Asymmetric Effects of Fiscal Deficit Financing and Inflation Dynamics in Ghana

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Abstract

Fiscal Deficit Financing (FDF) has been unsustainably high in Ghana and this has led to unstable and high inflation episodes since 1980. The FDF averaged 4.6% from 2005-2011 and 6.9% to 2012-2018, while inflation averaged 11.0% and 13.1% relative to medium-term to long-term inflation target of 8.0% in the same periods, respectively. Previous studies on deficit financing-inflation nexus in Ghana have primarily focused on linear and symmetric relationship, thereby ignoring the asymmetric policy effects of FDF on inflation dynamics. Disregarding the asymmetry of FDF could impact negatively on efforts of Bank of Ghana in forecasting and controlling inflation effectively. To address this problem, this study was therefore designed to investigate the asymmetric policy effects of FDF on inflation dynamics in Ghana over the period 1980-2018. The fiscal theory of the price level provided the theoretical framework. The Non-linear Autoregressive Distributed Lag (NARDL) econometric methodology was deployed to examine the asymmetric effects of FDF on inflation dynamics. The paper found that FDF had asymmetric effects on inflation dynamics in Ghana as the positive outcome of FDF had a significant positive asymmetric effect of 29.0% on inflation while its negative outcome had a relatively less asymmetric effect of 22% on inflation dynamics, suggesting that consolidating fiscal policy was disinflationary. The paper finally recommends that fiscal authorities should adopt consolidating and prudent fiscal policies that could lead to fiscal solvency and sustainability, which could potentially moderate the effect of FDF on inflation dynamics.

Keywords: fiscal deficit financing in Ghana, fiscal theory of the price level, Inflation dynamics

1. Introduction

Deficit financing implies the direct addition to the gross national budget through budget deficits. Usually, the deficits are either on the revenue or on the capital account. This suggests that deficit financing is both a fiscal and a monetary phenomenon. In practice, the approaches to deficit financing can be through increased taxation or reduced government expenditure, money creation or seigniorage, domestic and/or foreign borrowings. By implication, deficit financing tends to run down government-accumulated balances or alters the balance sheet of the banking sector. As a result, deficit financing is under the control of the Ministry of Finance of a particular country while the central bank oversees monetary policy implementations respectively (Alagidede, 2016).

Generally, there are microeconomic and macroeconomic conceptualizations of fiscal deficit financing. The idea that fiscal consolidation should be the basis for financing fiscal deficit has been categorized as a form of microeconomic thinking. Specifically, Pettifor (2018) posited that corresponding fiscal deficit to household deficit creates a perception for considering budget deficit as the excess of government expenditure over government revenue. This is the cashflow perception to fiscal deficit (Hassan, 2018). However, budget deficit is seen as the result of unfavourable macroeconomic fundamentals in the economy. This could be due to downswing in the economy, inefficient financial market, poor capital market performance among others.

On the other hand, inflation has been widely defined as the persistent, sustained or continuous increase in the price level of an economy. Inflation leads to a fall in the purchasing power of money as more money tends to 'chase' fewer commodities during inflationary period (Labonte, 2011). Inflation only occurs when price increases permeate every aspect of the commodity markets. It is, thus, broad-based but narrowly defined as it concerns basket of commodities. The definition of inflation is not as controversial as the causes of inflation. Many authors have provided a blanket causal factor for the general price increase in the economy, other authors have been

philosophical about the causes of inflation; owing to various perspectives in economic science.

Fiscal deficit financing and its impact on inflation has remained one of the major macroeconomic problems facing many countries in the world today especially in emerging and developing countries struggling to change the structure of their respective economies to take advantage of prospects of industrialization. Many countries continued to have aggregate revenue shortfalls relative to increasing government expenditure levels, thus creating huge revenue and financing gaps in these countries. Historically, the ensuing revenue-expenditure gap had been bridged through financing from both domestic and external sources with its attendant economic implications on price stability and other macroeconomic indicators as a consequence. According to recent data released from the International Monetary Fund(IMF), overall fiscal deficit averaged 9.6 percent of Gross Domestic Product(GDP) in Ghana; stood at 6.7 percent of GDP in Kenya; 5.4 percent of GDP in Tanzania, 5.6 percent of GDP in Uganda and 3.2 percent in Nigeria for 2004-2018 period relative to the sub-Saharan regional average of 4.3 percent of GDP respectively, thus suggesting worsening fiscal deficit financing situation in these economies, which also had implications on the efforts of regional central banks in fighting inflation as a result.

On the other hand, inflationary pressures in these sub-Saharan countries also remained elevated within the period under discussion as a consequence of worsening fiscal deficit financing among other macroeconomic challenges faced by these economies as a result. Inflation in the countries stood above regional average as evidenced by an average of 11.9 percent experienced in Ghana; 11.9 recorded in Nigeria; 8.2 percent in Tanzania and 7.7 percent in Kenya for the same period of 2009-2018 as against a global average of 3.5 percent and sub-Saharan Africa's average of 8.7 percent respectively. Historically, financing of the fiscal deficit experienced by several countries particularly in sub-Saharan economies had been done mostly through bank and non-bank financing as well as loans contracted from external sources. Ghana continues to missed both the fiscal deficit target set by the fiscal authority as well its inflation target set by the central bank of Ghana over the years though some relative achievement had been made in more recent periods. Specifically, inflation in 2018 stood at 9.5 percent, relatively above the inflation target of 8 percent for the country while fiscal deficit stood at 3.9 as a percent of gross domestic product below a target of 4.5 percent for the same year respectively. Ghana's experience of fiscal deficit financing challenges and price instability are not different significantly from her peer countries in the sub-Saharan region as discussed above. Hence, any research project investing this fiscal deficit financing-inflation relationship should be welcomed as the findings could potentially reveal more information relating to this relation and therefore could also facilitate future policy discussions and formulations as this study seeks to examine the asymmetry of fiscal deficit financing and its effects on inflation dynamics in Ghana for 1980-2018 period.

1.1 The Research Problem and Justification for this Study

The increasing gap between government revenue relative to its expenditures levels in Ghana had ballooned fiscal deficit financing challenges and these negative happenings had contributed immensely to price instability as result over the years. The continued fiscal deficit financing challenges and its subsequent influence on inflation dynamics had raised the need for policy actions by authorities that aim at fiscal sustainability, consolidation as well as the achievement and maintenance of price stability in recent policy discussions in Ghana. Although Ghana adopted lite Inflation-Targeting (IT) monetary policy framework in July 2002 and later in September 2007 became a fully-fledged IT regime country, which was aimed initially at moving the country into a sustained disinflationary path from a higher double-digit inflation environment. However, achieving this medium to long-term inflation target set by the Central Bank of Ghana (BoG) as core monetary policy objective had remained an elusive inflation target over the years even though some relative progress in the fight against price instability had been made by the country in more recent times. The influence of the fiscal performance especially when it comes to fiscal deficit financing and its impact on price stability cannot be ruled-out as the Central Bank of Ghana continued to missed its inflation target of plus and minus 8 percent over the years. Available data suggested that Ghana had been breaching the regional benchmark of 10 percent of previous year's government tax revenue collections limit on central bank financing of government fiscal deficit until recently when the country started making some remarkable progress.

Several studies investigating fiscal deficit financing-inflation nexus in Ghana such as Sowah (1994), which examined the causes of inflation in Ghana concluded that inflation was mainly caused by both monetary and non-monetary factors. Several other studies also investigated causes of inflation in Ghana (Ocran, 2007; Gharty,2001, Sowah and Kwakye; Alagidede,2016; Bawumia and Abradu-Otoo, 2003; Osei (2014); Yvonne, 2015). However, most of these studies investigated the linear and symmetric relationship between fiscal deficit financing and inflation, thus ignoring the non-linear policy effects of fiscal deficit financing on inflation dynamics which can be caused by policy asymmetry of fiscal deficit financing. Theoretically and empirically, it is possible that effects of expansionary fiscal policy may differ from the effects of restrictive fiscal policy on inflation dynamics as their

impacts may depend on several factors such as the presence of policy asymmetries. Many studies had revealed that different policies tend to have different policy asymmetric impacts on macroeconomic indicators. This was evident in the work by Lamgruber (1980), which suggested that expansionary monetary policy had different effects on output relative to its effects from restrictive monetary policy, thus providing the evidence of asymmetric effects in policy actions. Other researchers have also provided evidence that positive shocks of monetary policy had less real policy effects on other macroeconomic indicators such as inflation relative to an impact of negative shocks on the economy (Cover,1992; Rhee and Rich, 1995; Karras and Stokes,1999). Again, both fiscal and monetary policies may tend to have different policy impacts within the business cycle phases and that these policies could have stronger effects on recession than the expansion phase (Kaufman,2002; Dolado and Maria, 2006). In reference to the above gaps in the literature on Ghana, this paper therefore seeks to extend the frontier of knowledge by filling this identified research and literature gap by investigating the asymmetry of fiscal deficit financing and its effects on inflation dynamics in Ghana.

2. Some Stylized Facts

2.1 Analysis of Trends in Fiscal Deficit and Financing Options

In the early part of the Economic Recovery Programme (ERP) between 1983-1991, Ghana recorded a deficit of 0.36 million Ghana cedis during the military regime before the first republic. In 1983, an overall fiscal deficit of Ghc 0.48 million was solely financed by domestic borrowing with the banking sector accounting for 44.9 percent (of which commercial banks accounted 78.8 percent and central bank borrowing also represented 21.1 percent) while the non-bank public contributed 55.1 percent respectively. Available data further suggests that the first and second republics led by National Democratic Congress (NDC) incurred an average fiscal deficit of Ghc 69.99 million cedis during the period 1992-2000 which was mainly financed by debt (both domestic and external sources) and central bank borrowing, thus representing 4.09 percent of GDP.Similarly, overall fiscal deficits picked up significantly to an average of Ghc 7,437.72 million between 2009-2016 period which was financed largely by increased external debt relative to domestic debt with dwindling central bank financing, thus representing 7.81 percent of GDP. It must be noted that fiscal deficit ballooned again to an average of Ghc 11,958.74 million cedis between the period 2017-2018 period, thus representing 4.93 percent respectively.

The fiscal deficit in 2018 was financed largely by both domestic and external sources. Out of Ghc 11,672.75 million cedis overall fiscal deficit recorded in 2018(representing 3.9 percent of GDP), Ghc9,800.14 million was sourced from the domestic market, borrowing from the banking sector accounted for 55.1 percent (of which commercial banks represents 83.6 percent and central bank borrowing represented 16.4 percent), followed by borrowing from the non-bank public with 40.8 percent and borrowing from other sources domestic accounted 4.1 percent. External borrowing for financing the 2018 fiscal deficit was Ghc7,992.74 million Ghana cedis with a due amortisation of Ghc5,268.56 million Ghana cedis which resulted into a net foreign financing of Ghc2,724.18 million Ghana cedis. Out of the total external financing of the fiscal deficit, sovereign bond alone accounted for 64.7 percent, followed by project loans which accounted for 24.2 percent whilst the share of program loans was 11.1 percent respectively (See Table 1 below).

Table 1. Profile of fiscal deficits and financing options in Ghana (Million Cedis)

	1983	1991	1992	1999	2000	2008	2010	2012	2016	2017	2018
Overall Balance	(0.48)	3.90	(14.44)	(133.98)	(234.14)	(1,976.49)	(2,999.87)	(8,648.66)	(13,144.93)	(12,244.73)	(11,672.75)
% of GDP	*(2.61)*	*1.51*	*(4.80)*	*(6.51)*	*(8.62)*	*(6.55)*	*(6.47)*	*(11.54)*	*(7.85)*	*(5.95)*	*(3.91)*
Domestic Financing	0.48	(4.64)	14.42	111.75	239.77	1,152.68	2,142.55	6,921.87	11,264.55	11,969.83	9,800.14
BANKING SECTOR	0.22	(5.07)	10.25	104.20	191.02	673.21	972.94	2,535.90	5,546.48	(6,437.85)	5,401.43
Bank of Ghana	0.05	-	-	21.95	178.78	572.34	(182.61)	2,196.79	2,391.98	(3,563.66)	884.29
Commercial banks	0.17	-	-	82.25	12.24	100.87	1,155.55	339.12	3,154.50	(2,874.19)	4,517.14
NON-BANK	0.26	0.43	4.17	7.55	48.75	245.23	1,169.61	4,385.97	5,718.06	18,407.68	3,994.82
Foreign Financing	-	1.27	0.03	22.23	(5.63)	241.94	1,302.32	8,648.66	13,144.93	12,244.73	2,724.18
INFLOWS	-	5.20	4.31	97.28	181.12	661.81	1,711.14	1,231.40	2,960.29	(47.42)	7,992.74
Project Loans	-	-	-	73.71	100.91	508.52	1,441.29	1,855.01	7,564.03	4,865.29	1,934.26
Program Loans	-	5.20	4.31	23.57	80.21	153.30	269.86	1,667.36	4,595.23	3,775.56	889.10
Interest Payments	0.22	2.52	6.10	115.03	203.34	679.18	1,439.36	2,436.15	10,770.44	13,572.12	16,968.70
Interest Domestic	0.00	1.06	3.49	87.18	144.62	481.93	1,124.32	1,879.71	8,466.37	11,039.46	13,722.00
Interest External	0.22	1.46	2.61	27.85	58.72	197.25	315.04	556.44	2,304.07	2,532.66	3,246.70
AMORTIZATION	0.00	3.93	4.28	75.05	186.75	497.41	502.31	623.60	4,603.74	4,912.71	5,268.57

Source: Ministry of Finance and Economic Planning

2.2 Inflation Episodes and Profile in Ghana

Finally, the inflation history in Ghana can be classified as consisting of high inflation episode (high inflation regime), moderate inflation episode (moderate inflation regime) and relatively low inflation episode (relative low inflation regime) reflecting the influence of both fiscal and monetary policies implementation over the course of Ghana's economic history particularly after Ghana obtained her political independence (See Figure 1). The period between 1974 and 1983 has been classified as the high inflation episode where Ghana recorded an average inflation of 72.3 percent as a result of excessive fiscal deficit financing particularly through central bank financing which led to high growth in monetary aggregates during that period.

The period under discussion was characterized by direct controls by government where monetary policy was under direct control of government which has been referred to in the literature as the financial repression era. Similarly, the period between 1984 and 2001 has been referred to as moderate inflation episode with an average inflation of about 29 percent which suggests a sharp decline in inflation compared to the average inflation recorded during 1974-1983 period. Monetary policy framework within these periods was characterized by monetary-targeting where growth in money supply and reserves were targeted as monetary policy targets through the use of open market operation to control credit expansion and eventually tame inflation in the process.

Also, the period between 2002 and 2018 has been classified as low inflation episode referring to the period where the central bank of Ghana changed its monetary policy framework from monetary-targeting to inflation-targeting policy regime where the prime rate became a key instrument of monetary policy in the monetary policy transmission mechanism in Ghana (i.e., the use of the interest rate channel). The average inflation for the low inflation regime was 14.8 percent, suggesting a significant disinflationary episode though the rate inflation still remained within the double- digit range which is above the medium-term policy band of plus or minus 8 percent (i.e., +/- 8%). The influence of fiscal deficit and its financing options on inflation dynamics in Ghana cannot be over-emphasized as discussed above particularly through fiscal policy choices of government and the subsequent monetary policy responses and actions of monetary authorities to the effects of fiscal policy actions of government respectively. The discussions above further suggest that monetary policy actions in Ghana over the years have been determined by various fiscal policy actions of government, thus indicating the effects of fiscal dominance through the creation and financing of fiscal deficits on inflation dynamics during the period under consideration.
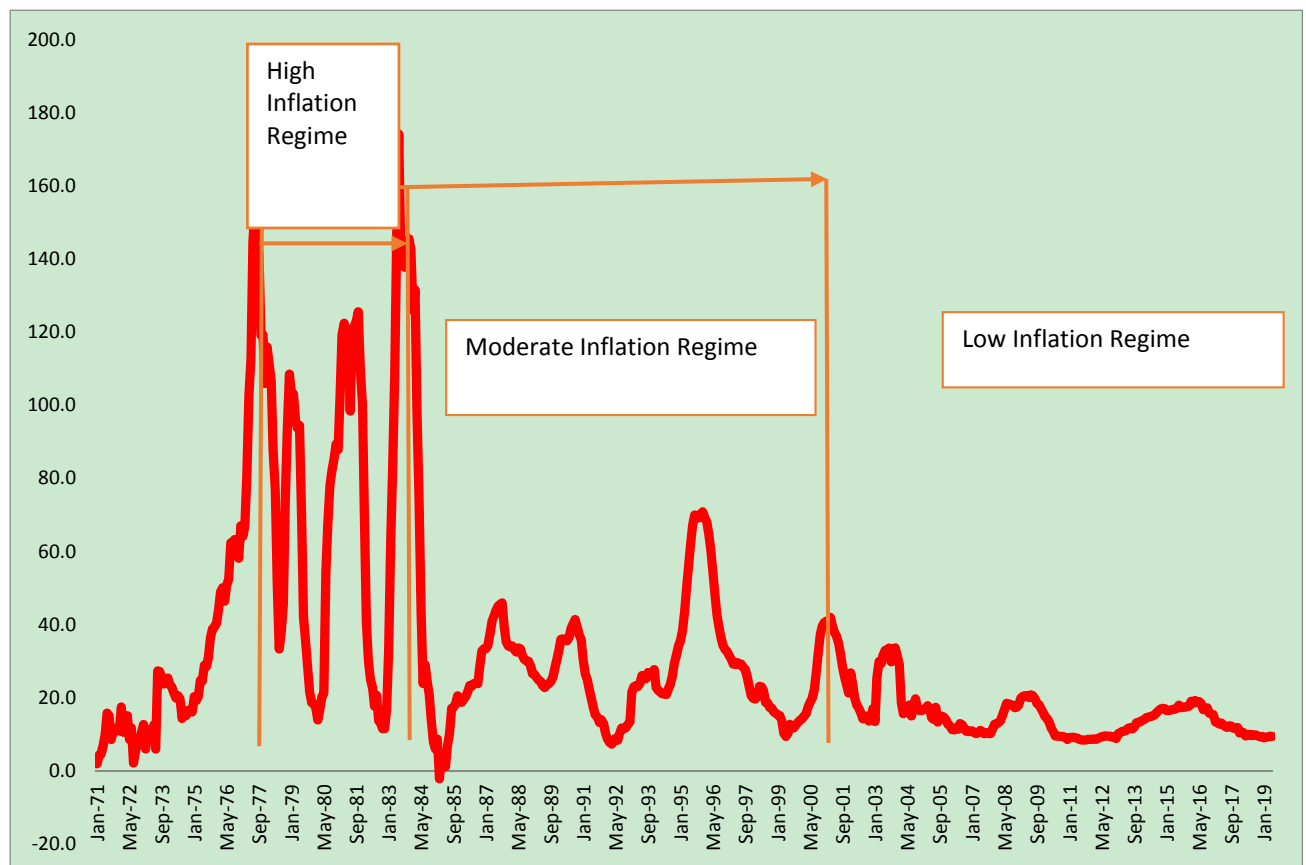
Figure 1. Inflation episodes in Ghana

2.3 Macroeconomic Consequences of Fiscal Deficit Financing

There are macroeconomic consequences for excessive deficit financing due to uncontrolled government spending as a result of continued fiscal indiscipline. Two of the mediums of financing government fiscal deficits are domestic and external borrowing. Countries with fiscal deficits can boldly issue sovereign debt instruments on the international market to raise the needed resources in the form of inflows to finance its revenue - expenditure gaps in the budget. Another channel is that government can also contract programme and project loans which are sometimes concessionary in nature or at a commercial interest rates charged by foreign financial institutions. These channels of fiscal deficit financing can reduce the pressure on domestic funding of fiscal deficit which might lead to increased domestic private sector credit expansion to the critical sectors of the economy, thus reducing the negative economic consequence of crowding out effect on the private sector. However, it must also be noted that excessive external borrowing to finance government fiscal deficits have dire economic implications and consequences as it can lead to debt excessive debt accumulation, debt unsustainability, debt overhang and potential debt default due to increased debt burden associated with build-up in interest rates payments on external loans apart from the strict conditionalities attached to such loans especially if the loans are contracted from the IMF and the World bank.

Similarly, if the loans are contracted on non-concessionary basis from international commercial banks, then the country run the risk of paying high interest rates on its contracted loans at a floating interest rates which is more punitive and therefore add to the already debt burden on the respective country as global interest rates trended up. High foreign interest rate payments have both current account and exchange rate implications as it can lead to excessive pressures on the domestic currency, thus causing it to depreciates and this may have exchange rate pass-through effects on the domestic inflation in the process. It is evidenced that exchange rate depreciation induced by high interest payments on external loans and sudden reversal of portfolio investments on the domestic economy do affect price stability in Ghana as these unfavourable trends put excessive pressures on the domestic currency to fluctuate unexpectedly, thus increasing exchange rate volatility which positively increases inflation volatility and expectations (See Figure 2).

It is evidenced that a sizeable share of Ghana's external debt particularly all the sovereign bonds that have been issued by the government were secured on floating interest rate basis and debt service burden has increased due to international interest rate changes influenced largely by increases in Federal Reserve rate. In 2002, external interest payments as a percentage of overall government expenditure picked-up to 26.3 percent up from 17.1 percent in 2001.Also, in 2004, external interest payments as a percentage of government spending increased to 29.2 percent from 23.3 percent in 2003.Similarly, interest payments on external loan s as a percentage of government inched-up again to 22.8 percent in 2012 from 18.8 percent in 2011. Also, external interest payments as percentage of overall government expenditure trended up to 20.4 percent in 2018, up from 17.3 in 2017 and relatively slightly down from 20.7 notwithstanding it still remains high compared to historical data over the years (See Figure 3 below).

It must be noted with keen interest that all the sovereign bonds issued by Ghana on the international capital market attracted a relatively higher than expected interest rates as compared with similar issues of the same bond by other peer countries in the Sub-Saharan region. Ghana's issuance of the fourth sovereign bond with the value $1.00 billion for fifteen years maturity tenure on the international capital market attracted high interest rates of 10.7 percent in 2015 relative to an interest of 6.625 percent and 6.25 percent charged on a similar issuance of Eurobond on the same market Côte d'Ivoire and Senegal respectively according to data released by Economist Intelligence Unit, 2014. The high interest rate on Ghana's sovereign bonds makes it expensive to raise capital on the international capital market and also add significantly to the borrowing cost, this increases the burden of interest payments on external debt which depletes the country's international reserves in the process.

Hence, government must adopt consolidating fiscal policies to ensure prudent management of the fiscal purse and reduce expenditure profligacy that could potentially undermined government fiscal solvency in order to aid government to secure external loans at a relatively cheaper cost than what is prevailing currently on the global bond market. The high interest payments on government loans secured externally disrupts future budgetary outlays and has implications on private sector growth and macroeconomic stability and also deprives government of the needed financial muscle to fund key infrastructures such as health and educational projects among others.

Another important source of fiscal deficit financing in Ghana is government borrowing from the domestic bond market principally comprising of the banking sector (including commercial banks and Bank of Ghana) and the non-bank public (non-bank private sector). Government borrowing from the domestic market reduces the impact of external loan repayments on domestic currency exchange rates and its passthrough effects on domestic price stability on one hand. However, excessive borrowing on the domestic market can also starve the private sector of the crucial funds for investment, thus leading to complete crowding out of the private sector which can have negative implications for private sector development and growth in the domestic country. Available data from the Ministry of Finance and Economic Planning and Bank of Ghana suggests that domestic borrowing by government has become one of the key financing options for government as trends in domestic interest payments on domestic debt point to that direction of increased domestic financing of government fiscal deficit (See Figure 4 below).

The share of domestic interest payments on domestic debt as part of overall government spending was 89.4 percent in 1985, up from 84.6 percent in 1985. The average share of domestic interest payments on domestic debt paid by government as a percentage of overall government spending was 66.5 percent for the 1980-1989 period. In the 1990s, domestic financing of government debt continued to play key as evidenced by the share of interest payments on domestic of government was improved to 70 percent in 1993 from 57.3 percent recorded in 1992. The share of domestic interest payments on total government interest payments on its overall debt portfolio as a percentage of government overall expenditures picked again to 80 percent from 76.5 percent in 1997. The average of domestic interest payments out of overall government interest payments as a percentage of overall government spending was 63.7 percent which still remained high for 1990 – 1999 period, marginally below that of the period 1980-1989. The trends in domestic payments pointed to an upward direction to 76.7 percent in 2002 from 73.7 percent in 2001. Again, the share of domestic interest payments inched-up to 78.1 percent in 2009, up from 74.9 percent in 1998 and 71.0 percent in 1997 respectively. The average share of domestic interest payments as a percentage government spending was 75 percent for the 2000-2009 period which compares more favourably with the trends for 1980-1989 and 1990-1999 periods, suggesting an uptick in domestic financing of government overall fiscal deficit financing from the domestic front relative to foreign financing of government fiscal deficit in Ghana. Also, the share of domestic interest payments on government debt as percentage of overall government expenditure reached as high as 86.3 percent in 2014, up from 86.2 percent in 2013 and 77.2 percent in 2012 respectively. The share of domestic interest payments further increased to 82.7 percent in 2016 from 80.6 percent in 2015 and this marginally dipped to 79.3 percent in 2017 and 79.6 percent in 2018 correspondingly. The average share of domestic interest payments on domestic of government as a percentage of overall government spending reached as high as 81.2 percent for

the 2010-2018 period, thus suggesting importance of domestic financing of government overall fiscal deficit over the periods in Ghana.

It can be inferred from the above discussions that government of Ghana has depended largely on domestic sources of funds in financing its fiscal deficit over the years in Ghana and these sources are diverse. The data also supports the notion that central bank financing has played key role in domestic financing of government budget in Ghana which has had resulted into excessive money growth over the years as monetization of the fiscal deficits have significantly impacted on domestic inflation as trends in money supply growth and inflation move in tandem as shown by Figure 5 below. It can be seen in the Figure below that inflation mirrors money supply growth with a lag as it takes time for full impact of monetary changes to transmit into inflation on one-on-one basis or partially.
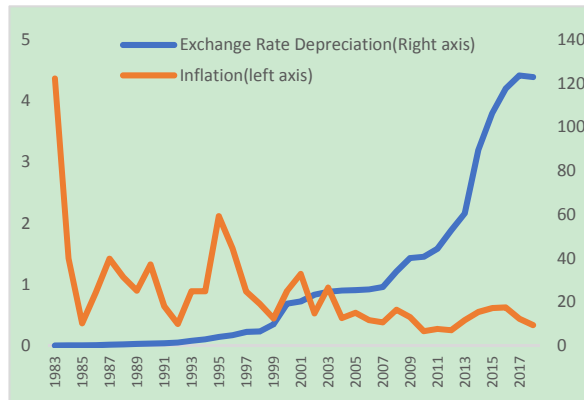

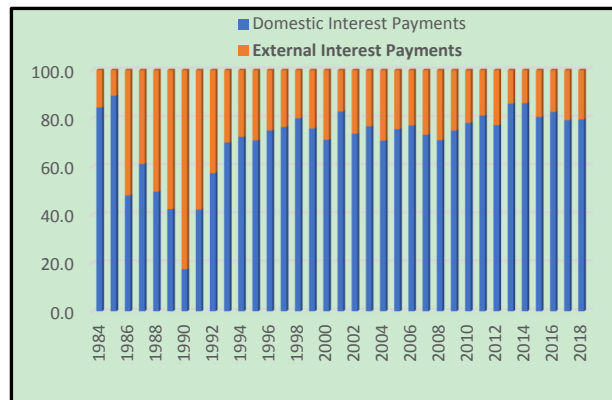Figure 2. Inflation and exchange rate depreciation

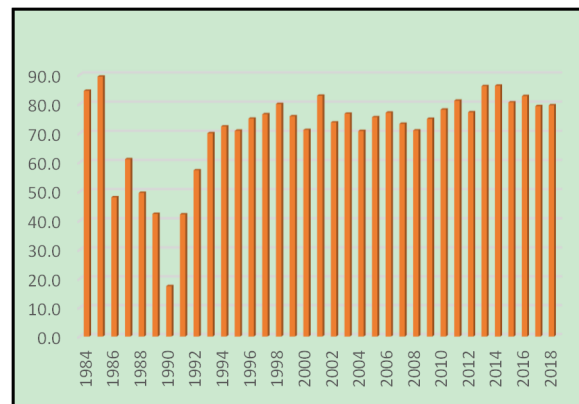

Figure 3. Share of debt interest payments

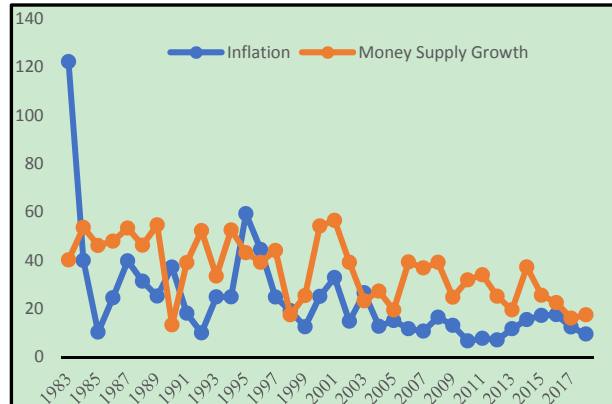Figure 4. Share of domestic debt interest payments

Figure 5. Trends in inflation and money supply

Another macroeconomic implication of domestic financing of government fiscal deficits is the risk of rollover of maturing government debt held by non-residents which may have potential negative impacts on exchange rate development in the country. Portfolio are procyclical in nature as positive developments in a country attracts huge portfolio investments, it is also the case that negative macroeconomic developments in country can also cause a sudden reversal on these portfolio investments by non-residents holders of government domestic debt instruments as it happened in Ghana in the early part of 2016 and 2018 where non-residents investors decided not to rollover government debt instruments held by them which led to massive depreciation of the Ghanaian currency.

3. Survey of Relevant Literature

3.1 Theoretical Literature

Several economic theories underscored that budget deficits and its financing leads to inflation through changes in money stock through seignoirage creation to finance government budget. For instance, the monetarist view of creation and financing of government fiscal deficit suggests that government fiscal deficit financing is inflationary because it can lead to higher money growth which affects inflation on one-to-one basis. Miller (1983) explained that budget deficits lead to inflation through two financing channels. The central government may finance a budget

deficit by money creation or by private monetization (by borrowing from both external and local sources). Because private monetization, leads to higher interest rates, it tends to crowd out private investments, reduce the growth rate of real output, and increase prices. Furthermore, many researchers theorize that money printing and domestic market borrowings are positively related to inflation (Cardoso, 1992; Sowa, 1994; Agha and Khan, 2006). The Keynesian's view on the other hand highlights the effects of government spending on aggregate demand which pushes up the general price levels in both short-run (adaptive expectation case) and long-run (rational expectation case). Apart from the monetarist and the Keynesian's views of fiscal deficit financing and its effects on price dynamics in general, there are equally several relevant theories of fiscal deficit financing and its impact on inflation dynamics such as the Ricardian equivalence theory, the theory of fiscal price, the seignorage theory of hyper-inflation, the political and institutional theory of fiscal deficits and their impacts on inflation dynamics among others. This section seeks to review critically all of these relevant theoretical literature in this study going forward and as a result, the following relevant theories of fiscal deficit financing and its effects on general price dynamics are reviewed and discussed in this study accordingly.

3.1.1 Keynesian Theory

The Keynesian theory asserts that government fiscal deficit causes inflation since it leads to expanded aggregate demand. This approach is based on the deficit financing channel, through aggregate demand and supply theory. Key assumptions of the Keynesian theory are that government can use both monetary and fiscal policy as an intervention policy to influence both employment and output. Keynesian theory of aggregate demand assumed that wages do not adjusts instantaneous in the labour market and as a result actual unemployment can be reduced below the natural rate of unemployment using both fiscal and monetary policies as a policy intervention effort. According to Keynesian theory of income determination, aggregate price level including wages are assumed to be fixed primarily due to wage contracts and other reasons. Central notion in the Keynesian theory of income determination is that equilibrium level of output requires that output be equal to aggregate demand. Because equilibrium output is affected by changes in government spending and taxes, these fiscal policy instruments can be used to affect output in the economy particularly if investment is declining in the economy. The increase in government spending will lead to increased demand for goods and services in the economy thus increasing aggregate demand and equilibrium output and the general price level as well (Keynes,1936).

3.1.2 The Ricardian Equivalence Hypothesis

The key proposition of Ricardian equivalence theory is that government fiscal deficits is related only to the deferment of taxes. This conclusion leads to the indifference between agents paying one Ghana cedi for taxes today and paying one Ghana cedi plus interest in future time period because the agents are forward looking and aware that their current consumption depends only on their permanent income or life-time income but not on the timing of government taxes. However, the assumptions of the Ricardian equivalence theory have been criticised in a number of empirical studies such as the conclusion from Diamond (1965), who criticised that the Ricardian equivalence theory will only remained valid if the economic agents live indefinitely. Feldstein (1988) also criticised the ubiquitous altruistic assumption of Barro (1974) in extending each generation's time horizon into infinite in defence of the Ricardian equivalence theory by concluding that there is no valid empirical evidence of the existence intra-family transfer between current and future family members. Seater (1993) criticised the Ricardian equivalence theory by asserting that a fifth of all families are childless and therefore care less about the imposition of higher government taxes on the future generations. As a result, according to Seater (1993), childless economic agents will increase current consumption if government decides to swap today debt for future taxes today without considering the future generation.

3.1.3 Tax-Smoothing Hypothesis

The hypothesis focuses on government desire to minimise tax distortions associated with revenue generation efforts. According to this hypothesis, distortions created by taxes are more likely to increase more than proportionally with the amount of tax revenue collected by government. When distortions rise more than proportionally with taxes, they are on average higher under the policy of variable taxes than under one with steady taxes at the same average level. Therefore, the desire by government to minimize distortions results into government policy actions that smooth-out the path of taxes over time (Barro, 1979). The hypothesis assumes that government chooses deficits optimally over time and provides the reasons why deficits might be high in many countries such as emerging and developing nations.

3.1.4 Strategic Debt Accumulation Theory

This theory was developed by Tabellini and Alesina (1990) and it is based on the optimal choice of a policy-maker between current and future period expenditures given the optimal choice of his rival in an election contest. The

policy-maker's optimal choice is assumed to be single peaked and a scalar and must therefore satisfy the median voter's preference choice. According to this theory, the policy-maker whose policies satisfy the median voters' preference choice will get elected or will be re-elected. This theory tries to explain what determines the choices of different policy-makers in a democratic setting and how the actions of these policy-makers can lead to strategic debt accumulation in a country. The theory implies that a policy-maker who believes that he is likely to be succeeded by a candidate from his own political party will not accumulate debt in the current period by not increasing current period expenditures against the future period government expenditures.

3.1.5 Monetarist Theory

The monetarist hypothesis is based on economist Fisher's quantity theory of money, which proposes that inflation is driven by money growth. The quantity theory of money assumes that output growth is given and velocity of money is constant and therefore, the behaviour of price level is determined by changes in money supply in economy. From the monetarist perspective (Friedman,1968), fiscal deficits financing is mainly monetary phenomenon. According to the theory, financing of uncontrolled budget deficits of government by the central bank(monetisation), whereby the government borrows resources directly from the central bank in order to funds its budgets deficits often leads to higher inflation in the economy. The monetarist theory concludes that, it is the monetisation of the budget deficits financing that normally leads to increases in monetary base (i.e. high-powered money), thus resulting into higher inflation in the economy.

3.1.6 The Theory of Fiscal Price Level (TFPL)

The theory of fiscal price level (TFPL) proposes that the price level is principally influenced by fiscal policy decisions. The fiscal theory of the price level has two forms namely the weak-form and the strong form. The weak-form of the fiscal theory of the price level postulates that inflation is undeniably a monetary phenomenon, nevertheless that growth of money is determined by the fiscal authority. Consequently, the central bank has no control over the supply of money. The strong-form of fiscal theory of the price level on the other hand, posits that even if growth of money growth remained constant, fiscal policy autonomously dictates the general price level and subsequently inflation rate. Hence, the strong-form of fiscal theory of the price level implies that the central bank may be unable to commit to an inflation objective, since inflation is not certainly a monetary phenomenon as suggested by the works of Sargent and Wallace (1981), Woodford (1994), Carzoneri, Cumby, and Diba (1998), Carlstrom and Fuerst (1999), Komulainen and Pirttila (2002).

3.1.7 The Seignoirage Theory of Hyper-Inflation

Seignorage is defined as the issuing of currency by central bank to finance government general expenditures which acts as an inflation tax on real money balances in an economy. Increases in seignorage revenue to government to finance its planned spending can be inflationary as it increases the growth rate of money supply in the economy. The seignorage defined further in the theoretical literature as the difference between the cost of currency printing and its real face value. The relevance of seigniorage as a source of revenue has been investigated by several researchers such as Oblath and Valentinyi (1994), Hochreiter et al (1996). Again, seigniorage revenue is one of the major sources of central government financing of its fiscal expenditures as confirmed by studies conducted by Gros (2004) and Cukrowski (2001). There are different operational definitions of seignorage and the choice of the seignorage concept depends on the monetary, fiscal or operational characteristics or domain. Based on these classifications, there are three main definitions of seignorage according to Drazen (1985), namely (i) monetary seignorage, (ii) opportunity cost and (iii) fiscal seignorage. Hence, there is no single definition of seignorage in the literature.

3.2 Survey of Empirical Literature

The theoretical literature reviewed so far has asserted that fiscal deficits and it's financing normally lead to high inflation in many instances as confirmed by the seminary empirical research works conducted on the effects of deficit and its financing on inflation by Patinkin (1979); Friedman (1968 and 1971); Sargent (1981), Hamburger and Zwick (1981); Dwyer (1982); Ahking and Miller (1985) and many more studies. Nevertheless, it must be noted that several empirical investigations of the link between fiscal deficits and its financing on inflation dynamics remained inconclusive.

Catao and Terrones (2005) examined whether government fiscal deficit causes inflation in a panel of one hundred and seven (107) nations for using a panel data spanning 1960-2001 period. The selected countries were classified as developed, developing, low-inflationary and high-inflationary economies. The study included the following variables in the model, the variables include gross domestic product, government fiscal deficits, inflation rate and supply of money and examined the interactions among these variables in the model. The study concluded that

inflation is positively and significantly influenced by government fiscal deficit in developing and high-inflation countries and further revealed that inflation is not determined by government fiscal deficits in low-inflation and developed economies respectively. Additionally, Kwon et al (2009) examined the linkage between government fiscal policy, growth of money supply and inflation for a panel 71 selected countries using panel data spanning 1963-2004 period. The suggested that public debt strongly and positively affect inflation only in developing countries and public debt has no effect on inflation in developed countries in the selected sample. Similarly, the study grouped the 57 developing economies into low debt countries and high debt countries and based on this sub-group classification, the study revealed that inflation is significantly determined by growth in public debt in developing economies with high debt.

Lin and Chu (2013) investigated the fiscal deficit-inflation nexus in selected panel of 91 economies for the 1960 - 2006 period. The study examined the relationship between fiscal deficit and inflation in these countries. The study finally concluded that the effects of fiscal deficits on inflation is homogeneous in OECD economies but remained heterogeneous in non-OECD economies and the study further suggested that the difference in the effects of fiscal deficit on inflation in OECD countries and non-OECD countries could be due to lack of central bank independence, lower tax base, lack of access to both domestic and external debt financing, political instability. Tahira and Hassan (2015) also examined fiscal deficits and inflation nexus in eleven Asian countries for the period 1980-2010. The study concluded that deficits lead to inflation in these selected eleven Asian countries. Chibber and Shafik (1990) investigated determinants of inflation in Ghana by examining the interaction among inflation, exchange rate variations, cereal production, persistence of inflation and money supply. The study revealed that inflation in Ghana is highly influenced by cereal production, exchange rate and inflation persistence in the short-run while inflation in the long-run is significantly determined by changes in money supply. However, effects of money supply were dominant in the long-run. The paper confirmed the monetarist proposition inflation in Ghana is strongly and positively influenced by monetary factors.

According to Sowa and Kwakye (1993), structural factors strongly remain key determinants of inflation during the implementation of Ghana's economic recovery program much more than monetary factors which was the main source of inflation during the pre-economic recovery program period. Their conclusion strongly confirmed the structuralist school of thought about major causes of inflation. Applying Error-Correction Model, Sowa (1994) modelled an inflation equation for Ghana for the period 1963-1990. The study revealed that inflation in Ghana determined largely by output volatility much more than monetary factors in the short-run and long-run. The further found that parallel exchange rate had not strong effect on inflation dynamics and remained insignificant. This conclusion supported the earlier conclusion by Sowa and Kwakye (1993) on that inflation in Ghana. The findings of this study by Sowa (1994) were strongly re-confirmed in other study conducted by Sowa and Acquaye (1999) also employing an Error-Correction model. Their study concluded that output variations had more impact on inflation than any other selected variable in the inflation equation. Similarly, Ghartey (2001) investigated the relationship between macroeconomic instability and inflationary using quarterly data from the second quarter of 1970 through to the fourth quarter of 1992 in the Ghanaian economy. The study included private sector credit, inflation, real gross domestic product, exchange rate, log of monetary high-powered money, and overall fiscal deficit divided by gross domestic product and attempted to examine the relationship between these variables in Ghana. The study concluded that growth in money supply granger-causes inflation and there was further evidence as indicated by Granger causality tests that inflation and fiscal deficit granger-causes each other in bi-direction fashion. The paper strongly concluded that monetisation of government fiscal deficits is a major cause of inflation in Ghana.

Bawumia and Abradu-Otoo (2003), examined the causes of inflation in Ghana employing an Error-Correction methodology utilizing monthly data for the 1983-1999. Their study revealed that money supply and exchange rate were the principal determinants of inflation in Ghana as changes in both money supply and exchange rate depreciation positively and significantly explained the variations in inflation. Nevertheless, the study found out that real growth in economic activity has a negative impact on inflation in Ghana in the long-run. The paper further concluded that the impact on inflation due to changes in exchange rate took place after a month, that of real economic activity takes place after two months while the effects on inflation principally due to money supply changes takes place after four months. Again, Bawumia and Atta-Mensah (2003), investigated the determinants of inflation in Ghana utilizing this time round a Vector Error-Correction Model (VECM). The empirical results from the VECM suggested that growth in monetary aggregates (money supply growth) remains a key determinant of inflation in Ghana. However, the model used ignored other equally determinants of inflation in Ghana such as structural and real factors and therefore their conclusion seemed to focused mainly on monetary factors.

Also, Ocran (2007), investigated factors that caused inflation in Ghana employing Johansen cointegration

approach and Error-Correction methodology for the period 1960-2003. The variables included in the Error-Correction model were growth of money supply, inflation, exchange rate and Treasury bill rat respectively. The paper concluded that inflation inertia was found to be a principal determinant of inflation in Ghana relative to inflation responses to changes in exchange rate, money supply and treasury bill rate accordingly. Again, Adu and Marbuah (2011) examined the factors that determined inflation dynamics in Ghana using the Pesseran Autoregressive Distributed Lag (ARDL) for the period spanning 1960-2009. The economic variables included in the model were inflation, real gross domestic product, interest rate and money supply and fiscal deficit in examining the factors of inflation in Ghana. The study observed from the results of the empirical estimation of the ARDL model that real economic activity measured by growth in real gross domestic product was the principal factor that caused inflation in the long-run in Ghana whereas growth of money supply also remained a key factor that determines inflation in the short-run in Ghana relative to nominal interest rate which was the second most important factor that influenced inflation dynamics followed by changes in fiscal deficit in the short-run respectively. The paper finally suggested that structural and monetary factors jointly determined inflation in Ghana during the selected period of the study, thus confirming the conclusions of previews studies in that respect.

Doh-Nani (2011) investigated the sustainability of budget deficit in Ghana applying cointegration approach for the period 1960-2007.The cointegration test result revealed that government budget was sustainable at 10 percent significance level in Ghana. The results from the CUSUM stability test concluded that government fiscal budget was stable and sustainable over the study period in Ghana and that 53 percent of disequilibrium within the government fiscal budget is corrected quickly in the short-run. Employing the Ordinary Least Square methodology (OLS), Gyebi and Boafo (2013) examined the causes of inflation in Ghana for the selected period of 1990 – 2009. The estimated results revealed that inflation was positively and significantly determined by real exchange rate and money supply in Ghana during the selected period of the study. The study further revealed that real growth of economic activity proxied by growth in real gross domestic product and government spending also influenced inflation dynamics in Ghana as suggested by the estimated results from the OLS model. Another study investigating the factors that determine inflation in Ghana for the selected periods of 1962-2012 was conducted by Ahiakpor (2014). The sought to see the effects of exchange rate, broad money, lending rate, budget deficit, real output, population growth on inflation in Ghana. The empirical results from the estimated inflation equation concluded that inflation in Ghana is significantly determined by population growth, budget deficit, broad money, lending rate, and exchange rate only that the direction of the effects on inflation differs among these selected economic variables. The study revealed that apart from real output which inversely related to inflation, all the other variables including broad money, population growth, exchange rate, lending rate and exchange rate positively affect inflation for the study period in Ghana.

Alagidede, Coleman and Adu (2014) examined the existence of inflation persistence at the and regional levels and national level using monthly data spanning 2005:02-2014:02. The study utilized the fractional integration methodology in examining the persistence of inflation in Ghana for the selected period. The variables included in the model included the following overall regional consumer price Index and the CPI of all the subsectors consisting of food and non-alcoholic beverages, Alcoholic beverages, non-food, tobacco and narcotics, clothing and footwear, housing, water, electricity, gas and other, furnishings household equipment, transport communications, Recreation and culture Education, hotels, cafés and restaurants Miscellaneous goods and services. The results from the estimated empirical model concluded that there is presence of asymmetries in the degrees of inflation persistence at both regional and sectoral levels in Ghana. More so, Employing Johansen Cointegration approach and Error-Correction method, Enu and Havi (2014) investigated the macroeconomic determinants of inflation in Ghana for the period 1964-2008. The Johasen cointegration test aimed at confirming or otherwise whether there was a contemporaneous long-run relationship inflation and agricultural and services output, foreign direct investment, foreign aid, and population growth respectively. The empirical results from the estimated Johasen cointegration equation concluded that inflation in Ghana is determined by foreign direct investment, foreign aid, population growth, services and agricultural output in the long-run in Ghana. The paper further concluded that whereas services output and population growth positively influence inflation, agricultural output foreign direct investment and foreign aid negatively affect inflation dynamics in Ghana in the long-run.

Johnson (2014) investigated the causal relationship between fiscal deficits, money growth and inflation in Ghana for the period 1960-2012. The study employed Autoregressive Distributed Lag (ARDL) approach to analyse the short-run and long-run dynamics of inflation in Ghana. The variables included in the model were inflation, exchange rate, interest rate, fiscal deficit and money supply. The results from the estimated model concluded that inflation is caused by fiscal deficit in the short-run while money supply affects inflation both in the short-run and long-run in Ghana, hence inflation is a monetary phenomenon. Also, Yvonne (2015) examined the effects of budget

deficit on Inflation utilizing Error-Correction model (ECM) approach for the selected periods of 1983-2013. The study sought to analyse the interaction between inflation and budget deficit, exchange rate, interest rate and real gross domestic output using annual data points. The estimated results from the Error-Correction model revealed that inflation was positively influenced by fiscal deficit proxied by central bank financing in this study in the long-run in Ghana. The study further suggested the existence of uni-directional causality running from fiscal deficit to inflation as indicated by the result of the Engel-Granger causality test statistics with the accompanying probability value. The study finally concluded that episodes of high inflation in Ghana for the study periods of 1983 to 2013 were principally caused by excessive growth of money supply due to central bank financing of government budget deficit.

Employing Vector Autoregressive method (VAR) using monthly data from 2000:2 to 2014:12, Osei (2014) examined the determinants of inflation in Ghana. The study estimated ten-variable VAR model which sought to analyse the interactions among inflation, food inflation, non-food inflation, world energy price, world food price, domestic fuel price, exchange rate, real gross domestic product, money supply and wages. The estimated results from the ten-variable VAR concluded domestic food prices, inflation inertia, exchange rate and petroleum prices strongly influenced inflation dynamics in Ghana while world food price and money supply weakly explained inflation variation. Finally, Acquah-Sam (2017) examined the major triggers of inflation using quarterly time series spanning 1990:1 -2011:4 in Ghana. The study employed multiple linear regression analysis based on structural equation modelling through path analysis. The results from the estimated model suggested that inflation is positively and significantly determined by interest rate changes in Ghana while market capitalisation, GDP growth, gross fixed investment, and foreign direct investments had insignificant effects on inflation in Ghana. The study concluded that interest rate strongly influences inflation, thus authorities and various policy-makers must critically take into accounts when implementing pro-poor growth policies.

3.3 Gaps in the Surveyed Literature

Evidence from the literature surveyed in various studies on fiscal deficit financing and inflation nexus merely concentrated on the linear and symmetric relationship. The missing gaps in the literature surveyed were the issues of effects of asymmetry of fiscal deficits financing and how it affects inflation dynamics in Ghana. The presence of asymmetry of fiscal deficit financing and its effects on inflation have been ignored in the literature which had rendered the findings of most studies inconclusive. Hence, this study is designed to examine the asymmetry of fiscal deficit financing and how it affects inflation dynamics using Ghana's data.

4. Theoretical Framework, Methodology, Estimation and Discussion of Model Results

4.1 Theoretical Framework

In order to derive the general price equation to be estimated in this study, we utilised the general theory of fiscal price level. The theory of fiscal price level was selected relative to other theoretical frameworks of deficit financing and inflation relation since it better suits the kind of study such as this research paper especially in a developing country setting such as Ghana where fiscal dominance remains a policy challenge to the independence and credibility of an inflation-targeting Central Bank such as Bank of Ghana. The assumptions of the fiscal price theory best fit the structure of the Ghanaian economy. Hence, the choice of theory of fiscal price level in this study to investigate the fiscal deficit financing – inflation nexus is an appropriate choice and it cannot be over-emphasized.

The theory of fiscal price level assumes non-Ricardian and that government fiscal policy is calibrated to satisfy its intertemporal budget constraints for all values of the price level in the economy. The theory further assumes that government intertemporal budget constraint is an equilibrium condition that must be satisfied always. In its strongest form, the theory assumes that both fiscal and monetary policies are exogenous and therefore current and future inflation are mainly determined by fiscal policy of government. These assumptions constrain the role of the monetary authorities in controlling inflation. In many developing countries such as Ghana, the actions of the fiscal authority always constrain the ability and independence of the Central Bank in fighting price instability especially where government participation in the economy is strongest like the situation in Ghana. Hence, adopting the fiscal theory relative to the other several theoretical frameworks remain a justifiable choice in this study. The theoretical framework of the theory of fiscal price level is therefore discussed as follows.

4.4.1 Households Intertemporal Budget Constraints

The representative household chooses his consumption and asset holdings optimally, subject to an intertemporal budget constraint. Suppose the period t budget constraint of the representative household takes the form:

$$D_t + P_t y_t - T_t \geq P_t c_t + M_t^d + B_t^d \qquad (1)$$

Where D_t is the household's beginning-of-period financial wealth, P_t is the price level, y_t is real household

labour income, T_t is total government nominal tax revenue, c_t is real household consumption. The superscripts indicate that M^d and B^d are the household's demand for money and interest-bearing debt, in nominal terms. It follows that path of household future financial wealth will be given by the following relation as follows:

$$D_{t+1}^d = (1 + i_t)B_t^d + M_t^d \qquad (2)$$

From equation (2) we have,

$$B_t^d = \left(\frac{1}{1+i_t}\right)D_{t+1}^d - \left(\frac{1}{1+i_t}\right)M_t^d \qquad (3)$$

Substituting equation (3) into equation (1) gives,

$$D_t + P_t y_t - T_t \geq P_t c_t + M_t^d + \left(\frac{1}{1+i_t}\right)D_{t+1}^d - \left(\frac{1}{1+i_t}\right)M_t^d \qquad (4)$$

$$D_t + P_t y_t - T_t \geq P_t c_t + [M_t^d - \left(\frac{1}{1+i_t}\right)M_t^d] + \left(\frac{1}{1+i_t}\right)D_{t+1}^d$$

$$D_t + P_t y_t - T_t \geq P_t c_t + [1 - \left(\frac{1}{1+i_t}\right)]M_t^d + \left(\frac{1}{1+i_t}\right)D_{t+1}^d$$

$$D_t + P_t y_t - T_t \geq P_t c_t + [\left(\frac{1+i_t-1}{1+i_t}\right)]M_t^d + \left(\frac{1}{1+i_t}\right)D_{t+1}^d$$

$$D_t + P_t y_t - T_t \geq P_t c_t + \left(\frac{i_t}{1+i_t}\right)M_t^d + \left(\frac{1}{1+i_t}\right)D_{t+1}^d \qquad (5)$$

Therefore, we have the following fundamental household budget constraint condition.

$$D_t + P_t y_t - T_t \geq P_t c_t + M_t^d + B_t^d = P_t c_t + (\frac{i_t}{1+i_t})M_t^d + (\frac{1}{1+i_t})D_{t+1}^d \qquad (6)$$

Dividing equation (6) by the price level, P_t, the household budget constraint becomes:

$$d_t + y_t - \tau_t \geq c_t + m_t^d + b_t^d = c_t + (\frac{i_t}{1+i_t})m_t^d + (\frac{1}{1+i_t})d_{t+1}^d \qquad (7)$$

Where expected nominal rate of return is given by

$$(1 + r_t) = (1 + i_t)(1 + \pi_{t+1}) \quad \dots \qquad \dots(8)$$

Where r_t is nominal interest rate.

Let discount factor be

$$\lambda_{t,t+i} = \prod_{j=1}^{i}\left(\frac{1}{1+r_{t+j}}\right) \qquad \dots(9)$$

Assumes that the discount factor, $\lambda_{t,t} = 1$ and with this assumption and other standard assumptions, the household intertemporal budget constraint takes the form:

$$d_t + \sum_{i=0}^{\infty} \lambda_{t,t+i}(y_{t+i} - \tau_{t+i}) = \sum_{i=0}^{\infty} \lambda_{t,t+i}(c_t + (\frac{i_{t+i}}{1+i_{t+i}})m_{t+i}^d) \qquad \dots\dots(10)$$

The household choices must satisfy this intertemporal budget constraint. The left-hand side is the present discounted value of the household's initial real financial wealth and after-tax income. The right-hand side is the discounted value of consumption spending plus the real cost of holding money. The condition holds with equality because any path of consumption and money holdings for which the left-hand side exceeds the right-hand side would not be optimal.

4.1.2 The Government Intertemporal Budget Constraints

The budget constraint for the government sector in nominal terms, takes the form:

$$P_t g_t + (1 - i_{t-1})B_{t-1} = T_t + M_t - M_{t-1} + B_t \qquad \dots(11)$$

Where P_t is price level, g_t is real government spending, B_t is government current bond issue (debt), T_t is government tax revenue, M_t is current money supply and $(1 - i_{t-1})B_{t-1}$ is interest payment expenditure on

existing government debt, $(M_t - M_{t-1})$ represents seigniorage revenue for government and $P_t g_t$ is nominal government expenditure respectively.

We know that

$$D_{t+1}^d = (1 + i_t)B_t^d + M_t \dots \qquad .(12)$$

From equation (12) we have,

$$B_t^d = \left(\frac{1}{1+i_t}\right)D_{t+1}^d - \left(\frac{1}{1+i_t}\right)M_t \dots \qquad \dots\dots(13)$$

By lagging equation (12) one-period backward, we have

$$D_t^d = (1 + i_{t-1})B_{t-1}^d + M_{t-1} \quad \dots \qquad .(14)$$

Therefore, we have the relation,

$$D_t^d - M_{t-1} = (1 + i_{t-1})B_{t-1}^d \quad \dots \qquad \dots(15)$$

Putting equation (13) and (15) into (11) results into the following fundamental government budget constraint condition:

$$P_t g_t + D_t^d - M_{t-1} = T_t + M_t - M_{t-1} + \left(\frac{1}{1+i_t}\right)D_{t+1}^d - \left(\frac{1}{1+i_t}\right)M_t \quad \dots \qquad \dots(16)$$

$$P_t g_t + D_t^d = T_t + M_t - \left(\frac{1}{1+i_t}\right)M_t - M_{t-1} + M_{t-1} + \left(\frac{1}{1+i_t}\right)D_{t+1}^d$$

$$P_t g_t + D_t^d = T_t + [1 - \left(\frac{1}{1+i_t}\right)]M_t + \left(\frac{1}{1+i_t}\right)D_{t+1}^d$$

$$P_t g_t + D_t^d = T_t + \left(\frac{1 + i_t - 1}{1 + i_t}\right)M_t + \left(\frac{1}{1+i_t}\right)D_{t+1}^d$$

$$P_t g_t + D_t^d = T_t + \left(\frac{i_t}{1+i_t}\right)M_t + \left(\frac{1}{1+i_t}\right)D_{t+1}^d \quad \dots \qquad \dots\dots(17)$$

Dividing (17) by the price level, P_t gives the real intertemporal government budget constraint as follows:

$$g_t + d_t = \tau_t + \left(\frac{i_t}{1+i_t}\right)m_t + \left(\frac{1}{1+r_t}\right)d_{t+1} \qquad \dots(18)$$

Recursively substituting for the future values of d_{t+1}, this budget constraint implies that

$$d_t + \sum_{i=0}^{\infty}\lambda_{t,t+i}(g_{t+i} - \tau_{t+i} - s_{t+i}) = \lim_{T\to\infty}\lambda_{t,t+T}d_T \qquad \dots\dots(19)$$

Where $s_t = \frac{i_t}{1+i_t}m_t$ is the government's real seignoirage revenue. Policy paths for $(g_{t+i}, \tau_{t+i}, s_{t+i}, d_{t+i})_{i\geq 0}$ such that

$$d_t + \sum_{i=0}^{\infty}\lambda_{t,t+i}(g_{t+i} - \tau_{t+i} - s_{t+i}) = \lim_{T\to\infty}\lambda_{t,t+T}d_T = 0 \qquad (20)$$

For all prices path, $i \geq 0$, are Ricardian policies. Policy paths for $(g_{t+i}, \tau_{t+i}, s_{t+i}, d_{t+i})_{i\geq 0}$ for which $\lim_{T\to\infty}\lambda_{t,t+T}d_T \neq 0$ for all price paths are called non-Ricardian.

Again, assuming a perfect-foresight equilibrium. Regardless whether the government follows Ricardian or non-Ricardian policy, equilibrium in the goods market in this with no capital requires that,

$$y_t = c_t + g_t \dots\dots\dots \qquad .(21)$$

Equation (21) implies that,

$$c_t = y_t - g_t \quad \dots \qquad \dots\dots(22)$$

The demand for money must also be equal supply of money, that is

$$m_t^d = m_t^s \qquad \dots\dots\dots(23)$$

Substituting equations (22) and (23) into the household intertemporal budget constraint in equation (10) gives:

$$d_t + \sum_{i=0}^{\infty}\lambda_{t,t+i}(y_{t+i} - \tau_{t+i}) = \sum_{i=0}^{\infty}\lambda_{t,t+i}(y_{t+i} - g_{t+i} + \left(\frac{i_{t+i}}{1+i_{t+i}}\right)m_{t+i}^s) \quad \dots \qquad \dots(24)$$

$$d_t + \sum_{i=0}^{\infty} \lambda_{t,t+i}(y_{t+i} - \tau_{t+i}) - \sum_{i=0}^{\infty} \lambda_{t,t+i}\left(y_{t+i} - g_{t+i} + \left(\frac{i_{t+i}}{1+i_{t+i}}\right)m_{t+i}^s\right) = 0$$

$$d_t + \sum_{i=0}^{\infty} \lambda_{t,t+i}\left(y_{t+i} - \tau_{t+i} - y_{t+i} + g_{t+i} - \left(\frac{i_{t+i}}{1+i_{t+i}}\right)m_{t+i}^s\right) = 0$$

$$d_t + \sum_{i=0}^{\infty} \lambda_{t,t+i}\left(g_{t+i} - \tau_{t+i} - \left(\frac{i_{t+i}}{1+i_{t+i}}\right)m_{t+i}^s\right) = 0$$

$$\frac{D_t}{P_t} + \sum_{i=0}^{\infty} \lambda_{t,t+i}\left(g_{t+i} - \tau_{t+i} - \left(\frac{i_{t+i}}{1+i_{t+i}}\right)m_{t+i}^s\right) = 0$$

$$\frac{D_t}{P_t} = \sum_{i=0}^{\infty} \lambda_{t,t+i}\left(\tau_{t+i} + \left(\frac{i_{t+i}}{1+i_{t+i}}\right)m_{t+i}^s - g_{t+i}\right)$$

$$\frac{D_t}{P_t} = \sum_{i=0}^{\infty} \lambda_{t,t+i}(\tau_{t+i} + s_{t+i} - g_{t+i}) \quad \dots\dots \tag{25}$$

Where $s_{t+i} = \left(\frac{i_{t+i}}{1+i_{t+i}}\right)m_{t+i}^s$, s_{t+i} is government seigniorage.

Equation (25) suggests that at time t, the government's outstanding liabilities, D_t are predetermined by past policies. Given the present discounted value of the government's future surpluses, the only endogenous variable is the current price level, the price must be adjusted to ensure that the equilibrium condition in (25) is satisfied. Assuming that fiscal authority determines g_{t+i} and τ_{t+i} for all i ≥ 0 and monetary authority pegs the nominal interest rate $i_{t+i} = \bar{\imath}$ for all i ≥ 0, hence seigniorage equals to $\frac{\bar{\imath}f(1+\bar{\imath})}{(1+\bar{\imath})}$ and is fixed by monetary authority.

Since D_t is predetermined at time t, (25) can be solved for equilibrium price level, P_t^* as follows:

$$P_t^* = \frac{D_t}{\sum_{i=0}^{\infty} \lambda_{t,t+i}(g_{t+i} - \tau_{t+i} - s_{t+i})} \quad \dots\dots \tag{26}$$

The equation (26) suggests that changes in fiscal policy directly alter the steady state price level even though seigniorage as measured by $\sum_{i=0}^{\infty} \lambda_{t,t+i}(s_{t+i})$ is unchanged. Equation (26) is long-run intertemporal government budget constraint.

Assuming that growth in government debt remains constant and government finances its budgets only through seigniorage financing, then we have following equilibrium condition for government budget constraint in the short-run:

$$\frac{D_{t-1}}{P_t} = g_t - \tau_t - s_t \quad \dots \tag{27}$$

$$\text{Where } s_t = \frac{\dot{M}}{P_t} = \frac{\dot{M}}{M_t} \cdot \frac{M}{P_t} \dots\dots \tag{28}$$

$$s_t = \pi \cdot \frac{M}{P_t} \quad \dots \tag{29}$$

Substituting (29) into (27) and solving gives

$$\frac{D_{t-1}}{P_t} = \tau_t - g_t + \pi_t \cdot \frac{M_t}{P_t} \quad \dots \tag{30}$$

$$\frac{D_{t-1}}{P_t} + \quad g_t - \tau_t = \pi_t.\frac{M_t}{P_t}$$

$$d_{t-1} + \quad g_t - \tau_t = \pi_t.\frac{M_t}{P_t}$$

$$b_t = \pi_t.\frac{M_t}{P_t}......\qquad\qquad\qquad .....(31)$$

where $b_t = \frac{D_{t-1}}{P_t} + \quad g_t - \tau_t$, b_t represents real government budget deficits at time t. from (31) we have,

$$\pi_t \quad = \frac{P_{tb_t}}{M_t}$$

$$\pi_t \quad = \frac{B_t}{M_t}...........\qquad\qquad .....(32)$$

Dividing (32) by nominal GDP (Y_t) gives,

$$\pi_t \quad = \frac{B_t/Y_t}{M_t/Y_t}...........\qquad\qquad .....(33)$$

Where π_t inflation rate at time t, B_t denotes nominal government budget at time t, M_t is representing money supply at time t and represents gross domestic product at time t respectively.

Following the derivation of inflation equation as expressed above by equation (33) and incorporating other major determinants of inflation based on the theoretical and empirical considerations, the model to be estimated is expressed in a functional form as follows:

$$IFt \; = f(EX_t, BD_t, MS_t, INT_t, \; OUTPUTGAP_t \;) \qquad\qquad (34)$$

Expressing (34) in an econometric model form to be estimated in this study is as follows.

$$INF_t = \varphi_0 \quad + \quad \varphi_1 EX_t + \varphi_2 BD_t + \varphi_3 MS_t + \varphi_4 INT_t + \varphi_5 OUTPUTGAP_t + \varepsilon_t \qquad (35)$$

Where $\varphi_0, \varphi_1, \varphi_2, \varphi_3, \varphi_4 , \varphi_5$ are coefficients to be estimated, ε_t represents the disturbance term which is assumed to be white-noise. Also, INF represents inflation variable, EX_t represents exchange rate, BD_t represents budget deficits, BS_t represents money supply, INT_t represents interest rate and $OUTPUTGAP_t$ represents output gap respectively.

4.2 Methodology

4.2.1 Modelling Asymmetry

To derive the general form of the asymmetric model, we strictly follow the earlier derivations of Pesaran and Shin (1998) and Pesaran, Shin and Smith (2001). The equation below is a multiple asymmetric long-run equation form:

$$y_t = \delta^{+\prime} x_t^+ + \delta^{-\prime} x_t^- + \; \varepsilon_t \; ... \qquad\qquad .....(36)$$

$$\Delta x_t = \; \omega_t,...... \qquad\qquad ....(37)$$

where x_t is a k × 1 vector of independent variables with $x_t = \; x_0 + x_t^+ + x_t^-$ and δ^+ and δ^- represent long-run asymmetric long-run coefficients. Assume that the expression $z_t = (\varepsilon_t, \omega_t^\prime \;)$ is data generating process that follows a general n^{th} order Vector Autoregressive model (VAR) such that

$$z_t = \; \sum_{i=1}^{n} \beta_i z_{t-i} + \mu_t............ \qquad\qquad .....(38)$$

Where t = 1,2,3,4, 5,.............,T, β_i, I = 1,2,3,.......n are (k +1) x (k + 1) matrices of unknown parameters, μ_t is independent and identically distributed (i.i.d.) with mean zero(0) and a constant variance given by Π which is a (k + 1) x (k + 1) positive definite matrix and $z_0 \equiv (\; z_{t-n},......, z_0)$. The error term, μ_t is further partitioned conformably with $z_t = (\mu_{1t,} \mu_{2t}^\prime)^\prime$ and its variance matrix as

$$\Pi = \begin{bmatrix} \sigma_{11} & \sigma_{12} \\ \sigma_{12}^\prime & \sigma_{22} \end{bmatrix} ... ... \qquad\qquad ..(39)$$

Therefore, expressing μ_{1t} conditionally in term of μ_{2t} leads to the following expression

$$\mu_{1t} = \; \lambda \mu_{2t} + v_t \; ... \qquad\qquad ....(40)$$

where $\lambda = \sigma'_{12}\Pi_{22}^{-}\sigma_{12}$, $v_t \sim iid(0,\sigma_v^2) \equiv \sigma_{11} - \sigma'_{12}\Pi_{22}^{-}\sigma_{12}$, and v_t is uncorrelated with μ_{2t}.

Substituting equation (5) into equation (3) and partitioning $\beta_i = (\beta'_{1i}, \beta'_{2i})'$, i = 1,2,…..n leads to the following condtional equation for μ_t,

$$\varepsilon_t = \lambda\omega_t + \sum_{i=1}^{n}\boldsymbol{\phi}_i \boldsymbol{z}_{t-i} + v_t \; … \qquad\qquad ....(41)$$

Where $\boldsymbol{\phi}_i = \beta_{1i} - \lambda\beta'_{2t}$, I = 1,2,3,……..,n and marginal equation for the vector autoregression ω_t is given as follows:

$$\boldsymbol{\omega}_t = \sum_{i=1}^{n}\boldsymbol{\beta}_{2i}\boldsymbol{z}_{t-i} + \mu_{2t} \qquad …… \qquad\qquad ……(42)$$

Defining $\phi_i = (\phi_{1i}, \phi_{2i})$ and applying equation (38), equation (42) can be re-expressed as follows:

$$\boldsymbol{\varepsilon}_t = \sum_{i=1}^{n-1}\boldsymbol{\phi}_{1i}\boldsymbol{\varepsilon}_{t-i} + \lambda\Delta x_t + \sum_{i=1}^{n}\boldsymbol{\phi}_{2i}\Delta x_{t-j} + v_t … … … … … … … … … … (43)$$

Equation (8) can further be expressed as,

$$\Delta\boldsymbol{\varepsilon}_t = \alpha\varepsilon_{t-1} + \sum_{i=1}^{n-1}\boldsymbol{\pi}_i\Delta\boldsymbol{\varepsilon}_{t-i} + \lambda\Delta x_t + \sum_{i=1}^{n}\boldsymbol{\phi}_{2i}\Delta x_{t-j} + v_t … … … … … … \quad ..(45)$$

Where $\alpha = (\sum_{i=1}^{n-1}\boldsymbol{\phi}_{1i}\boldsymbol{\varepsilon}_{t-i}) - \mathbf{1}$ and $\boldsymbol{\pi}_i = -\sum_{j=i}^{n-1}\boldsymbol{\phi}_{1j}$.

Taking the first difference of equation (39) and combining it with equation (45) gives the following cointegrated asymmetric error-correction model expressed as follows:

$$\Delta\boldsymbol{y}_t = \alpha\varepsilon_{t-1} + \sum_{i=1}^{n-1}\boldsymbol{\pi}_i\Delta\boldsymbol{y}_{t-i} + \sum_{i=0}^{n}\psi_i^+\Delta x_{t-i}^+ + \sum_{i=0}^{n}\psi_i^-\Delta x_{t-i}^- + v_t … … … \quad ..… \quad (46)$$

Alternatively, making the error-term in equation (37) the subject and lagging by one-period backward and combine with equation (46), we can then obtain the following non-linear autoregressive distributed lag model in asymmetric cointegration form highlighting the short-run and long-run dynamics of the model.

$$\Delta\boldsymbol{y}_t = \alpha y_{t-1} + \eta^+ x_{t-1}^+ + \eta^- x_{t-1}^- + \sum_{i=1}^{n-1}\boldsymbol{\pi}_i\Delta\boldsymbol{y}_{t-i} + \sum_{i=0}^{n}\psi_i^+\Delta x_{t-i}^+ + \sum_{i=0}^{n}\psi_i^-\Delta x_{t-i}^-$$

$$+ \qquad\qquad\qquad\qquad v_t … … … … .... \qquad\qquad\qquad .(47)$$

Where $\eta^+ = -\alpha\delta^+$, $\eta^- = -\alpha\delta^-$, $\psi_0^+ = \delta^+ + \lambda$, $\psi_j^+ = -\pi_i\delta^+ + \phi_{2j}$ for j=1,2,3,4…….n and $\psi_0^- = \delta^- + \lambda$, $\psi_j^- = -\pi_i\delta^- + \phi_{2j}$ for j=1,2,3,4…….n

Equation (47) is a formal transformation of an Autoregressive distributed lag model or ARDL (p, q, q) model for dependent variable, y_t and the independent regressors, x_t^+ and x_t^+ with q = p + 1 respectively. The model satisfies the following assumptions, (i) the error-term is assumed to be independent and identically distributed (i.i.d), (ii) the error-term is uncorrelated with other innovations and finally, (iii) the condition that $\alpha < 0$ ensures the stability of the model to be estimated.

4.2.2 The Empirical Asymmetric Model

In investigating the asymmetric impacts of fiscal deficit financing on inflation dynamics in Ghana, we deployed the non-linear autoregressive distributed lag model (NARDL) proposed by Shin et al (2014) to our data set as follows.

$$INF_t = \beta_0^L + \beta_0^H + \beta_1 EX_t + [\theta^L(\Delta BD_t)^{-1} + \theta^H(\Delta BD_t)^+] + \beta_2 INT_t + \beta_3 BS_t + \beta_4 OUTPUTGAP_t + \varepsilon_t \quad (48)$$

Where β_0^L, β_0^H, θ^L, θ^H, β_1, β_2, β_3, β_4 are coefficients to be estimated, ε_t represents the disturbance term which is assumed to be white-noise. Also, IF represents inflation variable, EX represents exchange rate, ΔBD represents changes in budget deficits, BS_t represents money supply, INT represents interest rates, and $\beta_4 OUTPUTGAP_t$ represents output gap. The coefficients of the two constant terms are subject to practical examination. The asymmetric definitions of the budget deficits can be momentarily defined as observed below:

$$(\Delta BD_t)^{-1} = Min[(\Delta BD_t)^{-1}, 0] \Rightarrow \begin{cases} (\Delta BD_t)^{-1} = \Delta BD_t, if \; \Delta BD_t < \tau \quad and \\ \Delta BD_t)^{-1} = 0 \; if \; \Delta BD_t \geq \tau \end{cases} \qquad (49)$$

$$(\Delta BD_t)^{+1} = Max[(\Delta BD_t)^{+1}, 0] => \begin{cases} (\Delta BD_t)^{+1} = \Delta BD_t, if \ \Delta BD_t \geq \tau \quad and \\ (\Delta BD_t)^{+1} = 0 \ if \ \Delta BD_t < \tau \end{cases} \tag{50}$$

It should be noted in equation above conditional on whether budget deficit, defined as ΔBT_t, is below or above a certain threshold value (τ), its assumed that the short-run effect on inflation will then be either or θ^L or θ^H. Similarly, the dependent variable is allowed to have a different intercept term depending on the threshold value: β_0^L for the time period when $\Delta BD_t < \tau$ or budget deficits is low and β_0^H for the time period, when budget deficits is high or $\Delta BD_t \geq \tau$. It is hypothesized that increasing budget deficits will lead a decline in inflation $\theta^H < 0$ principally when budget deficit is relatively high. Nevertheless, once budget deficit is sustainable and far below τ the estimated θ^L could have a positive sign (i.e. $\theta^L > 0$).

4.3 Model Estimation and Analysis

4.3.1 Stationarity Test

To be able to carry out the necessary estimations of the empirical models, one needed to test the properties of the selected variables in order to understand the characteristics of the data generation process to be able to effectively and efficiently analyse the estimated models as a key requirement. As a result, a unit root test was carried out for each of the variables in the model at both levels first and those variables that were not stationary at levels were differenced and a further unit root tests were conducted for those variables at their differenced. All of the variables had unit root in their levels as the null hypothesis of the presence of unit root was accepted at a high probability value using the Augmented Dickey-fuller, Phillips-Perron and the Ng-Perron statistics for testing the presence of unit root in the variables or otherwise, which indicated insignificance at 1 percent and 5 percent levels respectively except the dependent variable, inflation which was stationary at the level at 1 percent (See Table 2 below). The unit root tests conducted suggested that all of the variables were I(1) except inflation variables which was I(0).

Table 2. Unit root test summary results

	Levels			First Difference		
Variables	**Augmented Dickey-Fuller (ADF)**	**Phillip-Perron (PP)**	**Ng-Perron (NgP)**	**Augmented Dickey-Fuller (ADF)**	**Phillip-Perron(PP)**	**Ng-Perron (NgP)**
Inflation	-5.2148***	-5.2193***	0.6639***			
Money Supply	-3.2655	-3.1823	1.7239	-8.4118***	-17.2481	0.0026
Real GDP	1.4180	1.0494	2.5480	-3.5036***	-17.9296	-0.6222
Exchange Rate	-0.3073	1.7857	0.1149	-2.7364*	-12.9117**	-1.4490**
Interest Rate	-2.2719	-2.2904	4.7488	-11.8347***	-11.9447***	0.3451**
Fiscal Deficit Financing	-2.3310	-2.2492	2.7574	-11.8357***	-12.8117***	0.3551***
Domestic Financing Net	-3.6429	-3.9317	-3.8075	-9.9858***	-36.5368***	-10.4417***
Foreign Financing Net	-1.0831	-0.9472	-0.9472	-12.1658**	-12.4136***	-5.9546**

Source: Author's Computations

Again, the unit root tests were carried out for each of the non-stationary variables at their difference using the Augmented Dickey-Fuller unit root test, the Phillips-Perron unit root test and the Ng-Perron unit root tests and all of the unit root tests failed to accept the null hypothesis of unit root in all of the variables as shown in Table 2. The conclusion of the various unit root tests conducted suggested that inflation was I(0), real gross domestic product was I(1), money supply was I(1), interest rate was I(1),exchange rate was I(1), fiscal deficit financing indicator was I(1), domestic financing net was I(1) and finally, foreign financing net was also I(1) respectively.

4.3.2 Granger Causality Test

The result for the linear granger causality test was very instructive with three forms of causal links (these were no causality, unidirectional and bidirectional causalities). There was no linear causality between domestic finance and

inflation, on the one hand, and fiscal deficit financing and inflation, on the other hand. Exchange rate, interest rate, budget deficit financing and foreign finance had unidirectional causality with inflation in Ghana (see Table 3). Exchange rate, budget deficit financing and foreign finance granger significantly cause inflation at the 1 percent and 5 percent level respectively.

However, inflation granger significantly causes interest rate at the 1 percent level. Other variables such as the monetary growth and import capacity had bidirectional relationship with inflation rate in Ghana. This indicated that as these variables could lead to inflationary pressure, inflation pressure could also engender growth of money and increasing import pressure in the country.

Table 3. Pairwise granger causality test summary

S/N	Pairwise Relations	F-statistics
1.	Money growth does not granger causes inflation	24.605*
	Inflation does not granger causes money growth	10.548*
2.	Inflation does not granger causes exchange rate	1.229
	Exchange rate does not granger causes inflation	7.274*
3.	Inflation does not granger causes imports capacity	7.828*
	Imports capacity does not granger causes inflation	11.740*
4.	Interest rate does not granger causes inflation	0.455
	Inflation does not granger causes interest rate	2.984**
5.	Fiscal deficit financing does not granger causes inflation	0.123
	Inflation does not granger causes fiscal deficit financing	1.278
6.	Budget deficit financing does not granger causes inflation	5.468*
	Inflation does not granger causes budget deficit financing	1.821
7.	Domestic financing does not granger causes inflation	0.123
	Inflation does not granger causes domestic financing	1.079
8.	Foreign financing does not granger causes inflation	2.992**
	Inflation does not granger causes foreign financing	0.631

Source: Author's Computations.

4.3.3 Nonlinear-Autoregressive Distributed Lag (NARDL) Bound-Testing

The basis of asymmetry between fiscal deficit financing was to suggest that positive and negative outcomes of fiscal deficit financing do not impact proportionately on inflation in Ghana. In the light of this, a Wald test was carried out to test for the presence of asymmetry. Specifically, two models were estimated to investigate this relationship. In the first model (model 1), budget deficit financing variable was employed while the second model (model 2), we employed the use of fiscal deficit financing variable. This was meant to address the measurement issues in empirical investigations. Before the long-run equilibrium condition was examined, a stepwise regression (detailed in Table 4 and Table 5) was estimated for this purpose. After the examination for a long-run co-movement, long-run coefficients were also estimated to ascertain the long-run impacts of fiscal deficit financing on inflation in Ghana.

Table 4. Stepwise regression estimates

Variables	Model 1	
	Coefficient.	T-statistics
C	3.549***	5.976
Inflation (-1)	-0.111***	-11.227
Budget Deficit Financing Positive Changes	0.286***	2.854
budget Deficit Financing Negative Changes	0.219***	4.662
Exchange Rate Positive Changes	-1.478**	-2.416
Exchange Rate Negative Changes	-82.764**	-2.526
Interest Rate Positive Changes	0.243***	5.860
Interest Rate Negative Changes	0.028	1.101
Output gap Positive Changes	-0.939***	-2.983
Output gap Negative Changes	-1.122**	-2.008
Broad Money Supply(M2) Growth Positive Changes	-0.058***	-5.195
Broad Money Supply(M2) Growth Negative Changes	0.063***	7.955
Import-RGDP Positive Changes	0.058*	1.870
Import-RGDP Negative Changes	-0.012	-0.255
R-squared	0.998	
Adj. R-squared	0.996	
F-statistics	786.3	
Prob. (F-stat.)	0.000	

Source: Author's computations. Note that Model 1 has budget deficit financing as regressor. Note that ***, ** and * represents 1%,5% and 10% significance levels respectively.

Table 5. Stepwise regression estimates

Variables	Model 2	
	Coefficient.	T-statistics.
C	11.846***	5.067
Inflation (-1)	-0.118***	-10.109
Fiscal Deficit financing Positive Changes	0.0012	0.299
Fiscal Deficit financing Negative Changes	-0.003***	-7.111
Exchange Rate Positive Changes	-1.361***	-5.615
Exchange Rate Negative Changes	43.521***	3.167
Interest Rate Positive Changes	0.100***	5.457
Interest Rate Negative Changes	-0.136***	-7.252
Output gap Positive Changes	-0.551***	-3.174
Output gap Negative Changes	-1.927***	-5.675
Broad Money Supply(M2) Growth Positive Changes	-0.016**	-2.403
Broad Money Supply(M2) Growth Negative Changes	0.060***	9.241
Import-RGDP Positive Changes	-0.089***	-4.654
Import-RGDP Negative Changes	-0.049	-1.618
R-squared	0.998	
Adj. R-squared	0.998	
F-statistics	1165	
Prob. (F-stat.)	0.000	

Source: Author's computations. Note that Model 2 has fiscal deficit financing as regressor. Note that ***, ** and * represents 1%,5% and 10% significance levels respectively.

There exists a long-run equilibrium condition among the variables includes in the model; particularly between fiscal deficit financing and inflation in Ghana. Both models 1 and 2 have F-statistics ratios of 12.95 and 21.29 respectively. These statistics, with 0.000 probability values, were statistically significant at the 1 percent level. More importantly, the F-statistics ratios were higher than the upper bound critical value of 4.35 (see Table 6). This suggested that there exists equilibrium condition that allows both budget deficit financing and inflation, on the one hand, and fiscal deficit financing and inflation in Ghana on the other hand in the long run.

Table 6. Cointegration test summary (Long-Run Equilibrium)

Test Statistics	Model 1	Model 2
F-statistics	12.95 (0.000)	21.29 (0.000)
Chi-Square	168.34 (0.000)	276.71 (0.000)
Critical Values		
Upper Bound I(1)	4.35	
Lower Bound I(0)	3.23	

Source: Author's Computation. Note that Figures in parenthesis are probability values

4.3.4. Long-Run Asymmetric Effects of Fiscal Deficit Financing on Inflation

Consequent upon this, the impact analysis for the long-run became imperative. It was evident from the estimated regression results in Tables 7 and 8 that there truly exists asymmetric relationship between fiscal deficit financing and inflation in Ghana on one hand or budget deficit financing and inflation in Ghana on the other hand. Although, the positive outcome of budget deficit financing had a negligible negative impact on inflation while its negative

outcome had a statistically significant impact on inflation in Ghana. In contrast, the positive outcome of fiscal deficit financing had a negligibly positive impact on inflation while its negative outcome had a significant negative impact on inflation. The implication of these estimates was that budget deficit financing and fiscal deficit financing had asymmetric impacts on inflation dynamics in Ghana during the period under discussion (see Table 7 and Table 8).

A similar pattern of asymmetry was also observed for the monetary growth, growth of gross domestic product, interest rate and exchange rate. This was because either the positive outcome was negligible while the negative outcome was significant or vice versa. Sometimes, also, these variables alternate sign effects. Positive outcomes of both the monetary growth and real gross domestic products were negatively related to inflation while the corresponding negative outcomes were positive related to inflation. A similar alternating sign effects was observed for the exchange rate in Model 2.

Table 7. Summary results for long-run estimated asymmetric coefficients of budget deficit financing in Ghana

Variables	Model 1	
	Coefficient	Prob. Values
Budget Deficit Financing Positive Changes	-0.658	0.512
Budget Deficit Financing Negative Changes	2.110**	0.038
Exchange Rate Positive Changes	1.655	0.102
Exchange Rate Negative Changes	3.757***	0.000
Interest Rate Positive Changes	3.626***	0.001
Interest Rate Negative Changes	-0.051	0.959
Outputgap Positive Changes	-2.420**	0.018
Outputgap Negative Changes	0.198	0.843
Broad Money Supply(M2) Growth Positive Changes	-0.827	0.410
Broad Money Supply(M2) Growth Negative Changes	3.649***	0.001
Import-RGDP Positive Changes	1.547	0.126
Import-RGDP Negative Changes	-0.611	0.543

Source: Author's computations and note that ***, ** and * denotes significance levels at 1%,5% and 10% respectively.

Table 8. Summary results for long-run estimated asymmetric coefficients fiscal deficit financing in Ghana

Variables	Model 2	
	Coefficient	Prob. Values
Fiscal Deficit financing Positive Changes	0.301	0.764
Fiscal Deficit financing Negative Changes	-6.520***	0.000
Exchange Rate Positive Changes	-5.482***	0.000
Exchange Rate Negative Changes	3.389***	0.001
Interest Rate Positive Changes	5.231***	0.000
Interest Rate Negative Changes	-8.061***	0.000
Outputgap Positive Changes	-3.022***	0.003
Outputgap Negative Changes	-5.241***	0.000
Broad Money Supply(M2) Growth Positive Changes	-2.438**	0.017
Broad Money Supply(M2) Growth Negative Changes	8.927***	0.000
Import-RGDP Positive Changes	-4.760***	0.000
Import-RGDP Negative Changes	-1.634	0.106

Source: Author's computations and note that ***, ** and * denotes significance levels at 1%, 5% and 10% respectively.

4.3.5 Asymmetric Test for Effects of Budget Deficit Financing and Fiscal Deficit Financing on Inflation Dynamics

While the asymmetric effects in terms of signs effects could be considered atheoretical, a theoretical way to check was to conduct formal test of asymmetry based on the Wald test. As detailed in Table 9 and Table 10, model 1 suggested an absence of asymmetric effects of budget deficit financing on inflation while Model 2 indicated the presence of asymmetric effects of fiscal deficit financing on inflation. Also, the null hypothesis of no asymmetric for the growth of real gross domestic product could not be rejected in Model 1 while the null hypothesis of no asymmetry effects of import capacity on inflation could not be rejected in Models 1 and 2. For all other variables, such as the exchange rate, interest rate and monetary growth, the null hypotheses of no asymmetry for these variables were altogether rejected for both Models 1 and 2 (see Table 9 and Table 10).

Table 9. Test for asymmetric effects of budget deficits financing on inflation dynamics in Ghana

Asymmetric Variables	Model 1	
	Coefficients	Prob. Value
Positive and Negative Changes in Budget Financing	1.593	0.115
Positive and Negative Changes in Exchange Rate	3.778***	0.000
Positive and Negative Changes in Interest Rate	-4.043***	0.000
Positive and Negative Changes in Outputgap	0.855	0.395
Positive and Negative Changes in Broad Money Supply(M2) Growth	3.083***	0.003
Positive and Negative Changes in Import to RGDP	-1.108	0.271

Source: Author's computations and note that ***, ** and * represent significance levels at 1%,5% and 10% respectively.

Table 10. Test for asymmetric effects of fiscal deficits on inflation dynamics in Ghana

Asymmetric Variables	Model 2	
	Coefficients	Prob. Value
Positive and Negative Changes in Fiscal Deficit Financing	8.002***	0.000
Positive and Negative Changes in Exchange Rate	-3.510***	0.001
Positive and Negative Changes in Interest Rate	8.625***	0.000
Positive and Negative Changes in Outputgap	3.010***	0.003
Positive and Negative Changes in Broad Money Supply Growth	-7.432***	0.000
Positive and Negative Changes in Import to RGDP	-0.920	0.360

Source: Author's computations and note that ***, ** and * represent significance levels at 1%,5% and 10% respectively.

5. Conclusion

This study investigated the presence of asymmetry of fiscal deficit financing and how it had impacted on inflation dynamics in Ghana over the 1980-2018 period. The study had confirmed the presence of asymmetry of fiscal deficit financing in Ghana and that fiscal deficit financing had affected inflation asymmetrically over the years in Ghana. The study revealed that positive changes in fiscal deficit financing had a significantly stronger effect on inflation dynamics in Ghana while negative changes in fiscal deficit financing had less impact on inflation dynamics respectively.

6. Some Policy Discussions

The implications of the findings and conclusions of this paper was that fiscal policy implementation impacted differently on inflation dynamics in the Ghanaian economy in general dependant on the policy direction at the time of implementation. The apparent policy shocks to the fiscal sector could have been well-managed if fiscal consolidation policy already existed. Hence, going forward, there is the need for government of Ghana particularly, the fiscal authorities to fashion out fiscal policies that aim at promoting fiscal sustainability based on a policy of

continued consolidation. Some of the policy reform options available to Ghana government are to embark on tax revenue and expenditure reform policies. The government of Ghana could implement tax reform agenda that could aim at broadening the existing tax base by formalising the large informal economy in order to rake in more tax revenues to finance its ever-increasing expenditure demands. On the expenditure reforms side, government could institute expenditure-reducing and expenditure-switching policies that prioritise expenditures on capital formation and other growth poles of the economy such as improved infrastructure expenditures which could generate multiplicative effects on the other sectors of the Ghanaian economy for higher economic growth to be achieved as a result of the expenditure policy reforms.

Finally, the established fiscal rules under the Ghana's Fiscal Responsibility Act must be strictly followed. The Fiscal Council should have the courage and the teeth to penalise all government agencies that violate the limits set by the government fiscal budget for each financial year of implementation. These rules as enshrined in the Ghana's Fiscal Responsibility Law could potentially eliminate the fiscal imbalance that exists on the fiscal accounts over time when all stakeholders are made to strictly adhered to its full implementation. It must be noted with concern that, the Fiscal Responsibility law in its current form could be rendered useless and therefore have no effects on the fiscal performance and position for the country as a consequence due to lack of will by authorities to fully implement it. Thus, defeating its intended purposes for establishing the law in the first place.

References

Acquah-Sam, E. (2017). Influencers of inflation in Ghana. *European Scientific Journal, 13*(7), 140-158. https://doi.org/10.19044/esj.2017.v13n7p140

Adu, G., & Marbuah, G. (2011). Determinants of inflation in Ghana: an empirical investigation. *South African Journal of Economics, 79*(3), 251-269. https://doi.org/10.1111/j.1813-6982.2011.01273.x

Agha, A. I., & Khan, M. (2008). An empirical analysis of fiscal imbalances and inflation in Pakistan. *SBP Research Bulletin, 2*(2), 344-362.

Ahiakpor, F. (2014). Rethinking about determinants of inflation in Ghana: which econometric model tell the true story. *European Journal of Business and Management, 6*(6), 78-86.

Ahking, F. W., & Miller, S. M. (1988). The relationship between government deficits, money growth and inflation. *Journal of Macroeconomics, 7*, 447-467. https://doi.org/10.1016/0164-0704(85)90036-9

Alagidede, P. (2016). Central bank deficit financing in a constrained fiscal space. *International Growth Centre (IGC) Working Paper series* S-33306-GHA-1: 1-14.

Alagidede, P., Coleman, S., & Adu, G. (2014). Regional analysis of inflation dynamics in Ghana. *International Growth Centre (IGC) Working Paper Series*:1-32.

Barro, R. J. (1974). Are government bonds net worth? *Journal of political Economy, 8*(6), 1095-1117. https://doi.org/10.1086/260266

Barro, R. J. (1979). On the determination of the public debt. *The Journal of Political Economy, 87*(5), 940-971. https://doi.org/10.1086/260807

Bawumia, M., & Abradu-Otoo, P. (2003). Monetary growth, exchange rates and inflation in Ghana: an error correction analysis. *Bank of Ghana Working Pape series* BOG-2003/05:1-35.

Bawumia, M., & Atta-Mensah, J. (2003). A simple vector-error-correction forecasting model for Ghana. *Working Pape series* BOG-2003/01: 1-30.

Blejer, M. I., & Cheasty, A. (1991). The measurement of fiscal deficits. Analytical and methodological issues. *Journal of Economic Literature, 29*(4), 1644-1678.

Bliss, R. R., & Kaufman, G. R. (2002). Bank Procyclicality, Credit Crunches, and Asymmetric Monetary Policy Effects: A Unifying Model. Federal Reserve of Chicago, working Paeper. WP 2002-18. 1-25. https://doi.org/10.2139/ssrn.367166

Canzoneri, M. B., Cumby, R. E., & Diba, B. T. (1998). Is the price level determined by the needs of fiscal solvency? *American Economic Review, 91*(5), 1221-1238. https://doi.org/10.1257/aer.91.5.1221

Cardoso, L. (1992). Inflation and poverty. *National Bureau of Economic Research* (*NBER) Working Paper Series* 4006: 1-52. https://doi.org/10.3386/w4006

Carlstrom, C. T., & Fuerst, T. S. (1999). Optimal monetary policy in a small open economy: a general equilibrium analysis. *Central Bank of Chile Working Papers, 70*, 1-32. https://doi.org/10.26509/frbc-wp-199911

Catao, L. A. V., & Terrones, M. E. (2005). Fiscal deficits and inflation. *Journal of Monetary Economics, 52*(3), 529-554. https://doi.org/10.1016/j.jmoneco.2004.06.003

Chibber, A., & Shafik, N. (1990). Exchange reform, parallel markets, and inflation in Africa. *World Bank PPR Working Paper Series* 427: 1-56.

Cover, P. J. (1992). Asymmetric Effects of Positive and Negative Money-Supply Shocks. *The Quarterly Journal of Economics, 107*(4), 1261–1282. https://doi.org/10.2307/2118388

Cukrowski, J. (2001). Financing budget deficit by central bank seigniorage in selected transitional Economies: a comparative study. *Centre for Social and Economic Research of Central European University (CASE-CEU) Working Papers Series* 37: 1-42.

Diamond, P. A. (1965). National debt in a neoclassical growth model. *The American Economic Review, 55*(5), 1126-1150.

Doh-Nani, R. (2011). Is Ghana's budget deficit sustainable? a cointegration analysis. Unpublished Mphil thesis, Department of Economics, Kwame Nkrumah university of science and technology: 1-76.

Dolado, J. J., & Maria-Dolores, R. (2006). State Asymmetries in the Effects of Monetary Policy Shocks on Output: Some New Evidence for the Euro-Area. *Contributions to Economic Analysis, 276*, 311-331. https://doi.org/10.1016/S0573-8555(05)76012-0

Drazen, A. (1985). A general measure of inflation tax revenues. *Economics Letters, 17*, 327-330. https://doi.org/10.1016/0165-1765(85)90252-6

Dwyer, G. P. (1982). Inflation and government deficits. *Economic Inquiry, 20*(3), 315-329. https://doi.org/10.1111/j.1465-7295.1982.tb00350.x

Enu, P., & Havi, E. D. K. (2014). Macroeconomic determinants of inflation in Ghana: a cointegration approach. *International Journal of Academic Research in Business and Social Sciences, 4*(7), 95-110. https://doi.org/10.6007/IJARBSS/v4-i7/993

Feldstein, M. (1988). The effects of fiscal policies when incomes are uncertain: a contradiction to Ricardian equivalence. *The American Economic Review, 78*(1), 14-23.

Friedman, B. M. (1968). The role of monetary policy. *American Economic Review, 58*(1), 1-17.

Friedman, B. M. (1971). A memorandum to the Federal Reserve. *Wall Street Journal* (January 30). 1981b. Deficits and inflation. *Newsweek* (February 23):70.

Ghartey, E. E. (2001). Macroeconomic instability and inflationary financing in Ghana. *Economic Modelling, 18*(3), 415-433. https://doi.org/10.1016/S0264-9993(00)00047-X

Gros, D. (2004). Profiting from the euro? Segniorage gains from euro area accession. *Journal of Common Market Studies, 42*(4), 795–813. https://doi.org/10.1111/j.0021-9886.2004.00530.x

Gyebi, F., & Boafo, G. K. (2013). Macroeconomic determinants of inflation in Ghana from 1990–2009. *International Journal of Business and Social Research, 3*(6), 81-93.

Hamburger, M. J., & Zwick, B. (1982). Deficits, money and inflation. *Journal of Monetary Economics, 7*, 141-150. https://doi.org/10.1016/0304-3932(81)90057-X

Hamilton, J. D. (1989). A new approach to the economic analysis of nonstationary time series and the business cycle. *Econometrica, 57*(23), 57-84. https://doi.org/10.2307/1912559

Hamilton, J. D. (1990). Analysis of time series subject to changes in regime. *Journal of Econometrics, 45*, 39-70. https://doi.org/10.1016/0304-4076(90)90093-9

Hassan, Z. (2018). Deficit financing in developing countries: applications and consequences. *International Centre for Education in Islamic Finance* (INCEIF)*:* 1-13. Retrieved January 20, 2021, from https://mpra.ub.uni-muenchen.de/89654

Hochreinter, E., Rovelli, R., & Winckler, G. (1996). Central banks and seigniorage: a study of three economies in transition. *European Economic Review, 40*, 629-643. https://doi.org/10.1016/0014-2921(95)00075-5

Johnson, R. (2014). Fiscal deficit, money growth and inflation dynamics in Ghana. Unpublished Mphil thesis, department of economics, Kwame Nkrumah university of science and technology: 1-56.

Karras, G., & Stokes, H. H. (199). Why are the effects of money-supply shocks asymmetric? Evidence from prices, consumption, and investment. *Journal of Macroeconomics, 21*(4), 713-727. https://doi.org/10.1016/S0164-

0704(99)80003-2

Keynes, J. M. (1936). The General Theory money-wage and prices. *Cambridge University Press*. Book 5, Chapter 19, 20 and 21: 255-310.

Keynes, J. M. (1937). The general theory of employment summary. *The Quarterly Journal of Economics, 51*(2), 209-223. https://doi.org/10.2307/1882087

Komulainen, T., & Pirttilä, J. (2000). Fiscal explanations for inflation: any evidence from transition economies? *Economics of Planning, 35*, 293–316. https://doi.org/10.1023/A:1022491613255

Kurayish, S., & Bbaale, E. (2019). Budget deficit and inflation nexus in Uganda 1980–2016: a cointegration and error correction modelling approach. *Journal of Economic Structures, 8*(3), 2-14. https://doi.org/10.1186/s40008-019-0136-4

Kwon, G., Lavern, M., & Robinson, W. (2009). Public debt, money supply, and inflation: a cross-country study. *IMF Staff Papers, 56*(3), 476-515. https://doi.org/10.1057/imfsp.2008.26

Labonte, M. (2008). Inflation: core versus headline. *Congressional Research Service (CRS) Report for Congress, Order Code* RS22705: 1-5.

Labonte, M. (2011). Inflation: causes, costs and current status. *Congressional Research Service (CRS) Report for Congress, Order Code RL*30344: 1-12.

Lemgruber, A. C. (1980). expectativas racionais e o dilema produto real/inflação no Brasil. *Revista Brasileira de Economia, 34*(4).

Lin, H., & Chu, H. (2013). Are fiscal deficits inflationary? *Journal of International Money and Finance, 32*, 214-233. https://doi.org/10.1016/j.jimonfin.2012.04.006

Miller, P. (1983). Higher deficit policies lead to higher inflation. *Quarterly Review, Federal Reserve Bank of Minneapolis*, 8-19. https://doi.org/10.21034/qr.712

Nkalu, C. N. (2015). The effects of budget deficits on selected macroeconomic variables in Nigeria and Ghana. *Asian Economic and Social Society, 5*(10), 167-180.

Oblath, G., & Valentinyi, A. A. (1994). Seigniorage and inflation tax: some theory and an application to Hungary. *Working paper. Budapest: KOPINT-DATORG*: 1-24.

Ocran, M. K. (2007). A modelling of Ghana's inflation experience: 1960-2003. *Studies in Economics and Econometrics, 31*(1), 119-144. https://doi.org/10.1080/10800379.2007.12106424

Ogunsakin, S., & Olalere, S. S. (2017). Nexus between inflation and budget deficit: a comparative study between Nigeria and South Africa. *International Journal of Economics, Commerce and Management, 8*, 98-112.

Osei, V. (2014). Inflation dynamics in Ghana. *Journal of International Finance and Banking, 2*(1), 38-58. https://doi.org/10.5296/ifb.v2i1.7913

Osei, V. (n.d.). Managing interest rate spreads in Ghana: some policy discussion. *Journal of Economics and Sustainable Development, 7*(24), 16-31.

Patinkin, D. (1979). The inflationary experience: some lessons from Israel. *Essays in post-Keynesian inflation, 1*, 25-34.

Pettifor, A. (2018). Deficit financing or deficit reduction? debate in contemporary economics: origins, confusion and clarity. *Journal of King Abdulaziz University-Islamic Economics, 32*(1), 67-78. https://doi.org/10.4197/Islec.32-1.4

Rhee, W., & Rich, R. (1995). Inflation and the asymmetric effects of money on output fluctuations. *Journal of Macroeconomics, 17*(4), 683-702. https://doi.org/10.1016/0164-0704(95)80089-1

Sargent, T., & Wallace, N. (1981a). Some unpleasant monetarist arithmetic. *Quarterly Review, Federal Reserve Bank of Minneapolis, 5*, 1-18. https://doi.org/10.21034/qr.531

Sargent, T., & Wallace, N. (1981b). The ends of four big inflations. *Federal Reserve Bank of Minneapolis Working Paper* 158: 41-97. https://doi.org/10.21034/wp.158

Seater, J. (1993). Ricardian equivalence. *Journal of Economic Literature, 31*(1), 142–190.

Sowa, N. K. (1994). Fiscal deficits, output growth and inflation targets in Ghana. *Journal of Emerging Trends in Economics and Management Sciences (JETEMS), 22*, 1105-1117. https://doi.org/10.1016/0305-750X(94)90079-5

Sowa, N. K., & Acquaye, I. (1999). Financial and foreign exchange markets liberalization in Ghana. *Journal of International Development, 11*(3), 385-409. https://doi.org/10.1002/(SICI)1099-1328(199905/06)11:3<385::AID-JID590>3.0.CO;2-P

Sowa, N. K., & Kwakye, J. (1993). Inflationary trends and control in Ghana. *Africa Economic Research and Consortium Research Report, 22*, 1-31.

Woodford, M. (1994). Monetary policy and price level determinacy in a cash-in-advance economy. *Economic theory, 4*, 345-380. https://doi.org/10.1007/BF01215377

Yvonne, A. D. (2015). Examining the effects of fiscal deficits on inflation in Ghana. Unpublished MPhil thesis, Economics Department University of Ghana, Legon:1-94.

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