vector autoregression analysis. | • Hybrid cointegration analysis, • Vector autoregressive models | Positive (long-term association) |
| Kwon, McFarlane, and Robinson (2006) | Public debt, money supply, and inflation: A cross-country study and its application to Jamaica. | • Vector autoregression (VAR), • Pooled panel OLS, • Dynamic fixed effects panel, • Panel generalized method of moments (GMM) Arellano-Bond | Positive |
| Bildiric and Ersin (2007) | Domestic debt, inflation and economic crises: A panel cointegration application to emerging and developed economies. | • Vector Error Correction models, • Panel cointegration models | Positive |
| Reinhart and Rogoff (2010) | Growth in a time of debt | • Analysis of relevant statistical data. | Positive (emerging economies) |
| Ahmad, Sheikh, and Tariq (2012) | Domestic debt and inflationary effects: An evidence from Pakistan. | • OLS estimation technique | Positive |
| Ngerebo (2014) | Domestic debt burden, debt overhang and inflationary pressure in Nigeria | • OLS estimation technique | Positive |
| Bilan and Roman (2014) | Interconnections between public indebtedness and inflation in contemporary economies | • Analysis of relevant statistical data | Positive |
| da Veiga, Ferreira-Lopes A, and Sequeira (2016) | Public debt, economic growth, and inflation in African economies. | • Pooled analysis of relevant statistical data. | Positive |
| Nastansky and Strohe (2015) | A vector error correction model for the relationship between public debt and inflation in Germany | • Vector Error Correction Model, • Generalized Impulse Response analysis, • Multivariate Beveridge-Nelson trend/cycle decomposition | Positive |
| Nguyen (2015) | The effects of public debt, inflation, and their interaction on economic growth in developing countries: empirical evidence based on difference panel GMM | • Panel generalized method of moments (GMM) Arellano-Bond | Positive |
| Romero and Marin (2017) | Inflation and public debt. | • Vector autoregression (VAR), • Dynamic fixed effects panel, • Panel generalized method of moments (GMM) Arellano-Bond | Positive |
| Afonso and Ibraimo (2018) | The macroeconomic effects of public debt: An empirical analysis of Mozambique | • Vector autoregression model, • Impulse response functions, • Variance decomposition | Positive |
| Negative Association | | | |
| Bleaney (1996) | Inflation and public debt | • Ordinary Least Square | Negative (1983–1989) |
| Wheeler (1999) | | • Vector autoregressive model | Negative |

(Continued)
The error correction representation of Equation (1) is specified in Equation (2).

\[
\Delta \ln \text{INF}_t = \psi_0 + \sum_{i=1}^{n} \psi_{1i} \Delta \ln \text{INF}_{t-i} + \sum_{i=0}^{n} \psi_{2i} \Delta \ln \text{PD}_{t-i} \\
+ \sum_{i=0}^{n} \psi_{3i} \Delta \ln \text{MS}_{t-i} + \sum_{i=0}^{n} \psi_{4i} \Delta \ln \text{NT}_{t-i} \\
+ \sum_{i=0}^{n} \psi_{5i} \Delta \ln \text{GDP}_{C,t-i} + \sum_{i=0}^{n} \psi_{6i} \Delta \ln \text{GFCF}_{t-i} \\
+ \sum_{i=0}^{n} D_{95} \Delta \text{DUM}_{95,t-i} + \beta_1 \text{ECM}_{t-1} + \omega_t.
\]

where all variables remain as defined in Equation (1). \(D_{95}\) is the short run coefficient of the dummy variable. The error-correction term is lagged once \((\text{ECM}_{t-1})\) and derived from the estimated cointegrated equation. The coefficient of the lagged error-correction term \(\beta_1\) is expected to be negative and statistically significant, suggesting the adjustment speed to equilibrium after a shock to the system (see also Asongu 2013).

### 4.1.1. Data and definition of variables

The study used annual time-series data from the period 1983–2018. The choice of the period was influenced by the availability of credible and reliable data on the variables for Ghana. Data were sourced from the International Monetary Fund (IMF) and the World Bank data base. Table 2 further shows how each of the data was measured and the theoretical expectation of the coefficient for each variable.

### 4.2. Empirical analysis

#### 4.2.1. Unit root test

Before estimating the relationship between inflation, public debt, money supply, interest rate, economic growth and private investment, it is important to test the stationarity of variables. This is to ensure that none of the variables used in this study are integrated of order two or higher. The Dickey-Fuller Generalized Least Squares (DF-GLS) and Phillips-Perron (PP) unit root tests have been employed for this purpose both at level and first difference. In addition, the study addressed the structural break issues associated with time-series data by using the Zivot-Andrews (ZA) structural break unit root test. This test endogenously corrects for one structural break to test the order of the
integration among the variables. The results of the unit root tests are reported in Appendices 1 and 2.

The results of the DF-GLS and PP unit root tests displayed in Appendix 1 show that none of the variables are integrated of order two (i.e., I(2)) or higher. The results of the ZA test reported in Appendix 2 also show that none of the variables is I(2) and that the structural change in inflation took place in 1995. This period coincides with the implementation of the Financial Sector Adjustment Programme (FINSAP), which took place in the 1990s. During this period, the country also moved from direct control to indirect control of monetary aggregates in achieving inflation objectives by focusing largely on the use of market-based monetary policy instruments (Brownbridge 1995; Sowa 2002; World Bank 2019).

4.2.2. ARDL bounds cointegration test

The results of the ARDL bounds cointegration test reported in Table 3 show that the calculated F-statistic exceeds the upper bound critical value, as prescribed by Pesaran, Shin, and Smith (2001). Hence, the study rejects the null hypothesis of no cointegration, suggesting the existence of a long-run relationship between inflation, public debt, money supply, interest rate, economic growth, private investment, and DUM95.

4.2.3. Long-run and short-run estimates

Given the presence of a long run relationship between inflation and the explanatory variables, long run and short run estimates were estimated for Equation (1). These results are presented in Table 4.

The long-run and short-run results presented in Table 4 (Panel A and Panel B) show that the coefficient of public debt is positive and statistically significant, irrespective of the period. These results suggest that public debt plays a significant role in the process of inflation levels in Ghana, regardless of whether it is in the long run or in the short run. This finding is consistent with previous studies such as Kwon, McFarlane, and Robinson (2006), da Veiga, Ferreira-Lopes A, and Sequeira (2016), Nastansky and Strohe (2015) and Romero and Marin (2017) that found a positive association between public debt and inflation. The argument for this result could also be based on a similar reason highlighted in

### Table 2. Data sources and measurement of variables.

| Variables | Description | Measurement | Expectation | Source |
|-----------|-------------|-------------|-------------|--------|
| INF       | Inflation  | Consumer prices (annual %) | –           | WB (2019) |
| PD        | Public debt| Total public debt (% of GDP) | Positive    | IMF (2020) |
| MS        | Money supply| Broad money supply (% of GDP) | Positive    | WB (2019) |
| INT       | Interest rate| Monetary policy rate (annual %) | Positive    | IMF (2019) |
| GDPC      | Economic growth| Real gross domestic product (GDP) per capita, measured as gross domestic product divided by midyear population | Positive or Negative | WB (2019) |
| GFCF      | Private investment| Gross fixed capital formation (% of GDP) | Positive    | WB (2019) |

Source: Authors’ Compilation.

### Table 3. Results of ARDL bounds cointegration test.

| Dependent variable | Function | F-test statistic | Cointegration status |
|--------------------|----------|------------------|----------------------|
| ARDL (1, 0, 1, 0, 0, 0, 0) Selected based on Akaike Information Criteria | F(\(lnINF\), \(lnPD\), \(lnMS\), \(lnINT\), \(lnGDPC\), \(lnGFCF\), \(DUM95\)) | 7.04*** | Cointegrated |

(Continued)

Notes: ***, ** and * denote statistical significance at 1%, 5% and 10% levels, respectively.

### Table 4. Long-run and short-run coefficients.

| Panel A: Long-run coefficients (dependent variable is INF) | Regressor | Coefficient | T-ratio | p-value |
|-----------------------------------------------------------|----------|-------------|---------|---------|
| Constant                                                  | 6.2044***| 7.7520      | [0.0000]|
| Public debt                                               | 1.0109** | 1.9294      | [0.0651]|
| Money supply                                              | -0.8682  | -1.1763     | [0.2506]|
| Interest rate                                             | -0.1083  | -0.1981     | [0.8446]|
| Economic growth                                           | -1.5277**| -2.5110     | [0.0189]|
| Private investment                                        | 0.0608   | 0.1547      | [0.8783]|
| Dum95                                                      | 0.2268   | 0.5837      | [0.5648]|

| Panel B: Short-run results (dependent variable \(\Delta INF\)) | Regressor | Coefficient | T-ratio | p-value |
|--------------------------------------------------------------|----------|-------------|---------|---------|
| \(\Delta INF\)                                              | -0.6996**| -7.8179     | [0.0000]|

R-Bar Squared: 0.7172
F-Statistic: 29.7458*** [0.0000]
Akaike Info. Criterion: 0.5326
Schwarz-Bayesian Info. Criterion: 0.7104

Notes: ***, ** and * denote statistical significance at 1%, 5%, and 10% level, respectively.
the fiscal theory of price level determination. The theory posits that public debt through wealth effect has a positive impact on inflation (Kwon, McFarlane, and Robinson 2006).

The results also show that the coefficient of economic growth is negative and statistically significant in both the short run and long run. This suggests that economic growth negatively influences the rate of inflation, irrespective of the period. This finding is in line with previous studies such as Stockman (1981) that advocates a negative relationship between these variables. In the short run, money supply has a negative impact on inflation, but no impact in the long run. This result, although contrary to the expectation of the study, is not unusual (see also Bairam 1990; West African Monetary Agency (WAMA) 2009). The coefficient of interest rate suggests a positive impact on inflation in the short run, but no impact in the long run. The findings, however, reveal that private investment and DUM95 have no impact on inflation, irrespective of the period.
in Ghana. This implies that an increase in private investment in Ghana is unlikely to lead to an increase in inflation. It also shows that the structural change that occurred in 1995 did not significantly affect inflation in Ghana. The estimated result of the ECMt−1 from Table 4 (Panel B) also shows that the sign of ECMt−1 is negative as expected and statistically significant. The regression results are a good fit, as indicated by the adjusted R-squared of about 72%.

The study performed stability tests for the estimated ARDL framework using the cumulative sum (CUSUM) and cumulative sum of square (CUSUMSQ) tests. Brown, Durbin, and Evans (1975) and Pesaran and Pesaran (1997) have also used these tests for model stability. Figures 2 and 3 show that the plots of CUSUM and CUSUMSQ statistics are within the 5% critical bounds, suggesting that the model is stable over time.

5. Conclusion

The main objective of this study was to examine the relationship between public debt and inflation in Ghana using annual data from 1983 to 2018. The study employed the ARDL approach to cointegration and the error-correction model. The study also used Zivot and Andrews (1992) model to account for the possibility of a structural break in the series. The findings revealed a stable long-run relationship between inflation, public debt, money supply, interest rate, economic growth, and private investment in the presence of structural breaks. Similarly, the long-run and short-run coefficient estimates from the ARDL framework show that public debt has a positive and significant impact on inflation in Ghana. This finding supports the Fiscal Theory of the Price Level, which posits that government debt adds to household wealth. Hence, the demand for goods and services would increase exacting price pressures. Overall, the study confirms the inflationary effects of public debt management in Ghana. Hence, the government should be prudent when considering increases in public debt to minimize volatility in inflation and its associated risks on the economy. The control of inflation dynamics is vital in achieving the objectives of monetary and fiscal policy. Notwithstanding its novel contribution, this research is limited by the use of aggregate public debt data. In future studies, researchers may, therefore, wish to use disaggregated public debt data in order to disentangle the impact of external and domestic public debt on inflation. In addition, the possibility of nonlinearity within the framework could also be investigated in order to explore the dynamic impact of public debt on inflation fully.

Acknowledgement

The authors are grateful to the editor and the anonymous reviewers for their useful comments that helped to improve the quality of this paper.

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Akingbade U. Aimola  http://orcid.org/0000-0003-1610-4704
Nicholas M. Odhiambo  http://orcid.org/0000-0003-4988-0259

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Appendices

Appendix 1. Results of standard unit root test

| Variables | Stationarity of all variables in levels | | | Stationarity of all variables in first difference | | |
| --- | --- | --- | --- | --- | --- |
|  | Dickey-Fuller Generalized Least Squares (DF-GLS) | Phillips-Perron (PP) | Dickey-Fuller Generalized Least Squares (DF-GLS) | Phillips-Perron (PP) |
|  | Without Trend | With Trend | Without Trend | With Trend | Without Trend | With Trend | Without Trend | With Trend |
| lnINF | −0.0450 | −1.9819 | −0.1425 | −5.1238*** | | | | |
| lnPD | −0.9562 | −1.8229 | −1.7845 | −2.0563 | | | | |
| lnMS | −1.0515 | −1.7646 | −2.2603 | −1.7543 | | | | |
| lnINT | −1.5322 | −1.9026 | −1.8685 | −2.3638 | | | | |
| lnGDPC | 1.1817 | −1.4541 | 1.5165 | −0.6578 | | | | |
| lnGFCF | −1.4527 | −2.0286 | −3.8941*** | −3.0442 | | | | |

Source: Authors’ compilation.
Notes: *** and ** denote stationarity at 1% and 5% significance levels, respectively.

Appendix 2. Results of structural break unit root test

| Variables | Zivot-Andrews structural break unit root test | | |
| --- | --- | --- |
|  | t-Statistic | Break year | t-Statistic | Break year |
| lnINF | −4.7497 | 1995 | −5.8441*** | 1998 |
| lnPD | −3.8407 | 2004 | −5.7083*** | 2007 |
| lnMS | −5.0849* | 2006 | −6.0286*** | 2003 |
| lnINT | −2.9708 | 1999 | −6.3665*** | 2012 |
| lnGDPC | −3.4239 | 2002 | −4.9565* | 2010 |
| lnGFCF | −3.9519 | 2006 | −7.1585*** | 2012 |

Source: Authors’ compilation.
Notes: *** and ** denote stationarity at 1% and 5% significance level, respectively.