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**Article**

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# DOES MONEY SUPPLY GROWTH CAUSE INFLATION IN THE WEST AFRICAN MONETARY ZONE?

Hassan O. Ozekhome<sup>1</sup>

## Abstract

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Anecdotal evidence shows that monetary expansion (excess liquidity) induces inflation in the West African Monetary Zone (Zone). Uncertainty about the nature of inflation persistence often undermines regional convergence due to the asymmetric responses from the monetary authorities. It is against this background that this paper sought to examine the dynamics of money supply growth and inflation in the WAMZ countries, using panel data methodology for the period 2000-2015. The empirical results show that monetary expansion, exchange rate depreciation, oil price, fiscal deficits and lagged inflation (proxy for previous inflation) are the principal drivers of inflation in the WAMZ countries; an evidence of monetary and structural-induced inflation in the sub-region. Real output growth on the other hand, is found to reduce inflation in the sub-region. We recommend amongst others; the curtailment of excessive monetary expansion in order to tame domestic inflationary pressures, adoption of sound and prudent fiscal expenditure, coherent and stable macroeconomic policies in terms of exchange rate and interest rates, increase output capacity, and policy coordination and harmonisation with respect to inflation control, in order to achieve low inflation rate relevant for monetary and economic integration.

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## 1.0 INTRODUCTION

The past few years has witnessed increased theoretical and empirical research among economists, policy makers and central bankers on the conduct of monetary policy, particularly with respect to price level and inflation control. The impetus for the theoretical and empirical research is two developments which stand out. First, and foremost, progress advance in macroeconomic theory has been significant, with the development of quantitative models under the New Keynesian and monetarist paradigms that have explicitly aided the study of the effect of stabilization policies on economic performance, in a more coherent and rigorous analytical context.

The second reason is advancement in central banking itself and macroeconomic policy management. A growing number of central banks have come to organize monetary policy around an explicit set of objectives. One way of specifying such objectives is via an explicit inflation forecast targeting rule that helps in controlling inflation. Increased efforts to communicate policy goals to the general public also emphasize the importance of a clear framework to guide policy decisions (Woodford, 2003, cited in Saborowski, 2009). Economists differ on the effect of an increase in money supply on inflation. While some (see Leebow, 1992 et al; Svensson, 2000) agreed that variation in the quantity of money is the most important determinant of inflation and, that countries that devote more time to studying the behaviour of aggregate money supply rarely experience much variation in their economic activities, others (Diamond, 2003; Gali, 2008) express a sceptical disposition about the effect of money growth on inflation.

The development of effectively structured macroeconomic models based on explicit theoretical micro-foundations and capable of successfully explaining monetary policy evaluation have led to a comeback of the quantitative assessment of the optimal conduct of monetary policy (Gali and Gertler, 2007). Works by Barro and Gordon (1983) have examined the design of monetary institutions and the role of monetary policy in a coherent and rigorous analytical framework. These studies confirm the conventional wisdom that in an inter-temporal economy, price level targeting raises output variability because inflationary mistakes must be reversed in order to prevent base drift in the price level, and the reversal of inflationary mistakes leads to extra output variability (Lebow, et al, 1992; Haldane & Salmon 1995). The studies further emphasized that monetary policy credibility is anchored on low and stable inflation. Starting from a period of high inflation and low credibility, the restoration of credibility depends on the vigour with which the anti-inflationary policies are pursued by central banks. In this wise, the optimality of price stability as an objective for monetary policy has been at the core of this renewed interest.

Given the monetary expansion that has been witnessed alongside rising inflation rates in the sub-region, there is need for a more rigorous empirical examination of the money growth-inflation nexus. To the best of the author's knowledge, the effects of monetary expansion on inflation and the implications of such for regional macroeconomic stability, has not received notable empirical attention in the literature, at cross-country and regional levels, particularly against the backdrop that low inflation (less than 5 percent) is a desideratum for full monetary and economic integration. In addition, the few related existing studies on the subject matter (see Akinbobola, 2002; Folawewo, & Osinubi, 2006; Owoye & Onafowora, 2007, Imimole, and Enoma 2011) are country-specific studies, thereby, ignoring the broad implications for regional convergence in terms of monetary and economic and integration. Importantly, none of these studies and other related studies has specifically explore the question of whether monetary expansion is relatively more important than structural factors in explaining inflation dynamics in the WAMZ sub-region. Specifically, in this regard, this study examines the money supply growth-inflation nexus by using an estimation technique that accounts for potential endogeneity and country specific effects in terms of structural and economic peculiarities in explaining inflation variation across countries, which no study in the sub-region has done.

In addition, given that inflation has continued to pose serious challenge to most economies in the WAMZ zone, which has resulted in most countries not being able to meet the convergence criterion on inflation, a study of this type that examines the dynamics of money supply and inflation within the WAMZ zone is highly likely to be of significant benefit to policymakers. In this respect, an understanding of the main drivers of inflation is critical to managing domestic inflation. The study is, therefore, relevant for the purposes of economic and monetary policy. In particular, given the current state of affairs regarding the proposed single currency drive in which sound macroeconomic stability in the context of low inflation rate is critical in terms of the inflation convergence criterion with the causal role of money growth in the picture, this study becomes imperative.

Aside this introduction, the paper is structured as follows. Section two provides a review of money supply growth and inflation performance in the WAMZ. Section three consists of literature review, which considers key theoretical, empirical and policy issues associated with the money supply growth-inflation nexus. Section four presents the methodology, model specification and data, while section five contains the empirical results and analysis. The conclusion and policy recommendations are presented in section six.

## 2.0 MONETARY INDICATORS IN THE WAMZ

This section presents a quantitative assessment and overview of recent macroeconomic developments in the context of money growth and inflation performance, as well as the correlation between money supply and inflation in WAMZ countries. This exposition provides a solid basis for analysing and ascertaining the sources and consequences of monetary expansion critical to devising appropriate policies and strategies to addressing the prevalence of excess liquidity in the system that will facilitate monetary and financial convergence.

### 2.1 Money Supply Growth, Sources and Development in the WAMZ

Table 1 show the broad money supply growth in the WAMZ countries, with the exclusion of Liberia, due to lack of adequate data. It indicates that monetary policy has generally been expansionary in WAMZ countries, especially in the reference periods. It is evident that Nigeria and Ghana, the two largest economies in the zone, including Guinea, recorded high liquidity growth rates over the three sub-periods, characterizing high incidence of monetary expansion. Except for Gambia and Sierra-Leone, which recorded their highest expansion during the period 2002-2005, majority of the countries in the Sub-region had high growth in money supply above the observed average in the zone.

**Table 1. Broad Money Supply Growth in WAMZ**

	2002-2005	2006-2010	2011-2015	Country Average
The Gambia	27.5	16.5	17.3	20.4
Ghana	29.9	37.6	32.5	33.3
Guinea	30.5	34.1	30.5	31.7
Nigeria	23.5	44.2	32.8	33.6
Sierra-Leone	25.7	21.2	19.8	22.2
Zonal Ave	27.4	30.7	26.6	

*Sources: Author's Computation: Underlying Data from ECOWAS Central Banks and WDI*

According to official statistics from WAMA (2009), the main sources (components) of money supply growth in the WAMZ economies consists of Net foreign assets and Net domestic assets connected to the banking systems, Net claims on government, Claims on the private sector, Claims on public enterprises, and the rest of the economy. The WAMZ countries are generally characterized by excessive liquidity creation. Ghana, Guinea and Nigeria, for instance had high incidence of broad money supply growth rates of 39.8 percent, 38.3 percent and 57.8 percent, respectively, in 2008 during the global financial turmoil. In terms of liquidity management performance, The Gambia has been able to manage the growth rates in broad money supply in recent years. Nevertheless, the contribution to liquidity in Gambia rose from 6.7 percent to 18.4 percent in 2008 (WAMA, 2009). This growth was largely due to an increase in net credit to government which constituted 17.8 percent of the growth in broad money supply. Net foreign assets had a deteriorating impact on liquidity.

Aside 2005 and 2015, Ghana in general, pursued an expansionary monetary policy. Broad money supply rose to about 40.0 percent in the three consecutive years of 2006, 2007 and 2008. The growth in liquidity mainly arose from a surge in the volume of credit extended by the banking system to the private sector, even though, net foreign assets periodically contributed to the expansion. Nevertheless, net credit to the government contributed to the expansion recorded. The contribution of net credit to the government soared from negative 7.7 percent in 2007 to 21.4 percent, while credit to the private sector declined from 28.8 percent to 27.0 percent over the same period, an indication of a crowding-out effect on the private sector (WAMA, 2009). In recent times, Ghana has followed a contractionary monetary policy to tame the incidence of rising inflation. This has been alternated with mild monetary expansion to ease liquidity constraints and propel growth.

In Guinea, monetary expansion reached its highest of 59.4 percent in broad money supply in 2006. After a soothing performance in 2007, a contractionary monetary policy followed in 2008, resulting in an expansion of 38.3 percent. Net credit to the government contributed mainly to this development, next to net foreign assets, which rose by 17.3 percent and 14.3 percent, respectively. The post-2008 period has been generally marked by expansionary monetary policy. Nigeria recorded the highest broad money supply growth rate of 57.8 percent in 2008. The period of 2008-2011 was characterized by monetary expansion. The main components that accounted for this expansion were credit to the private sector and net foreign assets. The period 2011-2015 was characterized by contractionary monetary policy geared primarily towards inflation control.

In Sierra Leone, monetary expansion has relatively been moderate, with an average growth rate of 22.0. The expansion in broad money supply was largely driven by the banking system's claims on the private sector, although net foreign assets made significant contribution in 2005, 2006 and 2007. The contribution of net claims on government rose from a negative 4.3 percent in 2007 to 4.3 percent in 2008. In the same vein, claims on the private sector also rose from 8.5 percent in 2007 to 13.9 percent in 2008 (WAMA, 2009, ECOWAS Macroeconomic Convergence Report, various issues).

## 2.2. Inflation Performance in WAMZ

Table 2 shows the inflation rates in the WAMZ. An examination of the table shows that inflation has generally been high in the WAMZ countries, as the average inflation rate in the three sub-periods was above two digits. The high inflation rates in the sub-region have largely undermined the inflation convergence criterion (macroeconomic convergence). It is evident that most of the individual country's average exceeded the average in the zone. Nigeria and Ghana (the two largest economies in the zone), had higher incidence of inflationary pressures during the period, with inflationary rate in Nigeria standing at 14.5 percent in 2000, 16.4 percent in 2001 and 23.8 percent in 2003, while that of Ghana in the same period stood at 40.5 percent, 21.3 percent and 23.6 percent respectively (ECOWAS, Macroeconomic Convergence Report, Various Issues).

In addition to these difficulties, the economies of the WAMZ are vulnerable to externally generated and transmitted shocks associated with resource and commodity exports and the resulting incidence of foreign transmitted inflation (imported inflation).

**Table 2: Inflation Rates in WAMZ**

	2000-2004	2005-2010	2011-2015	Country Average
The Gambia	9.4	4.7	7.0	7.0
Ghana	22.5	14.5	14.8	17.3
Guinea	9.8	20.5	12.5	14.3
Nigeria	15.4	10.9	12.6	13.0
Sierra-Leone	5.0	12.3	12.5	9.9
Zonal Ave	12.2	12.6	11.9	

*Sources: Author's Computation: Underlying Data from ECOWAS Central Banks and WDI*

### 2.3. Money Supply Growth and Inflation

Although price stability has long been suggested as a primary objective for monetary policy, a number of major questions have risen about its desirability in practice. As an indicator of stable macroeconomic environment, inflation rate assumes greater importance. Macroeconomic stability, coordination of economic policies and their convergence are desideratum for the success of greater economic integration, particularly in the push towards monetary union in the region. From an average monetary growth of 30.2 percent, in 2000, with an inflation rate of 16.2 percent, money supply growth was 24.0 percent in 2005, against an inflation rate of 10.4. Growth in money supply stood at 35.4 percent in 2008, with an inflation rate of 15.3 percent, and in 2015, the growth in money supply was 37.5 with a corresponding average inflation rate of 16.2 percent (ECOWAS Macroeconomic Convergence Report, Various Issues, WDI, 2016).

For instance, the prevalence of output shortages, high import propensity and unstable macroeconomic policy environment facilitate the transmission increases in money supply through the aggregate demand channel that fuels inflation. The analysis also indicates that the relationship between money supply growth and inflation depends on the peculiar economic circumstances of the country concerned. Other determinants of inflation (exogenous factors), which may be structural in nature or attributable to supply-side factors, e.g oil price are also prevalent.

In Nigeria, for instance, despite the fact that monetary expansion was high, in particular years, inflation showed a decreasing trend. This apparently suggests that the Nigerian economy has not yet attain its productive capacity and, thus has the capacity to absorb additional investment. For Sierra Leone, the evidence points to the huge infrastructure need to support growth, leading to a situation where these two variables could move in opposite directions. In both countries, evidence therefore suggest that an important determinant of inflation could be structural and supply-constrained factors rather than monetary. Again, some countries have had consistently high rates of inflation, while others have experienced short bursts of high inflation. These are usually caused by an external shock (such as oil price shock), or by a devaluation necessitated by the consequences of poor terms of trade, higher interest rates and structural rigidities in the economy, such as supply bottlenecks or low production and output

capacities. Added to this, Iyoha (2004) maintained that in most African economies, including ECOWAS, because the money and capital markets are underdeveloped, budget deficits are usually financed not primarily through domestic borrowing but by money creation, which inevitably fuels inflation, compounding macroeconomic stabilization efforts. He posits that the key to macroeconomic stability lies in providing checks on large fiscal deficits and uncovering non-inflationary mechanisms for financing them.

### 3.0 LITERATURE REVIEW

#### 3.1 Theoretical Issues

Monetary policy is traceable to Irving Fisher (see Diamond, 2003) who laid the foundation of the quantity theory of money through his equation of exchange. In his proposition, money has no effect on economic aggregates but price, an adumbration of the concept of money neutrality. The role of money in an economy received further explication from (Keynes, 1930) and other Cambridge economists, who posited that money has an indirect effect on other economic variables through its influence on the interest rate, which in turn affects investment and cash holding of economic agents. Keynes' position is that insufficient aggregate demand can be increased through increase in money supply, which in turn generates increased spending, increased employment and output. However, he recommended a proper combination of monetary and fiscal policies (policy-mix) at some occasions for more potent results, as monetary policy could fail to achieve its objective. The role of monetary policy which encompasses influencing the volume, cost and direction of money supply was effectively expounded by (Friedman, 1968). He posits that inflation is always and everywhere a monetary phenomenon, while recognising that in the short run, an increase in money supply can reduce unemployment, but can also induce inflationary pressures and, as such, the monetary authorities should increase money supply with caution (Onyiewu, 2011, cited in Ozekhome, 2015).

The literature on monetary policy decisions in an economy characterized by rational expectations, and time inconsistency, has addressed questions regarding inflationary bias under discretionary monetary policy. For instance, the works of Taylor (1979) and Ball (1993) explicitly provide insights on the plausibility of dynamic inconsistency if the central bank operates on a path of loss function not fitted for example, with low and stable inflation. As opined by Woodford (2003) among others, the presence of inflation not only signals an inefficient level of economic activity but also incurs a more direct cost by leading to an inefficient allocation of resources and suboptimal quantities of goods produced and consumed. At the same time, it is important to note that there are good arguments in favour of stabilizing inflation at a strictly positive rate (e.g. in order to avoid the zero lower bound on nominal interest rates) and at the medium-term horizon (Gali, 2008). For example, Svensson (2000) and Christiano et al. (2005) show that strict inflation targeting, a policy tolerating only minor deviations from target, leads to substantial output volatility than a more flexible rule that targets inflation at a longer horizon. Evidence shows that the sub-optimality of strict inflation targeting may be even more severe when the policy is adopted as a disinflation policy, i.e. if it is applied to reduce the prevailing inflation rate to a lower level. This is motivated by the idea that inflation control differs from other disinflation policies in important respects. In particular, policies to prevent inflationary distortions such as wage and price differentials to an exceptional degree have been found to be critical to macroeconomic stabilization. Giannoni and Woodford (2005) conclude that inflation should not be reduced too abruptly if it has been allowed to exceed its optimal long-run level.

The neoclassical synthesis suggests a set of major conclusions about the role of monetary policy. First, it suggests that monetary policy actions can have an important effect on real economic activity, persisting over several years, due to a gradual adjustment of individual prices and the general price level. Second, even in settings with costly price adjustment, the models suggest little long run trade-off

between inflation and real activity. Third, the models suggest significant gains from eliminating inflation, which stem from increased transactions efficiency and reduced relative price distortions. Fourth, the models imply that credibility plays an important role in understanding the effects of monetary policy. These four ideas are consistent with the public statements of central bankers from a wide range of countries (Goodfriend and King, 1997). For example, post-war U.S data support the conclusion that exogenous increases in the supply of money generate substantial and persistent declines in short-term interest rates, leading to increased investment, output and inflation. This view contrasts sharply with that of the traditional literature on the subject, which has tended to conclude that money supply shocks raise, rather than lower, short-term interest rate. The generic implication of these models is that, if money growth displays positive persistence, then unanticipated shocks to the growth rate of money drives the nominal interest rate up, decline in output and consequently, induces inflation. This reflects the fact that, in these models, money shocks affect inflation through interest rates. The only way for an exogenous shock to the money supply to drive the interest rate down in these models is for the shock to signal a subsequent decline in money growth (Christiano & Eichenbaum, 1992). Thus, money growth affects prices basically through the aggregate demand channel and interest mechanism.

### 3.2. Monetary Policy Transmission Mechanism

The various transmission channels through which monetary policy affects economic activities are expounded under the monetarist and Keynesian postulation. The monetarists suggest that a change in the money supply leads directly to a change in the real magnitude of money. Friedman and Schwartz, (1963) assert that an expansionary monetary policy through open market operations by the central bank, increases the stock of money, leading to an increase in commercial bank reserves, and bank's ability to create credit, and thus, increase in money supply through the multiplier effect. Tobin, (1978) examining the transmission effect in terms of assets portfolio choice posits that monetary policy generates asset substitution between equity, bonds, and commercial paper and bank deposits. Tight (restrictive) monetary policy accordingly affects liquidity and the ability of banks to lend, which, therefore, restricts loan to prime borrowers and business firms, thereby, contracting effective demand and investment. The effect of monetary policy on domestic prices thus depends upon whether such policy is expansionary or not. For example, an expansionary monetary policy, represented by a growth of credit and money supply, will exert an upward pressure on domestic prices, fuelling inflation (Ozekhome, 2015).

On the contrary, the Keynesians posit that a change in money stock influences activities in the financial markets, affecting interest rate, investment, output and employment, and prices. Supporting this view, Modigliani (1963) introduced the concept of capital rationing and argues that banks' willingness to lend affects monetary policy transmission. Further investigation by (Borio, 1995), using evidence from fourteen industrialised countries, shows that it is influenced by factors such as terms of loan, as interest rates, collateral requirement and willingness to lend.

### 3.3. The Transmission Mechanism of Changes in Money Supply

The existing literature shows that money supply has a significant effect on economic activity. Two transmission mechanisms seek to balance the variables in the model: the indirect mechanism, that works through interest rates, leading to increased consumption with a delayed impact on prices, and the direct mechanism, which works through aggregate demand, and thus, has a more immediate and potent effect on prices. The indirect channel involves the manipulation of interest rates by the central bank. For example, reducing interest rates spurs investment, aggregate demand, output and consequently, prices. Business firms subsequently respond to increased sales arising from the excess money supply by demanding more raw materials and increasing production. The business activity leads to increase in the demand for labour and raises the demand for capital goods.



For a buoyant economy where output growth has reached its limits, a continuous monetary expansion will generate an increase in prices. The structuralist macroeconomics theory demonstrates that expansionary monetary credit when channelled into productive activities tends to raise domestic capacity to its optimal level. If this happens, the domestic price level tends to fall. However, in most developing countries where monetary expansion may be due to increased deficit financing, not connected with output growth, the domestic price level tend to rise. Due to inflation expectation on the part of the public, lenders insist on higher interest rates to offset the expected decline in purchasing power over the life of their loans. The converse effect is the case when the supply of money declines or when its rate of growth decreases, leading to a decline in economic activity, which leads to either a disinflation (reduced inflation) or deflation (falling prices). The transmission of excess money to inflation through the direct aggregate demand channel is very strong and has a significant effect on macroeconomic stability, as it involves increased real balances in the hands consumers (making them feel wealthier and, thus, stimulate spending). The rise in aggregate demand wields an upward pressure on the general price level in the domestic economy, with the magnitude of its impact, depending on the elasticity of supply.

The more inelastic is aggregate supply in the economy, the greater the impact on price level. In addition, the rise in demand could cause an increase in imports, leading to a downward pressure on the exchange rate, due to increase imports bill, thereby, causing a further increase in inflation. Furthermore, the resultant rise in the demand for labour arising from increase production demand generates a rise in money wages and unit labour costs. This may induce cost-push inflation. In general, there is palpable evidence that excess money supply, either created through the direct or indirect channels, influences economic activity (growth) and, may cause downside risks on macroeconomic stability, raising inflation, interest rates and exchange rate (WAMA, 2009, cited in Ozekhome, 2015).

### 3.4. Review of Empirical Studies

A number of empirical cross-countries studies and country-case studies have examined the macroeconomic impact of monetary policy actions particularly, monetary expansion on inflation in both developed and developing economies. These studies are briefly reviewed.

Empirical studies on the impact of money on in the economy and the effectiveness of monetary policy, in particular, focused on the ability to identify conclusively the influence of money on inflation (see Laury, et al., 1978; Coghlan, 1981; Wren-Lewis, 1981). The ingenious and path-breaking contributions of earlier works on inflationary dynamics, in the context of the potential feedbacks between money supply and price level, and inflationary expectations by Cagan (1956), Sargent and Wallace (1975) are also notable. These studies have largely focused on addressing four issues. First, if money supply growth forecast inflation, given the predictive power of past values of inflation and, if so, to examine the explanatory power and the stability of such relationship overtime, the potential feed-back between them, and the role expectations in inflation dynamics. The empirical evidence established a significant money supply growth- inflation relationship. Using various econometric techniques and simulation approach, the findings reveal that money supply growth significantly explains inflation and other macro variables. In terms of developing countries, monetary and non-monetary factors explain the inflation process. For instance, Calomiris and Domowitz (1989) investigating the money demand-inflation process in Brazil, find that expected inflation is determined simultaneously with equilibrium real balances and real government debt. They also find that changes in money do not predict changes in the price level whereas changes in the price level do predict changes in money. Other studies in developing countries show that one of the dominant predictors of inflation is the growth of money (Owoye, 1997).

Chibber (1991) constructs a detailed econometric model, which takes account of both monetary and structural factors, while investigating the cause of inflation in Zimbabwe. The findings reveal that

monetary growth, foreign price, exchange rate, interest rate, unit labour cost and real income are the principal determinants of inflation in this country. Using a similar macroeconomic model of inflation for Ghana for the period 1965-1988), Chibber and Shafik (1990) find that the growth of money supply is one key variable explaining the Ghanaian inflationary process.

Bayoumi and Eichengreen (1994) using a model of VAR simulations of inflation and output growth, attempt to measure asymmetry among contemporaneous shocks across a range of countries by analyzing the prospects for monetary unification in various parts of the world. They identify permanent and transitory shocks arising from macroeconomic instability such as inflation using the Blanchard-Quah decomposition method. The empirical findings reveal that supply shocks are not highly correlated relative to the degree of symmetry of shocks in regions examined. Nwaobi (1999) examine the interaction between money, output and inflation in Nigeria between the periods 1960-1995. The model assumed the irrelevance of anticipated monetary policy for short run deviations of domestic output from its natural level. The empirical results show that unanticipated growth in money supply would have positive impact on output and prices.

Holod (2000) investigates the impact of money growth on inflation in Ukraine. Employing Vector Auto Regression to examine the relationship between inflation, money supply and inflation rate in Ukraine, the empirical findings reveal that money supply growth significantly influences price level behaviour. Honohan and Lane (2004) using a variety of regressions, explain annual inflation variations across the Euro zone over the period 1999-2001, and found a significant role of money growth in explaining divergent inflation rates.

Nicolleta and Edward (2001) modify and extend Friedman's (1972) evidence on the lag between monetary policy actions and the response of inflation. Using data from the UK and US covering the period 1953-2001 to examine the relationship between money growth rates, inflation and interest rates, as well as annual data on money growth and inflation, the findings corroborate previous findings that monetary policy actions have their peak effect on inflation with a one year lag.

Canetti and Greene (2000) disaggregate the influence of monetary expansion from exchange rate changes on prevailing and expected rate of inflation. Using evidence from ten countries, which include The Gambia, Ghana, Kenya, Nigeria, Sierra-Leone, Somalia, Tanzania, Uganda, Zaire and Zambia, and Vector Auto Regression analysis, the findings show that monetary dynamics dominate inflation levels in four countries, while exchange rate depreciation is the principal factor in three countries.

Clemens and Alex (2002) working on a sample of ten European countries, for the period 1974Q1-1998Q2, on the degree of inflation persistence, used a non-linear autoregressive inflation equation for the estimation. After allowing for the presence of an unknown number of shifts in the mean of inflation, they find confirmation for the existence of a positive relationship between monetary policy variables and inflation persistence for majority of the smaller countries, which were dependent on exchange rate mechanism (ERM). In the case of the larger countries and the countries outside the ERM for most of the period, they find no evidence of such positive link. On the whole, they find modest support for the existence of the theoretically presumed assumed positive link between monetary policy variables and inflation persistence.

Mahamadu and Philip (2003), investigate the link between monetary growth, exchange rates and inflation in Ghana, using Error Correcting Mechanism. The empirical results confirm the existence of a long run equilibrium relationship between inflation, money supply, exchange rate and real income. The findings show that in the long-run, inflation in Ghana is positively related to the money supply and the exchange rate, while the relationship with real income is negative.

Folawewo and Osinubi, 2006) investigate the extent to which monetary policy objective of controlling inflation rate and intervention in the financing of fiscal deficits affect the variability of inflation (macroeconomic instability) in Nigeria. It is assumed that monetary authority's effort to influence the financing of government fiscal deficit through the determination of the inflation-tax rate affects inflation variability. The findings reveal the existence of a significant relationship between monetary policy and inflation in Nigeria.

Owoye and Onafowora (2007) examine the stability of real broad money supply and the effects of deviations of actual real broad money supply growth rates from targets on real GDP growth and inflation rate on the Nigerian economy, since the commencement of the Structural Adjustment Program (SAP) in 1986. Employing cointegration and vector error correction methodology on quarterly data from 1986:1 to 2001:4, the results show the existence of a long-run relationship between the real broad money supply, real GDP, inflation rate, domestic interest rate, foreign interest rate, and expected exchange rate.

In a quantitative assessment by the West African Monetary Agency (WAMA) (2009) on money supply growth and macroeconomic convergence, a positive correlation between money supply and inflation in eight of the fifteen countries of ECOWAS is observed. The findings (though did not examine the impact of monetary expansion on inflation in a cause-effect regression model) further show a positive correlation between money supply growth and inflation in four of the six member countries of the WAMZ (The Gambia, Ghana, Guinea and Liberia) to the tune of 0.72 for Guinea and 0.74 for the Gambia, with the exception of Nigeria and Sierra-Leone, where an inverse relationship was observed. In most of the fifteen countries examined, the expansion in money supply explained inflation. Nevertheless, a positive but weak correlation is observed in Ghana and Liberia (between 0.23-0.33). The high degree of positive correlation between money supply growth and inflation on the average provides an indication that an increase in money supply is likely to induce inflationary pressures. A further review of the conduct of monetary policy appears to explain that interest rate (the prime or monetary policy rate) is the key monetary policy instrument used to react to high inflationary pressures. The increases in interest rates (the cost of capital) complemented with other monetary policy instruments, as anti-inflationary devices, tend to reduce liquidity and credit, which in turn affect output adversely.

Bakare (2011) examine the determinants of money supply growth and its implication on inflation in Nigeria. Employing cointegration and error correction techniques, the findings (although country-specific) show that credit expansion to the private sector dominates money supply growth in Nigeria. The findings further show a positive relationship between money supply growth and inflation in Nigeria. In particular, a 1 percent rise in money supply in the current period leads to 5.6 percent rise in inflation. This finding is in contrast to the observed negative correlation between money supply and inflation for Nigeria, using regional evidence of WAMA (2009).

Imimole and Enoma (2011) using evidence from Nigeria for the period 1986–2008 and employing Auto Regressive Distributed Lag (ARDL) Cointegration procedure found evidence of money supply as one of the main determinants of inflation in Nigeria. Against this backdrop, the paper recommends the need for policymakers to use macro-economic policies to stabilize the volatile inflationary rate in Nigeria.

Akinbobola (2012) examines the dynamics of money supply, exchange rate and inflation in Nigeria. Using quarterly data from 1986Q1 to 2008Q4 and Vector error correction mechanism (VECM), the empirical results show that in the long run, money supply and exchange rate have significant negative effects on inflationary pressure, while real output growth and foreign price changes have direct effects on inflationary pressures. The author concludes that the possible justification for the inverse effect of

money supply on price level is that inflation may not be due to aggregate demand pressure but rather due to hiccups in the supply chain of goods both from the domestic and foreign supply outlets.

Ozekhome (2015) investigates the money-output growth nexus in Nigeria. In particular, he sought to examine the non-neutrality hypothesis of money on real variables and aggregate demand. Employing cointegration and dynamic estimation techniques, the empirical results show that money causes output growth, albeit weak and predictive impact.

From the review of the pertinent literature, it is apparent that the empirical findings on the effects of monetary expansion on inflation are still rather mixed and inconclusive for the developing countries. Importantly, no regional study in the WAMZ has empirically examined the money growth-inflation nexus, as the only study conducted by WAMA (2009) on money supply and macroeconomic convergence did not specifically focus on the role of monetary expansion in the inflation process. Besides, the study was not empirical, employing correlation analysis. Given that correlation does not establish cause-effect relationship and by extension does not empirically show the effect of monetary expansion and other determinants on inflation, there is need for further empirical investigation at cross-country, particularly the WAMZ sub-region on the role of monetary expansion in inflation process.

## 4.0 METHODOLOGY

### 4.1. Theoretical Framework and Model Specification

To investigate the potential determinants of inflation in the WAMZ countries, a modified version of the framework used by Akinbobola (2012) is developed. The modification becomes necessary because of the need to model inflation in the context of money growth, alongside other potential determinants of inflation in the WAMZ countries.

The traditional monetarist's approach to the study of inflation emphasizes the importance of the link between money supply growth, and inflation, and also that increases in aggregate demand lead to increases in the price level, depending on the level of economic activity (real output) Thus, we specify

$$P = f(\text{MSG}, \text{GRGDP}) \dots \dots \dots (1)$$

Where

P = general price level, which is expressed as a weighted average of the price of tradable goods and non-tradable goods

MSG = Money supply growth

GRGDP= Growth rate of real GDP (a measure of real economic output)

The structuralists on the other hand, emphasize the role played by deficit financing or government expenditure in fuelling inflation. This is a characteristic of the economic and structural context of developing countries. Deficit financing is an important explanatory variable of the growth of money supply. Since most developing economies like the WAMZ are highly import dependent with internationally transmitted price increases, the possibility of imported inflation through the exchange rate pass-through is inevitable. Thus, an increase (depreciation) in the exchange rate and a rise in foreign prices induce domestic inflationary pressures. The level of economic activity measured by real output, and oil price are subsumed in the structuralists theory since their theory pertains to developing economies where full employment is yet to be attained and supply bottlenecks or structural rigidities explains inflation phenomenon in the sub-region. In this regard, oil price oil price is used to capture

supply side factor that could possibly explain inflation in the sub-region. One could, therefore, econometrically specify the structuralist theory of inflation as:

$$P = f(\text{FD, EXR, OILP, GRGDP}) \dots \dots \dots (2)$$

where the symbols in bracket stands for deficit finance (fiscal deficits), exchange rate, oil price (OILP and level of economic activity (real output level), respectively. By synthesizing equation (1) and (2), we have:

$$P = f(\text{MSG, FD, EXR, OILP, GRGDP}) \dots \dots \dots (3)$$

The main structuralist position is that inflation can result from a number of special contextual problems and not just from excessive money growth. Their search for explanations of inflation centres around “structural” problems such as supply bottlenecks, rigidities or high dependency on imported intermediate goods. This is important especially, in the sub-region where structural rigidities appear to be important factors driving inflation. Inflation could also arise from the cost side (cost -push or cost-induced). Costs could change through a supply shock or an increase in cost of production, arising from an increase in the cost of loanable funds (interest rate). Demand for higher nominal wages could also drive up production costs, and consequently, increases final goods prices. A synthesis of the Monetarists and the Structuralist specification, thus, gives the appropriate specification, since MSG, FD, EXR, INT, OILP and GRGDP are common to both. In empirical specification, the model for identifying the factors responsible for price inflationary pressures in WAMZ in the period under review is thus:

$$P = f(\text{MSG, FD, EXR, INT, OILP, GRGDP}) \dots \dots \dots (4)$$

Equation (4) shows that potentially, inflation rate is determined by MSG, FD, EXR, INT, OILP and RGDP

Where INF = Inflation rate- measured as percentage change in Consumer price index (CPI); MSG = Money supply growth-measured as growth in broad money supply (M2); and a vector of other macroeconomic variables according to the literature, that determines inflation rate. The inclusion of these variables is to include, as much as possible, other critical variables that impact on the assumed relationship, and, thus, avoid omitted variable bias. These variables include;

FD =Fiscal deficits- Fiscal deficits to GDP ratio

EXR = Exchange rate to the US Dollar as a common denominator

INT= interest rate –measured as lending rate

OILP= World oil price-measured in US dollars per barrel

GRGDP= Growth rate of Real GDP – (a measure of real output/economic activity)

The empirical specification of the model to be estimated is therefore:

$$CPI_{i,t} =, \alpha_0 + \alpha_1 CP_{i,t-1} + \alpha_2 MSG_{i,t} + \alpha_3 FD_{i,t} + \alpha_4 EXR_{i,t} + \alpha_5 INT_{i,t} + \alpha_6 OILP_{i,t} + \alpha_7 GRGDP_{i,t} + \epsilon_{it} \dots \dots (5)$$

Where *i* represents country fixed effect (5 of the six WAMZ countries), with the exception of Liberia, due to lack of adequate and complete data, and *t* represents period (2000-2015); and INF, MSG, FD, EXR, INT, OILP and GRGDP are as earlier defined.

The apriori expectations are  $(\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6) > 0$ , and  $\alpha_7 < 0$ . The apriori expectations are based on economic theory, as theory predicts that an increase in money supply, fiscal deficits, the exchange rate, interest rate and oil price drive up prices, while a rise in real output leads to a decline in the inflation rate. Adding the effect of lagged inflation to the equation captures the effect of (dynamics i.e previous inflation level, arising from sluggish adjustment to prices due to rigidities and inertia.

$\alpha_0 - \alpha_7$  are parameters to be estimated,  $t$  is year fixed specific effect, and  $\epsilon$  is the unobserved error term.

#### 4.2. Justification of the variables used

Several variables are critical to the determination of inflation as its principal drivers in the theoretical literature. First, money supply as a monetary variable influences or determines inflation given its importance as a monetary instrument (tool) to control the rate of inflation in line with the postulates of the quantitative theory of money, structuralist macroeconomics approach and monetarists, that a change in money supply affects prices.

Second, exchange rate as a pass-through variable via the monetary transmission mechanism is critical in the determination of the rate and variation of inflation across countries. As a monetary concept, it is the price of one currency in terms of another, thereby facilitating the conversion of prices quoted in the different currencies into common denomination (Obadan and Ozekhome, 2015). It, thus, acts as an external anchor. A change in the exchange, therefore, has a direct influence on inflation rate. The inclusion of exchange rate is thus in line with the external transmission effect of imported prices.

Third, interest rate variable through the direct and indirect mechanism influences prices, and hence, inflation. The indirect transmission mechanism works through interest rates, leading to increased consumption with a delayed impact on prices, while the direct mechanism operates through aggregate demand, output, and then, prices. The indirect channel involves the manipulation of interest rates by the central bank. For instance, lowering interest rates spurs investments, aggregate demand, output and consequently, prices. In the same vein, a rise in interest rate implies high cost of loanable funds for productive output. This automatically translates to high cost of production, and then, prices, via the mark-up effect. Fourth, oil price is theoretically presumed to be positively related with inflation rate in line with the 'Dutch Disease', which indicates that windfalls from a sharp surge in oil price generate inflationary pressures in most developing economies because the economy is not well-diversified to absorb the inflow of foreign earnings. The resulting resource pull and spending effects, combined with weak (supply) or output capacities induce inflation pressures. Supply bottlenecks or structural rigidities thus explain inflation variation across countries.

Fifth, due to its critical importance in the determination of inflation in accordance with extant theoretical literature, real output should be included. For instance, an increase in output capacity through the supply mechanism could reduce prices, thus dampening inflationary pressures, while insufficient output could induce inflationary pressures via artificial scarcity mechanism. Sixth, fiscal deficits (proxy for fiscal policy actions) are particularly appropriate to developing countries since rising fiscal deficits are pervasive and a regular feature of their economies. Such deficits are usually financed using the printing press (pump priming) and/or through domestic and external borrowing, which tend to generate inflationary pressures.

#### 4.3. Estimation Technique

The Panel data methodology is adopted in this study. In achieving this, the study adopts different panel estimators-panel least squares and panel fixed effect (FE). The latter method builds upon the weakness of the former. While the OLS gives a prima facie kind of evidence, it is however not potent enough in the case of panel data because it does not account for time-invariant country-specific characteristics and

the ensuing heterogeneity amongst them. Specifically, the pooled specification assumes that the intercept and slope coefficients are constant across years, and countries. This assumption is over simplistic since it does not account for country-specific varying effects. The study employs the Within Estimator (also called Entity Demeaning estimator) for the fixed effect model. The fixed effect controls for country-specific effect or factor, which may have potential bias on the predictor or outcome (inflation in this context). In this sense, it eliminates the effect of time-invariant characteristics from the outcome variable, thus enabling an evaluation of the outcome’s net effect. Relevant diagnostics (such as R<sup>2</sup> and F-value) are used to choose between the Pooled OLS and fixed effect model.

The specification for the pooled-OLS is:

$$y_{it} = \alpha_i + \beta_t x_{it} + e_{it} \dots\dots\dots(6)$$

Where  $y_{it}$  is the dependent variable  $x_{it}$  and  $\beta_t$  and are  $k$ -vectors of non-constant regressors and parameters for  $i = 1, 2, 3, \dots, N$  cross-sectional units (countries). Each cross-section is observed for dated period  $t = 1, 2, 3, \dots, N$ .

The *Fixed-effect* estimator allows  $\alpha_i$  to differ across country units, by estimating different constants for each country. This is done by subtracting the “within” mean from each variable and estimating it with OLS, using transformed data.

$$y_t - \bar{y}_t = \beta(x_t - \bar{x}_t) + (e_t - \bar{e}_t) \dots\dots\dots(7)$$

Where,  $\bar{y}_t = \sum_{t=1}^T \frac{y_{it}}{T}; \bar{x}_t = \sum_{t=1}^T \frac{x_{it}}{T}; \bar{e}_t = \sum_{t=1}^T \frac{e_{it}}{T};$

In general, the main advantage of the panel data analysis is that it comprehensively takes the individual characteristics of the different countries used in the study. It is generally observed that country-level characteristics are strong factors in the explanation of inflation variation, and hence, this differentiation may bring endogeneity bias into the estimation. The panel data analysis helps to correct this inherent estimation problem. The basic class of models that can be estimated using panel techniques may be written as:

$$Y_{it} = f(X_{it}, \beta t) + \delta_i + \gamma_t + \epsilon_{it} \dots\dots\dots(8)$$

The leading case involves a linear conditional mean specification, so that we have:

$$Y_{it} = X_{it}'\beta\delta_i + \gamma_t + \epsilon_{it} \dots\dots\dots(9)$$

Where  $Y_{it}$  is the dependent variable,  $i =$  entity,  $t =$  time;  $X_{it}$  is a -vector of regressors,  $\beta i$  is the coefficient vector of the explanatory variables; and  $\epsilon_{it}$  are the error terms for  $i = 1, 2, \dots, M$  cross-sectional units observed for dated periods  $t = 1, 2, \dots, T$ . The  $\alpha$  parameter represents the unknown intercept for each country entity (n-entity specific-effects) in the model, while the  $\delta_i$  and  $\gamma_t$  represent cross-section or period specific effects (random or fixed).

The Hausman Test is used to choose the appropriate model of estimation or estimates of coefficients between the fixed and random effect models.

#### 4.4. Data

This study employs panel data covering the period 2000-2015 for five (5) member countries of the West African Monetary Zone (WAMZ). The West African Monetary Zone is made up of six countries in West Africa; The Gambia, Ghana, Guinea, Liberia, Nigeria and Sierra-Leone, with the objective of attaining economic and monetary union through the coordination and harmonization of monetary and fiscal policies and their convergence. Liberia is, however, not included in this study due to lack of complete and adequate data. All the data for this study (except oil price) are obtained from the Statistical Bulletin (various issues) of member countries, World Bank's World Development Indicators (WDI), WAMZ Macroeconomic and Convergence Report (various issues) and the International Financial Statistics (IFS) of the International Monetary Fund (IMF). The data for world oil price is sourced from Reuters.

## 5.0 EMPIRICAL RESULTS AND ANALYSIS

### 5.1. Descriptive Statistics

Table 3 presents the descriptive statistics of the sample data on the variables used for the analysis. Average inflation rate for the sampled WAMZ countries during the period is 12.1 percent, with a median value of 12.5 percent, an indication that inflation rate in some of the WAMZ countries far exceeded the average. Apparently, there is differential rate of inflation in the zone, characterizing a situation where some of the countries have relatively higher rates of inflation that largely undermines the inflation convergence criteria. The maximum and minimum values are 38.8 percent and 0.3 percent respectively. This wide disparity further buttresses the differential rates of inflation in the sampled countries over the period. The mean value of money supply growth in the sub-region is 27.5, with a median value of 28.2. Thus, some of the countries' monetary expansion far exceeded the observed average in the sub-region. The mean and median values of fiscal deficits are 21.5 percent and 19.8 percent respectively. The maximum and minimum values are 38.2 percent and 2.5 percent, respectively. Exchange rate has a mean value of 177.2, with the corresponding maximum and minimum values of 380.2 and 122.6 respectively. Thus, exchange rate has risen dramatically in the sub-region over the sample period, an indication of abrupt currency depreciation, which possibly had worsened the rate of inflation in the region through the exchange rate-pass through mechanism, given that the countries in WAMZ are largely import dependent on essential raw materials, capital machineries and technology. The mean value of interest rate (lending rate) is 26.2 percent, with a median value of 24.9 percent. The maximum and minimum values are 44.1 percent and -1.2 percent, respectively. The mean value of oil price is 32.0, with a median value of 30.9. The maximum and minimum values are 120.2 and 26.2 respectively.

Average real GDP growth for the sample WAMZ countries during the period is 4.9 percent with a median value of 5.1 percent. The maximum and minimum values are 8.2 percent and 0.8 percent. This implies that the rate of real output growth in the zone is diametrically dispersed among the sampled countries over the period of the study. This wide dispersion and differential growth rate is confirmed by the standard deviation value of 4.5 percent. In terms of standard deviation, exchange rate, oil price and inflation rate have the highest values of 5.4 percent, 5.1 percent and 4.9, respectively. This is a clear indication of inflation and exchange rate variability, as well as oil price fluctuation in the sampled countries during the period of study (Nigeria in particular) in recent times. Apparently, output growth rates and other macroeconomic performance indices generally indicate poor performance in the WAMZ countries over the period of study.



**Table 3: Descriptive Statistics**

	<i>Mean</i>	<i>Median</i>	<i>Max.</i>	<i>Min.</i>	<i>Std. Dev.</i>
<i>CPI</i>	12.1	12.5	38.8	0.3	4.9
<i>MSG</i>	27.5	28.1	57.4	7.2	2.1
<i>FD</i>	21.5	19.8	38.2	2.50	2.6
<i>EXR</i>	175.7	168.3	380.2	122.6	5.4
<i>INT</i>	26.2	24.9	44.1	-1.2	2.5
<i>OILP</i>	32.0	30.9	120.2	26.2	5.1
<i>GRGDP</i>	4.9	5.1	8.1	0.8	4.5

*Source: Author's computation*

### 5.2 Correlation Analysis

In order to examine the correlation between the variables used in the analysis, we conduct the correlation analysis. An incidence of strong correlation among the independent variables may violate the working assumptions of our estimation technique, and, thereby, produce unrealistic results. The result of the pairwise correlation matrix tests are reported in Table 4 below. In the correlation matrix, a positive relationship is observed between inflation growth rate and all the variables (except real GDP and oil price). An overall consideration of the result of the correlation coefficients indicates that multi-collinearity is not a considered problem in the model to be estimated.

**Table 4: Correlation Matrix**

	<i>CPI</i>	<i>MSG</i>	<i>FD</i>	<i>EXR</i>	<i>INT</i>	<i>OILP</i>	<i>GRGDP</i>
<i>CPI</i>							
<i>MSG</i>	0.41						
<i>FD</i>	0.27	0.36					
<i>EXR</i>	0.19	0.28	0.25				
<i>INT</i>	0.31	0.26	0.33	0.35			
<i>OILP</i>	-0.20	0.27	0.18	0.24	0.30		
<i>GRGDP</i>	-0.19	0.30	0.29	-0.32	0.28	0.37	

*Source: Author's computation*

### 5.3. Unit Root Analysis

The study begins by performing a panel unit root test. LLC, Fisher-PP and Fisher-ADF unit root tests were conducted to examine the level of all variables in order to investigate the stationarity status of variables in both panels. If all the variables are stationary at their level, they would enter the model in

their level form. The result of the panel unit root in Table 5 indicates that all variables are overwhelmingly stationary at their level and consequently, enter the model directly. Apparently, employing data in a panel framework usually eliminates non-stationary. This justifies the estimation of a panel model to establish the variables explaining inflation.

**Table 5: Unit Root Test for Variables in Levels**

Test	INF	MSG	FD	EXR	INT	GRGDP
LLC	-2.445**	-2.981***	-3.662**	-3.153***	-2.180*	-3.761***
Fisher-PP	28.420**	44.105**	22.203*	38.711*	40.272**	60.043***
Fisher-ADF	42.18**	55.152***	40.104**	54.086***	50.240**	47.281**

\*\*\* *Statistical significance at the 1% level*

\*\* *Statistical significance at the 5% level*

\* *Statistical significance at the 10% level*

*Source: Author's computation*

#### 5.4. Empirical Results and Analyses

The empirical results are presented in this section. We specifically analyzed our growth equation with the pooled OLS and the fixed effect approaches. A choice is made between these two approaches using relevant diagnostics. We also estimated the model with the random effect approach, however, using the Hausman test, the fixed effect estimator is chosen as the best model. The Entity Demeaning approach, also called the Within Estimator of fixed effect model is explored for the fixed effect model. The choice of the latter is based on the fact that the estimation of the fixed effect panel regression is based on the assumption of no correlation between the error-term and the independent variables. The fact that pooled OLS regression analysis method does not differentiate amongst the countries in term of their structural peculiarities, individual countries' heterogeneity, fixed and time varying effects, the estimates are usually biased and inconsistent. The individualities of the countries are subsumed in the error-term. This makes the panel data regression option better than pooled OLS regression technique. Table 6 revealed that the fixed effect is the best model for the estimation of the growth equation. The analysis is thus based on the fixed effect, which is interpreted and relied on for policy perspectives.

**Table 6: Inflation and its Explanatory Variables**

Dependant Variable: CPI		
Variables	Pooled OLS	Panel Fixed Effect
Constant	0.031	0.244
	0.894	1.470
CPI(-1)	0.043 (1.764)	0.177* (1.802)
MSG	0.296* (1.944)	0.293** (2.081)
FD	0.117 (0.831)	0.251 (2.311)**
EXR	0.252** (2.184)	0.212** (2.274)
INT	-0.021* (-0.932)	0.094 (1.501)
OILP	0.140 (1.572)	0.115* (1.871)
GRGDP	-0.471** (2.262)	-0.412*** (2.912)
Adjusted R <sup>2</sup>	0.21	0.72
Durbin-Watson	1.38	1.70
F-statistics	7.25**	24.30***
Hausman Test		10.32 (0.03)
Mean VIF		1.82
Breusch-Pagan LM Test		4.09 (0.06)

*Note: \*\*\*, \*\* & \* indicate 1%, 5% & 10% level of significance; Relevant diagnostics tests to choose between Pooled OLS & Fixed Effect Models ; T-ratios are in parenthesis.*

*Source: Author's computation*

The adjusted R<sup>2</sup> value of 0.72 shows that about 72 percent of the net systematic variations in economic growth in the WAMZ sub-region over the period is explained by the independent variables. This implies the explanatory variables of the model are relevant factors explaining inflation in the sub-region, making the predictive ability of the model good. The F-value of 24.3 is highly significant at the 1 percent level, validating the hypothesis of the existence of a significant linear relationship between economic growth and all its explanatory combined. An examination of the results shows that all the variables have the correct signs. The coefficient of lagged inflation rate is appropriately signed and is significant at the 10 percent level. This implies that previous inflation rate may fuel current inflation, an implication of inflation persistence, particularly when economic agents engage in acts capable of inducing further inflation in the succeeding year, thereby creating incidence of 'inflation carrying effect' or transmission syndrome'. This finding is in line with the findings of Imimole and Enoma (2011) and Akinbobola (2012) for developing economies.

Accordingly, a 10 percent increase in previous inflation level will induce inflationary pressures in the succeeding year by 1.8 percent. The coefficients of money supply growth (monetary expansion) and fiscal deficit have the expected positive signs and are significant at the 5 percent level respectively. The positive coefficients affirm the usual theoretical linkage between monetary expansion and inflation and/or increased fiscal actions and inflation. In line with the traditional macroeconomic theory, money should have positive and significant effect on price level in the long run. The significance of both

coefficients invariably shows the strong influence of monetary expansion both from monetary sector (i.e monetary-induced) and fiscal impulses on the liquidity level in the WAMZ countries. An increase in liquidity in these economies raises the real money balances of the people, which induce aggregate demand. The sluggishness of supply to respond to the unexpected increase in demand arising from weak production capacity and hiccups in the supply chain of goods, both from the domestic and foreign supply outlets, generates pressure on prices and, hence, induce inflationary tendency. The result corroborates the findings of Canetti and Green (2000) for a panel of African economies and Akinbobola (2012) for a developing economy like Nigeria. In line with the estimates, a 10 percent increase in money growth and fiscal deficits will on the average, generate inflation in the WAMZ countries by 2.9 percent and 2.5 percent, respectively.

The coefficient of exchange rate is positive in line with the theoretical projection and significant at the 5 percent level. This implies that, rising exchange rate (exchange rate depreciation) fuels inflationary pressures in the WAMZ countries, particularly through the exchange rate pass-through, given the fact that WAMZ countries have high import propensity. This finding corroborates the results of Brouwer and Ericsson (1998), Durevall (1998) and Akinbobola (2012). Accordingly, a 10 percent increase in exchange rate (exchange rate depreciation) will generate a 2.1 percent growth in inflation in the WAMZ. The coefficient of interest rate (lending rate) is appropriately positive in line with the theoretical expectation, but is not statistically significant at the 5 percent level. Since the t-value of its coefficient is greater than unity, we may infer that rising interest rate induces inflation in WAMZ countries but its effect is rather weak. Rising interest rate tends to discourage loanable funds for productive activities, generating output-shortages which trigger inflation. For instance, increased production costs, caused by high lending rates tend to fuel inflationary pressures under the mark-up effect and cost-push channel. Its coefficient of 0.09 implies that a 10 percent increase in lending rate will induce inflation by 0.9 percent in the WAMZ. The coefficient of oil price is positive in line with theoretical evidence and passes the significance at the 10 percent level. Invariably, rising oil price tend to induce inflationary pressures via the 'resource pull' and 'spending effect'. In general, rising oil price tends generate overvalued currency, uncompetitive non-resource sectors, increase import demand propensity, all of which induce inflationary pressures. Its coefficient indicates that a 10 percent rise in oil price will cause inflation in the WAMZ by 1.2 percent. The coefficient of growth rate of real GDP (a measure of real output) has the correct negative sign in line with the apriori expectation (i.e consistent with theoretical projection) and passes the significance test at the 1 percent level. Thus, an increase in real output dampens inflationary pressures in the WAMZ countries. This finding buttresses the results of Canetti and Greene (2000) and Clemens and Alex (2002). In line with the estimates, a 10 percent increase in real output will reduce inflation impact (inflationary pressures) by 4.1 percent.

Considering key diagnostic test for the robustness and validity of results obtained, the DW statistic of 1.70 shows that there is no autocorrelation in the results. The post-estimation evidence also leads to the non-rejection of the null hypothesis of no serial cross-sectional dependence and contemporaneous correlations, using the Breusch-Pagan LM test for cross-sectional dependence and contemporaneous correlation {with  $\text{Chi}^2 = 4.09(0.62)$ }. The mean variance inflation factor (VIF) of 1.82 shows the absence of multicollinearity in the estimated model. There is thus no evidence to invalidate the model, as it can be used for structural and policy analysis.

## 6.0 CONCLUSION AND POLICY RECOMMENDATIONS

This study examines whether or not money supply growth contributes to inflation in the WAMZ countries, given the fact that excess liquidity from monetary and fiscal impulses could generate inflationary pressures in these economies. The choice of the estimation period (2000-2015) was informed partly by the high inflation rates, juxtaposed with monetary expansion recorded during the period, making it worth studying, and partly by data availability. The empirical results show that money

supply growth (monetary expansion), fiscal deficits, oil price and exchange rate depreciation are the principal drivers of inflation in the WAMZ countries, while real output reduces it. Lagged inflation (proxy for previous inflation) is also found to be significant; an indication of inflation persistence in the sub-region, arising from sluggish adjustment to prices due to rigidities and structural inertia. Given the empirical findings of this study, the basic conclusion is that monetary variables and structural factors both explain inflation dynamics in the zone, with monetary expansion relatively more important than structural factors.

Considering the significance of monetary expansion in generating inflation in the region, it is important that expansion in money supply be closely tied to the objective of spurring growth. This is necessary to suppress inflationary tendencies arising from monetary expansion in the region. Thus, monetary policy management should be anchored on stabilizing prices. This requires strengthening of liquidity management mechanisms of the central banks in the sub-region to comply strictly with money supply growth targets. Strong fiscal expenditure control mechanisms should also be put in place in order to control excessive, unwarranted, and imprudent spending by the governments of the sub-region. Importantly, policies that will stimulate output through increased production capacities, particularly those that will minimize domestic and foreign supply bottlenecks/ shortages, and structural rigidities are important to controlling inflation. In the same vein, policies to diversify the economic base of the WAMZ countries in order to enhance the value of their domestic currencies so as to avoid precipitous depreciation of their currencies against other major currencies are critical. Such policies will also entail prudence in fiscal spending, arising from oil windfalls, and the resultant 'spending effects', which fuels inflation. This will ensure a sustainable fiscal policy and output growth patterns that is capable of depressing inflationary tendencies arising from supply shocks and other structural rigidities. The adoption of sound, stable and realistic exchange rate and interest rate policies are particularly important in this respect. Very importantly, policy coordination and harmonization with respect to money supply growth target and inflation to achieve faster macroeconomic convergence among member countries relevant for full economic and monetary integration in the sub region is imperative.

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