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The Impact of Key Monetary Variables on the Economic Growth of the CEMAC Zone

Forgha Godfrey NJIMANTED[1*], Daniel AKUME[1] and Emmanuel Mbella MUKETE[2]

[1]University of Bamenda, Cameroon
[2]Catholic University Institute of Buea, Cameroon

This study seeks to empirically explore the impact of key monetary policy variables on the economic growth in the CEMAC zone from the period of 1981 to 2015. Carried out using the Ex post facto research design based on the principal components selection approach, the study interacts money supply, interest rate, economic growth, and inflation rate, among themselves and their lagged values using the Vector Auto-regressive (VAR) analytical technique. The Classical quantity theory of money, the Cambridge Cash Balanced, the liquidity preference theory and the Monetarists as theoretical frameworks were explored to appreciate the time trends of the selected variables on the economic growth of the CEMAC zone. Based on the (VAR) methodology, the study reveals that key monetary policy variables influence economic growth of the CEMAC zone in different ways with inflation rate as the impact factor. On the basis of the above findings and the evidence from other studies, lending and inflation rate generated substantial destabilizing impacts on the economic growth, suggesting that the monetary authorities should play a critical role in creating an enabling environment for growth. The determination of the optimal lending rate should reflect the overall internal rate of returns in the productive sectors with due attention to market fundamentals. In line with this, the Central Bank of CEMAC should be given complete instrumental autonomy to operate depending on a set of in-built targets by the individual countries of the zone. Effective monetary targeting and accommodating monetary policies should be designed and implemented as the need arises with little or no political motives.

***Keywords**: Money Supply, Interest Rate, Inflation, Economic Growth, Effectiveness, Vector Autoregressive*

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[*] Corresponding Author:
[1] Forgha Godfrey Njimanted, Associate Professor of Economics, Head of Division, Tertiary Science and Technology, Department of Economics Science Higher Technical Teacher Training College Bambili, University of Bamenda, North West Region, Cameroon.

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1. Introduction

In recent years, the impact of money supply, interest rate and inflation rate on economic growth has been at the centre of attention more so than other topics related to monetary economics due to its present direct effects in the world. The importance of economic growth as a main macroeconomic objectives of developing and developed countries, has been encompassed by monetary economists such as McKinnon (1973), Shaw (1973), Mathieson (1980), Odedokun (1996), Levine (1997) and Asogu (1998) who have all dedicated their studies in examining the influence money supply and interest rate on output, with mixed findings. As some authors conclude that the most important influence of economic growth is the variations in the quantity of money, other researchers state the nations that pay particular attention to examining behaviour of aggregate money supply rarely experience high levels of variations in their economic activities (Handler, 1997, Mansor, 2005, Townsend and Ueda, 2005, Owoye and Onafowora, 2007), as such are sceptical about the role of money or gross national income (Robinson, 1952, pp. 547-582).

Monetary policy comprises a combination of strategies and instruments used by the monetary authorities to control money supply in an economy consistent with a desired level of short term interest rate, inflation and economic growth. In a changing economic environment, the choice of a monetary policy strategy is intertwined with the objectives of monetary policy which include ensuring price (inflation, exchange rate and interest rate) and financial stability. Thus, the conduct of monetary policy and the goal of price stability lie within the mandate of central banks (CBN, 2007).

A majority of independent nations have their own currencies. At a global level, there are only four groups of countries that issue a common currency and conduct joint monetary policy (Gulde and Tsangarides, 2008). The four monetary unions are CEMAC, WAEMU, the Euro area, and the Eastern Caribbean Currency Union (ECCU). As it can be observed, two of these four monetary unions are located Africa, namely the Central African Economic and Monetary Community (CEMAC) and the West African Economic and Monetary Union (WAEMU). Even though CEMAC and WAEMU have their own distinct currency, they do have similarities, as Gulde and Tsangarides (2008) assert: "both unions peg their currencies to the euro at the same level, they share certain institutional features, and they are commonly referred to as the CFA franc zone".

The Central African Economic and Monetary Community (CEAMC) was established by a Treaty signed in 1972 and revised in March 1994 and 1996. It was ratified by six states: Cameroon, the Central African Republic, Chad, the Republic of Congo, Equatorial Guinea and Gabon. The Treaty was based on the monetary co-operation arrangements in effect under the common central bank since 1959 and on those of the Customs and Economic Union of Central Africa (UDEAC) established in 1966. This organisation has four main priorities: development of abilities to keep peace, security and stability; development of physical, economic and monetary integration; development of culture integration; and establishment of an autonomous financing mechanism for the Economic Community of Central African States (ECCAS). To achieve these objectives, the CEMAC adopted in 2001 a matrix of four macroeconomic convergence criteria: a zero or positive budget balance by 2002, a public debt/GDP ratio below 70%, overdue payments to be settled by 2004, and an inflation rate to be maintained below 3% per year (Strauss Kahn, 2003).

To facilitate the conduct of the monetary policy in CEMAC and to achieve price stability, two monetary policy rules are incorporated in its statutes: the BEAC limits the stock of total advances to governments to 20 percent of the previous year's fiscal revenues; and the BEAC designed to keep gross foreign reserves for each Central Bank above 20% of sight liabilities. The economic performance of CEMAC countries had experienced improvements following the devaluation of the FCFA in 1994, although there were occasional droppings, according to Zafar and Kubota (2003): "Gabon's fiscal crisis during the 1998 election year; Congo's civil war of 1997-1999, several army mutinies in the Central African Republic in 1990 and 2002, and the impact of oil price volatility among others". Price stability has been partially kept since the FCFA devaluation from 1994. The BEAC's member governments comprehended the fact that devaluation could bring back competitiveness and macroeconomic stability only if the price level (including wages) did not proportionately increase (Zafar and Kubota, 2003).

According to trends observed during the first half of 2011, macro-economic estimates tend to be favourable, with an expected increase in real GDP to the tune of 4.3% against 4% in 2010. Inflation rate dropped to 2.8% as against 3.6% in 2010, extra gifts base commitment budget surplus evolved from GDP 4.2% in 2013 to10% one year later, while current account balance turned positive, settling at GDP 3.8% in 2014, against GDP 0.6% deficit in 2010 (IMF, 2015). Over the period 1963–1985, the BEAC adjusted its intervention rate (discount rate) only five times, and the interest rate differential between the CEMAC and France remained largely negative. This period was characterised by sustained economic development– with regional GDP

growth averaging more than 6% annually. The ratio of broad money to GDP (M2/GDP) increased from 15% in 1963/64 to over 20% in 1984/85 (Nachega, 2001).

The period 1986-94 was characterised in the CEMAC Zone by a severe economic and financial crisis, with real GDP growth averaging negative 4% annually and the ratio of broad money over GDP declining from 24% in 1991/92 to less than 17% in 1993/94. Thus, broad money velocity, which had been on a downward trend since the 1960s with the exception of the late 1970s and early 1980s, when it somewhat temporarily stabilised experienced a structural break in 1992. Owing to significant banking sector problems and devaluation expectations, the steady decline observed since the early 1960s in the share of currency in broad money came to a halt with the ratio stabilising around 21% over 1986-94

The period 1994-2014, presents positive records for CEMAC and its member states. RGDP growth rate increased by 1.2% per year though individual country performances varied considerably, with Gabon having the highest annual average GDP per capita growth rate of 2.7% and Chad having the lowest at –0.7%. Average inflation rate declined to 3.1% in 2014 from an average of 4% between 1997 and 2013. The stock of broad money (M2) rose by 25.3 % a year on average, between 1997 and 2011 as a result of large capital inflows, particularly owing to increases in aid inflows and revenues from the export of oil. In general, there has been a marked improvement in most macroeconomic indicators. Improvements in the public finance management, better trade performance and greater price stability which have resulted from both better macroeconomic management and external factors such as favourable oil prices.

However, the economic performance of CEMAC raises important problems that need to be discussed. First, economic growth needs to surpass the growth of so that the benefits of economic growth can reach a greater number of people (Zafar and Kubota, 2003). Secondly, the amount of liquidity has been growing rapidly owing to increase in M_2 and in the absence of an active sterilisation policy by the BEAC, excess liquidity increases further. Furthermore, the Bank of Central African States (BEAC) organises monetary policy in the framework of a fixed exchange rate against the Euro. According to Laurens et al. (2006) "while the BEAC formulates common monetary policy targets, systemic liquidity management remains largely country-based due to the lack of integration of the money market". Moreover, the financial relations between the BEAC and CEMAC governments do not necessarily mean a clear divide between money creation and budget financing, and the growing fiscal surpluses in several nations have highlighted the issue of BEAC remuneration of government deposits (Laurens et al., 2006). Therefore, the continued use of country-specific monetary instruments reflects the reality that the product and factor markets of CEMAC members are not well integrated (Masson and Patillo, 2005). The case of the 25,000 new jobs recently advertised by the government of Cameroon clearly substantiates this fact. Thirdly, because of the recent improvement in the economic outlook in many countries in the CEMAC region there is now increasing concern that the growth of liquidity poses significant inflationary risks.

Following the deterioration in the economic and financial situation in the CFA franc zone after 1986 and with the necessity of maintaining a positive net foreign assets position, the BEAC adopted a more active interest rate policy, such that the interest rate differential with France became positive or null at the minimum thereafter. During the period 1989 - 1993, the BEAC shifted from direct to indirect instruments of monetary policy; interest rates were liberalised and credit controls lifted in order to influence monetary outcomes. In September 2001, BEAC decided to impose minimum reserve requirements on commercial banks in order to contain the rise in liquidity in the region. BEAC decided in July 2004 to introduce differentiated reserve requirements across countries with a higher reserve ratio in Cameroon, the Republic of Congo, and Equatorial Guinea than in Chad, Gabon, and the Central African Republic (CAR). Reserve requirements in the CAR were temporarily suspended in May 2003 in response to the difficult economic situation in the country.

Member states reacted to the macroeconomic imbalances by pursuing an "internal adjustment strategy" as an alternative to devaluation. This was to deflate domestic prices in order to achieve the required depreciation in the real exchange rate. The consequence of the strategy was a severe recession in the region with per capita GDP falling by 3.9% between 1985 and 1993 (Magnus, 2006). The significant restrictions on international payments that were imposed during this period did not help improve this situation. (Zafar and Kubota, 2003).

In March 1994, the Heads of States and Governments were left with no option than to devalue the CFA Franc at an exchange rate of 1FF = 100FCFA allowing the economies in the region to recover (ECA, 2008). Other efforts made by CEMAC member states to enhance economic growth include the adoption of the Growth and Employment Strategy Paper (GESP) whose objectives include raising the average annual growth rate to 5.5% over the 2010-20 periods and reducing the monetary poverty rate from 39.9% in 2007 to 28.7% in 2020.

Despite these efforts, an assessment of CEMAC's economic performance over the last several decades presents dismal economic growth. This therefore reveals that the root cause or causes of poor growth determinant(s) in the CEMAC Zone is still to be identified and solved. Therefore, this study aimed at providing answers to the following research question: how does money supply, inflation and interest rate systematically influence the economic growth of the CEMAC zone. This is done by examining the effect of money supply, inflation rate, and interest rate on the economic growth in the CEMAC region. The rest of this paper is organised as follows; section two explores the review of literature. The methodology employed is discussed in section three. Results are presented and discussed in section four while section five gives the recommendations and conclusion of the paper.

2. Literature Review

Nnanna (2001) defines monetary policy as the instruments at the disposal of the monetary authorities to influence the availability and cost of credit/money with the ultimate objective of achieving price stability. Depending on the mandate of the monetary authorities, the objectives of monetary policy may well go beyond price stability. More often than not, monetary authorities particularly in developing countries are saddled with the dual mandate of price stability and sustainable growth. In such a situation, monetary policy is used to achieve both objectives.

In designing monetary policy, the BEAC reviews developments in the economy over a period, articulates the major pressure for and risk to price stability and formulates a framework which will guide its monetary policy implementation. The framework which is essentially an approach to monetary management is based on a programme which sets out future trends in macroeconomic aggregates. The monetary programme defines the quantitative targets to be attained. The BEAC uses the IMF financial programming framework in a medium term framework. This programme is updated from time to time to take account of developments in the course of the semi - annual programme period. The Monetary programming exercise enables the BEAC's Monetary Policy Committee (MPC) to set semi-annual targets on the net international reserves coverage of the monetary base and the growth rates of bank credit to the economy and broad money (M_2) in each member state.

The programming exercise is based on real sector projections from the supply side of national accounts, which drives the outlook for the balance of payments. These are combined to form an estimate of the expected change in net foreign assets of the central bank and commercial banks. The growth of broad money is assumed to follow the nominal GDP projection with constant velocity. The aggregate money projection is then broken down into currency in circulation and sight and term deposits using historic patterns. The change in net domestic assets is obtained from the monetary survey identity; ($\Delta M = \Delta NFA + \Delta NDA$); Where; ΔM = aggregate money projection; ΔNFA = change in net foreign assets; ΔNDA = change in net domestic assets.

The modifications projected in net domestic assets, that are derived from fiscal budgets and their mid-year execution, are utilized to establish targets for government use of statutory advances from the BEAC; the change in banking sector domestic credit to the rest of the economy (ΔDC^P) is then obtained as a residual from the monetary survey identity ($\Delta NDA = \Delta NDA^G + \Delta NDA^P$) and used to set targets on BEAC refinancing of commercial Banks.

Money Supply here is defined as the amount of currency in actual circulation as well as on deposit at financial institutions (where the money is often held in a more or less virtual form, since usually the bank never physically holds 100% of the money on deposit). There are three measures of the total money supply known as the monetary aggregates. They are designated M_1, M_2, and M_3 with higher numbers containing a wider variety of assets. "M" stands for money; the numbers represent increasing levels of liquidity. M_1 - is the sum of currency (and coins) issued by government and held by the nonbank public and checkable deposits issued by banking institutions. M_2 - is the sum of M_1 (currency and checkable deposits) and a collection of financial assets termed near monies. M_3 - is the sum of M_2 (currency, checkable deposits, and saving near monies) and another group of slightly less liquid near monies. Interest is the price paid for the temporary provision of funding. In a state of equilibrium it aligns supply ("saving") and demand ("investment") on the capital market. Interest rates control the flow of money in the economy. High interest rates curb inflation, but also slow down the economy. Low interest rates stimulate the economy, but could lead to inflation. Therefore, we need to know not only whether these rates are increasing or decreasing, but the other economic indicators which jointly influence economic activities in the CEMAC economy.

To connect money supply to economic growth, authors have paid attention to role of the financial structure in relation to economic growth literature (Ogunmuyiwa and Ekone, 2010). Montiel (1995), Osikoya

(1994) all established that, the possible influence of financial depth (namely money in circulation) on economic growth can be established in three routes: "improved efficiency of financial intermediation; improved efficiency of capital stock; and, increased national savings rate" (Ogunmuyiwa and Ekone, 2010). Moreover, according to Ogunmuyiwa and Ekone (2010) raise two issues: "First, to examine if money could forecast output given predictive power of past values of output. Secondly, examine whether such a relationship if any is stable over time or not. Some researchers have found evidence of the predictive ability of monetary aggregates" (Beckett and Morris, 1992; Krol and Chanian, 1993).

Asogu (1998) examined the influence of money supply and government expenditure on Gross Domestic Product. He adopted the St Louis model on annual and quarterly time series data from 1960 -1995. He finds money supply and export as being significant. This finding according to Asogu corroborates the earlier work of Ajayi (1974) and Nwaobi (1999) while examining the interaction between money and output 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 (Ogunmuyiwa and Ekone, 2010). The finding showed that an unanticipated growth in money supply would have positive influence on output. A more specific examination indicated that there is no general consensus on the determinant of economic growth in the Nigerian economy (Ogunmuyiwa and Ekone, 2010).

Claude Nachega (2001) investigates the behaviour of broad money demand in Cameroon using data spanning from 1963/64 – 1993/94. He applies cointegration analysis and error – correction modelling and finds that the estimated long – run broad money demand function has both unitary income elasticity and a strong effect and is relatively sensitive to opportunity costs. The finding of a sufficiently stable money demand function in Cameroon provides a useful guide for the conduct of monetary policy by the BEAC.

In the CEMAC zone however, the influence of money supply on economic growth can only be taken with mixed reactions. Several studies have confirmed the significant impact of money supply on economic growth. Samba (2010) examined the liquidity effect of monetary policy in the CEMAC countries using data spanning from the first quarter of 1990 to the fourth quarter of 2006. He adopted a methodology advocated by Christiano and Eichenbaum (1992) which seems appropriate in the special case of the CEMAC countries and found that the conventional wisdom which states that a cornerstone for the central bank to stimulate the economy is to lower interest rates by increasing the supply of narrow money holds both on individual level and on a regional basis when the monetary aggregate measures the stance of monetary policy.

Tabi and Atangana (2011) analysed the relationship between economic growth, inflation and money in circulation using a VAR model for the period 1960-2007. They found that increase in money supply increases growth and that growth causes inflation.

There exist two opposing debates on the causes of inflation. We have the monetarist dominated by the works of Friedman (1953; 1960) and the structuralists dominated by the works of Bruno (1978) and Cordon (1988). According to the monetarist, the immediate cost of inflation is an increase of the quantity of money with respect to the volume of production. Thus, inflation is an excess aggregate demand problem stimulated by an expansionary monetary policy. The structuralists observed that, neither monetary policy nor fiscal policy cause inflation; rather, it is caused by the economic structures of developing countries. Price mechanism functions in a framework of structures and these structures exist in imperfect markets. Thus, sectors like agriculture and international trade are characterised by institutional rigidities that increase prices. This upward pressure of prices transforms into a general inflationary process through propagation mechanisms (Argy, 1970).

Empirical studies do not seem to differentiate between these two schools of thought. For many years now, studies have not been able to offer a clear empirical relationship between economic growth and inflation (Hwang, 2007). For example, during the periods of inflation and deflation, the economy of United States and a number of other countries witnessed high and low growth rates. One of the first studies on the relationship between economic growth and inflation was conducted for 17 industrialised countries between 1958 and 1967. The findings show that growth is positively correlated with low rates of inflation (below 8%). However, during the same period on a sample of 7 developing countries, high rate of inflation (above 8%) negatively influence growth (Thirwall and Barton, 1971).

Fernandez, Gerling and Valdovinos (2011) focus on inflation in the West African Economic and Monetary Union (WAEMU). They highlight the importance of keeping inflation low to reduce inflation uncertainty and relative price variability, which could lead to resource misallocation in the context of a currency union. Baldini and Poplawski-Ribeiro (2011), in turn, analyse the fiscal and monetary determinants of inflation for a sample of Sub-Saharan African (SSA) countries. These authors find that countries within the CFA franc arrangement (including CEMAC countries) were more successful in achieving price stability and single-digit inflation in 1980–2005.

Many economists agree that a positive shock to money growth brings about two opposing effects on the nominal interest rate. The Liquidity Effect View follows that money and interest rates are negatively related while the Anticipated Inflation View which follows from the Fisher equation is that money and interest rates are positively related. There are a lot of empirical studies (Bernanke and Mihov (1998), Dow (1995), and Cochrane (1989)) on how monetary policy shocks affect interest rates. Recently, Braun and Shioji (2006) showed little support for the liquidity effect in Japanese and U.S. data. Monnet and Weber (2001) present the empirical evidence that is consistent with both views by using annual data from 40 countries. Thoma (1994), using band spectral techniques, shows that there are two sets of cycles in the change in the nominal interest rates that correspond to these two effects.

2.1. Theoretical Literature

The quantity theory of money forms the cornerstone of monetarism. Monetarists believe that the source of inflation is fundamentally derived from the growth rate of the money supply and that an increase in money supply leads to a proportional increase in inflation. Consequently, these groups of Economists are of the view that money supply should be kept within an acceptable bandwidth so that the levels of inflation can be controlled. Money growth that surpasses the growth of economic output results in inflation as there is too much money behind too little production of goods and services. On the other hand, less orthodox monetarists state that an expanded money supply will not exhibit any influence on real economic activity, namely production, employment and spending (Heakal, 2005). However, for a majority of monetarists, any anti-inflationary policy will originate from the basic notion that there should be a subtle and gradual decrease in money supply. Monetarists also insist that as an alternative to the governments' regulations of economic policies (i.e. government spending, and taxes), it may be better to let non-inflationary policies lead an economy to full employment.

Notwithstanding its criticisms, the quantity theory of money was very popular in the 1980's as it was rooted in monetarism. Until recently, most political leaders and economists applied its principles, to economies where money growth targets were set. However, a new realization arises that a strict adherence to controlled money supply may not provide the cure for the economy (Heakal, 2005). John Maynard Keynes was the one who disputed this theory in the 1930s, stating that a rise in money supply causes a reduction in the velocity of circulation, and meanwhile real income, the flow of money to the factors of production rises. These propositions constitute the basis of what is now referred to as the Liquidity Preference Theory.

In 'Liquidity Preference Theory', Keynes provides explanations regarding people's desire to hold cash. Keynes states three motives that support this desire of people to have liquid cash, namely transaction motive, precautionary motive, and speculative motive (Keynes, 1936). The transaction motive is relative to the desire of individuals to hold money to meet up with day to day activities like food, shelter, clothing and taxi to work. Precautionary motive is related to people's desire to have money for unforeseen contingencies, illness, accidents, unemployment and other unforeseen events or situations. Similar to individuals, businessmen hold reserves of cash for business situations that are not favourable to daily operations or for deals that may arise unexpectedly. Keynes stated that these transaction and precautionary motives are highly elastic in relation to income, and relatively inelastic in relation to interest. The amount of cash money held based on the transaction and precautionary motives (M_1) is a function (L_1) of the level of income (Y) in the equation form of $M_1 = L_1$ (Y) (Keynes, 1936).

The speculative motive refers to the desire to have liquid resources to profit future modifications in interest rate or bond prices (Keynes, 1936). Bond prices and interest rate are in an indirect relationship. If bond prices are expected to rise, i.e., the rate of interest is expected to fall, people will buy bonds to sell when the price later actually rises. Keynes (1936) states that if the interest rate is high, then the speculative demand for money will be lower, also the inverse relationship applies: if the interest rate is low, then the speculative demand for money will be higher. This takes the form of equation $M_2 = L_2$ (r). Furthermore, if M nominates the total liquid money, M_1 nominates transactions plus precautionary motives, and M_2 the speculative motive, we have $M = M_1 + M_2$. While $M_1 = L_1$ (Y) and $M_2 = L_2$ (r), then total liquidity preference function takes the form of equation M = L (Y, r) (Keynes, 1936).

However, it has been highlighted that the interest rate of is not entirely a monetary concept and phenomenon. Other real factors, such as capital productivity and savings, also have a major part in determining interest rate. Keynes' theory of liquidity preference does not provide explanations for different interest rates that appear in the market simultaneously. It also ignores sayings as a means of investible fund. To part with liquidity without there being any saving is meaningless.

The Austrian Business Cycle Theory expresses that a business cycle can be altered, and even forecasted, by different analysts particularly when a Central Bank aims to control the monetary policy by

artificially modifying the interest rate. This theory further states that this kind of control can cause a boom in the economy, but it can also lead to a crash. Therefore, a Central Bank, for example the Central Bank of the CEMAC region (BEAC), keeps up a tight control on the rate of interest or, all the more fittingly, a few distinctive interest rates.

This is done to stimulate and control the so that it does not get too hot too quickly. To goad the economy and avert a long haul downturn in business cycles, the BEAC may bring down the interest rates. This causes credit to be facilitated. In any case, since this is an artificial credit easing, it does not usually last for a long period of time. Once the economy begins to warm up, interest rates must also ascent to forestall undesirable inflation.

The economy tends to falls harder after an endeavour to ease credit through decreases of interest rate because of the created effect of bubble. Regularly, amid a business cycle, when a downturn arises it does so bit by bit. However, while in a bubble, organizations tend to have concerted activities. As per the Austrian Business Cycle Theory, this can bring about a genuine rapid downturn. Actually, in light of the fact that the downturn takes a longer time to be created, it is enhanced. The best way to maintain a strategic distance from Mises' hypothesis might be to trust that the monetary downturn is fought off sufficiently long to permit a natural increment in subsequent economic activities. Be that as it may, given the way that bubbles tend only to mask symptoms in the economy, this will be harder to fulfil. All things considered, if the economy looks sound, there will be less endeavours to alter it.

3. Analytical Methodology

This study covers the period between1981-2015 based on monetary policy indicators adopted by the Central Bank of the CEMAC zone in view of sustaining economic growth. Our choice for this period is also on the ground that the period exists during which the economy of the CEMAC zone faced several challenges. Some of these challenges include, the recession in the mid-1980s resulting to serious economic contraction, the adoption of the Internal Adjustment Strategy in 1986 in response to severe external shocks that struck the region, the devaluation of the CFA in March 1994, the adoption of the Structural Adjustment Programme (SAP), the Poverty Reduction Strategy Paper (PRSP), and the Highly Indebted Poor Country Initiative (HIPC). Furthermore, the reason for this timeframe is due to data availability from different sources as listed below.

3.1. Model Specification

The Vector Autoregressive (VAR) model adopted by Christiano and Eichenbaum (1992b) and Tabi and Atangana (2011) was used in analyzing the impact of monetary variables on economic growth in Cameroon from 1960 to 2007. In assessing the goal of this study, we considered that the Gross Domestic Product (GDP) is at the same time controlled by money and real factors. Money in circulation represents a function of GDP's growth rate and public revenue. Inflation (P) is a monetary instrument. An expansion of money (M_2) in circulation should lead to a higher general price level and could also increase economic activity.

Inflation affects the nominal interest rate via the fisher effect and the nominal interest rate affects money demand. Therefore, in line on our study the choice of the variables were based on the Austrian Business Cycle Theory, Liquidity Preference and the monetarists' views of the transmission mechanism. We estimate a series of four-variable VAR equations as

$$GDP_t = f(M_{2t}, IR_t, INFLA_t) \quad (2a)$$
$$M_{2t} = f(GDP_t, IR_t, INFLA_t) \quad (2b)$$
$$IR_t = f(GDP_t, M_{2t}, INFLA_t) \quad (2c)$$
$$INFLA_t = f(GDP_t, M_{2t}, IR_t) \quad (2d)$$

In the relation (2a) to (2d), exogenous variables can influence endogenous variables at time t, at time t-1 and at time t-2. Relation (2) therefore specifies a VAR model which can be represented by the equations (3.1 to 3.4).The two years lagged is designed following the Koyck's geometric lag-scheme which suggested that more recent values of an event exert greater influence on itself or others than more remote values. Thus:

$$GDP_t = A_0 + A_1GDP_{t-1} + A_2GDP_{t-2} + A_3M_{2t-1} + A_4M_{2t-2} + A_5IR_{t-1} + A_6IR_{t-2} + A_7INFLA_{t-1} + A_8INFLA_{t-2} + U_1 \quad (3.1)$$

$$IR_t = B_0 + B_1IR_{t-1} + B_2IR_{t-2} + B_3GDP_{t-1} + B_4GDP_{t-2} + B_5M_{2t-1} + B_6M_{2t-2} + B_7INFLA_{t-1} + B_8INFLA_{t-2} + U_2 \quad (3.2)$$

$$M_{2t} = C_0 + C_1M_{2t-1} + C_2M_{2t-2} + C_3IR_{t-1} + C_4IR_{t-2} + C_5GDP_{t-1} + C_6GDP_{t-2} + C_7INFLA_{t-1} + C_8INFLA_{t-2} + U_3 \quad (3.3)$$

$$INFLA_t = D_0 + D_1INFLA_{t-1} + D_2INFLA_{t-2} + D_3M_{2t-1} + D_4M_{2t-2} + D_5GDP_{t-1} + D_6GDP_{t-2} + D_7IR_{t-1} + D_8IR_{t-2} + U_4 \quad (3.4)$$

Where, GDP_t is GDP growth rate in percentage in current period, IR_t is interest rate in percentage in current period, M_{2t} is money supply (M_2) in percentage of GDP, $INFLA_t$ is inflation rate in percentage in current period. U_1 to U_4 are Stochastic error terms and A_0 to A_8, B_0 to B_8, C_0 to C_8, and D_0 to D_8 are structural parameters of the variables for estimation.

3.2. Sources and Method of Data Collection

This study has made use of substantial statistical information much of which are generated from the UNCTAD database and World Bank Development Indicators online. Data are also gotten from the CEMAC Central Bank (BEAC) Annual Reports. Therefore, the study depends intensively on library research on which secondary time series data are generated and analysed.

3.3. Estimation Techniques

This study therefore, adopts the multivariate systems of equation approach (VAR models) as technique to estimate the various parameters specified in equations (3.1) to equation (3.4). VAR methodology superficially resembles simultaneous-equation modeling in that we consider several endogenous variables together. But each endogenous variable is explained by its lagged values and the lagged values of all other endogenous variables in the model; usually, there are no exogenous variables in the models. It is advantageous in the sense that the VAR methodology avoids the imposition of potentially spurious a priori constraints that are employed in the specification of structural models and also there is no issue of simultaneity (Njimanted and Mukete, 2013).

3.4. Validation of Results

As an economic and financial study, a series of tests are carried out to validate the VAR findings starting by testing the stationarity of the time series data included in the models by employing the Univariate Augmented Dickey-Fuller (ADF) test which assumes that the error term U_t is uncorrelated. That is the COV (U_t, U_{t-1}) = 0. There is the breakdown in any system especially when results from such systems have their COV (U_t, U_{t-1}) $\neq$ 0. A solution to this is provided when an added lagged value is introduced in the Dickey and Fuller test called the Augmented Dickey-Fuller unit root test given as:

$$\Delta Y_t = b_0 + \delta Y_{t-1} + \sum_{i=1}^{n} \alpha \Delta Y_{t-1} + \sum t \qquad (3.5)$$

Where $\sum t$ is a white noise process. It is expected that the value of calculated δ should be more negative than those obtained from the table t-value at 10% or less. A confirmatory test is also conducted using the Phillips-Perron (PP) unit root test. This is carried out because the ADF test assumed that the error terms U_t and U_{t-1} are independent and identically distributed, which is empirically not true. The PP unit root test also has added advantage in that it uses non-parametric statistical methods to take care of the serial correlations in the error term without adding lagged difference terms. Furthermore, the use of the PP unit root test replaces the use of lags in the ADF test which has been criticised as being arbitrary (Nyong, 2005). Further tests such as those of the Kwiatkowski-Phillips-Schmidt-Shin (1992) (KPSS) test for stationarity, which are strongly related to the lagrange multiplier (LM) test are not conducted since the graphs of the variables not presented due to space are not truncated. The Johansen (1988); Johansen and Juseluis (1990) methodology based on SVAR approach to test for the Cointegration of the variables in our models were not adopted in this study due to the fact that the monetary agreements by CEMAC member countries is still not very strong as such any finding obtained from them will be misleading. More so, because of the fact that serial correlation is a major problem when using the VAR technique, this study uses the Braisch LM statistics and the Portmanteau test, to test for the existence of serial correlation and not the D.W test due to the lags introduced in the models.

4. Presentation and Discussion of Results

Since our study involves the use of time series data, there is need for us to check for stationarity by examining the graphs of the variables (GDP, money supply, inflation and interest Rate) to see if they have deterministic or stochastic trend. This has not been presented here because of space, however the graphs exhibit no particular trends within our period of study, initially the period of study is mentioned under the analytical methodology to span from 1981-2015, and not 1980-2014 instead they are stochastic with drift. This implies that they are non-stationary. Therefore, testing for stationarity of the variables and order of integration

without trend but with drift strongly support the hypothesis that the variables used in our models are non-stationary at levels but they however, achieve stationary after their first difference as shown below.

Looking at the VAR estimates for Economic growth in the CEMAC zone shows that while last year's inflation rate influenced current year GDP positively, the year before last year's inflation rate had a negative effect on current year GDP. The important implication of this result is that holding other independent variables constant, every one per cent increase in last year's inflation rate decreased current year GDP by 0.59731 per cent and, every one per cent increase in the inflation rate of two years ago increases current year GDP by 0.44608 per cent all things being equal. The coefficient of multiple determinations is low indicating that the explanatory variables included in the model have approximately 49 percent ability to predict the behaviour of GDP in the CEMAC zone and a non-statistically significant F-ratio which connotes that the model is not reliable in determining the outcome of economic growth in CEMAC. The GDP regression is also tested for autocorrelation at five per cent level of significance and found that there is no autocorrelation.

Table 1. *Unit Root Test*

	Variable	ADF Test	PP Test	Remark
CEMAC Zone	DLGDP	-7.052893*	-8.679091*	I(1)
	DLINFLA	-5.271510*	-7.708473*	I(1)
	DLM2	-5.523122*	-11.13674*	I(1)
	DLINRATE	-3.901078*	-5.413379*	I(1)
***Asymptotic critical values:**				
1%				-3.6852
5%				-2.9705
10%				-2.0242

*Note: implies significant at 1% level, ** implies significant at 5% level and *** implies significant at 10% level.*

From the result presented above the VAR equations for CEMAC are generated thus:

Economic Growth Equation for CEMAC

DlogGDP= -1.859 + 0.103DlogGDP(-1) + 0.532DlogGDP(-2) + 0.002DlogM2(-1) + 0.495DlogM2(-2) – 0.597DlogINFLA(-1) + 0.446DlogINFLA(-2) + 1.971DlogINRATE (-1) – 1.497DlogINRATE (-2)

t-value of constant = -0.53168	
t-value of DlogGDP(-1) = 0.30161	t-value of DlogGDP(-2) = 1.03367
t-value of DlogM2(-1) = 0.00518	t-value of DlogM2(-2) = 0.896
t-value of DlogINFLA(-1) = -1.569***	t-value of DlogINFLA(-2) = 1.889***
t-value of DlogINRATE(-1) = 1.559***	t-value of DlogINRATE(-2) = -0.812
R^2 adjusted= 0.494948	
F – Statistics = 0.734995	
Portmanteau Statistics = NA*	

*Note: significance level: * = significant at 1%, ** = significant at 5% and ***= significant at 10%*

In this study we have adopted both the statistical significant criteria as well as the theoretical expectation criteria for accepting or rejecting the null hypothesis which states that "key monetary policy indicators have no significant impact on the economic growth of the CEAMC zone". The findings reveal that M_2 has a positive effect on economic growth in the CEMAC zone. However, issues such as discipline, confidence and credibility on the part of monetary authorities as argued by Dordunoo and Njinkeu (1997) are essential but apparently lacking in the CEMAC zone as partly reflected in the IMF (2006) Financial Systems Stability Assessment (FSSA) for the CEMAC region in which the IMF found that the BEAC had only limited transparency regarding monetary policy's execution. This effect is consistent with status-quo or theoretical expectation. It is also in line with studies by Ngoa and Ondoa (2011) in Cameroon, Samba (2010) for the CEMAC, Ogunmuyiwa and Ekone (2010) in Nigeria, Alain and Cruz (2007) in the Philippines and Daniela and Cociuba (2010) in Romania who reported a positive influence of expansionary monetary policy on economic growth. Although our empirical results support the existence of economic growth in the CEMAC zone as caused by money supply, the effect is not statistically significant. By implication the volume of monetary expansion over our period of study has not been substantial to influence real output significantly.

Further responding to our hypothesis, we investigated whether or not there is any statistically significant influence of inflation rate on economic growth in the CEMAC zone. The growth equation for

CEMAC shows that inflation rate for the previous year has a negative impact on economic growth. Furthermore, the findings are statistically significant at 10% confidence interval for CEMAC giving us 90% degree of reliability of this result on its impact on economic growth. These findings are also consistent with theoretical expectations and are in line with studies by Mamalepot (2004) on CEMAC, Qayyum (2007) in Pakistan and Ngoa and Ondoa (2011) in Cameroon who reported a negative influence of inflation on economic growth.

It is also in line with the findings of Motley (1994) and Taylor (1995) who reported that a 1% increase in inflation reduces productivity by 0.03% and 0.25% respectively. We equally noticed that the inflation rate of the year before last [INFLA(-2)] is having a positive significant impact on economic growth. Although this influence is neither robust nor in line with theoretical expectations (as supported by the monetarists hypothesis) the statistically significant "t-values" shows that inflation is a strong explanatory variable in the economic growth equations. Given the economy of the CEMAC zone in general and the quantity theory of money in particular, we accept our alternative hypothesis that inflation has some effects on the level of economic growth in the CEMAC zone.

This concern reflects the thinking that low inflation is an important requirement for sustained economic growth. Consequently, we maintain that whether economic growth is measured by aggregate demand or by real output, inflation still remains an important factor in enhancing economic growth. In the short run, faster real growth may be associated with more rapid inflation. Often, this is because strong growth is the result of a rise in aggregate demand that causes real output to increase at the same time as it bids up prices (Tabi and Atangana, 2011).

Money Supply Equation for CEMAC

DlogM2= 6.920 – 0.367DlogM2(-1) – 0.070DlogM2(-2) + 0.0552DlogGDP(-1) – 0.480DlogGDP(-2) + 0.025DlogINFLA(-1) – 0.239DlogINFLA(-2) – 1.980DlogINRATE(-1) + 1.263DlogINRATE(-2)

t-value of constant = 2.548*	
t-value of DlogM2(-1) = -1.069	t-value of DlogM2(-2) = -0.164
t-value of DlogGDP(-1) = 0.20769	t-value of DlogGDP(-2) = -1.601***
t-value of DlogINFLA(-1) = 0.084	t-value of DlogINFLA(-2) = -1.635
t-value of DlogINRATE(-1) = -1.629***	t-value of DlogINRATE(-2) = 0.883
R^2 adjusted= 0.554984	
F – Statistics =4.935333	
Portmanteau Statistics = NA*	

*Note: significance level: * = significant at 1%, ** = significant at 5% and ***= significant at 10%*

The above equation represents the Broad Money Supply (M2) regression for the CEMAC region. The results show that previous year GDP positively influenced current year M_2 while the GDP result of two years lagged negatively influenced current year M_2. The implication of this result is that holding other explanatory variables constant, every one per cent increase in previous year GDP increased current year M_2 by 0.0552 per cent while everyone per cent increase in the year before lasts' GDP decreased current year M_2 by 0.4802 per cent all things being equal. In the M_2 regression, only the 2-period-lagged GDP term is statistically significant at 10 per cent. The estimated parameter for inflation rate shows that the two year's inflation rate has a negative significant impact on current year money supply. This implies that everyone per cent increase in the inflation rate of two years ago could have retarded current year M_2 by 0.239 per cent all things being equal. Evidence from the M_2 regression depicts a negative influence of the previous year's interest rate on current year money supply. The coefficient of the adjusted R^2 shows that above 55 per cent of the variation in money supply in the CEMAC zone is explained by the estimated relations. This finding shows that the observed F– ratio is significant at 1 per cent confidence level. The M_2 regression is also tested for autocorrelation at five per cent level of significance and found that there is no autocorrelation.

Inflation Equation for CEMAC

DlogNFLA= 5.59 + 0.429DlogINFLA(-1) - 0.227DlogINFLA(2) + 0.394DlogGDP(-1) -0.751DlogGDP (-2) + 0.642DlogM2 (-1) – 0.153DlogM2 (-2) + 0.0636DlogINRATE (-1) – 1.877DlogINRATE (-2)

t-value of constant = 1.688	
t-value of DlogINFLA(-1) = 1.191	t-value of DlogINFLA(-2) = -0.962
t-value of DlogGDP(-1) = 1.215	t-value of DlogGDP(-2) = -1.541***
t-value of DlogM2(-1) = 1.529***	t-value of DlogM2(-2) = -0.293
t-value of DlogINRATE(-1) = 0.043	t-value of DlogINRATE(-2) = -1.076
R^2 adjusted= 0.706239	
F – Statistics = 1.803095	
Portmanteau Statistics = NA*	

*Note: significance level: * = significant at 1%, ** = significant at 5% and ***= significant at 10%*

The inflation equation reveals that, the two-period-lagged GDP term has a negative significant effect on current year inflation rate. The implication of this finding is that if all other explanatory variables are held constant, a one per cent expansion in the 2-period-lagged GDP term retards current inflation by 0.7517 per cent. The impact of previous year expansionary monetary policy on current year inflation rate is positive at the first lag. Consequently a one per cent increase in previous year M_2 increases current inflation rate by 0.1539 per cent. The coefficient of multiple determinations (R^2 adjusted) is 0.706239. This means that the regression line captures more than 70 per cent of total variations in inflation rate explained by the variations in the explanatory variables. The findings also show that the observed F–ratio is significant at 10 per cent confidence level. Finally but not the least, tested for autocorrelation at five per cent level of significance reveals that there is no autocorrelation.

Interest Rate Equation for CEMAC

$$\text{DlogINRATE} = 0.263 + 0.827\text{DlogINRATE}(-1) + 0.051\text{DlogINRATE}(-2) - 0.00365\text{DlogGDP}(-1) - 0.049\text{DlogGDP}(-2) + 0.083\text{Dlog}M_{2(-1)} + 0.0822\text{Dlog}M_{2(-2)} - 0.071\text{DlogINFLA}(-1) + 0.0801\text{DlogINFLA}(-2)$$

t-value of constant = 0.608	
t-value of DlogINRATE(-1) = 4.264*	t-value of DlogINRATE(-2) = 2.223
t-value of DlogGDP(-1) = -0.086	t-value of DlogGDP(-2) = -0.782
t-value of DlogM2(-1) = 1.523***	t-value of DlogM2(-2) = 1.69964***
t-value of DlogINFLA(-1) = -1.52329***	t-value of DlogINFLA(-2) = 2.59283*
R^2 adjusted= 0.926297	
F – Statistics = 9.425934	
Portmanteau Statistics = NA*	

*Note: significance level: * = significant at 1%, ** = significant at 5% and ***= significant at 10%*

The interest rate regression for the CEMAC zone presented above explains that the past years interest rates have positive significant influenced on current year interest rate. This implies that a one per cent increase in previous years' interest rate increased current year interest rate by 0.8277 and 0.051per cent respectively, all things being equal. From our findings, previous years expansionary monetary policy would have positively and significantly affected current year interest rate precisely by 0.0837 per cent and 0.08226 per cent respectively all things being equal these findings are in agreement with the financial liberalisation thesis. The inflation rate of last year has a negative influence on current year interest rate and is statistically significant at 10 per cent. The inflation rate of year before last has a positive impact on current year interest rate and is statistically significant at 1 per cent level of significant. Specifically, a 1 per cent increase in previous year inflation rate caused current year interest rate to drop by 0.07188 per cent all things being equal. In like manner, a one per cent increase in the inflation rate of two years ago increased current year interest rate by 0.0801 per cent all things being equal. The adjusted coefficient of multiple determinations (R^2) is 0.926297. This means that the regression line captures more than 92 per cent of total variation in interest rate explained by the variations in the explanatory variables. The results also show that the observed F–ratio is significant at one per cent confidence level.

The finding also shows that an increase in interest rate causes economic growth in the CEMAC zone. This finding is in line with the McKinnon and Shaws Financial Liberalisation Thesis of 1973. This is due to the fact that in third world countries where CEMAC zone is found there is the absence of strong capital market and financial markets and the utilities from consumption in these countries are very high at the expense of investment. As a result, high interest rate crowd- out investment decisions in favor of those with positive

internal rate of returns, positive net-present values leading to economic growth. This effect is not in line with the study of Samba (2010) in CEMAC, and Nelson (2000) in the UK.

5. Recommendations and Conclusion

Since evidence has shown that low inflation is an important requirement for sustained economic growth, research efforts should therefore be directed at examining the reason for this relationship. Although an attempt has been made by the Central Bank of CEMAC to elucidate this aspect and the preliminary results are insightful, further efforts need to be geared towards this direction. Besides, by drawing inferences from the review of related literature and our VAR models, a stable and sustainable monetary policy stance and policies that enhance income growth are crucial for taming inflationary pressures.

Evidence from the study further revealed that shocks to the lending and inflation rate generated substantial destabilising impacts on the economic growth, suggesting that the monetary authorities should play a critical role in creating an enabling environment for growth. The determination of the optimal lending rate should reflect the overall internal rate of returns in the productive sector with due attention to market fundamentals. This could be achieved along with appropriate monetary growth targeting that would not destabilise the price formation process. In line with this, the Central Bank of CEMAC should be given complete instrumental autonomy to operate depending on a set of in-built targets by the individual countries of the zone. Effective monetary targeting and accommodating monetary policies should be designed and implemented as the need arises with little or no political motives.

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