

Regime Effects of Fiscal Deficit Financing and Inflation Dynamics in Ghana

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How to cite this paper: Osei, V., & Ogunkola, E. O. (2022). Regime Effects of Fiscal Deficit Financing and Inflation Dynamics in Ghana. *Theoretical Economics Letters*, 12, 258-286.

<https://doi.org/10.4236/tel.2022.121015>

Received: December 18, 2021

Accepted: February 20, 2022

Published: February 23, 2022

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Abstract

Fiscal deficit financing is confirmed in both theoretical and empirical literature to often lead to higher-than-expected inflation. The unsustainable regime of fiscal deficit financing in Ghana over the years had contributed to price instability in Ghana. Previous studies on deficit financing-inflation nexus in Ghana concentrated completely on linear and symmetric relation while ignoring the effect of regime of fiscal deficit financing on inflation. This study investigated the regime of fiscal deficit financing and its effects on inflation dynamics in Ghana over the 1980-2018 period. The Theory of Fiscal Price Level (TFPL) was adopted as the theoretical framework for the study. The TFPL highlighted the macroeconomic consequences of fiscal dominance over monetary policy actions and how it impacts on price stability due to the financing of government fiscal deficit in a country. The study employed Markov-Switching Regime Dynamic Model (MSRDM) to investigate the regime effects of fiscal deficit financing on inflation. The study revealed the presence of two fiscal regimes in Ghana and that the regime of fiscal deficit financing remained persistent over the study period. The paper further found that fiscal deficit financing had a stronger effect on inflation dynamics in Ghana in the higher regime of fiscal deficit financing while its impact on inflation in the lower regime of fiscal deficit financing remained relatively subdued. The paper recommends that the government of Ghana should adopt fiscal policy actions that could lead to the achievement and maintenance of fiscal sustainability and consolidation consistent with a low inflation regime going forward.

Keywords

Fiscal Deficit Financing, Inflation Dynamics, Regime Effect, Theory of Fiscal Price Level

1. Introduction

Many developing countries face budget deficits challenges and problems due to fiscal imprudence normally caused by fiscal indiscipline on the part of various governments especially against the backdrop of uncontrolled government expenditures given its fixed revenue generation base. For many years, Ghana has faced fiscal challenges in terms of government expenditure overruns relative to its revenue base. The consequence of fiscal challenges has been reflected in terms of instability in many other macroeconomic variables including inflation in the country (Friedman, 1968; Keynes, 1936; Sowah & Kwakye, 1993; Bawumia & Abrade-Otoo, 2003; Bawumia & Atta-Mensah, 2005). The containment of Ghana's fiscal deficits continuous to pose a major macroeconomic challenge to fiscal authorities in the country as well as the central bank of Ghana in its fight against price instability which remains a key policy objective of the central bank (Ghartey, 2001; Dadson, 2015; Ahiakpor, 2014).

Price stability remains crucial macroeconomic policy target of Central Banks in every economy in order to promote an enabling environment for sustaining long-term economic growth as government seeks to industrialise the economy. To maintain stable inflation and low inflation regime, it becomes key to critically examine the type of policy regime and how they impact on inflation in the respective economy (Lemgruber, 1980; Bliss & Kaufman, 2002). Theoretical and empirical studies have confirmed that unsustainable fiscal deficit financing in an economy adversely affects price stability as well as the entire economy particularly if it is caused by increased monetisation (Woodford, 1994; Friedman, 1968; Sowah, 1994; Ocran, 2007; Alagidede et al., 2014; Alagidede, 2016).

It is in the light of these major developments regarding Ghana's long experiences of fiscal slippages, financing challenges and its consequential effects on inflation dynamics among others on the Ghanaian economy over the years that this study seeks to re-examine critically the relation between Fiscal deficit financing and inflation in Ghana especially in the context of regime policy shifts. The study seeks to identify the impact of fiscal deficits on inflation based on the type of policy regime in this relation. And this research gap remains to be filled in the literature in Ghanaian context.

2. The Research Problem and Justification for This Study

Ghana's fiscal deficits and its effects on price stability and output growth have been a major source of concern to various governments in the past, Central Bank of Ghana, the private sector, civil society, domestic and international investors and other major international financial institutions like the IMF, the World Bank and Rating Agencies among others. Fiscal deficits picked up from 6.3 percent of GDP in 2015 to 7.8 per cent of GDP in 2016. Though it declined to 5.9 percent of GDP in 2017 against a program target of 6.3 percent of GDP, it significantly ballooned again to 7.2 percent of GDP in 2018 against a revised program target of 4.4 percent of GDP in consultation with the International Monetary Fund. Var-

ious governments in the past including the current government had to deal with the negative the plaque of fiscal deficits financing and its negative consequences on other macroeconomic variables particularly on inflation in the Ghanaian economy. In the past three decades, several IMF stabilisation programs had been fashioned-out all aimed specifically at reducing central government budget deficits and its negative effects on inflation, output growth and other macroeconomic indicators in the domestic economy. However, these stabilization programs produced various mixed results and were unsuccessful at least in the past.

The country under the recent Three-Year IMF stabilisation program which initially was planned to end on September 2018 though it was extended to 2nd April, 2019. One of the core objectives of the program was to ensure significant consolidation of fiscal deficit to a sustainable level through debt sustainability and restoration of growth. The programme placed strict restrictions on debt accumulation and central bank financing of government budget deficit all aimed at controlling fiscal and current deficits respectively in the medium to long-run to best global benchmarks in order to also reduce its attendant negative effects on price stability and economic growth. These policies were fashioned in a way to complement the efforts of the Central Bank of Ghana in fighting against inflation in the country and also enhance its policy independence and credibility in the country. Trends in fiscal deficits have not been encouraging over the years. The overall fiscal deficits as a percentage of GDP stood at 6.1 percent in 2000 which reflected in 25.1 percent of inflation. Overall fiscal deficits picked-up again from 7.2 percent of GDP in 2007 to 8.0 percent of GDP in 2008. This development culminated into inflationary pressures in the country, thus leading to a high inflation rate of 18.1 percent in 2008 from 12.7 percent in 2007. The high and continues build-up in fiscal deficits balance on the monetary sector of the economy, thus constraining the efforts of monetary authorities from achieving their policy target.

Recent studies examining fiscal deficit financing-inflation nexus in Ghana included Sowah (1994), which found that both monetary and non-monetary factors remained key determinants of inflation in Ghana. An empirical study (Ocran, 2007; Ghartey, 2001; Sowah & Kwakye, 1993; Sowah & Acquaye, 1999; Alagidede, 2016; Bawumia & Abradu-Otoo, 2003; Osei, 2016; Dadson, 2015; Nelson, 2015; Ogunsakin & Olalere, 2017; Kurayish & Bbaale, 2019) supported that assertion that inflation was caused by other factors of inflation such exchange rate, money supply and deficit financing among others. It must be noted with concern that all of these studies were based on linear and symmetric links from fiscal deficit financing to inflation, therefore completely disregarding regime policy effects of fiscal deficit financing on inflation dynamics which could as result of nonlinear policy effects of fiscal deficit financing. Theoretically and empirically, it is possible that depending on the type of regime policy in place, the 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 regimes. Many studies had revealed that policies in different regimes tend to have different policy regime impacts on macroeconomic indicators. This was evident in the work by Lemgruber (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 type of regime 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 depending upon the type policy regimes at adopted by the policy-makers in the economy (Cover, 1992; Rhee & Rich, 1995; Karras & 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 due to the type of regime (Bliss & Kaufman, 2002; Dolado & Maria-Dolores, 2006).

It is therefore worth investigating this problem of sustained fiscal deficits and their impacts on inflation in Ghana in a broader perspective especially in the context of effects of regime policy changes on inflation dynamics which continues to remain a missing research gap yet to be filled in Ghana's case. Again, since time series variables turn to be non-linear over time, the apparent linear relationship between fiscal deficits and inflation has been questioned recently in the economic literature. As a result, the existence of potential non-linearity between fiscal deficit financing and inflation calls for re-examination of the deficit financing-inflation nexus since it also further suggests the likely existence of regime of fiscal deficit financing. In reference to the above gaps in the literature on Ghana, this paper therefore seeks to contribute to the literature fiscal deficit financing-inflation nexus in this case by examining the regime policy effects of fiscal deficit financing on inflation dynamics in Ghana between 1980-2018.

3. Some Stylized Facts

3.1. Performance of Government Revenue, Expenditure Outturns and Fiscal Deficit

The performance of government revenue has been abysmal over the years as against ever-growing government expenditure. There are occasions where government revenue has been excellent (close to earlier projections). This has created fiscal deficits cycles over the years as financing options become costly due to high interest payments on government bonds issued both domestically and externally. Government revenue in Ghana is derived from the formal sector leaving the large informal sector untaxed which affects the value of tax collections as the same tax base become over-burdened mostly due to lack of innovation in tax collection system. While government tax revenue collections remained low, government expenditure has been skyrocketing as government needs also grow uncontrollably. Although many reforms have been introduced

in the past in order to improve government revenue collections and control government expenditure, the reforms have not produced the much-expected outcome.

Government revenue collections grew by 119.9 percent in 1984 to Ghc 2.26 million from Ghc 1.09 million in 1983. The relative improvement in government revenue was mainly due to a significant performance of tax revenue which contributed about 79 percent to the growth in government revenue collections. Non-tax and grants accounted for 17 percent and 4 percent respectively. Government expenditure, on the other hand, improved by 82.1 percent to Ghc 2.78 million in 1984, from Ghc 1.54 million in 1983. The growth in government expenditure was explained by the substantial increase in non-interest payments expenditure which accounted for about 87.5 percent of the growth in government spending whilst interest payments contributed about 12.5 percent. The revenue and the expenditure flows in 1984 resulted into an overall fiscal deficit of Ghc 0.48 million and a primary deficit balance of Ghc 0.26 million in 1983 (Figure 1).

Again, there was a pickup of 82.6 percent in revenue collections to Ghc 7.36 million in 1986 as against Ghc 4.04 million, whereas government expenditure grew by 53.1 percent to Ghc 7.33 million in 1986 relative to Ghc 4.78 million in 1985 with a corresponding overall fiscal and primary surplus of Ghc 0.77 million and Ghc 0.03 million.

The performance of government revenue in 1986 was partly due to an expansion in tax revenue component of the overall government revenue which accounted for 85 percent while non-tax component and grants contributed 10 percent and 5 percent respectively. Also, the expansion in government expenditure in 1986 was mainly due to a significant growth in non-interest payments

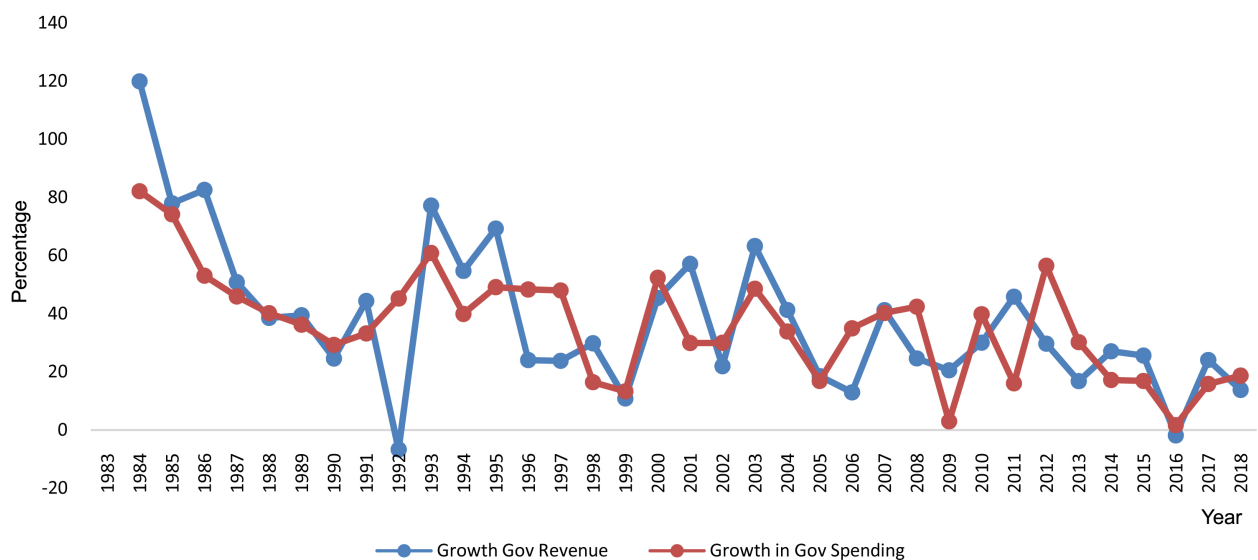


Figure 1. Growth rates of government revenue and expenditures (percentage).

component of government expenditure which contributed about 90.1 percent while interest payments on government loans accounted for 9.9.

In the late 1980s and early 1990s, government revenue performance fell short of government expenditure, thus creating a high fiscal deficit especially in the run-up to the 1992 first democratic and multi-party election after a long period of military regime from the 1980s. Government revenue declined by 6.6 percent to Ghc 36.03 million in 1992, from Ghc 38.60 million in 1991. The poor performance of government revenue in 1992 was due to a significant reduction in all of the major sources of revenue as shown by a reduction in tax revenue component of government overall revenue by 5 percent, a reduction in non-tax revenue by 16 percent and a dip of 10 in total grants received from international donor partners. Government expenditure, on the contrary, went up significantly relative to revenue collections in 1992 as total government revenue increased remarkably by 45.24 percent to Ghc 51.07 million as against Ghc 35.16 million. The main drivers of the huge growth in government expenditures in 1992 were attributed to a huge increase in interest payment on government loans which grew by 142 percent and a significant growth of 37.8 percent in non-interest payment expenditure of government. The uncontrolled government expenditure relative to the low revenue collection resulted into a high fiscal deficit of Ghc 14.44 million and a corresponding primary deficit of Ghc 9.90 million in 1992. This was relative to a fiscal surplus of Ghc 3.90 million and a primary surplus of 6.30 million in 1991.

Fiscal indiscipline from 1992 continued into the subsequent years which resulted into huge debt overhang and catapulted Ghana into a Highly Indebted Poor Country (HIPC) status in the late 1990s through the early 2000s. As result, Ghana was declared a HIPC country in 2001 in order to grant the country access to debt relief funds from the IMF and World Bank under the HIPC programme drawn by the IMF and World Bank. Although government revenue grew by 57.2 percent to Ghc 846.31 million in 2001, it was far below a huge government expenditure which also went up by 29.9 to Ghc 982.733 million, up from Ghc 756.46 million in 2000. These trends in government revenue and expenditure thus culminated into a fiscal deficit of Ghc 166.08 million and a primary surplus of Ghc 167.654 million in 2001 relative to a fiscal deficit of Ghc 234.14 million and a primary surplus of Ghc 62.53 million recorded in 2000. Government revenue again improved by 24.6 percent to Ghc 5619.70 million in 2008 as against Ghc 4508.22 million in 2007 while government expenditure also grew by 42.4 percent to Ghc 8009.82 million relative to Ghc 5624.53 million. This led to a fiscal deficit of Ghc 1976.49 million and a primary deficit of Ghc 1773.18 million. The fiscal deficit and primary deficit recorded in 2008 constituted a growth of 75 percent and 106 percent over Ghc 1132.18 million and Ghc 861.61 million registered in 2007, thus representing a huge build-up in both overall fiscal deficits and primary deficit due to election-related expenditures coupled with other spending runs during the 2008 general election (**Figure 2**).

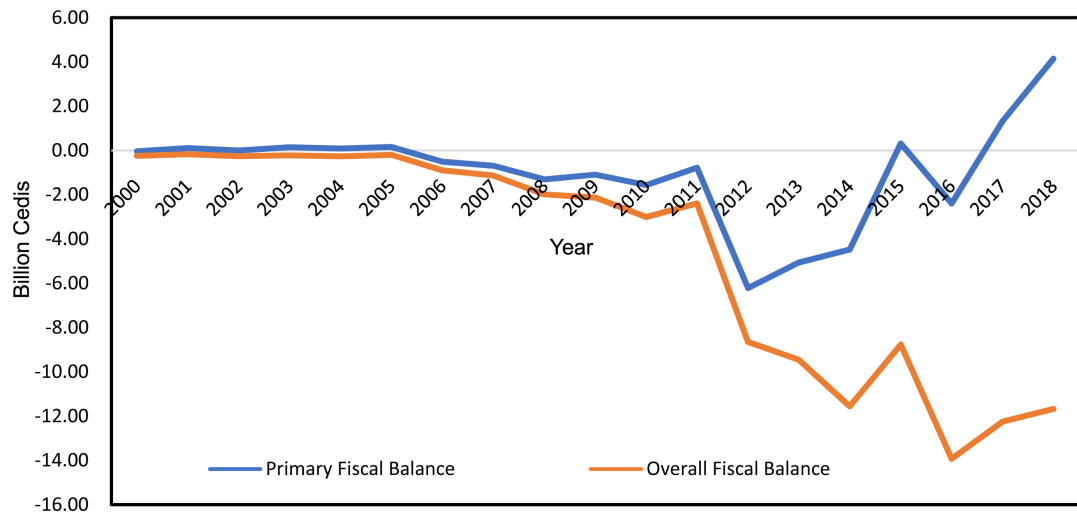


Figure 2. Overall fiscal deficits and primary deficits (billion Cedis).

For the 2010-2018 period, government spending continued to outpace its revenue, due to a lack of restraint on the part of government. As a result, fiscal deficit challenges reemerged as government expenditures went up significantly during this period. Government revenue grew by 29.70 percent to Ghc 16,668.41 million in 2012 from Ghc 12,851.56 million in 2011. Corresponding government expenditure also went up significantly by 56.5 percent to Ghc 20,944.73 million relative to, 379.98 million. This culminated into an overall fiscal deficit of Ghc 8648.66 million and a primary deficit of Ghc 11,721.27 million in 2012 as against an overall fiscal deficit of Ghc 2,395.43 million and a primary deficit balance of Ghc 1601.57 million Ghana cedis recorded during a corresponding period in 2011.

Also, government revenue suggested a dip of 1.8 percent to Ghc 30,526.23 million, down from Ghc 31,088.28 million in 2015 whereas government expenditure grew by 1.7 percent to Ghc 37,974.85 million relative to Ghc 37,344.58 million. This resulted into a fiscal deficit of Ghc 9771.99 million and a primary surplus of Ghc 4004.43 million as against a fiscal deficit of Ghc 9438.18 million and a primary surplus of Ghc 5565.59 million during a similar period in 2015. In 2018, government revenue improved by 13.8 percent to Ghc 43,124.61 million from Ghc 37,889.35 million in 2017 while government expenditure at the same period, grew by 18.7 percent to Ghc 52,201.01. This was against Ghc 43,983.83 million in 2017 which resulted into an overall fiscal deficit of Ghc 12,818.95 million and a primary surplus of Ghc 7023.62 million in 2018 relative to an overall fiscal deficit of Ghc 8407.84 million and a primary surplus balance of Ghc 8221.45 million.

3.2. Deficit Financing, Money Supply and Inflation Dynamics

Inflation remains one of the crucial macroeconomic indicators that impacts substantial effect on both macroeconomic and financial stability in Ghana. It has

become a key policy objective of both fiscal and monetary authorities pursuing policies targeting increased productivity and economic growth on a sustainable basis for the medium-to-long term.

Ghana has witnessed several episodes of high and persistent inflation over the span of its economic history commencing from the post-independence era to the period being discussed. The various governments in the past decades have implemented many economic policies, all aimed at taming inflation and restoring macroeconomic balance and financial stability. Several macroeconomic stabilisation programmes have been implemented with the assistance of the International Monetary Fund and the World Bank. Before 1980, the economy of Ghana had experienced a long period of macroeconomic instability which led to high and persistent inflation caused by monetisation of government fiscal deficits coupled with other economic challenges.

These severe economic problems led to the introduction of Economic Recovery Program in 1983 and later adopted Structural Adjustment Program in 1986 with the aim of restoring external imbalance, reducing inflation and the fiscal deficits and promoting economic growth. Although the full expectations of these economic stabilisation programmes were not met, there was some restoration of macroeconomic stability as the implementation led to fiscal deficit sustainability and reversed most of the severe economic challenges which plagued the Ghanaian economy before the economic reforms were introduced.

Empirical evidence on the causes of inflation in Ghana over the years by studies conducted by Sowah (1994), Ocran (2007), Bawumia and Abradu-Otoo (2003), Adu and Marbuah (2011), Osei (2014) and others have shown that unstable inflation in Ghana was partly caused by currency depreciation, excessive money growth, food supply bottlenecks and monetisation of government budget deficit. To begin with, inflation in Ghana after Ghana's independence in 1957 suggested that Ghana witnessed a stable inflation regime as inflation rate was within the single digit range during the late 1950s and the early part of 1960s. On the contrary, inflation picked up significantly during the 1970s spanning to the early 1980s as Ghana experienced high and volatile inflation. Ghana experienced a high inflation of 116.5 percent in 1981 mainly due to excessive growth in money supply of 51.3 percent as monetisation of fiscal deficit became the order of the day. Inflation continued to rise due to loosed monetary and fiscal policies of government which further led to one of the highest inflation ever experienced by Ghana with inflation reaching as high as 122.9 percent in 1983. This was primarily occasioned by high monetary growth of 40.2 percent through excessive fiscal deficit financing. It must be noted that trends in inflation within these periods continued to point to relatively high inflationary situation.

The Central Bank continued to miss its inflationary objective due to high fiscal deficit financing through domestic and external borrowing particularly from the Central Bank which led to excessive growth in monetary aggregates. Except in 1984 and 1985 where the Central Bank achieved its inflation objective of 40.6

percent and 25.6 percent against the actual inflation rates of 39.7 percent and 10.3 percent recorded, the Central Bank missed its inflation objective over several decades during the course of Ghana's economic history. The Bank of Ghana's failure to achieve its monetary policy objective of price stability over the past decades suggests that the conflicts between fiscal and monetary policies as the effects of fiscal dominance reflected in high fiscal deficit financing during the period under discussion. The high fiscal deficit and its financing options, particularly the monetisation of the government fiscal deficit as reflected in excessive growth of monetary aggregates impacted strongly on inflation dynamics in the Ghanaian economy (Figure 3). The discussions so far suggest how the efficiency, transparency and credibility of monetary policy were affected through policy decisions by the fiscal authority in Ghana.

This excessive fiscal deficit financing by government over the years has reflected in higher than the expected inflation in Ghana. Notably, inflation was 12.7 percent when Bank of Ghana adopted a full-fledged inflation targeting in 2007 as against 10.9 percent in 2006. Inflation picked up significantly to 18.1 percent in 2008 though it reduced marginally to 16 percent in 2009. It declined to 13.5 percent in 2013 but picked uncontrollably again to 17 percent in 2014. In 2015, inflation inched up pointedly to 18.99 percent though it declined in 2016 to 15.40 percent and 11.8 percent in 2017. In 2018, inflation declined further to a single digit of 9.4 percent partly due to strict adherence to the IMF conditionality of zero Central Bank financing of government fiscal deficits as one the performance criteria of the three-year Extended Credit Facility (ECF) stabilisation programme which ended on 3rd April, 2019. Although, Ghana achieved a single digit inflation in 2018 after missing it for several years, the 9.4 percent inflation

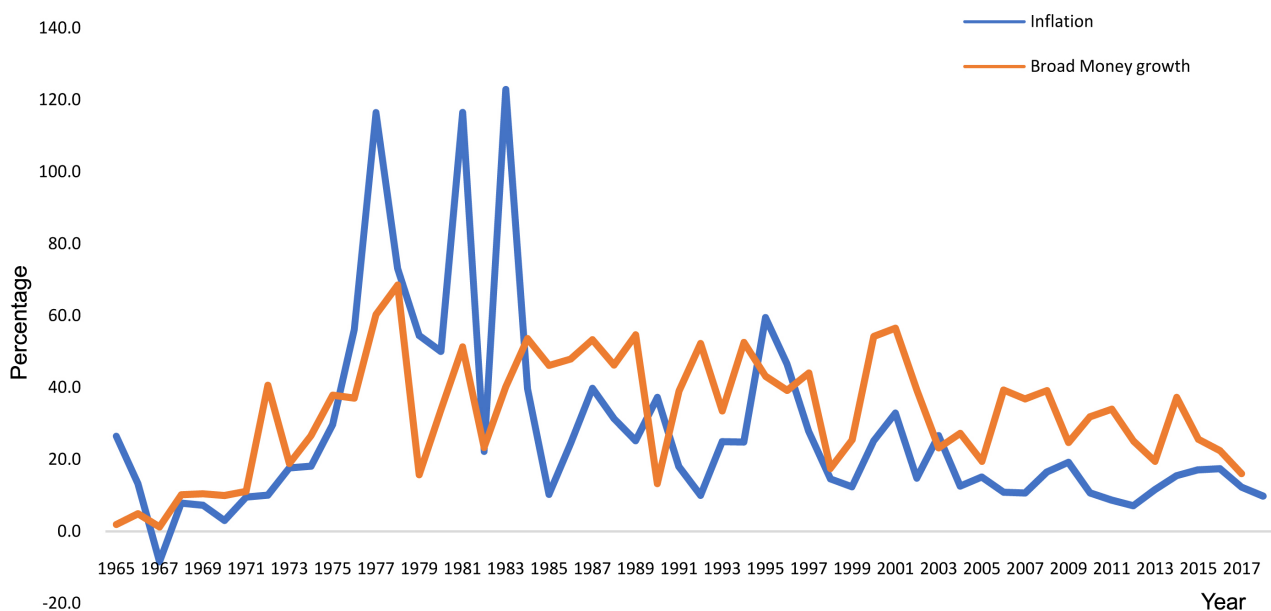


Figure 3. Inflation and money supply growth.

achieved still remains high when compared with inflation performance in selected peer inflation-targeting regime countries (Figure 4). This high inflation regimes during the period under discussion were influenced strongly by excessive government fiscal deficit financed by increased external and domestic debt accumulation and some level of Central Bank financing.

4. Survey of Relevant Literature

Hamburger and Zwick (1981) studied the link between fiscal deficits and growth of money supply in the United States of America between the period of 1954-1976. They tested Barro's theoretical money supply model. They proxied fiscal deficits as a ratio of budget deficit to gross national product, measured unemployment, central government total spending and the growth of money supply. Their study concluded that fiscal deficits positively affected growth of money supply and thus, inflation dynamics. Dwyer (1982) also investigated the long-run economic relationship among price level, money supply, economic activity measured by national income, debt held by the public, debt help by the Federal Reserve and the interest rate on a 91-day treasury bill instruments issued by government in the United States of America between 1952:1-1978:4. The key objective of the study was to establish the potential long-run interaction between fiscal deficits and the rate of inflation. The paper drew three key conclusions in that fiscal deficits led to price hikes through the wealth effects of household financial asset; fiscal deficit further led to increased purchase of government debt instruments by the Federal Reserve of the United States of America which led to monetisation through positive growths in money supply and finally, fiscal deficits affect inflation expectation of economic agents, thus significantly influencing future inflation.

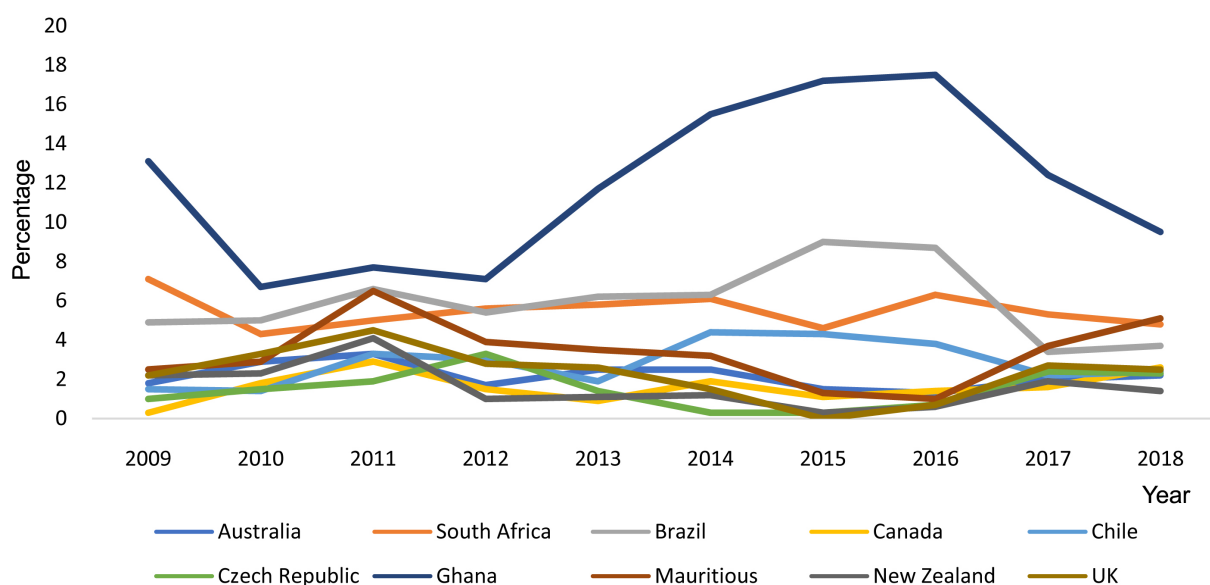


Figure 4. Inflationary trends in selected IT countries.

Blinder (1983) conducted an empirical work on monetisation of the United States of America budget deficits and its impact on inflation between 1952-1981. The study revealed a systematic link between budget deficits and growth in reserves in the US. The paper suggested the need for the Federal Reserve to monetise deficits more when inflation was low and monetises budget deficits less when inflation was high. Ahking and Miller (1985) investigated the economic relationship between money growth, government deficits, and inflation in the United States of America using three different sub-samples. The first sub-sample spanned from the second quarter of 1950 through the fourth quarter of 1960, the second sub-sample covered the first quarter of 1961 through the fourth quarter of 1970 and the final sub-sample spanned the first quarter of 1971 through the third quarter of 1980. The Study concluded that fiscal deficit granger caused inflation and inflation also granger caused fiscal deficits (bi-directional causality) for the first and third sub-samples but not in the case of the second sample.

Dharmendra et al. (1994) examined the determinants of the inflation rate in the United States. They applied a Vector Autoregressive (VAR) methodology in their estimation of what determines inflation in the USA. The results of their estimation revealed that changes in the money supply, the wage rate, the budget deficit and energy prices are important determinants of the inflation rate in the United States. Also, Giannaros and Kolluri (1986) examined the effects of fiscal deficits on money supply and inflation in a panel of ten developed economies using panel data methodology. Using money supply divided by gross domestic product, fiscal deficits divided by gross domestic product, government spending divided by gross domestic product and consumer price index (CPI) as variables in the study. The result from the estimated money supply model revealed that money supply was positively influenced by government fiscal deficits in Japan, United States of America and Belgium. The study concluded that fiscal deficit caused inflation in Switzerland, United States, Italy, Netherlands. Regarding the linkage between inflation and money, the paper further revealed that increase in money supply positively affected inflation in the United States and Italy only. Favero and Spinelli (1999) examined the fiscal deficit-inflation nexus between 1895-1994 in Italy. The authors employed Structural Vector Autoregressive (SVARS) to examine the economic relationship among fiscal deficit, money growth and inflation. The study revealed that fiscal deficit financing led to increased money growth and inflation in Italy. The study concluded that monetary policy was endogenously determined due to fiscal dominance and fiscal deficit financing was more inflationary in Italy during the study period. Similarly, in examining the relationship between money growth and inflation for ten developed nations for 1952-1983 period, Protopapadakis and Siegel (1987) used three variables measured by inflation rate, money supply divided by gross national product and national debt divided by gross national product. The paper revealed that there was no linkage between fiscal deficit and growth in money supply. However, the study discovered that inflation was weakly determined by

money growth in these countries.

Barnhart and Darrat (1988) investigated the causal linkage between budget deficits and money growth in seven major Organization for Economic Co-operation and Development (OECD) economies. The paper revealed that deficits did not Granger-caused changes in money growth across all countries. The feedback proposition that money growth Granger-caused changes in deficits was rejected across countries. These findings revealed that monetary and fiscal policies were autonomously set in all OECD countries. Hondroyiannis and Papapetrou (1997) investigated impacts of deficit and its financing on inflation in Greece for 1957-1993 period. They included in their error-correction model estimation consumer price index (CPI), fiscal deficit divided by gross domestic product and money supply divided by gross domestic product. The paper concluded that inflation was determined by money supply in Greece and that a unit increase in money supply will lead to 1.25 per cent increase in inflation. The paper also investigated the indirect effect of fiscal deficit on inflation through increases in money supply and concluded that increases in fiscal deficit financing led to increases in inflation indirectly in Greece but there was no evidence of direct effects of fiscal deficit on inflation.

Darrat (2000) criticised the conclusions of Hondroyiannis and Papapetrou (1997) rejecting any direct effect of fiscal deficit on inflation in Greece. His paper reinvestigated the linkage between fiscal deficit and inflation in Greece between 1957-1993. The author used the same variables utilised in the earlier study such as consumer price index, budget deficit divided by gross domestic product and money supply divided by gross domestic product money supply. Darrat (2000) critiqued the estimation model used by Hondroyiannis and Papapetrou (1997) and re-investigated the stationarity properties of the variables and found that the price variable was only stationary after second differencing and suggested that the differenced variables of consumer price index, money supply and budget deficit needed be included in the model in investigating the long-run properties of the model. Again, Darrat (2000) found that Hondroyiannis and Papapetrou (1997) did not include the fiscal deficit variable in the long-run equation in their study, thus, the wrong conclusion. The study concluded that fiscal deficit financing had direct effect on inflation as against the results of the study conducted by Hondroyiannis and Papapetrou (1997).

Carlos (2000) examined deficits-inflation nexus in six European countries (Belgium, France, Germany, Italy, Netherlands and the UK) using post-economic data spanning the period of 1950-1996. The study examined the fiscal deficit-inflation relation in these selected EU countries during the post-war era to identify what really influence inflation in these countries by focusing largely on the effects of fiscal deficit and its financing on price stability. The study revealed a more flexible fiscal policy options in the EU countries during the post-war period. Cedula (2000) investigated the impact of budget deficits on ex post real long-term interest rates between 1973-1995 in the United States of America. The study ex-

amined the causality between the federal government budget deficit and the ex-ante real long-term interest rate. The study revealed a bi-directional relationship between the primary budget deficit and the ex-ante real long-term interest rate yield in the US. [Agha and Khan \(2006\)](#) also investigated the long-run relationship between inflation and fiscal indicators in Pakistan using annual data from Fiscal Year (FY) 1973 through FY 2003. They tested the quantity theory of money which was developed by Fisher and subsequently restated by Friedman into a theory of nominal income determination assuming constant velocity of money and found a significant error correction coefficient that concluded that inflation was affected by government's bank borrowing.

[Loungani and Swagel \(2003\)](#) investigated the potential sources of inflation using panel data from 53 less developed countries between 1964-1998. The study examined the interaction among output gap, growth of money supply, oil price growth, past inflation, non-oil commodity price growth and growth of exchange rate (exchange rate depreciation). The empirical results from the study revealed that exchange rate depreciation and growth of money supply jointly accounted for about 75 percent variation in inflation in both short-run and long-run. The study stated that price expectations significantly determined inflation. The study concluded that shocks to innovations in government fiscal deficit significantly influenced the inflation process in these 53 developing countries. [Aviral et al. \(2015\)](#) examined the relationship between budget deficits and inflation for nine EU countries between 1990-2013, utilising quarterly data. The study investigated the short-run and long-run effects causal effects of budget deficit on price development these nine selected EU countries. The paper found that there was no relationship between budget deficits and inflation in all the countries under investigation, except in Belgium, and France using the bootstrap causality approach and frequency domain causality test.

Recent study by [Sowah and Kwakye \(1993\)](#) found that structural factors strongly remain important 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 Preeconomic recovery program period. Their conclusion strongly confirmed the structuralist school of thought about major causes of inflation. 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.

Again, [Dadson \(2015\)](#) 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. Also, [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.

The literature reviewed indicated that inflation has many determinants and each of the factors impacts on inflation in a dynamic fashion as fiscal deficit financing may affect inflation depending on the type of regime policy implemented as well. All of these studies completely ignored the regime of fiscal deficit financing and its effect on inflation and this study seeks to fill that gap in the literature using Ghana's data in this instance.

5. Methodology

5.1. Dynamic Markov Regime-Switching Model

The Markov regime-switching econometric method developed by [James Hamilton \(1989\)](#), referred to in the theoretical literature as the state (switching) methodology, remains one of the robust non-linear time-series approaches in the econometric literature review. This methodology consists of several forms that can illustrate time series properties in different states. The Markov switching econometric method can allow the econometric model's structure to switch from one state (regime) to another state (regime), which makes the model more dynamic in its applications to economic data. An innovative characteristic of the Markov regime-switching approach is that the unobservable state-dependent variable, which is strictly assumed to be a first-order Markov chain process, actually determines the switching mechanism of the model. It must be noted that

the Markovian features of the model ensure that the previous value of the state-dependent variable will determine the current value of the state-dependent variable, respectively. Consequently, a particular feature of the model will dominate for a selected period of time, and it can switch to another feature in the future periods when regime changes occur. The structure of the Markov regime-switching regime model can be expressed in the following form, assuming that r_t represents the state-dependent variable, which is unobservable, and it takes the value zero (0) and one (1). It follows that a simple Markov switching regime dependent model for the variable x_t consists of two autoregressive specifications:

$$x_t = \begin{cases} \delta_0 + \alpha x_{t-1} + e_t, & r_t = 0, \\ \delta_0 + \delta_1 + \alpha x_{t-1} + e_t, & r_t = 1, \end{cases} \quad (1)$$

where $|\alpha| < 1$ and e_t are independent identically distributed (i.i.d) innovation term with mean zero ($\mu = 0$) and constant variance, σ_e^2 . Equation (36) shows a first-order autoregressive stable process with a constant mean of $\frac{\delta_0}{1-\alpha}$ if $r_t = 0$, and this switches to a new first-order autoregressive stable process with a mean of $\frac{\delta_0 + \delta_1}{1-\alpha}$ when $r_t = 1$. Admittedly, this model assumes two

dynamic structures at different levels depending on the value of the state variable provided that $\delta_1 \neq 0$. Thus, x_t are influenced by two distinct regimes (distributions) with different means, and the movements from one regime to another regime are mainly controlled by the state dependent variable given by r_t .

The state dependent variable given by r_t is strictly assumed to be a first-order Markov-chain process with the transition matrix of the following form:

$$T = \begin{vmatrix} T(r_t = 0 | r_{t-1} = 0) & T(r_t = 1 | r_{t-1} = 0) \\ T(r_t = 0 | r_{t-1} = 1) & T(r_t = 1 | r_{t-1} = 1) \end{vmatrix} \quad (2)$$

$$T = \begin{vmatrix} t_{00} & t_{01} \\ t_{10} & t_{11} \end{vmatrix} \quad (3)$$

where $t_{ij} = (i, j = 0, 1)$ indicates the transition probabilities of $r_t = j$ conditioned on $r_{t-1} = i$. Notably, it is established that the sum of the transition probabilities must be equal to 1, thus satisfying the condition $t_{i0} + t_{i1} = 1$. The random behaviour of the state dependent variable is controlled by the properties of the transition matrix and it holds only two coefficients, these are t_{00} and t_{11} respectively.

The structures of x_t are together regulated by the state dependent variable r_t and the random features of the error-term, e_t . The transition probabilities regulate the persistence of each state and the state dependent variable controls the random and regular changes of model features and properties as well. One advantage that the Markov regime switching methodology has over the other models such as the threshold models is that it is easier to employ in estimation since it does not require choosing a priori the threshold variable. As an alterna-

tive, the regime properties of the Markov-switching method are based on the law of probabilities and also largely determined by the type of data. However, one key disadvantage of the Markov regime switching approach is that it is difficult to interpret the results because the state variables are unobservable though it is implementable.

A general form of the Markov-switching model which allow for more general dynamic structures can be expressed as follows:

$$x_t = \delta_0 + \delta_1 r_t + \alpha_0 r_{t-1} + \dots + \alpha_k r_{t-k} + e_t \quad (4)$$

where $r_t = 0, 1$ denotes the Markovian state variables with the transition matrix still given as

$$T = \begin{vmatrix} T(r_t = 0 | r = 0) & T(r_t = 1 | r_{t-1} = 0) \\ T(r_t = 0 | r_{t-1} = 1) & T(r_t = 1 | r_{t-1} = 1) \end{vmatrix}$$

and e_t are i.i.d. random variables with zero mean, μ and a constant variance given by σ_e^2 . The above model is called a general k-order autoregressive dynamic structure and Markov switching parameter model in the literature. For the n-dimensional time series (X_t), we can re-write the above model as follows:

$$X_t = \delta_0 + \delta_1 r_t + \alpha_0 X_{t-1} + \dots + \alpha_k X_{t-k} + e_t, \quad (5)$$

where $r_t = 0, 1$ still represents the Markovian state variables with the transition matrix still given as

$$T = \begin{vmatrix} T(r_t = 0 | r = 0) & T(r_t = 1 | r_{t-1} = 0) \\ T(r_t = 0 | r_{t-1} = 1) & T(r_t = 1 | r_{t-1} = 1) \end{vmatrix}$$

and e_t are i.i.d. random vectors with zero mean, μ and a variance-co-variance matrix given by ξ_0 while $\alpha_i (i = 1, 2, 3, 4, \dots, k)$ are $n \times n$ matrices of coefficients. It is clear that the above Markov switching form is a Markov switching vector autoregressive model (Markov switching VAR) with a switching intercept. It must be noted that this Markov switching VAR is a generalization that is implementable, however, it may always not be realistic to require n-dimensional distinct variables to switch instantaneously.

The above Markov switching model can further be generalized since the two-state Markov switching model can be allowed to assume d values, suggesting that $d > 2$ in this case and we can derive the d -state Markov switching model with the following transition matrix and probabilities, T_{ij} respectively:

$$T = \begin{bmatrix} t_{00} & \dots & t_{0d} \\ \vdots & \ddots & \vdots \\ t_{d0} & \dots & t_{dd} \end{bmatrix} \quad (6)$$

Hence, the x_t variable will now be governed by both current x_t and past state variables, x_{t-1} . Explicitly, assume that $\bar{x}_t = x_t + \delta_0 + \delta_1 r_t$ then it follows that

$$\bar{x}_t = \delta_0 + \delta_1 r_t + \alpha_0 \bar{x}_{t-1} + \dots + \alpha_k \bar{x}_{t-k} + e_t, \quad (7)$$

Then, \bar{x}_t (and hence x_t) depends not only on r_t but also on r_{t-1}, \dots, r_{t-k} .

As there are 2^{k+1} possible values of the collection $(r_t, r_{t-1}, \dots, r_{t-k})$, the model above has 2^{k+1} states respectively.

5.2. General Form Markov Switching Model

The vector of coefficients of the general Markov switching model in Equation (42) can be estimated using Quasi-Maximum likelihood estimation method as follows:

$$\psi = (\delta_0, \delta_1, \delta, \alpha_1, \alpha_2, \dots, \alpha_k, \sigma_e^2, t_{00}, t_{11}) \tag{8}$$

Assume that $X^t = (X_t, X_{t-1}, X_{t-2}, \dots, X_{t-3})$ represents set of actual economic variables based on information available at time w. Similarly, assume that X^T is based on full sample information set. There is the need to assess the conditional expectation (optimal forecast) of the scenario $r_t = i, i = 0, 1$ based on distinct information available in order to be able to evaluate the likelihood of the state dependent variable. The optimal forecast of the state variable include the prediction probabilities which is based on information before time w given by $T(r_t = i | X^{t-1}; \psi)$, and the filtered probabilities which is focused on current and past information set given as, $T(r_t = i | X^t; \psi)$. The quasi-log-likelihood function can be used to derive the quasi-maximum likelihood estimates (QMLE) computed as follows:

The density of X_t conditional on X^{t-1} and $r_t = (i = 0, 1)$ under the assumption of normality is expressed as follows:

$$h(X_t | r_t = i, X^{t-1}; \psi) = \frac{1}{\sqrt{2\pi\sigma_e^2}} \text{exponent} \left\{ \frac{-(X_t - \delta_0 + \delta_1 r_t + \alpha_0 X_{t-1} + \dots + \alpha_k X_{t-k})^2}{2\sigma_e^2} \right\} \tag{9}$$

Knowing that the prediction probability is defined as follows, $T = (r_t = i | X^{t-1}; \psi)$, then the density of X_t conditional on X^{t-1} only can be formulated as:

$$h(X_t | X^{t-1}; \psi) = T(r_t = 0 | X^{t-1}; \psi) h(X_t | r_t = 0, X^{t-1}; \psi) + T(r_t = 1 | X^{t-1}; \psi) h(X_t | r_t = 1, X^{t-1}; \psi) \tag{10}$$

Equation (45) implies that for $i = 0, 1$ the filtered probabilities of the state dependent variable r_t are derived as follows:

$$T(r_t = i | X^t; \psi) = \frac{T(r_t = i | X^{t-1}; \psi) h(X_t | r_t = i, X^{t-1}; \psi)}{h(X_t | X^{t-1}; \psi)} \tag{11}$$

The relationship between the predicted probability and the filtered probabilities based on the Bayes theorem is given by the expression below:

$$T(r_{t+1} = i | X^t; \psi) = t_{0i} T(r_t = 0 | X^t; \psi) + t_{1i} T(r_t = 1 | X^t; \psi) \tag{12}$$

where $t_{0i} = T(r_{t+1} = i | r_t = 0)$ and $t_{1i} = T(r_{t+1} = i | r_t = 1)$ are transition probabilities. It can be deduce that Equations (10), (11) and (12) form a recursive sys-

tem for $t = k, \dots, T$. It must be noted that Equations (10), (11) and (12) can be iterated to derive both the filtered probabilities and the conditional densities based on the initial values for $t = k, \dots, T$. Thus, the quasi-log likelihood is obtained as follows:

$$M_T(\psi) = \frac{1}{T} \sum_{t=0}^T \ln h(X_t | X^{t-1}; \psi) \tag{13}$$

Equation (13) is a complex non-linear function of ψ . The parameter can be estimated using the appropriate estimator. The estimated parameters can be used to compute the predicted and filtered probabilities. Also, the smooth probabilities, $T(r_t = i | X^T; \psi)$ can be estimated as follows:

$$T(r_t = i | r_{t+1} = j, X^T; \psi) = T(r_t = i | r_{t+1} = j, X^t; \psi) \tag{14}$$

$$= \frac{t_{ij} T(r_t = i | X^t; \psi)}{T(r_{t+1} = j | X^t; \psi)} \tag{15}$$

The smooth probabilities can be expressed further for $i, j = 0, 1$ as follows:

$$T(r_t = i | X^T; \psi) = T(r_{t+1} = 0 | X^T; \psi) T(r_t = i | r_{t+1} = 0, X^t; \psi) + T(r_{t+1} = 1 | X^T; \psi) T(r_t = i | r_{t+1} = 1, X^t; \psi) \tag{16}$$

$$T(r_t = i | X^T; \psi) = T(r_t = i | X^t; \psi) \times \frac{t_{ij} T(r_{t+1} = 0 | X^t; \psi)}{T(r_{t+1} = 0 | X^t; \psi)} + \frac{t_{ij} T(r_{t+1} = 1 | X^t; \psi)}{T(r_{t+1} = 1 | X^t; \psi)} \tag{17}$$

The smooth probabilities can be obtained by iterating Equations (17), (12) and (10) backwards given the initial values of the filtered probability $T(r_T = i | X^T; \psi)$ for $t = T - 1, \dots, k + 1$. The estimated smooth probabilities are computed from the estimated parameter of the system accordingly.

5.3. The Empirical Markov Regime-Switching Model for Ghana

To empirically model the regime effects of fiscal deficit financing on inflation dynamics in Ghana, we deployed an econometric methodology based on Hamilton (1989, 1990) Markov-Switching regime approach described above. Since fiscal deficit financing is significantly influenced by current phase of economic cycle and government appetite for spending, we also estimated the state dependent model in addition to our inflation model which is further specified as follows:

$$IF_t = \varphi_0(r_t^F) + \varphi_1(r_t^F)EX_t + \varphi_2(r_t^F)BD_t + \varphi_3(r_t^F)BS_t + \varphi_4(r_t^F)INT_t + \varphi_5(r_t^F)OUTPUTGAP_t + \sigma(r_t^F)\varepsilon_t \tag{18}$$

where $r_t^F \in (1, 2, 3, \dots, N)$ represents the state of fiscal deficits at time t , which follows a first order Markov chain with transition matrix $T^F = (T_{ij}^F)$ with the elements $T_{ij}^F = T[r_t = i, r_{t-1} = j]$, for all $i, j \in (1, 2, 3, 4, \dots, N)$ and the other parameters can also take different values due to the type of fiscal policy regime at a

particular point in time and it must also be noted that the variance of the error term is state dependent. Where IF_t is inflation rate, BD_t is budget deficits, MS_t is money supply, INT_t interest rate, EX_t is real exchange rate and $OUTPUTGAP_t$ represents output gap respectively.

5.4. Model Estimation and Analysis

5.4.1. 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 1** below). The unit root tests conducted suggested that all of the variables were I(1) except inflation variables which was I(0).

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

Table 1. Unit root test summary results.

Variables	Levels			First Difference		
	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.

as shown in **Table 1**. 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.

5.4.2. 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 2**). 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 2. 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.

5.4.3. Non-Linear Granger Causality Test

The results of the non-linear causality test conducted are presented in **Table 3** below. The causality test suggested that money supply granger causes inflation in Ghana at one percent level (1%) of significance and there was no evidence of feedback effect running from inflation to money supply which was insignificant at five percent level (5%). The test result again indicated that real economic activity measured by real gross domestic product also granger causes inflation as the null hypothesis of real gross domestic product does not granger cause inflation was rejected at one percent (1%) level of significance and there was no evidence of feedback from inflation to real gross domestic product respectively. Also, the granger causality test indicated that fiscal deficit financing granger causes inflation in Ghana as the null hypothesis of fiscal deficit financing does not granger causes inflation was rejected at five percent (5%) level of significance and there was no evidence of feedback effect at one percent and five percent respectively. The results also further suggested that interest rate in Ghana granger causes inflation as the granger causality statistics of 6.3794 was significant at one percent (1%) level, indicating the null hypothesis of no granger causality running from interest rates to inflation was rejected. Finally, the granger causality test results concluded that exchange rate depreciation also granger cause inflation in Ghana at relatively five percent (5%) level of significance, proving the rejection of no causality as suggested by the null hypothesis (see **Table 3**).

5.4.4. Regime Effects of Fiscal Deficit Financing on Inflation Dynamics in Ghana

1) Regime-switching tests for budget deficit financing and fiscal deficit financing

Table 3. Non-linear causality test summary.

Null Hypothesis:	Observations	F-Statistic
Money Supply does not Granger Cause inflation	140	6.3794***
Inflation does not Granger Cause money supply		2.2681
Real GDP does not Granger Cause inflation	140	2.9881**
Inflation does not Granger Cause Real GDP		0.3601
Interest rate does not Granger Cause Inflation	140	3.8017***
Inflation does not Granger Cause interest rate		0.1829
Fiscal deficit financing does not Granger Cause inflation	140	3.2186**
Inflation does not Granger Cause Fiscal deficit financing		0.0983
Exchange rate depreciation does not Granger Cause inflation	140	2.1505**
Inflation does not Granger Cause exchange rate depreciation		0.2071

Source: Author's computations.

The estimates of the Structural Vector Autoregression (SVAR) indicates that fiscal deficit financing; conceptualized both as budget deficit financing and fiscal deficit financing, transmits to inflationary pressure in Ghana largely through interaction with monetary growth. This is instructive enough to note that fiscal deficit financing could be regime-based in Ghana. More so, regime-switching modelling of fiscal deficit financing could be considered more reliable at capturing the swings, shocks and breaks in time-series data (Hamilton, 1990). As a result, it becomes imperative that the regime-switching effects of fiscal deficit financing on inflation in Ghana is estimated and analysed. In order to formally validate the presence of regime switching effects, a regime-switching test was conducted using the conceptual measures of both budget deficit and fiscal deficits (see Table 4). For Model 1, there are evidently two states of fiscal deficit financing regime switching. This is supported by the highly significant values for Models 1 and 2 which have 0.000 probability values each. The closeness of these standard errors is an indication that the two regimes of fiscal deficit financing have not been substantially different from one another.

Table 4. Regime-switching tests for budget deficit financing and fiscal deficit financing in Ghana.

Variables		Coefficient	Z
Budget Deficit financing (Model 1)	State 1	-6.989***	-27.240
	State 2	-1.292***	-5.170
Fiscal Deficit financing (Model 2)	State 1	-522,090.900***	-34.680
	State 2	-3589.300	-1.240
Probability of Transition			
		Model 1	Model 2
State of Probabilities		Probabilities	State of Probabilities Probabilities
	P_{11}	0.976	P_{11} 0.794
	P_{12}	0.024	P_{12} 0.205
	P_{21}	0.023	P_{21} 0.007
	P_{22}	0.977	P_{22} 0.993
Durations of Transition			
		Model 1	Model 2
	State 1	42.3	4.9
	State 2	44.3	139.7

Source: Author's computation and ***, ** and * represents 1%, 5% and 10% significance levels respectively.

On the other hand, there exists only one State or regime of fiscal deficit financing for Model 2. This is evident in the fact that the standard error for State 2 of Model 2 is insignificant; even at the 10 percent level. In the second segment of Table, the probability of transition of maintaining a high fiscal deficit financing is 97.6 percent while that of sustaining a low fiscal deficit financing regime is 97.7 percent. The probability of transiting from a high fiscal deficit regime to a low fiscal deficit regime is 2.4 percent while the reverse is 2.3 percent. The probability of transiting from one regime to another regime of fiscal deficit financing is negligible. This is theoretically plausible as there is no incentive to transits. This occurs due to the fact that both regimes are not substantially different from one another (see **Table 4**). If transition is to occur eventually, it will take 42.3 quarters to transit to State 1 and 44.3 quarters to transit to quarter 2. This is an average of 10 - 11 years. It indicates that there is relative consistency in fiscal deficit financing in Ghana as it shows that successive government have sustained the regime of fiscal deficit financing in place for a long period of time.

2) Regime-switching of fiscal deficit and inflation dynamics in Ghana

Stemming from the foregoing, it suggests that regime-switching of fiscal deficit financing and inflation in Ghana could be appropriately modelled using the conceptual measure of budget deficit and that fiscal deficit financing in Ghana can be categorized as moderate. For both the high and low regimes of fiscal deficit financing in Ghana, budget deficit financing impacts positively and significantly on inflation.

For low regime, budget deficit increases inflation by 34.6 percent but by 88.2 percent for a high regime case. This evidence confirms the monetarist proposition, it is practical when fiscal deficit financing is monetized and foreign borrowing by government is significant as is the case in Ghana. Evidently, the impact of monetary growth is positive but has a very low possibility of creating inflationary pressure by 12 percent while exchange rate might reduce the pressure for the persistent general increase in the price level of the economy by 71.3 percent. However, these effects were inconsequential with the 0.621 and 0.121 probability values respectively. For the case of high regime of fiscal deficit financing, the effects of both monetary growth and exchange rate were positive and significant; at least at the 5 percent level. Exchange rate has the possibility of significantly increasing inflationary pressure by 86 percent while monetary growth can significantly increase the general price level by 6.5 percent. For both regimes, interest rate can spur inflationary pressure by 12.5 percent and 32.3 percent respectively (see **Table 5**).

3) Transition probabilities and expected duration

The lagged inflation for Model 1 suggests it can trigger inflation in regime 1 by 76.9 percent and also trigger inflation by 77.7 percent in the second regime. In general, inflationary pressure is itself self-reinforcing as the inflation in the previous quarter significantly and positively influenced inflation in the current quarter. The probabilities of transition suggest that, within the structure of the

Table 5. Regime-switching of fiscal deficit financing and inflation in Ghana.

Low Regime (State 1) of Fiscal Deficit Financing		
Variables	Coefficient	 Z
Inflation (-1)	0.769***	57.58
Budget Deficit financing	0.346***	3.54
Broad Money Supply (M2) Growth	0.012	0.49
Real GDP Growth	-0.987***	-5.12
Imports Capacity	0.0005***	4.79
Exchange Rate	-0.713	-1.55
Interest Rate	0.125***	3.45
High Regime (State 2) of Fiscal Deficit Financing		
Variables	Coefficient	 Z
Inflation (-1)	0.777***	26.31
Budget Deficit financing	0.882***	6.99
Broad Money Supply (M2) Growth	0.065**	2.06
Real GDP Growth	0.249	1.08
Imports Capacity	-0.0002	-0.92
Exchange Rate	0.860**	1.97
Interest Rate	0.323***	6.18

Source: Author's computation and ***, ** and * represents 1%, 5% and 10% significance levels respectively.

economy, sustaining fiscal deficit financing is 87.6 percent feasible in Ghana and the transition from one regime of fiscal deficit financing is averagely 12.5 percentage. The implication is that it will take barely 8 quarters to sustain the type of fiscal deficit financing adopted in Ghana. This is averagely a spate of two (2) years (see [Table 6](#)).

Also, regime classification based on the filtered probabilities of the estimated Markov-switching dynamic model suggested regime persistence of fiscal deficit financing in Ghana as regime 1 prevails in the periods 1983Q2 - 1984Q1, 1987Q1 - 1989Q2 and 1990Q1 - 1996Q1 while regime 2 also prevail in the periods 1984: Q2 - 1986Q4; 1989Q3 - 1989Q4 and 1996Q2 - 2018Q4 respectively (see [Figure 5](#) and [Figure 6](#)). The graphical analysis based on the filtered probabilities strongly corroborated the evidences obtained from the estimated Markov-switching dynamic model. Thus, the effect of a surge in fiscal deficit financing on inflation dynamics remained higher in regime 1 relative to regime 2 based on the estimated model where all the variables in the model are assumed to switch across the two regimes respectively.

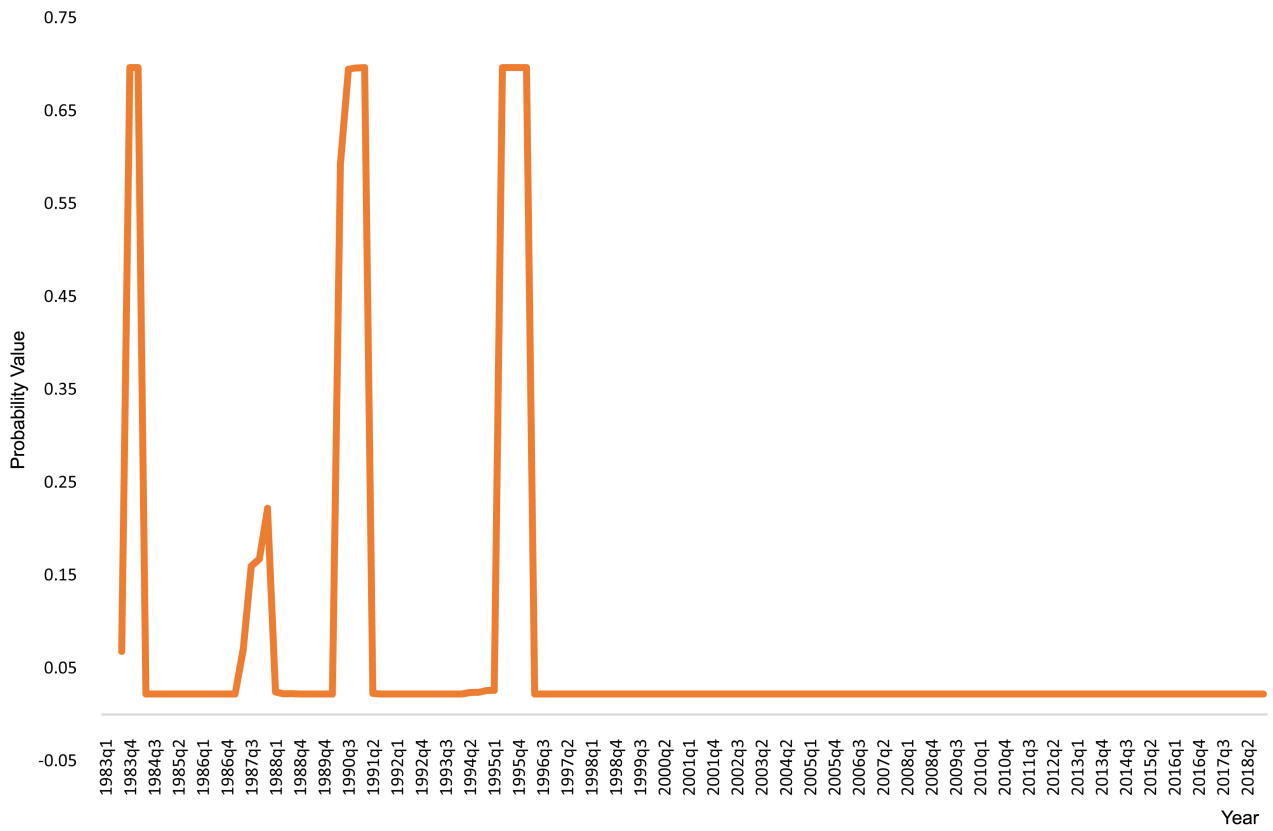


Figure 5. Filtered probabilities of regime 1.

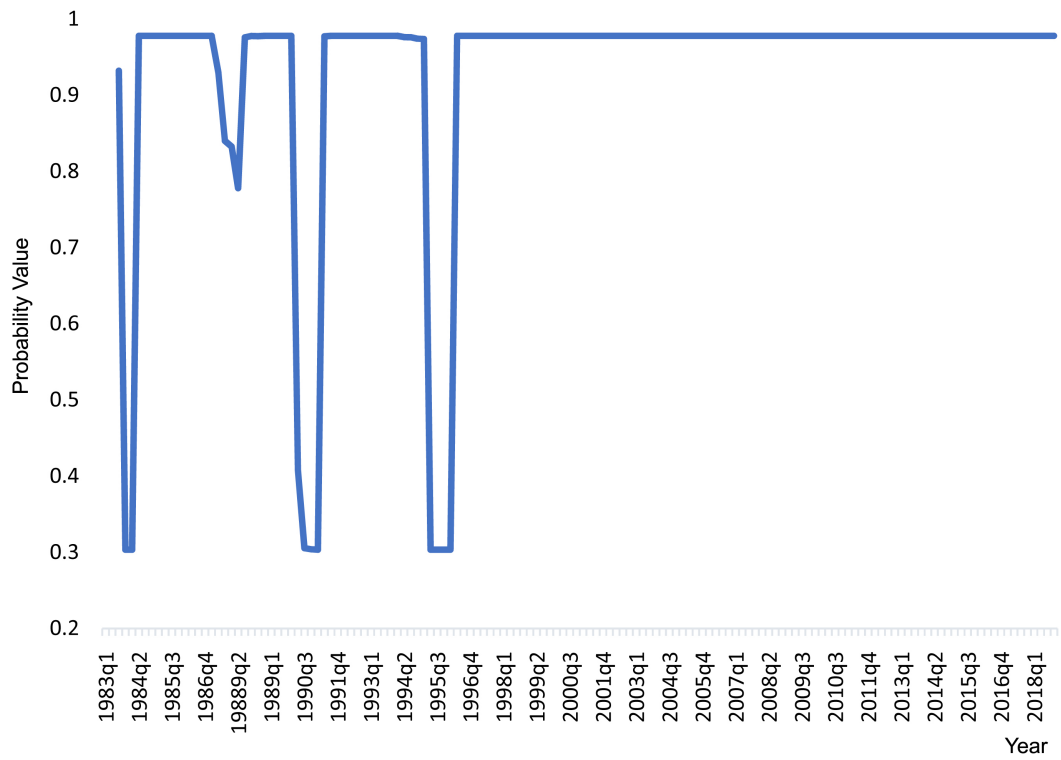


Figure 6. Filtered probabilities of regime 2.

Table 6. Regime probabilities and expected duration of regimes.

Probabilities of Transition	
State of Probabilities	Probabilities
P_{11}	0.876
P_{12}	0.124
P_{21}	0.125
P_{22}	0.875
Durations of Transition	
States	Probabilities
State 1	8.04
State 2	7.94

Source: Author's computation.

6. Conclusion

This paper examined the effects of regime of fiscal deficit financing on inflation dynamics in Ghana over the 1980-2018 period. The paper revealed the presence of two regimes of fiscal deficit financing in Ghana and further found an evidence of regime persistency in the transitioning from one policy regime to another policy. The paper therefore concluded that fiscal deficit financing impacted strongly on inflation dynamics in the higher regime of fiscal deficit financing while the regime effect of fiscal deficit financing in the lower regime was found to be less impactful on inflation dynamics in Ghana.

7. Some Policy Discussions

The implication of the findings and conclusions of this paper was that fiscal policy implementation had regime effects on inflation dynamics in the Ghanaian economy depending on the choice of regime by the fiscal authorities. A key take-away from this paper remains the fact that low inflation environment could be achieved consistent with a regime of low fiscal deficit financing as revealed by the conclusion of this paper. Hence, there is the need for government of Ghana particularly, the fiscal authorities to fashion out fiscal policy regime that leads to achievement and maintenance of fiscal consolidation and sustainability going forward. The fiscal authorities could embark on fiscal policy reforms that aim at increasing tax revenue while managing expenditure demands. Tax reform policies must focus on broadening the existing tax base by bringing the large informal sector into the tax net. On the other hand, expenditure reforms should also focus on expenditure-reducing and expenditure-switching policies that promote increased capital expenditure and funding for increased infrastructure expenditures which could impact on economic growth strongly in the future.

Finally, there is the need for government to enforce strictly the requirements of Ghana's Fiscal Responsibility Act. The Fiscal Council should have power and political independence to discipline governmental institutions that blatantly violate the rules set in the law and the benchmarks outlined in the annual budget. The full implementation of the content of the Ghana's Fiscal Responsibility Law could potentially lead to improvement in the country's fiscal position as strict adherence to these rules are followed over time otherwise the law will lose its relevance in terms of enabling the fiscal authorities to achieve fiscal sustainability.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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