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IMPACT OF DOMESTIC DEBT ON ECONOMIC GROWTH IN SIERRA LEONE: AN EMPIRICAL INVESTIGATION

Ozolina C.E. Haffner, Alfred J.H. Aruna and Kormay Adams

Abstract

The impact analysis of domestic debt on economic growth in Sierra Leone had over the years, received surprisingly little empirical attention. This study which covers the period 1970 to 2015, therefore, seeks to assess the impact of domestic debt on economic growth in Sierra Leone. Following some schools of thought which opine that the growth of domestic debt beyond a sustainable level adversely affects growth performance, mainly through the crowding out of private sector credit, we seek to investigate at what level does domestic debt exert deleterious effect on economic growth in Sierra Leone. Preliminary investigations reveal that our series are of different orders of cointegration and therefore justify the application of the Autoregressive Distributed Lag (ARDL) model. The regression results of the model show that both in the short and long runs domestic debt exerts negative impact on economic growth. Further, treasury bills rate also negatively affects economic growth, while private sector credit and net investment impact positively on economic growth. The paper also found that above the ratio of 20 percent of domestic debt to GDP, investment and private sector credit are crowded out, reinforcing “debt overhang”. In view of these findings, it is recommended that the government of Sierra Leone should reduce the level of domestic borrowing and also improve efficiency by utilising domestic debt for more productive economic activities, such as: promoting development in the financial sector to enhance private sector and investment growth.

Key Words: Domestic Debt; Economic Growth; Autoregressive Distributed Lag (ARDL)

JEL Codes: E62; O4; C51

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1.0 INTRODUCTION

In most African countries including Sierra Leone, the need for accelerated economic growth, financial market deepening and protection from negative external shocks has motivated the establishment of domestic markets for government securities. However, governments in these countries have found it difficult to meet their expenditure commitments from domestic revenue (tax and non-tax) and from externally-sourced grants and borrowings. Due to this mismatch between expenditures and resource inflows (both external & internal), most governments in Sub-Saharan African countries have resorted to domestic borrowing to finance their budgets. Therefore, the rationale for domestic borrowing in these countries currently focuses more on the need to achieve immediate and intermediate goals of financing fiscal deficits, rather than the ultimate desire for accelerated growth through monetary policy implementation and financial sector development.

The management and sustainability of domestic debt has become increasingly problematic with the dramatic increases in the breadth and depth of treasury instruments created to finance the growing budget deficits, and the associated costs of servicing them. In fact, in many highly indebted poor countries (HIPC), the cost of servicing domestic debt represents a larger claim on government revenue (liquidity burden) than external debt servicing even before the HIPC debt relief (Christensen 2004).

Evidence of studies conducted overtime show that domestic debt has indeed been increasing at an alarming rate, fuelled by high interest rates in most HIPC economies. Therefore, unlike past decades, when little or no attention was paid to the issue of escalating domestic debt in developing countries, it has in recent years become a growing concern for the International Monetary Fund (IMF) and other development partners, as its potential effect on fiscal budgets, macroeconomic stability, private sector credit, and in the long run growth performance, could be significant (Bua, Pradelli and Presbitero, 2014). From a survey of 14 HIPC countries conducted by Presbitero and Arnone (2006), it was noted that, although domestic debt is a relatively small percentage of total debt, the macroeconomic framework of these countries is already strained by enormous external debt, therefore, domestic debt stock however small, could adversely affect the economy. Other schools of thought albeit, reiterated that moderate levels of domestic debt stock can enhance monetary policy operations, develop the financial market, mobilise domestic savings and protect an economy from adverse external shocks.

Abbas and Christensen (2007) in their review of previous studies noted that moderate levels of domestic debt as a share of GDP and bank deposits, assuming sound monetary policies and broad financial market, can have an overall positive impact on economic growth via its contribution to macroeconomic stability, in terms of low inflation, reduced vulnerability to external as well as domestic shocks, generation of domestic savings and private investment. This is evident in fast-growing emerging markets such as China, India and Chile, which have maintained relatively low external indebtedness and concentrated their efforts on domestic borrowing, thereby avoiding major financial or fiscal crisis. There is also some evidence that as domestic debt grows beyond a sustainable level, it begins to undermine growth resulting from the crowding out of the private sector, increase in the price level, depreciation of the exchange rate and worsening of the government’s budget.

Based on a research conducted on the impact of domestic debt on government budget and private investment, Christensen (2004) concluded that, the sharp increase in domestic interest payments in The Gambia, Ghana, Malawi, Sierra Leone, and Zimbabwe have significantly worsened governments’ budget, as they have to set aside 15 percent of their revenue to pay interest on domestic debt. He further explained that given the significant domestic debt burden coupled with large stock of foreign debt and the degree of financial intermediation in these countries, further expansions in domestic debt, which is unavoidable, is more likely to crowd out private investment.
Sierra Leone’s domestic debt has been growing over the years (see figure 1) and given its potential effect on economic growth, it remains important to ask the question: what is the effect of domestic debt on growth in Sierra Leone? However, apart from some studies, notably Christensen (2004) and Bua et al (2014) on the impact of domestic debt on economic growth in low income/HIPC countries, Sierra Leone inclusive, there is no evidence in empirical literature of a study conducted; with particular focus on Sierra Leone. Therefore, there is a primary need to research on the subject, so as to provide empirical evidence on whether or not the growing domestic debt is harmful or supports economic growth in Sierra Leone. The findings from this study will not only assist in the formulation of sound policy decisions, but will also add to the existing body of literature on domestic debt and economic growth. Thus, this paper seeks to empirically assess the impact of domestic debt on economic growth in Sierra Leone.

The paper is divided into six sections. Following this introductory section, section 2 focuses on some stylized facts on the Sierra Leone economy and section 3 provides the theoretical and empirical review on the subject. Section 4 covers the methodology, while section 5 gives the model estimation and empirical results. Section 6 dwells on the conclusion and policy recommendations.

**2.0 SOME STYLIZED FACTS ON ECONOMIC GROWTH AND DOMESTIC DEBT**

**2.1 Overview of Economic Growth**

In the 1960s, Sierra Leone on average, recorded a real GDP growth of about 4 percent per annum. Though endowed with substantial natural resources in terms of minerals, agriculture and fishery, the physical and social infrastructure were not well developed to enhance growth in these industries. This status quo, coupled with ineffective economic policies and deteriorating terms of trade in the 1970s resulted to a considerable decrease in incomes.

By the end of the 1980s, the economic situation worsened, underpinned by instability of macroeconomic indicators such as GDP, inflation and balance of payments. As the trade deficit widened, the economic condition became practically insurmountable, leading to heavy indebtedness to international financial institutions such as the World Bank and IMF.

The ten-year civil war that started in 1991 exacerbated Sierra Leone’s already tragic situation, accounting for an average of 4.3 percent contraction in GDP growth between 1992 and 1998. The war adversely impacted on all sectors including educational and health facilities, settlements in both the rural and urban areas, as well as social and economic infrastructure. This worsened economic performance and, consequently, the poverty situation.

Notwithstanding the economic drag experienced in the 1990s, Sierra Leone started its growth recovery during the decade following the end of the war. The economy registered robust growth of 18.1 percent in 2001, 18.8 percent in 2002, 21.6 percent in 2003 and an average of more than 5.0 percent in the remaining years. After a relatively slower pace of growth since 2004, real GDP strengthened to 15.2 percent in 2012 from 6.0 percent in 2011, and the country was listed as one of the fastest growing economies in Africa (World Bank, 2013). Consistent with 2012, growth accelerated to 21.0 percent in 2013, with real GDP (including iron-ore) growing by 20.1 percent, whilst GDP (excluding iron-ore) grew by 5.5 percent supported mainly by agriculture and services. The improvement in economic growth was largely on account of increased domestic food production, vibrant mining activities (especially for iron-ore), sound macroeconomic management and favourable international commodity prices.
The positive developments witnessed in 2013 were, however, reversed with the outbreak of the Ebola Virus Disease (EVD) in May 2014, coupled with the weak global demand and depressed prices for primary commodities including iron ore, which had an adverse impact on the Sierra Leone economy. Economic activities were seriously disrupted in all the key sectors resulting in increased unemployment, erosion of business and investor confidence, reduced domestic revenue collection and increased Ebola-related spending. In addition, external sector performance deteriorated with the widening of the current account deficit owing to decline in exports, and depreciation of the domestic currency. Against these developments, as at end-2015, real GDP contracted by 21.1 percent.

2.2 Domestic Debt Profile

The primary objective for issuance of domestic debt instruments is to finance the government budget deficit as well as to manage liquidity in the banking system. The adherence to fiscal and monetary targets is crucial to determining the domestic debt issued.

Sierra Leone’s domestic debt stock comprises marketable securities, non-marketable debt instruments and arrears. The marketable securities are short-term with maturities of one year or less. Non-marketable instruments are mainly held by the Bank of Sierra Leone, consisting of Ways and Means Advances and medium to long-term bonds with maturities of two, three, five and ten years. Domestic arrears include outstanding obligations owed to suppliers and state-owned enterprises, as well as wages and other emoluments accruing to ex-diplomats.

Sierra Leone’s Domestic Debt Market is characterised by:

- **Dominance of Short-Term Paper**
  
  There is dominance of short-term paper in the securities market and this has resulted in increased roll-over and market risks, thus causing a significant burden on government budget. Financial liberalization has also induced more interest rate flexibility and made countries with large amount of short-term debt vulnerable to changes in market conditions.

- **Mismatch between Debt Issued and Government Expenditure**
  
  Domestic debt is not always issued with the appropriate maturity length to mirror the maturity structure of the short-term current and long-term capital expenditures, as short-term securities are sometimes issued to finance infrastructure projects, which represents a re-financing risk.

- **Large Ratios of Domestic Debt to Broad Money (M2)**
  
  There is a rise in domestic stock and hence, increase in debt burden (domestic debt/M2 ratio), which limits the scope for expanding domestic debt, given the small size of the financial sector. The large domestic debt/M2 ratio implies that further expansion of domestic debt would absorb increased commercial bank credit and thereby constrain credit to the private sector.

- **Narrow Investor Base**
  
  There is prevalence of narrow investor base and with commercial banks being major holders of government securities; this increases the risk of crowding out private investment.

Domestic debt is jointly managed by the Bank of Sierra Leone and the Ministry of Finance and Economic Development (MoFED). Techniques used by the Bank of Sierra Leone for the management of domestic debt involve rolling over of existing maturities supported by a secondary market for sale.
and purchase of securities. Ways and means advances are also occasionally converted into tradeable securities upon authorization by the MoFED.

As at end 2015, total stock of government securities stood at Le2.7 trillion, consisting of Le2.2 trillion marketable securities and Le0.5 trillion non-marketable securities. Figure 1 depicts the trend in domestic debt stock from 2001 to 2015. Sierra Leone’s domestic debt has consistently been increasing over time but notably from 2011 as shown in the chart. This can be attributed to the increase in both current and capital expenditures, resulting from higher wage bills and government’s investment on infrastructure during the period.

Figure 1: Trend in Domestic Debt: 2001-2015 (In Millions of Leones)

![Figure 1: Trend in Domestic Debt: 2001-2015 (In Millions of Leones)](image)

Source: Bank of Sierra Leone

Figure 2 shows domestic debt as a percentage of GDP from 1985 to 2015. Domestic debt as a percentage of GDP prior to 1993 shows a declining trend. However, as the war intensified with the intervention of the Economic Community of West African States Monitoring Group (ECOMOG) to fight back the rebels, there was a one-time jump in the ratio as it peaked at 70 percent in 1993. Thereafter, the ratio commenced a gradual decline but was above 20 percent up to 2005. From 2005 to 2010, the ratio continued to decline, and was below 20 percent. Albeit, there has been an upward movement in the ratio since 2011, as the domestic debt stock rises.

Figure 2: Domestic Debt as Percentage of GDP (1985-2015)

![Figure 2: Domestic Debt as Percentage of GDP (1985-2015)](image)

Source: International Financial Statistics
Figure 3 shows government securities by holders from 2001 to 2015. The chart portrays that the government securities market has been dominated by the commercial banks since 2008. This can be attributable to commercial banks’ risk-averse approach to investments, following the 2007 global financial crisis.

**Figure 3: Government Securities by Holders: 2001-2015 (In Millions of Leones)**

![Graph showing government securities by holders from 2001 to 2015. The chart indicates that the government securities market has been dominated by the commercial banks since 2008.](image)

Source: Bank of Sierra Leone

### 3.0 LITERATURE REVIEW

Both theoretical and empirical literature on domestic debt and its impact on economic growth has shown mixed results overtime. Some studies conducted on the topic reveal that domestic debt has a positive impact on economic growth, while others are of the view that domestic debt has a negative impact on economic growth.

#### 3.1 Theoretical Literature Review

According to the Classicalists, public borrowing to a large extent diminishes savings and, hence, the investment capacity of a nation. They argued against government running into fiscal deficits, as the resulting debt accumulation is considered “pernicious” for the economy even if all the borrowings is from the domestic market. In their opinion, government in redeeming the debt will increase taxes leading to domestic capital flight, depreciation of the local currency and retardation of domestic production, since resources could be diverted from private sector development to non-productive activities, thus, adversely affecting economic growth. (Tsoulfidis, 2007)

The Keynesians give a strong argument for a high level of fiscal deficit as a means of fighting unemployment. They believe that booms and busts are fundamental features of market economies. Therefore, with the reserves accumulated during the boom period, government can temporarily involve in deficit spending and borrowing to combat economic contraction, without causing explosion of debt-GDP ratios in the long term (Filger, 2011).

The Ricardian theory discusses two types of equivalence between taxation and bond financing of government expenditures. The contemporaneous equivalence ascribes that for a closed economy, taxation and public domestic borrowing as means to finance government expenditures are essentially equivalent in terms of the forgone private output. The intertemporal equivalence on the other hand, equates government bonds to the present value of future taxes to retire the debt. The implication is that, fiscal deficits only amount to tax postponement, as the fiscal deficit accumulated in any current
period is equivalent to the present value of future taxation that is required to redeem the additional debt resulting from deficit (Ahiakpor, 2013). In summary, the Ricardian theory shares the same view as the Classicalists that government expenditures are usually unproductive and biased in nature, so, financing of budget deficits through public borrowing reduces investment and, thus, wealth accumulation and economic growth.

Sachs and Larrain (1993) point out that financing the fiscal deficit with higher domestic debt often postpones the day when the inflation tax comes into effect. The problem with domestic borrowing is that, although it provides resources today, it is in itself a debt that has to be serviced tomorrow. Interest payments on government debt add to fiscal expenditures, and, thereby, increase the deficit overtime. In other words, borrowing today might postpone inflation, but at the risk of even higher inflation in the future. They further aver that in the short run, domestic borrowing is a viable option that may truly enable the government to buy time so as to implement the expenditure cut/tax increases that will eventually close the deficit.

Itsede (1998) indicates that domestic debt involves government’s resort to borrowing from the domestic economy to finance its investment programme when tax receipts fall below programmed expenditure. Alison (2003) also highlights that for most developing countries, the term “domestic debt” is generally a shorthand expression for debt instruments issued by the Central Bank.

Christensen (2004) reveals that “extensive use of domestic borrowing can have severe repercussions on the economy, as servicing of domestic debt can constitute a huge fraction of government revenue, especially as interest rates on domestic debt is higher than that of external debt in most cases. Therefore, given the shallowness of financial markets in developing countries, interest payments on domestic borrowing have the tendency to increase as the debt stock increases. Another downside risk in the issuance of domestic debt is that, governments tap into domestic private savings that would otherwise have been available to the private sector, hence crowding out private investment. Furthermore, he is of the view that in HIPCs, particularly in The Gambia, Ghana, Malawi, Sierra Leone, and Tanzania, there is limited potential for domestic debt expansion when compared with non-HIPCs, as the commercial banks are the dominant players in the market. As such, further increase in domestic debt would reduce their resources available for private sector credit.

Omoruyi (2005) proposes that in a macroeconomic context, governments borrow domestically for three main reasons: budget deficit financing, monetary policy implementation and financial sector development.

Presbitero and Arnone (2006) in their analysis suggest that, one of the key challenges in forming a large secondary market and a stable demand for securities in developing countries is the concentration of government securities among few holders, particularly the banking sector. As such, these countries may not reap the expected benefits of increase in domestic debt, despite its overall low level.

Sheikh, Faridi and Tariq (2010) note that, public debt is as an imperative tool used by governments in developing countries to finance their expenditures. Issuing of public debt, they further note, can increase economic growth if the resources are effectively and proficiently utilised to achieve macroeconomic goals. However, if not properly used, public debt would constrain economic growth and become the biggest curse for the economy.

Sichula (2012) highlights that debt overhang which occurs at the peak of the Laffer debt curve, can worsen economic performance by changing the quality of investment. The reason is that, in tandem with the increase in debt service burden, the expected future taxes on the private sector increase, thus
reducing private investment. In other words, resources that would have been used to fund investments are consumed by debt servicing.

3.2 Empirical Literature Review

Cohen (1993) in his empirical study on the relationship between debt and investment in Least Developed Countries (LDC’s) in the 1980s, finds that the level of debt stock does not have significant impact on investment and, thus, does not explain the slowdown of investment observed in developing countries during the 1980s. He concludes, however, that the actual flows of net transfers matter and that the actual servicing of debt crowds out investment.

Christensen (2004) in investigating the impact of domestic debt on private sector credit on twenty seven SSA countries including Sierra Leone for the period 1980-2000, used a simple panel data model to estimate the effect of private sector lending on domestic debt (both variables were in percent of broad money). The regression results lend significant support for the crowding out hypothesis, as on average across the countries a 1 percent increase in domestic debt relative to broad money results to a decline in the ratio of private sector lending to broad money by 0.15 percent.

Abdi (2004) points to three potential factors in his New Growth Theory that influence output and productivity growth; investment in human capital, research & development (R&D), and investment in machinery and equipment (M&E). He employs panel data (1961-1997) for 20 Canadian manufacturing industries and time-series data (1961-2000) for the entire Canadian manufacturing sector, using a constant returns to scale Cobb Douglas production function. The results suggest that the elasticities of output with respect to M&E capital stock and M&E investment are well over the human capital’s share of national income. Nonetheless, the coefficient of labour is approximately the same as its income share. The results also indicate that investment in M&E is not the only source of growth as the elasticity of output with respect to investment in infrastructure is far above its income share. This implies that there exists the probability that both types of investments are complementary.

Demirgüç-Kunt and Detragiache (2005) using government domestic interest payments as proxy for domestic debt in 82 low income countries and emerging markets for the period 1990-2001, find that the coefficient on interest payments is significantly negative, but not as robust as in the case of regressing bank assets scaled to GDP, hence suggesting at first glance a typical crowding out effect. Albeit, interest payments on domestic debt enter the loans to GDP and deposits to GDP regressions positively, significantly and robustly, indicating a crowding in effect.

Adofu and Abula (2010) investigate the empirical relationship between domestic debt and economic growth in Nigeria. Using OLS regression techniques and time series data from 1986 to 2005, the result of their study shows that domestic debt adversely affects the growth of the economy.

Sheikh et al (2010) in investigating the impact of domestic debt on economic growth in Pakistan applied the OLS technique for the period 1972 to 2009. Their findings indicate that the stock of domestic debt impacts positively on economic growth in Pakistan. This implies that part of the resources garnered from domestic borrowing was utilised to finance government expenditures which contribute to economic growth. It was also noted that domestic debt servicing and economic growth has an inverse relationship. This is owing to the fact that economic growth is impeded if the percentage of non-development expenditures is high. The study concludes that the negative impact of domestic debt servicing on economic growth far outweighs the positive impact of domestic debt on economic growth.

Reinhart and Rogoff (2010) examine a new multi-country historical dataset on public debt to establish a systemic relationship between high public debt levels, growth and inflation. The main findings of their
study show that (i) there appears to be a relatively weak link between growth and debt at “normal” debt levels; (ii) countries with public debt over roughly 90 percent of GDP have median growth rates that are about one percent lower, and average (mean) growth rates that are several percent lower than countries with low levels of debt. However, they noted that the relationship between public debt and growth is remarkably similar across advanced economies and emerging markets.

Presbitero (2010) in his study of low and middle-income countries over the period 1990-2007 using panel analysis, reveals that public debt up to a threshold of 90 percent of GDP negatively impacts on output growth, beyond which, its effect is insignificant. Since debt overhang is a growth constraint only in countries with sound macroeconomic policies and stable institutions, it can be concluded that country-specific factors are responsible for this non-linear effect.

Checherita-Westphal and Rother (2012) investigate the impact of government debt on per-capita GDP growth in twelve euro area countries over a period of 40 years. Their findings reveal that debt has a non-linear impact of on growth with a turning point, because beyond a public debt-to-GDP ratio of about 90-100 percent, debt has a harmful effect on long-term growth. Based on the confidence intervals for the debt turning point, the negative impact of high debt on growth may have started from levels of around 70-80% of GDP, suggesting the need for more prudent indebtedness policies. There is also evidence that the annual change of the public debt ratio and the budget deficit-to-GDP ratio are negatively and linearly related to per-capita GDP growth. In addition, it was found that, the channels via which the change in government debt level impacts on the economic growth are: (i) private saving; (ii) public investment; (iii) total factor productivity (TFP), and (iv) sovereign long-term nominal and real interest rates.

Atique and Malik (2012) explore the long and the short run relationship between public debt and economic growth for Pakistan from 1972 to 2012, using the autoregressive distributed lag (ARDL) approach. The findings of the study reveal that external debt has a significant negative effect on GDP and GNP in both the short and long run, while debt servicing is inversely related to GDP and GNP only in the short run. However, domestic debt is found to have no impact on economic growth.

Onyeiwu C. (2012) investigates the relationship between domestic debt and economic growth in Nigeria. Using OLS and error correction model, he establishes a negative relation between economic growth and domestic debt. The empirical results also show that private sector credit has an inverse relationship with domestic debt and is statistically significant as a determinant of economic growth, while exchange rate and money supply were found to be positively related to domestic debt.

Putunoi and Mutuku (2013) in their study on the impact of domestic debt on economic growth of Kenya over the period 2000-2010, employ the Engel-Granger residual-based and Johansen VAR-based cointegration tests. The results of the analysis revealed that domestic debt markets play an increasingly important role in supporting economic growth. They find that domestic debt expansion has a positive long-run and significant effect on economic growth in Kenya for the period of study.

Mbate (2013) estimates a dynamic cross-country model to investigate the impact of domestic debt on economic growth and private sector credit in a panel of 21 sub-Saharan African (SSA) countries over the period 1985 to 2010. System-GMM results reveal a non-linear relationship between domestic debt and economic growth, characterized by a maximum turning point of 11.4 per cent of GDP. In addition, domestic debt is found to crowd out private sector credit by an elasticity of negative 0.3 per cent of GDP, deterring capital accumulation and private sector growth.

Bua et al (2014) introducing a new dataset in their study on domestic debt in 36 LICs for the period 1971 to 2011, found that i) domestic debt increased from 12.3 percent of GDP in 1996 to 16.2 percent
of GDP in 2011, almost reaching the size of external debt; ii) domestic debt burden is higher than external debt burden, but the former has been declining over time, as governments borrow at lower costs to enhance financial deepening; iii) the share of long-term instruments has been increased over time in LICs; and iv) the share of securities in government debt has increased, particularly for non-HIPCs, although for many HIPCs, central bank credit increased in response to the global financial crisis.

Serju (2014), using a finite distributed lag and VECM framework finds evidence that the high Treasury bill rates in Jamaica had an overall negative impact on the supply of loans to the productive sector. The paper concludes that, ceteris paribus, the relative low supply of credit to the private sector in Jamaica weaken its growth potential over the period of analysis and hence economic growth.

Babu, Kiprop, Kalio and Gisore (2015) empirically explore the impact of domestic debt as a percentage of GDP on economic growth in the East African Community for the period 1990-2010, based on the Solow growth model augmented for debt. The results show that domestic debt has a positive significant effect on per capita GDP growth rate in the EAC.

In assessing whether there exists a non-linear impact of domestic debt on real GDP growth rate in Sierra Leone, this research included a quadratic term in debt to the model. The quadratic term is used to capture the impact of increasing levels of domestic debt on the growth rate of real GDP in Sierra Leone. Despite the huge literature on domestic debt and economic growth for both developed and developing countries, the authors are not aware of any work on its non-linear impact in the case of Sierra Leone. Hence, this research fills the gap in that regard.

4. METHODOLOGY

4.1 The Model

The Empirical model is formulated, using the neoclassical production function analysis. Consistent with Cunningham (1993), the production function is employed to explain the relationship between GDP growth and debt burden. For heavily indebted nations, the fact that growth in exports only led to the payments of interest and principal on the debt inhibited the incentives for investment and growth in these nations, a phenomenon known as debt overhang. As debt burden affects the productivity of labour and accumulation of capital, it is, therefore, rational that it should be included in the production function. Hence, debt burden was added as an argument in the production function similar to the addition of exports in the neo-classical model.

\[ Y = f(K, L, DB) \] \hspace{1cm} (1)

Where, \( Y \)=GDP growth, \( K \)= capital, \( L \)=labour, \( DB \)=debt burden

The nation’s total debt burden which is included in the Cunningham model, is replaced with domestic debt burden in this model. To make the analysis more specific, only domestic debt measures are included in this analysis, as the effect of domestic debt on the economy is different from that of external debt. The relationship between domestic debt and economic growth is, thus, estimated, using the following basic regression equation:

\[ \ln RGDPS_i = \delta \ln X_i + \gamma \ln DDS_i + \mu_i \] \hspace{1cm} (2)
Where;

\( \text{In RGDPG}_t \) - is the growth rate of real GDP. It is the dependent variable.

- consists of different explanatory variables that were used. Net total investment, domestic credit to the private sector as a percentage of GDP and the treasury bills rate are the independent variables. These variables are known to be consistently associated with growth.

\( y \text{In DDS}_t \) - is the domestic debt variable, that is, the ratio of domestic debt to GDP.

\( \mu_t \) - is the error term.

To gauge the relationship between domestic debt and economic growth, several quantitative methods are available for conducting the cointegration test but Pesaran and Shin (1999) and Pesaran, Shin and Smith (2001) introduced a new method of testing for cointegration. The approach, known as the Autoregressive Distributed Lag (ARDL) has at least three significant advantages over the two alternatives commonly used in the empirical literature: the single-equation procedure developed by Engle and Granger (1987) and the maximum likelihood method postulated by Johansen (1991, 1995) which is based on a system of equations. The first advantage of the ARDL bounds testing approach is that it allows the analysis of long-term relationships between variables, regardless of whether they are integrated of order 0 \([I(0)]\), of order 1 \([I(1)]\) or mutually cointegrated. Secondly, this approach allows a distinction to be made between the dependent variable and the explanatory variables, an obvious advantage over the method proposed by Engle and Granger. Although, similar to the Johansen approach, it enables simultaneous estimation of both the short-run and long-run components, thus, eradicating the challenges associated with omitted variables and the presence of autocorrelation.

Finally, while the estimation results obtained using the proposed methods of Engle and Granger as well as Johansen are not robust to small samples, Pesaran and Shin (1999) show that the short-run parameters estimated using the ARDL approach are \( \sqrt{T} \) - consistent and the long-run parameters are super-consistent in small samples.

The ARDL framework implemented in its log format is outlined below:

\[
\Delta y_t = \beta_0 + \varphi y_{t-1} + \gamma j_{t-1} + \sum_{k=1}^{p} \phi_k \Delta y_{t-k} + \sum_{k=1}^{q} \lambda_k \Delta j_{t-k} + \sum_{i=0}^{g} \alpha_i \Delta X_{j,t-i} + \mu_t \] .............................(3)

In the model, the dependent variable \( Y_t \) (growth rate of real GDP), the main explanatory variable (measure by ratio of domestic debt to GDP) and explanatory variables (which include, investments, Treasury bill rate, domestic credit to the private sector) enter the ARDL regression with lag of order \( p \) and \( q \), respectively.

The coefficients on the level effects are \( \varphi \) and \( \eta \) with the long-run effects estimated as \( \frac{-\eta}{\varphi} \) and \( \frac{-\gamma}{\varphi} \), with \( \varphi \) representing the convergence parameter (speed of adjustment to the long run relationship). Additionally, the short run coefficients are \( \phi, \lambda \) and \( \alpha \).

Given that the research is interested in assessing whether there exists a non-linear impact of domestic debt on growth, a quadratic term in debt is included in the model. The latter is used to capture the impact of increasing levels of debt on economic growth. This is outlined in the model below:
\[ \Delta y_t = \beta_0 + \phi y_{t-1} + \gamma j_{t-1} + \eta X_{j,t-1} + \sum_{k=1}^{p} \phi_k \Delta y_{t-k} + \sum_{k=1}^{p} \lambda_k \Delta j_{t-k} + \sum_{l=1}^{q} \alpha_l \Delta X_{j,t-l} + \mu, \] 

(4)

Where: \( j_2 \) is the non-linear variable, which is derived by squaring the ratio of domestic debt to GDP. If the coefficients on the linear and quadratic debt terms are significantly different from zero then the hypothesis of a non-linear effect of debt on economic growth would be confirmed in Sierra Leone. Given the existence of a non-linear relationship between domestic debt and economic growth, equation 4 attempts to identify the level of debt at which the non-linear relationship holds by including dummy variables to capture specific debt levels. In this regard, the ARDL model employed is as follows:

\[ \Delta y_t = \beta_0 + \phi y_{t-1} + \gamma j_{t-1} + \eta X_{j,t-1} + \sum_{k=1}^{p} \phi_k \Delta y_{t-k} + \sum_{k=1}^{p} \lambda_k \Delta j_{t-k} + \sum_{l=1}^{q} \alpha_l \Delta X_{j,t-l} + D_i + \mu, \] 

(5)

Where \( D_i \), captures respective debt levels of interest.

To investigate the relationship between the domestic debt and economic growth in Sierra Leone the study estimates two models. The first model (Model 1), which is derived from equation 4, has real GDP as the dependent variable, the main independent variable as the ratio of domestic debt to GDP along with the quadratic term in debt and the vector \( X \) consisting of the other independent variables. These are private investment, lag real GDP, domestic credit to the private sector as a percentage of GDP, Treasury bill rate, and a dummy variable to capture the impact of the war. The second model (Model 2) seeks to determine the level at which domestic debt negatively affect economic growth. Model 2 consists of Model 1 (excluding the quadratic debt terms) along with a dummy variable to capture the threshold that debt negatively affect economic growth.

4.2 Data Sources and Measurement of Variables

4.2.1 Data Sources

Secondary data of selected variables is on annual basis from 1970-2015. The data sources are World Development Indicators (WDI) and the IMF International Financial Statistics (IFS). Private investment was obtained from IFS and the rest of the other annual series were obtained from the World Development Indicators. The brevity of the sample period is dictated by the availability of consistent data, most of which are compiled on an annual basis.

4.2.2 Measurement of Variables

The change in real GDP is used as a measure of economic growth while investment is measured by the change in gross fixed capital formation. This paper measures debt burden by the ratio of domestic debt to nominal GDP.

5.0. MODEL ESTIMATION AND EMPIRICAL RESULTS

5.1 Unit Root Test

The ARDL approach to cointegration theoretically does not require prior testing of the series for unit roots. However, some recent empirical studies have indicated that testing for unit root is necessary to ensure that none of the variables is I(2) which will invalidate the use of the ARDL approach (Shrestha and Chowdhury, 2005; and Jalil and Ma, 2008). The results of the Augmented Dickey-Fuller (ADF) test are reported in Appendix 1.
The results show that domestic debt stock (DDS), investment (INV), square of the domestic debt stock (DDS^2) and domestic credit to the private sector (DCPSG) are stationary at first difference. However, treasury bill rate (TBR) and GDP growth rate (GDPG) are stationary at levels. This result thus reinforces the use of the bounds test to determine cointegrating relationship among the series.

5.2 Bounds Cointegration Test

In order to perform the bounds testing procedure, we estimate equation (4) using the ARDL approach to cointegration. Narayan (2004) has provided critical values that are considered to be more appropriate for ARDL modeling using small samples as compared to Pesaran and Pesaran (1997) and Pesaran et al (2001).

Under the ARDL approach, the calculated F-statistics are compared against the critical values, which are extracted from Narayan (2004). The calculated F-statistics reported in Appendix 2 shows that; for equation (4) where the LGDPG is the dependent variable, F(lgdpg) = 4.5021 is higher than the upper critical bound value (4.303) at 5 percent significance level. This implies that the null hypothesis of no cointegration among the variables in equation (4) can be rejected.

The calculated F-statistics reported in Appendix 3 (Model 2) shows that; for equation (5) where the LGDPG is the dependent variable, F(lgdpg) = 4.1325 is higher than the upper critical bound value (3.637) at 10 percent significance level. This implies that the null hypothesis of no cointegration among the variables in equation (5) can be rejected.

5.3 Static Long Run Coefficients

Having established that output growth is cointegrated with its explanatory variables, we now estimate equation (4) for the long run elasticities using the appropriate lag lengths. A lag length of 2 is used in the bounds test in line with the Swartz Information Criterion (SIC) to ensure that the full dynamics are captured and the model is free of serial correlation. The results for the long run elasticities are reported in Table 1. The model estimates the relationship between domestic debt and economic growth in Sierra Leone. The results suggest that domestic debt has a non-linear impact on economic growth in the long and short run as indicated by the statistical significance of the non-linear variable. Furthermore, in the long and run, domestic debt at low levels as well as at high levels has a negative impact on growth.
Table 1: Estimated Long-Run Results Based on SBC- ARDL (1,1,0,1,2), RGDPG as Dependent Variable

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>LnDDS</td>
<td>-0.3023</td>
<td>0.1652</td>
<td>0.078*</td>
</tr>
<tr>
<td>(LnDDS)^2</td>
<td>-0.491</td>
<td>0.1281</td>
<td>0.004***</td>
</tr>
<tr>
<td>TBR</td>
<td>-0.1705</td>
<td>0.0843</td>
<td>0.078*</td>
</tr>
<tr>
<td>DCPSG</td>
<td>0.2432</td>
<td>0.1101</td>
<td>0.054*</td>
</tr>
<tr>
<td>LnINV</td>
<td>0.0887</td>
<td>0.0303</td>
<td>0.007***</td>
</tr>
<tr>
<td>C</td>
<td>-0.3873</td>
<td>0.1379</td>
<td>0.009***</td>
</tr>
</tbody>
</table>

Diagnostics Tests

<table>
<thead>
<tr>
<th>Test Statistics</th>
<th>LM Version</th>
<th>F Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial Correlation</td>
<td>CHSQ(1)=1.2607(0.234)</td>
<td>F(1,19)=0.588(0.432)</td>
</tr>
<tr>
<td>Functional Form</td>
<td>CHSQ(1)=1.0636(0.313)</td>
<td>F(1,36)=1.039(0.295)</td>
</tr>
<tr>
<td>Normality</td>
<td>CHSQ(2)=0.19034(0.913)</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Heteroscedasticity</td>
<td>CHSQ(1)=40.9698(0.000)</td>
<td>F(1,19)=755.642(0.000)</td>
</tr>
</tbody>
</table>

Note: ***, ** (*) imply significance at the 1, 5 & 10 percent levels respectively. Source: Computed by Author using Microfit Version 4.1 developed by Pesaran and Shin (1999).

More specifically, in the long run and at low levels of debt, economic growth decreases by 0.30 percent after a one percentage point increase in stock of domestic debt, while at high levels of debt, a one percentage point increase in the domestic debt stock reduces economic growth by 0.49 percent. Domestic debt has both positive and negative effects on economic growth. However, financial markets liberalisation and macroeconomic stability is a necessary condition for the domination of positive effects [Del and Piero (2003)]. Sierra Leone is lacking on these grounds so negative impacts of domestic debt are dominating. Notably, the result is consistent with the findings of Adofu I and M. Abula (2010) and Atique and Malik (2012) who found that debt has a negative effect on economic growth.

At the 10 percent level of significance, a one percentage increase in domestic credit to the private sector increase output by 0.24 percent in the long run but the effect on output growth is insignificant in the short run. This may have emanated from the government’s expensive borrowing from the domestic money market which may have crowded out private sector investment. The increase in interest rates had a further dampening impact on economic growth. This result is consistent with Charles (2012) for Nigeria, Christensen (2004) and Mbate (2013).

5.4 Short Run Coefficients

The existence of a cointegrating relationship between growth and its determinants provides support for the estimation of a short-run dynamic model. The results of the error-correction model are reported in Table 2. All the short-run elasticities have the expected signs and are inelastic like their long-run counterparts.

Similarly, in the short-run, at a high level of domestic debt, economic growth is reduced by 0.19 percent following a percentage point increase in the stock of domestic debt. At low levels of debt, a one percentage point increase in domestic debt decreases output growth by 0.02 percent. The above results
imply that debt has a statistically significant inverse relationship with economic growth at high levels in Sierra Leone. That is, the greater the level of debt the more economic growth decreases. The result may partly reflect the notion that a significant portion of debt proceeds in Sierra Leone is used to finance recurrent expenditure (domestic debt servicing for instance) rather than to boost capital investment. The results are consistent with the findings of Reinhart and Rogoff (2010), Bua et al (2014), and Checherita-Westphal and Rother(2012). Further, government’s absorption of losses and debt from loss making public entities such as Sierra Leone Commercial Bank and Rokel Commercial Bank and the exposure of the country’s public debt to exchange rate deprecation as well as the civil war also contributed significantly to its high debt levels. The crowding out of the private sector by Government, as it seeks to finance its debt payments, could also explain the negative relationship.

Table 2: Error Correction Representation of the Selected ARDL Model (1,1,0,0,1,2), RGDPG as Dependent Variable

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>dGDPG1</td>
<td>-0.1493</td>
<td>0.054</td>
<td>0.010***</td>
</tr>
<tr>
<td>dLnDDS</td>
<td>-0.0178</td>
<td>0.0105</td>
<td>0.093*</td>
</tr>
<tr>
<td>(dLnDDS)^2</td>
<td>-0.1921</td>
<td>0.0598</td>
<td>0.050**</td>
</tr>
<tr>
<td>dTBR</td>
<td>-0.4229</td>
<td>0.0500</td>
<td>0.000***</td>
</tr>
<tr>
<td>dDCPSG</td>
<td>0.5046</td>
<td>0.4123</td>
<td>0.235</td>
</tr>
<tr>
<td>dLnINV</td>
<td>0.2485</td>
<td>0.1193</td>
<td>0.071*</td>
</tr>
<tr>
<td>dwar</td>
<td>-0.0099</td>
<td>0.005</td>
<td>0.071*</td>
</tr>
<tr>
<td>dC</td>
<td>-0.0005</td>
<td>0.0002</td>
<td>0.002***</td>
</tr>
<tr>
<td>ecm(-1)</td>
<td>-0.3738</td>
<td>0.1376</td>
<td>0.001***</td>
</tr>
</tbody>
</table>

R-Squared: 0.7837, R-Bar Squared: 0.7694
S.E. of Regression: 0.0238, F-Stat: F(15,26): 109.6536(.000)
Mean of Dep. Var: 0.2435, S.D. of dependent variable: 0.1517
Residual Sum of Squares: 0.0119, Equation log-likelihood: 111.9573
Akaike Info. Criterion: 90.9573, Schwarz Bayesian Criterion: 72.7117
DW-Statistics: 2.0622

Note: ***, ** (*) imply significance at the 1, 5 & 10 percent levels respectively.
Source: Estimation results using Microfit Version 4.1

Domestic credit to the private sector promotes economic growth in both the long and short run, though not significant in the short run. Domestic credit to the private sector, however, is yet to be a significant driver of GDP growth in Sierra Leone at least in the short-run.

In both the long and short run and at 1 percent and 10 percent level of significance, a one percentage point increase in the treasury bill rate decreases GDP growth by 0.42 and 0.17 respectively, consistent with the findings of Serju (2014). Intuitively, this could be attributed to the shallow financial market and a narrow investor base, coupled with government’s extensive borrowing from the domestic market. Given that financial resources are limited, expansion in domestic debt will more easily lead to higher domestic interest rates. Since the government’s volume of revenue mobilization is low, the only resort to acquiring much needed funds is from the domestic market and, hence, the spike in the rates. Moreover, since the investor base in Sierra Leone is dominated by commercial banks, the government is most times held hostage by this group of investors and hence the spike in the Treasury bill rate.
Furthermore, a one percent increase in net investment increases GDP growth by 0.09 percent in the long run and by 0.25 percent in the short run at the 1 percent and 10 percent significance levels respectively. These results conform to the findings of Abdi (2004) who found a strong link between investment in general, and machinery and equipment investment in particular, with economic growth in Canada.

The literature postulates that the coefficient of the lagged error correction term should be negative and statistically significant to further confirm the existence of a long-run relationship. The coefficient of the lagged ECM term is -0.3738, which suggests a moderate adjustment process at the 1 percent level of significance. This implies that 37 percent of the disequilibrium of the previous year’s shock adjusts back to the long run equilibrium in the current year. The regression fit remarkably well (adjusted R-squared of 0.769) and pass the diagnostic tests against serial correlation, non-normality and functional-form misspecification but failed heteroscedasticity in the errors. This should not be a problem because the presence of heteroscedasticity alone does not cause bias or inconsistency in the OLS estimates (Wooldridge, 2015). The tests of CUSUM and CUSUMSQ suggest no evidence of structural instability in the parameters during the sample period as the plots (which are presented in appendix 4) lie within the 5 percent critical bounds. The result of the specification test supports the use of domestic debt stock in determining its effects on output growth.

The second model (Model 2) seeks to gauge the level at which domestic debt negatively affects economic growth in Sierra Leone. Model 2 consists of Model 1 (excluding the quadratic debt terms) along with a dummy variable to capture the threshold that debt negatively affect economic growth.

**Table 3: Estimated Long-Run Results Based on SBC- ARDL (1,1,0,1,0,1,2), RGDPG as Dependent Variable**

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>LnDDS</td>
<td>-0.507</td>
<td>0.096</td>
<td>0.000***</td>
</tr>
<tr>
<td>debt dum</td>
<td>-0.683</td>
<td>0.080</td>
<td>0.000***</td>
</tr>
<tr>
<td>TBR</td>
<td>-0.068</td>
<td>0.059</td>
<td>0.260</td>
</tr>
<tr>
<td>DCP SG</td>
<td>0.465</td>
<td>0.337</td>
<td>0.168</td>
</tr>
<tr>
<td>LnINV</td>
<td>1.321</td>
<td>0.828</td>
<td>0.150</td>
</tr>
<tr>
<td>C</td>
<td>-0.211</td>
<td>0.069</td>
<td>0.005***</td>
</tr>
</tbody>
</table>

**Diagnostics Tests**

<table>
<thead>
<tr>
<th>Test Statistics</th>
<th>LM Version</th>
<th>F Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial Correlation</td>
<td>CHSQ(1)=15.2093(0.385)</td>
<td>F(1,19)=0.588(0.432)</td>
</tr>
<tr>
<td>Functional Form</td>
<td>CHSQ(1)=1.1425(0.256)</td>
<td>F(1,36)=1.039(0.295)</td>
</tr>
<tr>
<td>Normality</td>
<td>CHSQ(2)=1.7716(0.535)</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Heteroscedasticity</td>
<td>CHSQ(1)=13.7135(0.431)</td>
<td>F(1,19)=755.642(0.000)</td>
</tr>
</tbody>
</table>

Hence, Table 4 (Model 2) indicates that on average, the ratios of debt to GDP in excess of 20 percent reduce economic growth by 0.38 percent at the 5 percent significance level when compared to ratios below 20 percent, holding other explanatory variables constant. Interestingly, both investment and domestic credit to the private sector are crowded out at domestic debt levels in excess of 20 percent of GDP in Sierra Leone. Though they are consistent on a priori grounds, they are both insignificant, thus,
reinforcing the phenomenon of “domestic debt overhang” in the economy and corroborating the long-run results. Moreover, at low levels of debt, a one percentage point increase in domestic debt decreases output growth by 0.31 percent. The results also indicate that the civil war has a statistically significant negative impact on economic growth in Sierra Leone.

Table 4: Error Correction Representation of the Selected ARDL Model (1,1,0,1,0,1,2) (MODEL 2), RGDGP as Dependent Variable

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>dGDPG1</td>
<td>-0.0250</td>
<td>0.0020</td>
<td>0.000***</td>
</tr>
<tr>
<td>dLnDDS</td>
<td>-0.3068</td>
<td>0.0229</td>
<td>0.000***</td>
</tr>
<tr>
<td>debtdum</td>
<td>-0.3768</td>
<td>0.0822</td>
<td>0.0500**</td>
</tr>
<tr>
<td>dTBR</td>
<td>-0.2801</td>
<td>0.2390</td>
<td>0.4200</td>
</tr>
<tr>
<td>dDCPSG</td>
<td>0.0769</td>
<td>0.1658</td>
<td>0.5261</td>
</tr>
<tr>
<td>dLnINV</td>
<td>0.0311</td>
<td>0.0406</td>
<td>0.4526</td>
</tr>
<tr>
<td>dwar</td>
<td>-0.2747</td>
<td>0.0862</td>
<td>0.0470**</td>
</tr>
<tr>
<td>dC</td>
<td>-0.0288</td>
<td>0.0142</td>
<td>0.0419**</td>
</tr>
<tr>
<td>ecm(-1)</td>
<td>-0.5928</td>
<td>0.2821</td>
<td>0.000***</td>
</tr>
</tbody>
</table>

Moreover, this model passes all the diagnostic tests including heteroscedasticity and the speed of adjustment to equilibrium from previous year’s shock is corrected in the current year at a speed of 59 percent.
6.0 CONCLUSION AND POLICY RECOMMENDATIONS

6.1 Conclusion

The main objective of this paper is to examine the impact of domestic debt on economic growth in Sierra Leone for the period 1970-2015. Using the ARDL approach, the study reveals that domestic debt exerts a significant negative effect on economic growth in Sierra Leone, both in the short and long runs and at low and high levels. This implies that, as the stock of domestic debt increases, economic growth decreases, thus, reflecting that domestic borrowings are not utilised for productive activities, among others. The results further show that private sector credit and net investment have positive effects on economic growth, while treasury bills rate has a negative effect. The study concludes that at ratios of domestic debt to GDP in excess of 20 percent, there is crowding out of private sector credit and investment, emphasising “debt overhang”. The implication is that government has limited capacity to increase domestic borrowings, given the debt to GDP ratio of 11.8 percent in 2015.

The need for domestic debt management has, hence, become urgent to mitigate the effect of the rising cost of servicing domestic debt associated with increase in the stock level, on government revenue and overall fiscal balance. Domestic debt growth if not contained will continue to adversely affect economic growth by crowding out private investment, as commercial banks will prefer to invest in government’s securities, rather than give out loans to the private sector, because of the seemingly risk-free nature of government debt instruments.

6.2 Policy Recommendations

Based on the empirical results, the following policies are recommended which are aimed at reducing government’s fiscal deficit and, hence, domestic debt:

i. Government should reduce its fiscal deficit by raising revenues through aggressive tax collection and/or reducing its expenditure.

   a. To enhance revenue mobilisation, it is imperative that the government enhance the capacity of the National Revenue Authority (NRA), so that the large informal sector will be captured in the tax net and tax evasion in the formal sector minimised.

   b. Fiscal discipline should be the watchword of government and this can be observed by profiling expenditure against revenue. Additional spending should only be undertaken when both fiscal and macroeconomic space are available to safeguard the solvency as well as stability for long-term growth. To achieve this, the government needs to strengthen the capacity of the Public Expenditure Tracking (PET) project being implemented by the Ministry of Finance.

ii. Strategies for effective debt management, which include incorporating ceiling to limit domestic debt, as well as the design of financial policies to enhance availability of credit, should be pursued.

iii. There is a dire need to deepen the money market, strengthen the capital market, and provide added impetus for government to broaden the domestic budget financing base, especially by the non-bank private sector.

iv. For effective debt management, debt restructuring is pertinent in order to limit debt service costs to sustainable levels: such as converting some proportion of government instruments to longer-term securities of more than one-year maturity tenor.
v. The authorities should pursue much more aggressive fiscal consolidation in order to ensure macroeconomic stability, so that the enabling environment will be created for financial market and private sector growth.

vi. Finally, given the gradual build-up of the domestic debt-GDP ratio from 8.00 percent in 2013 to 11.8 percent in 2015, government is cautioned to reduce its domestic borrowing so that the ratio will not revert to the above 20 percent level it was in the 1990’s and early 2000’s.
REFERENCES


APPENDIX 1

**ADF Unit Root Test Results**

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF Statistic</th>
<th>Lag Length</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intercept</td>
<td>Intercept</td>
<td></td>
</tr>
<tr>
<td></td>
<td>without Trend</td>
<td>with trend</td>
<td></td>
</tr>
<tr>
<td>LnDDS</td>
<td>-1.712</td>
<td>-1.126</td>
<td>1</td>
</tr>
<tr>
<td>D(LnDDS)</td>
<td>-4.23</td>
<td>-4.595</td>
<td>0</td>
</tr>
<tr>
<td>LnINV</td>
<td>-1.458</td>
<td>-3.248</td>
<td>0</td>
</tr>
<tr>
<td>D(LnINV)</td>
<td>-6.493</td>
<td>-6.379</td>
<td>2</td>
</tr>
<tr>
<td>TBR</td>
<td>-6.22</td>
<td>-6.182</td>
<td>1</td>
</tr>
<tr>
<td>DCPBG</td>
<td>-2.243</td>
<td>-2.374</td>
<td>1</td>
</tr>
<tr>
<td>D(DCPBG)</td>
<td>-3.866</td>
<td>-4.029</td>
<td>0</td>
</tr>
<tr>
<td>Ln(DS²)</td>
<td>-1.932</td>
<td>-1.324</td>
<td>1</td>
</tr>
<tr>
<td>D[Ln(DS²)]</td>
<td>-5.543</td>
<td>-5.856</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: critical values: without trend = -2.98; with trend = -3.57 at 5%

APPENDIX 2

**Bounds Test Results**

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>Value</th>
<th>Lag Length</th>
<th>Bounds Critical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td>I(0)</td>
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<td></td>
<td></td>
<td></td>
<td>3.979</td>
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<tr>
<td></td>
<td></td>
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<td>5%</td>
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<td></td>
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<td>2.860</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.390</td>
</tr>
</tbody>
</table>

Source: Critical values are obtained from Narayan & Narayan (2004)

APPENDIX 3

**Bounds Test Results (MODEL 2)**

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>Value</th>
<th>Lag length</th>
<th>Bounds Critical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>I(0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>3.979</td>
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<td>5%</td>
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<td>2.860</td>
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APPENDIX 4

Plot of Cumulative Sum of Recursive Residuals

Plot of Cumulative Sum of Squares of Recursive Residuals
The objective of this paper is to establish whether the estimated relationship between environmental degradation and per capita income corroborates the inverted U-shape hypothesis as exemplified by the Environmental Kuznets curves (EKCs) in selected ECOWAS countries. Considering two variants of emissions—sulfur dioxide (SO₂) and carbon dioxide (CO₂)—and using panel fixed and random effects estimation techniques, the study indicates the existence of EKCs for the two variants of environmental quality. Experimentation with augmented quadratic equations, however, does not in some cases produce consistent results for SO₂, while cubic polynomial forms suggest N-shaped EKCs for CO₂. The turning points estimated for the two indicators of environmental quality are relatively low, which suggests a demonstration of the low level of development in the sub-region that may be related to high incidence of poverty. The major drivers of SO₂ in the sub-region are fossil fuel processing and combustion led by Nigeria. For CO₂ emissions, it is driven by rapid population growth that is equally induced by Nigeria. The policy variable which interacted significantly with the income variable to create the inverted-U shape EKC signals the importance of public institutions in the enhancement of environmental quality. Although ECOWAS countries may have benefited from early learning effects and environmental awareness, the implication is that policymakers must be proactive to sustain the current trend as the region enters the phase of industrialization and may not necessarily wait for a long time to improve environmental conditions as is the case with developed countries. This can be accomplished by using environmental tax instruments such as fuel tax which has been advised to be progressive for some African countries. By way of recommendation, a functional population policy should be implemented particularly in Nigeria.

**JEL Classification:** I15, O13, O44, Q50, Q53

**Keywords:** Environmental Kuznets Curve, ECOWAS, Economic growth, Emissions, Sulfur dioxide, Carbon dioxide.

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1.0 INTRODUCTION

History of economic discourse on the environment-growth relationship which underpins the Environmental Kuznets Curve (EKC) dates back to the 1970s when some scientists began to question the compatibility of natural resource availability with sustained economic growth (Meadows et al., 1972). The other strand of the divide championed by neoclassical economists such as Beckerman (1974) and Jahoda (1973) among others; opposed the limits to growth aphorism due to challenges of resource limitation. More importantly, as the perception of general interdependence between ecosystems and economies gains traction, economists broaden their view on the links between them.

A comprehensible hypothesis about the relationship between environmental quality and economic growth was formally first mentioned by Grossman and Krueger (1991); in their remarks, they posit that during the early stages of economic development, a country experiences increased environmental degradation which will increase until a certain level of income is reached (known as the turning point). At that level, environmental improvement will occur. What is implied in this analysis is that at the early stage of economic development when agriculture and allied activities as well as light manufacturing dominate the typical economy, pollution intensity will be generally low. However, as the economy shifts to heavy industry, pollution will tend to increase. Besides, as the economy shifts into high technology and services, pollution intensity will tend to decline. According to Grossman and Krueger, this produces an inverted U-shaped curve, analogous to that proposed by Kuznets (1955) in the relationship that exists between income inequality and average national income. Kuznets hypothesizes that economic inequality increases over time and then after a threshold becomes more equal as per capita income increases; hence the income-environment nexus is dubbed the “environmental Kuznets curve” (EKC).

Since the seminal works of Grossman and Krueger’s (1991) particularly on the potential environmental impacts of NAFTA, and the 1992 World Bank Report, interest in studies on the environment-income relationship has been aroused. Many studies on the subject have come on stream in efforts to estimate, interpret and understand the existence and shape of the EKCs with respect to various emissions and greenhouse gases. In the light of those studies that followed the thought provoking Grossman and Krueger’s findings, EKCs are now known to have different shapes and signs depending on the distinctive measurement of environmental degradation and datasets employed (see Cole and Neumayer, 2005; Stern, 2004; Yandle et al., 2004 for overviews). In all and as can easily be anticipated, the statistical and econometric evidence of the EKC relationship is mixed and its interpretation ambiguous. Consequently, little may be done in breaking new ground in an attempt to synthesize the evidence and assess where matters stand. However, the contribution of this paper to the EKC- SO$_2$ and CO$_2$ empirical literature, to the author’s mind, is novel in its application to the ECOWAS sub-region.

Second, in their quest for economic integration and diversification, ECOWAS economies move into the next stage of economic growth with probable increase in per capita income, mitigating environmental degradation in the sub-region through appropriate policy design becomes inevitable. Third, the reality of rapid population growth (Nigeria is Africa’s most populous country) coupled with increased urbanization in the sub-region are matters of concern as both can, on the one hand, contribute to over-exploitation of the ecosystems through complex feedbacks that have important implications for sustainable resource use, and on the other hand, further deteriorate the relationship between their levels of economic growth and emission of pollutants (Jiang et al., 2008; Cumming et al.,2014; Apergis and Ozturk, 2015).

Fourth, Nigeria (Africa’s biggest oil producer and 13th largest producer of oil in the world with daily production reaching about 2.4 million barrels) is the only member of the Organization of Oil Exporting Countries (OPEC) in ECOWAS and accounts for over 76% of the sub-region’s GDP. Its enjoyment of relatively cheaper price of fossil fuels, reflecting government resource subsidies, implies that the sub-
region could experience relatively higher rates of atmospheric fossil fuel and irreversible environmental damage. The prognosis however, is a matter of empiricism which this study seeks to address. Nigeria alone is ranked among the top 50 CO₂ emitter countries in the world (The Guardian, 2011) and this attracts attention.

The significance of testing for the existence of an EKC therefore stems from the fact that, it is beyond a mere academic exercise. An EKC as a generalized phenomenon is an indication, *ceteris paribus*, that environmental degradation will inevitably fall in the long run as incomes rise. Nevertheless, if the EKC proposition does not hold, this would be an indication that policy intervention would be necessary to curb pollution and make sustainable development a reality. A wide variance would be an indication that policy action is still required to reduce current pollution intensities even as income rises. The modifying effects would therefore provide the framework for a holistic approach to environmental policy design (Orubu and Omotor, 2011; Omotor, 2016).

The dawn of the EKC has so far raised some questions: do all aspects of environmental quality deteriorate or improve systematically with economic development? Can the pattern of growth versus environmental impact as established by the developed countries’ EKCs be replicated for developing countries path? For how long will developing countries wait before tunneling the EKC? Are there policy implications for poor countries to grow themselves out of environmental problems rather than implement stricter regulations?

Although the study addresses these questions raised about the EKCs, it nonetheless acknowledges that there have been scores of empirical EKC publications since Grossman and Krueger’s path-breaking work. The major focus of the study, however, is to estimate EKCs for ECOWAS countries using two specific measures of environmental indicators: sulfur dioxide (SO₂) and carbon dioxide (CO₂) emissions. The choice of these indicators is partly influenced by the fact that some studies on the EKC with respect to developing countries though exist for some pollutants, detailed studies that deal specifically with ECOWAS countries using sulfur dioxide emission are few and far between. Second, the existence of a relatively consistent country level data series for the ECOWAS countries selected for the study, also informed the choice.

The specific objectives of this study are thus to:

- estimate the EKCs model based on the emissions and determine a threshold income level for ECOWAS countries; and
- ascertain the effect of other control variables such as population density and policy influences on the quality of the environment.

The study is limited to analyzing the relationship between environmental emissions and per capita income as espoused in the environmental Kuznets Curve hypothesis. The EKCs would precisely be estimated for two indicators of air quality (AQI), using panel data for some selected ECOWAS countries based on data availability. These environmental emissions (AQI) are sulfur dioxide (SO₂) and carbon dioxide (CO₂).

The effects of policy variables such as population density, quality of institutions, population growth and trade openness on the selected AQI are also explored. The expectation is that such policy variables which could lower pollution concentration if adequately captured in the analyses should strengthen the policy implications of the study. The analysis is limited in scope to time series of the ECOWAS countries for which relevant data is steadily available.
2.0 REVIEW OF RELATED LITERATURE

The basic hypothesis of the environmental Kuznets curve is that there exists an inverted “U”-shape relationship between economic growth and environmental degradation. The explanation is that in the early stages of economic growth, environmental quality improves until it reaches the peak, afterwards it declines when the income per capita increases. Subsequently, economic development would eventually lead to environmental improvement (de Groot et al., 2004).

Series of studies have developed theoretical models on how preferences and technology interact to result in different time paths of environmental quality (Selden and Song, 1994; Andreoni and Levinson, 2001) among others. This, notwithstanding, the EKC though an essentially empirical phenomenon, is in much of the literature provocative (Stern, 2003) and their results inconclusive.

Studies that confirm the EKC hypothesis for different pollutants are Shafik and Bandyopadhyay (1992) and Aldy (2005). In the literature, studies have questioned the real existence of an inverse-U-shaped curve by empirical evidence. Khanna’s (2002) result is a U-shaped relationship instead of the inverted-U-shaped EKC. Akbostanci et al. (2009) find an N-shaped curve for Carbon Dioxide (CO$_2$) and; Particulate Matter (PM$_{10}$) and Sulfur Dioxide (SO$_2$), respectively. Lekakis (2000), however, finds no relation between economic growth and environmental degradation.

The techniques of analyzing the EKC relationship over time have also varied, so also are the various forms of dataset ranging from time series, cross-sectional, cross-country to panel or longitudinal analyses with a set of control variables widely used in the empirical literature. Examples of such control variables are literacy rate (Orubu and Omotor, 2011); trade and structural change (Suri and Chapman, 1998), technology and technological progress (Baiardi, 2012), corruption (Leitao, 2010), among others.

At some other instances, there exist studies which have also designed economic instruments for environmental regulation. Examples of such are Orubu (2004), Ziramba et al. (2009), among others. As West (2004) further suggests, environmental taxes particularly gasoline tax is mildly regressive and may not be popular options in policy design. Ziramba, et.al, conclusion in the case of South Africa is that fuel expenditures are not regressive and as such, fuel tax would be an effective and desirable instrument for pollution control.

Other than OECD countries, some recent studies have concentrated on Africa and Asia regions. Examples are Osabuohien et al. (2014) and Apergis and Ozturk (2015). For the sake of emphasis, Osabuohien et al. (2014) study aim to establish the applicability of the EKC hypothesis in 50 African countries, using data from 1995–2010. The extension includes the application of panel cointegration to address some concerns of the econometric challenges. The empirical results suggest the existence of a long-term relationship between CO$_2$ and particulate matter emissions jointly with per capita income and other variables, including institutional factors and trade. The study recommends the need for African countries to reduce the level of environmental pollution at higher levels of economic development. Apergis and Ozturk (2015) focusing on income and policies, investigate the existence of the EKC hypothesis for 14 Asian countries spanning the period 1990–2011. The study employed the Generalized Method Moments (GMM) on panel dataset to test the EKC hypothesis. The multivariate framework includes CO$_2$ emissions, GDP per capita, population density, land, industry shares in GDP, and four indicators that measure the quality of institutions. The estimates have the expected signs and are statistically significant; yielding empirical support to the presence of an EKC hypothesis. The study proposes measures to enact regulations related with reducing the greenhouse gas arising from industry, transport and heating. Other suggested measures according to the study are implementing carbon sequestration technologies in power plants and supporting green investments through the application
of environmental technologies. Table A1 in Appendix 1 presents a chronological summary of EKC studies for both developed and developing countries.

3.0 ENVIRONMENTAL ISSUES IN ECOWAS AND GLOBAL ENVIRONMENTAL AGREEMENTS: SOME STYLISTED FACTS

As noted earlier, the two emissions used in this study are Sulfur Dioxide ($\text{SO}_2$) and Carbon Dioxide ($\text{CO}_2$). $\text{SO}_2$ is emitted when fuels containing sulfur are combusted. In the air, it can form tiny particles called aerosols, creating new ones or building up old ones. Aerosol particles help form cloud drops and potentially changes the amount of rainfall. Both clouds and the aerosols reduce the amount of energy that the planet can absorb (Smith, et.al; 2011). As for $\text{SO}_2$, it has the potential to acidify rain, soil and lakes, and it can counteract some of the warming effects of carbon dioxide. The acidic deposition of such subsequent impacts can be significant, and they include adverse effects on aquatic ecosystems in rivers and lakes which damage forests, crops and other vegetation (EEA, 2013). These concerns no doubt are worrisome and have aided the shift in the frontier of environment-development treatise.

The environment-development paradigm which shifted to sustainable development began in the 1970s with the aim of formulating sustainable development policies that will curtail emissions in the development process. The dialogues which followed the discourse were to conserve the deteriorating environment and these resulted in a series of government commitments covering at least nine treaties. Chief among those action plans are the Convention on Biological Diversity Earth Summit in 1992, United Nations Framework Convention on Climate Change also known as the Kyoto Protocol in 1997, the United Nations Convention to Combat Desertification, 1994 and 1996 and the most recent in this group; the Stockholm Convention which is an international legally binding instrument to protect human health and the environment from persistent organic pollutants. The Stockholm Convention was adopted in 2001 but put into force in 2004 (World Development Report, 2010:211).

Multilateral Environmental Agreements and Modifications are well up to 1,257 (Mitchell, 2018). Among these are 540 Agreements and 222 Protocols. These numbers are still counting; however, as observed in the World Development Report (2010: 211), signing of these treaties does not always guarantee that governments will comply with the treaty obligations. This notwithstanding a fundamental question is how the ECOWAS sub-region has fared relatively in some of these environmental agreements and profile in the midst of industrialized nations?

Although all ECOWAS countries have participated in signing most of the treaties since the 1990s, the United States of America for instance, did not sign some of the international treaties and agreements launched in the wake of the 1972 United Nations Conference on Human Environment in Stockholm and the 1992 United Nations Conference on Environment and Development (Earth Summit) in Rio de Janeiro. It was only recently in 2012 surprisingly the United States became the first major industrialized nation in the world to meet the United Nation’s original Kyoto Protocol 2012 with target for $\text{CO}_2$ reductions without ever ratifying it (Watts, 2013). It became international law when Russia ratified it in November 2004. The United States never ratified the Kyoto Protocol even though the then Vice President Al Gore of the US signed it. A second observation is that Germany and Japan are probably yet to prepare national environmental profiles and biodiversity strategies and profiles. It is also worthy of note that there exist an ECOWAS Environmental Policy (2008) which signals commitment and appreciation of the consequences of environmental problems by political leaders of the region.
3.1. Profile of $SO_2$ emissions in ECOWAS countries

The main sources of $SO_2$ emissions in the ECOWAS region as reported in Figure 1 are fuel processing (wholly contributed by Nigeria) which accounts for 78 per cent of total anthropogenic $SO_2$ and petroleum combustion 18 per cent. While coal combustion contributed a paltry 1 per cent of the total share of sulfur emissions; Nigeria accounted for the total coal combustion during the period under review; but has now drastically declined probably reflecting increased demand for petroleum combustion. In essence, fuel processing is the major driver of sulfur dioxide composition in the region and solely contributed by Nigeria, which can be related to the growth in the activities of the oil industry. A comparative examination of the data (Smith et al., 2011) shows that $SO_2$ emission in ECOWAS countries ranked relatively lower than what obtained in some industrial countries; though not surprising. For example, the mean or average $SO_2$ concentration for the period, 1960-2005 for Benin, Cote d’Ivoire, Ghana, Nigeria, Senegal and Togo stood at 2.5, 20.1, 18.8, 361.7, 20.5 and 202 Gg, respectively; while those of China, Germany, Japan, UK and USA, stood at 14224.6, 5597.1, 2057.6, 4070.7 and 22147.7 Gg, respectively (Smith et al., 2011). A fundamental lesson to be deduced from Figure 2 when $SO_2$ concentrations for the selected ECOWAS countries are compared with the selected Industrial nations is that, ECOWAS countries may have the benefit of learning early and by involving in environmental activism and awareness may not need to wait for too long for per capita income to improve to the levels recorded in industrial nations before they begin to appreciate cleaner environment. In other words, the challenge developing countries including those in the ECOWAS region face is how to improve the EKC for instance by pressing it downward, or by reaching the turning point faster, in their future development (Kander, 2002).

3.2. Profile of $CO_2$ emissions in ECOWAS countries

It has been argued that, given the current level of economic development in the ECOWAS region, recorded carbon dioxide per capita may be rising in recent years. This fear is buttressed by the fact that as the region’s economy grows; carbon dioxide per capita may escalate as a result of industrialization. In 1960 the rate of increase per year was 0.71 PPM (parts per million) while the rate of increase was 2.14 PPM per year in 2005 (Ernst-Georg, 2010). Comparatively, average measures of $CO_2$ per capita for ECOWAS countries are relatively low, compared to the numbers recorded for industrial countries. For example, $CO_2$ for China, Japan, UK and USA stood at 2.23, 8.41, 10.08 and 19.81, respectively in 1965-2009 (World Bank, 2013). These figures may be compared with those of Benin, Burkina Faso, Cote d’Ivoire, Gambia The, Ghana, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo measured at 0.19, 0.06, 0.48, 0.19, 0.29, 0.46, 0.05, 0.09, 0.60, 0.42, 0.53 and 0.21, respectively (World Bank, 2013).

The ECOWAS carbon dioxide emission intensity per capita averages are equally less than the SSA average and seem to be declining as portrayed in Figure 3. This notwithstanding, recent attitudinal change and concern in the climate change challenges particularly by China and the United States who hitherto were adamant in reduction of their emissions of $CO_2$, further provide the impetus for curbing $CO_2$ emissions by developing countries. This interest is informed by the fact that the ECOWAS region is in quest for rapid industrialization and carbon per capita may increase as the region industrializes. African countries may therefore, do better, by deliberately coming up with measures to curb the trend towards increased carbon intensity. An unanswered question that comes to bear is what the complex drivers of $CO_2$ emissions in the ECOWAS region are even at its present level of development?

In applying an accounting methodology based on a log mean Divisia Index, Kojima and Bacon (2009) in their analysis decompose countries’ absolute levels of $CO_2$ emissions from the combustion of fossil fuels as well as the levels of emissions per capita and per unit of gross domestic product (GDP). The
six ECOWAS countries’ (with consistent dataset) performance ranges closely (probably given that they relatively belong to the same income group) depending on metric used, as reported in Table 1. The methodology provides for changes in emissions which are separated into five factors:

- $C_{eff}$ = carbon intensity of fossil fuels consumed;
- $S_{eff}$ = share of fossil fuels in total energy used (fossil fuel intensity of energy);
- $I_{eff}$ = energy required to produce a unit of GDP (energy intensity);
- $G_{eff}$ = GDP per capita; and
- $P_{eff}$ = Population

Some inferences can be made from the decomposition of the selected ECOWAS countries emissions illustrated in Table 1 and Figure 4 during the period 1994-1996 to 2000-2004. First, the net increase in CO$_2$ emissions for the ECOWAS countries over the period is 30.98 million metric tonnes. Second, the rapid growth of population and GDP per capita contributed most of the net increase in CO$_2$ emissions in the region. This was closely followed by fossil fuel intensity of energy. Third, carbon intensity of fossil fuels and fossil fuel intensity of energy increased CO$_2$ by 6.65 million metric tonnes and 8.5 million metric tonnes, respectively. Fourth, offsetting these increases was a marked reduction in energy intensity of total energy which reduced total CO$_2$ emissions in the selected ECOWAS countries by 8.25 million tonnes (equally a sign of economic underdevelopment). Fifth and very strongly, Nigeria alone is the major emitter of CO$_2$ emissions in the region based on the selected ECOWAS countries’ figures and accounted for almost 64 per cent of the emissions during the period with a 0.00 conversion efficiency ($V_{eff}$) level. Sixth, as energy intensity in the ECOWAS countries is falling, fossil fuel intensity in contrast increased (probably due to declining traditional use of biomass that require hours of manual collection). On a separate note, Spence (2009) argues that a bracket of low income countries in which the ECOWAS countries belong, be permitted to increase their emissions into the foreseeable future. In contrast, it is the view of this paper that this set of countries should rather be encouraged to mitigate the factors that contribute to rising emissions by their own planning and policy efforts. This can be achieved through energy conservation, energy efficiency improvement via low-carbon energy sources, strengthening institutions, structural changes in their economies and population control, especially in the case of Nigeria.

4.0 THEORETICAL FRAMEWORK AND MODEL SPECIFICATION

Although many environmental economists take the EKC as a stylised fact that needs to be explained by theory despite the pieces of evidence that it may not apply to all pollutants or environmental impacts (Stern, 2004), some substantial efforts have been made to provide a theoretical framework that rationalizes the subsistence of the EKC as an observable fact. The rest of this section which draws heavily on Orubu et.al. (2009), offers an interesting micro-structure from Levinson (2000). The Levinson micro model which is derived from a polynomial pollution-income curve is based on the utility maximizing behaviour of economic agents in which pollution rises at lower levels of income, but falls at higher levels. In the modified Levinson’s Model, the EKC explanation can be presented in five basic equations (a social utility function, a pollution function, a modified pollution function, an abatement function, and a constraint, respectively);

$$U = U(C, P), \quad P = P(C, F), \quad P = C - C^\alpha F^\beta, \quad A = C^\alpha F^\beta, \quad C + F = Y \quad \text{...............}(1)$$

Where $U$ = total utility, $C$ = consumption, $P$ = Pollution effect of the processes of production and consumption in the economy, $F$ = effort expended in abating pollution, $A$ = total abatement, $Y$ = income, while $\alpha$ and $\beta$ are parameters. From these equations, the consumption-income, and pollution-income equations are derived as in Equation 2:
\[ \frac{\partial p}{\partial y} = \frac{a}{\alpha + \beta} - (\alpha + \beta) \left( \frac{a}{\alpha + \beta} \right)^\alpha \left( \frac{\beta}{\alpha + \beta} \right)^\beta y^{(\alpha + \beta - 1)} \]  \hspace{1cm} (2)

The sign of which depends on the parameters \( \alpha \) and \( \beta \).

From Equation (2), note that if \( (\alpha + \beta) > 1 \), abatement will reflect increasing returns to scale, and the pollution curve will correspond to the EKC in Figure 4(b). If \( (\alpha + \beta) < 1 \), then abatement exhibits diminishing returns to scale; EKC is convex and when, \( (\alpha + \beta) = 1 \), effort spent abating pollution has constant returns to scale, and income-pollution is constant, as in Figure 4a.

### 4.1 Model Specification

With the foregoing, and given the framework already considered above, the basic foundation of the EKC formulation is that pollution intensity worsens as incomes levels rise, but eventually falls once income crosses some threshold. By this postulation, the prime quadratic EKC equation in logarithms can be specified as:

\[
\ln(e_t) = \alpha_1 + \beta_1 \ln(y_t) + \beta_2 \ln(y_t)^2 + \mu_t \hspace{1cm} (3)
\]

where
- \( e \) = indicator of environmental degradation or indicator
- \( y \) = GDP per capita at constant prices (US$2000)
- \( t \) = time

\( \ln = \) natural logarithm of the relevant variable
\( \mu \) = stochastic disturbance term with zero mean and finite variance

For the EKC hypothesis to be established, \( \beta_1 > 0; \beta_2 < 0 \), and both must be statistically significant.

In a longitudinal data analysis, a parametric specification of Equation (3) would be formulated as:

\[
\ln(e_{it}) = \alpha_i + \gamma_t + \beta_1 \ln(y_{it}) + \beta_2 \ln(y_{it})^2 + \mu_{it} \hspace{1cm} (4)
\]

In this specification, the focus is still on the logarithms of both per capita GDP, denoted by \( y_{it} \), and per capita of the emission or environmental degradation index, denoted by \( e_{it} \). Within this framework and in this paper \( i = 1, \ldots, N \) indicates the country and \( t = 1, \ldots, T \) is the time mark. In qualitative terms, similar results have also been obtained when using levels instead of logarithms (Wagner and Müller-Fürstenberger, 2005). The stochastic error term of Equation (4) is denoted by \( \mu_{it} \) with the appropriate assumptions concerning serial correlation. The first two terms on the right hand side in Equation (4), are intercept parameters that vary across countries \( (i) \), and years \( (t) \). The above formulation of the EKC posits a strong homogeneity assumption which implies that although environmental degradation may vary among countries at any given level of income, the income elasticity is the same for all countries at a given level of income. In a further strand, the time specific intercepts take care of time-varying variables that are omitted from the model, including stochastic shocks. Panel data analysis combine the features of both time series and cross-sectional analysis and are often specified to take care of fixed and random effects (for details, see Torres-Rey
c, 2007). Fixed effects (FE) models treat \( \alpha_i \) and \( \gamma_t \) as regression parameters, while random effects (RE) models treat them as components of the random disturbance.

In the literature, some theoretical discourses and studies have also included a cubic term in their estimations (see for example, Martinez-Zarzoso and Bengochea-Morlancho, 2004; and Stern, 2014). In some of such specifications, the cubic model is cast as:

\[
\ln(e_{it}) = \alpha_i + \gamma_t + \beta_1 \ln(y_{it}) + \beta_2 \ln(y_{it})^2 + \beta_3 \ln(y_{it})^3 + \mu_{it} \hspace{1cm} (5)
\]
If $\beta_3 > 0$ in equation (5), this would be symptomatic of an N-shaped curve. In modelling the EKC relationship, Shafik (1994) expands the variables considered; thus suggesting that income is only one of the several factors which help to determine declining environmental quality generally. Other determinants of environmental quality in any country according to Shafik are: 1) endowment such as climate or location; 2) the structure of production, urbanization, and consumption patterns of private goods, 3) exogenous factors such as technology that are available to all countries but change over time; and 4) policies that reflect social decisions about the provision of environmental public goods depending on institutions. Khanna (2002) also identifies such other critical factors that may influence the EKC existence as race, education, population density, housing tenure and the structural composition of the workforce.

In the strict case, establishing an EKC in the presence of other moderate factors provides a more convincing basis for validation of the hypothesis. We, therefore, experiment by expanding the basic model to include such factors as population density (PDEN), trade openness (TPN), and political economy (POEC). The higher the population density, the greater will be the intensity of pollution, as well as the pressure brought to bear on environmental services and resources. If the cubic term in Equation (5) is dropped, for simplicity and building on Levinson’s (2000) micro-foundation, the estimable equation is,

$$\ln(e_{it}) = \alpha_i + \gamma_t + \beta_1 \ln(y_{it}) + \beta_2 \ln(y_{it})^2 + \sum_{j=1}^{n} \varphi_j(X_{jit}) + \mu_{it} \cdots \cdots \cdots \cdots(6)$$

where,

$X$ = vector of other explanatory variables (or control variables).

4.2 Sources of the Data

The data for the two indicators of environmental quality and other variables used in the study are obtained from the World Bank World Development Indicators (2012, 2013) source, and Smith et.al. (2011), Anthropogenic Sulfur Dioxide Emissions: 1850–2005; and Marshall and Jaggers (2010), Polity IV. The African Development Bank’s publication, Gender, Poverty and Environmental Indicators on African Countries (2007) was used to complement some gaps in the data series. The definition of variables and their sources are summarized in Table 2.

4.3 Description of the Data

Issues on the time series properties of the variables are highlighted in sub-section 5.1, while the ECOWAS countries used in the analysis are presented in Table 3. The time frame for the analysis is influenced by data availability and consistency, but range from 1960 to 2005 for SO$_2$ and 1965 to 2009 for CO$_2$.

4.3.1 Sulfur dioxide (SO$_2$)

A consistent annual data series for SO$_2$ is available for 6 ECOWAS countries for the period 1960 – 2005, as indicated in Table 3. This makes a total of 46 observations for each ECOWAS country, and total balanced panel observations of 276 for the selected ECOWAS countries included in the sample. SO$_2$ emission on the average has been on the decline in the ECOWAS countries included in the study sample over time. Data on Sulfur Dioxide measured in Gigagrams of SO$_2$ was collected from Smith et.al (2011).

4.3.2 Carbon dioxide (CO$_2$)

The CO$_2$ variable for all countries used in the study is measured in metric tons per capita/per annum in order to adjust for the population size of the countries used for the analysis. ECOWAS member average per capita carbon dioxide emissions range from 0.05 tons to 0.59 tons for Mali and Nigeria.
respectively. \( \text{CO}_2 \) data was collected for the period 1965 – 2009 for the twelve selected countries used in the analysis; thus, making a total of 45 cross-sectional observations for each country and total balanced panel observations of 540.

The total per capita \( \text{CO}_2 \) for the twelve ECOWAS states is 5.35; this is about four times less than the US average and equal to the average total emissions of Canada per annum. The relatively low per capita \( \text{CO}_2 \) emissions for the ECOWAS countries would obviously suggest that these levels should sustained by increasingly enhancing other ways of reducing emissions, for example through the use of environmental regulations. \( \text{CO}_2 \) emissions data was obtained from the World Bank, *World Development Indicators*, 2013.

### 4.3.3 Income per capita

Among the numerous variables that affect per capita carbon dioxide production, per capita income is the factor which has prompted the largest amount of theoretical and empirical analysis. Our measure of income per capita is GDP per capita at constant prices (US 2000) since this measure of GDP is more reliable and available than the measure of GNP and both measures are highly correlated. GDP is even more relevant to developing countries than Gross National Product (GNP) as a measure of output. There is an abundance of economic literature and empirical support of the EKC for series of pollutants. Economic Growth and the Environment by Grossman and Krueger (1995), formed the fundamental basis for many econometric tests of the EKC done over time (Peterson, 2009).

### 4.3.4 Population density

Population density is measured as people per sq. km of land. The supposition as earlier noted is that countries with less dense, dispersed populations emit high levels of \( \text{CO}_2 \), due to the high transportation costs (Neumayer, 2003; Emrath and Liu, 2008; Grazi et al., 2008; Peterson, 2009). In urban areas where the population is denser, on the other hand, there is a tendency to produce relatively less \( \text{CO}_2 \), as people travel less distance and may make use of public transportation. The variable may have ambiguous effects as some have also argued that more dense areas will make for greater use of coal and non-commercial fuels (Panayotou, 1997) and people exerting pressure more on economic and environmental resources. Population density data is extracted from the World Bank WDI (2013) data set.

### 4.3.5 Openness

Openness is proxied as trade as a percent of GDP and is measured in this instance as the ratio of the sum of exports and imports to the nominal GDP. Trade as suggested in the literature is a major determinant of international technology adoption and diffusion. This occurs through imports of intermediate input, learning-by-exporting experience, foreign direct investment (FDI), communication, etc (Kinda, 2011). These processes encourage the use of modern technology that promotes pollution abatement. The trade as a percent of GDP data is obtained from the World Bank, *World Development Indicators* (2013) data set.

### 4.3.6 Population growth

Population growth may result in growth of emissions (independently of the growth in per capita incomes) via the demand for public goods that are pollution-intensive, such as infrastructure and defense, as argued, for example, by Ravallion and Jalan (1997) and (Mitsis, 2012). Population growth statistics for the selected countries show the average growth rate in the region to be 4.93%. This is explained by the pollution concentration growth of 7.2%, 4.07%, 6.44%, 2.96%, 3.53 % and 5.04% of Togo, Senegal, Nigeria, Ghana, Cote d’Ivoire and Benin, respectively. It is also noted that more densely populated countries relatively emit higher levels of \( \text{SO}_2 \) concentration.
4.3.7 Polity variable

The polity variable captures the quality of institutions and the data is obtained from Marshall and Jaggers (2010), *Polity IV*. Polity IV contains, amongst many other variables, yearly composite indicators measuring both “institutionalized democracy” and “autocracy”. A summary “polity” measure is then defined as the difference between the democracy and autocracy scores, with 10 indicating “strongly democratic” and −10 indicating “strongly autocratic” Farzin and Bond (2006). The specification assumes that the quality of institutions, political regime and openness of the state to environmental preferences of the public can be captured using this index. The relationship between environmental quality and economic growth is consummated with political institutions in sharpening policy formulation. As often aptly underscored, “The connection between environmental protection and civil and political rights is a close one. As a general rule, political and civil liberties are instrumentally powerful in protecting the environmental resource-base, at least when compared with the absence of such liberties in countries run by authoritarian regimes” (Dasgupta and Maler, 1995). During the period under review, most of the countries in the ECOWAS region were either under authoritarian regimes or just emerging from civil crises.

5.0 EMPIRICAL RESULTS

5.1 Time-Series Properties of the data

As a first step to estimating the relevant equations, a panel unit root tests are performed for each of the two pollutants and the underlying income covariates using panel unit root test and possibly the panel cointegration test. The frameworks for implementation of unit root tests in panel data are credited to Levin et al., 2002; Breitung, 2000; Im, Pasaran and Shin, 2003; Maddala and Wu, 1999; 2001 and Hadri, 2000. Utilizing series of these tests, though relatively, proffers the possibility of improving on the weaknesses such as low-power and large-size distortions that may be associated with a single time series tests. As has been argued elsewhere, the EKC hypothesis is a non-linear function of income, thus making it inappropriate to subject it to panel unit root tests and possibly a waste (Coplien, 2014). However, Perman and Stern (2003) had argued earlier that such non-linear function can be analysed using linear cointegration methods. The linear cointegration method further suffers another drawback in the EKC relation as no cointegration can be expected between income and income squared. Again, Perman and Stern (2003) argued that cointegration test in this circumstance should be analysed from the perspective that the relation is between emissions and the two variables not for a relation between the two income variables themselves. Others who have joined in this debate in recent times are Warne (2014) and Holy (2015), among others. In order not to be enmeshed in the ensuing debate and attendant controversies, we have systematically in this study followed the standard practice of analyzing EKC panel dataset without testing for the time-series properties of the data panel cointegration. This is reserved for future application.

5.2. Panel FE, RE and OLS estimates for SO₂

The variants regression approaches to the test of the EKC model using the quadratic form in the sulfur (SO₂) model are displayed in Tables 4 - 6. The regressors here are the per capita income (Per capita GDP and its squares (Per capita GDP)). These techniques of analysis enable us to test whether the economic growth and SO₂ emission consistently hold for the ECOWAS countries used in the panel.

All slope parameters are statistically significant at 5% as ‘a priori’ expected and rightly signed; indicating that income per capita is an important factor in the estimation of SO₂ emissions. The implication is that the EKC hypothesis holds for local pollutants such as SO₂.

Specifically, the random effect model displays similar results in terms of signs of coefficients. Income per capita and income per capita square coefficients are respectively 28.31 and -2.25 and are significant. However, the effects of income per capita and per capita square appeared to have greater impacts in
the random effect model. The coefficients of determination are not to be worried about as they give highly negligible explanatory power of the regressors. This may reflect the omission of other fundamental variables from the basic model. The panel OLS results are not different from the random effect model. However, as for the choice between the fixed and random effects which becomes academic in a situation such as this, the paper has identified itself with and accepted the results of the Fixed Effects (though equally supported by the various Hausman statistics) because Random Effects models are generally considered inappropriate for most economic applications as nearly all economic cases encountered, the time-invariant component of the error term, \( a_i \), is correlated with one or more of the independent variables, rendering the Fixed Effects more appropriate (Hilmer and Hilmer, 2014).

On the basis of the expected coefficients, the turning point of the income per capita of the chosen model (fixed effects) is estimated as:

\[
\tau = \exp\left[ -\frac{\beta_1}{2\beta_2}\right].
\]

The income per capita turning point of the SO\(_2\) FE model is about $5,650 dollars over the period and, thus, is the income that exists at the inverted U-shaped EKC. The turning point value though on average is higher than the region’s average gross domestic product (GDP) per capita, which ranges from USD 800 in Niger to USD 4,400 in Cape Verde, are not too distant away from current levels of income. This suggests that regulation of this pollutant may not be very difficult to achieve if left to income alone and that current environmental policy action is required to stem emission. This result generally agrees with the findings of some earlier studies (for example, Stern 2004; Markandya et al., 2006; Apergis and Ozturk, 2015, among others).

The robustness of the EKC hypothesis is examined by estimating the pooled panel cubic EKC using the FE, RE and OLS. The results are poor as they were not significant, though correctly signed. The behaviour of the augmented quadratic EKC results for SO\(_2\) when other control variables were included in the analysis similarly indicates the existence of an inverted-U relationship with income. The parsimonious results are mostly devoid of insignificant variables. The GDP per capita has positive effect on SO\(_2\) emission and statistically significant, while the parameter of the squared GDP per capita is negative and significant at 5 percent level.

The political institution variable (DEM) though not significantly different from zero and does not have the expected a priori constraining sign, the asymmetries reported in Figure 7 suggest that the period under review in the ECOWAS region may have been marred by political violence, civil wars and lack of political openness and public voice. While a rise in income alone is not enough to drive climate change policies, what may be playing out is that the ECOWAS countries require higher levels of democratization in conjunction with improved behavior of other economic agents to mitigate rising emission as they move to the next stage of higher level of industrialization. The non-significance of this variable may suggest that other deliberative processes are required to address issues of environmental quality. Population density in ECOWAS countries tends to intensify pollution from SO\(_2\) concentration more than any other sources in the estimations, suggesting deliberate policy intervention in urban planning. As Figure 5 depicts, population density trends are on the increase in the ECOWAS region.

The openness variable, as trade literature suggests, is a major determinant of international technology adoption and diffusion. This variable has a positive, significant impact on emissions with a coefficient greater than zero; implying a monotonically increasing trend connoting that increasing trade is accompanied by a rise in the level of the emission. This evidence gives credence to the pollution haven hypothesis which suggests that developing countries are the destinations for dirty industries or dumping sites of richer nations. Thus, the argument that trade through imports of intermediate input, learning-by-exporting experience, etc. could encourage the use of modern technology, promotes pollution abatement and increased use of resource efficiency may not necessarily be correct. Rather, the presence of externalities and trade openness could inhibit environmental quality and sustainable development.
5.3. Panel FE, RE and OLS estimates for CO₂

Tables 7-9 report different variants of the panel fixed, random and the pooled OLS results for carbon dioxide (CO₂) emission. The main results of the CO₂ as in SO₂ are robust to specifications of income per capita and income per capita square given that they have the expected signs (0.001 and -6.74E^-07) and significant at the conventional level. Consequently, it can be concluded that the behavior of CO₂, a measure of global emission supports the EKC hypothesis of an inverted-U shaped relationship. The behavior of the other variables in the augmented estimations is not strikingly different from their SO₂ counterparts.

However, given that the polity variable which captures the quality of institutions, voice and accountability of the state to the environmental preferences of the populace is not significant, the CO₂ equation is re-estimated by interacting it with the income per capita variable. The underlining argument is that economic growth alone may be insufficient to improve environmental quality (Fazin and Bond, 2004). The augmented results from all the classes of estimation of this interaction report evidence of an unambiguous EKC relationship between income per capita, income per capita square and CO₂ while CO₂ is negatively related to environmental polity variable (through the Per Capita GDP*Polity interaction variable). This affirmative finding that the quality of public institutions matters in achieving environmental quality implies that deliberate and conscious choices of environmental policy efforts are required for cleaner environment as income per capita rises. This corroborates the findings for 14 Asian countries by Apergis and Ozturk (2015); who further suggest that the association of higher income per capita with better political systems and institutions would improve environmental quality, leading to less emission. The optimum turning point value of US$ 4.0475E-114 for CO₂ which fell outside the original data is not strange with the EKC phenomenon (Stern, 2004). In addition, to strenuously argue for a higher turning point value will amount to “income determinism” (Unruh and Moomaw, 1998). CO₂ turning points at best only represent the average among all the countries rather than a deterministic summit that marks the start of the downward phase of the curve (Poudel et al., 2009). From the CO₂ augmented interactive results; the Hausman test favoured the FE model. This also curries the support of Hilmer and Hilmer (2014) as FE being more appropriate in economic applications.

The cubic polynomial model of CO₂ where the income per capita appears in cubic form differs from the cubic form equation of the sulfur model. The expected sign (4.29 E^-09 and 4.40E^09) and significance of income per capita cube is really an appreciation of the ‘N’ shaped EKC hypothesis for the ECOWAS countries. The very rapid growing pattern of income seems to have further increased the degradation turning the scenario to the first case. This also points to the fact that higher income levels alone cannot automatically improve the environment (Beck and Joshi 2015), and as such, abatement effort by the ECOWAS governments against pollution is good to the environment.

6.0 CONCLUSIONS

In this study, the relationship between per capita income and environmental degradation in the ECOWAS countries has been investigated, using longitudinal data spread generally between 1960 and 2009. Recognizing the often-cited income-environmental quality relationship, the specific objective is to estimate environmental Kuznets curves for two indicators of environmental quality, namely: sulfur dioxide (SO₂) and carbon dioxide (CO₂) and to establish whether the estimated relationships conform to the inverted U-shape hypothesis.

The results of the empirical investigation generally suggest the existence of environmental Kuznets curves for environmental quality indicators. Other factors such as population density; which is the most significant explanatory variable, openness, and income-policy interaction variable are also found to affect environmental quality. Specifically, population density has a positive effect on environmental degradation, particularly for SO₂, while openness tends to reduce global pollution (CO₂). An N-shaped pollution – income curve was also indicated for CO₂ – an indication that more stringent policy measures may be required to stem pollution from this source, as incomes rise to higher bounds. The N-shape is,
however, inverted for the case of $\text{SO}_2$. The turning points estimated for the different indicators of environmental quality are relatively low, thus, suggesting a demonstration of the low level of industrial development in the sub-region occasioned by the high incidence of poverty. Second, when these turnings are compared to evidence from extant literature on the environmental Kuznets curve, they suggest that ECOWAS countries may be turning the corner of the environmental Kuznets curve, much faster, and at lower levels of income than expected. Third, fuel processing is the major driver of anthropogenic $\text{SO}_2$ in the region (solely accounted for by Nigeria) followed by petroleum combustion. As for $\text{CO}_2$, the major driver is growth in rapid population followed by GDP. Nigeria accounts for 77 per cent of total $\text{CO}_2$ emissions due to growth in population and GDP, whilst these two factors contribute a total change of 78 percent $\text{CO}_2$ emissions in the region. This calls for an urgent functional population policy intervention, especially in Nigeria.

The polity variable, which interacted significantly with the income variable to create the inverted-U shape EKC signals, the importance of public institutions in environmental protection. Although, ECOWAS countries may have benefited from early learning effects and environmental awareness in their appreciation of various Protocols and Agreement they are committed to, there must be frantic efforts in the sub-region to enact and enforce enabling laws that would curtail firms’ productive processes and consumption behaviour of other economic agents. To amplify this point further, policymakers, Non-Governmental Organizations, Civil Society Organizations, etc. in the sub-region must to be proactive to step up a sustainable roadmap and framework that would enhance emission abatement as the sub-region enters the phase of industrialization and may not need to wait for too long as the case with developed countries and developing Asia to improve environmental conditions. One of such ways is through the use of environmental tax instruments like fuel tax which has been found to be effective in some African countries (not ECOWAS countries).

The influence of other factors such as population density, population growth and trade openness on environmental quality provides justification for mainstreaming the environment into the entire process of planning for development in order to ensure environmental sustainability in the ECOWAS region. Although the estimates do not identify the underlying structural actions required to effectively tackle the reduction of these emissions, particularly $\text{CO}_2$, the study at least has demonstrated that ECOWAS countries do not need to be fully developed like those of the West with high GDP per capita before they appreciate cleaner environment and implement environmental sustainability policies that should include population control measures. To further strengthen this, policymakers and players in the ECOWAS countries (among them other stakeholders; non-market and non-state organizations, development partners, corporate institutions) must deliberately advocate and adopt energy policies that reduce carbon intensity in the match towards economic integration. Since fuel processing and fuel combustion are the major drivers of anthropogenic $\text{SO}_2$ in the region, fuel tax may be introduced in the countries of the region as an environmental instrument to curb environmental emissions. Extended research will be undertaken to determine whether the use of such environmental tax instrument (fuel tax) in the region particularly Nigeria (which is seen to have a bearing impact in both the emissions and income covariates of the region) will be effective. In that research, issues of unit root in panel dataset for the EKC study of the ECOWAS will be taken into account.
REFERENCES

African Development Bank (2007), *Gender, Poverty and Environmental Indicators on African Countries*.


Baiardi, D. (2012),“Innovation and the environmental Kuznets curve: the case of CO, NMVOCs and SOx in the Italian regions”; Quaderni di Dipartimento 156, University of Pavia, Department of Economics and Quantitative Methods.


Cole, M. A. and E. Neumayer (2005), “Environmental policy and the environmental Kuznets curve: can developing countries escape the detrimental consequences of economic growth?”, In P. Dauvergne


Table 1: Decomposition Analysis between 1994–1996 and 2004–2006 based on International Energy Agency (IEA) Data (million tonnes of CO₂)

<table>
<thead>
<tr>
<th>Country</th>
<th>$C_{df}$</th>
<th>$S_{df}$</th>
<th>$I_{df}$</th>
<th>$G_{df}$</th>
<th>$P_{df}$</th>
<th>$\Delta E$</th>
<th>$X(%)$</th>
<th>$V_{df}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benin</td>
<td>0.1</td>
<td>1.8</td>
<td>-0.2</td>
<td>0.2</td>
<td>0.4</td>
<td>2.3</td>
<td>-297</td>
<td>0.0</td>
</tr>
<tr>
<td>Ivory Coast</td>
<td>0.1</td>
<td>1.2</td>
<td>0.7</td>
<td>-0.3</td>
<td>1.0</td>
<td>2.7</td>
<td>-295</td>
<td>-0.8</td>
</tr>
<tr>
<td>Ghana</td>
<td>0.3</td>
<td>2.0</td>
<td>-0.7</td>
<td>1.1</td>
<td>1.2</td>
<td>3.9</td>
<td>-69</td>
<td>0.2</td>
</tr>
<tr>
<td>Nigeria</td>
<td>6.0</td>
<td>3.0</td>
<td>-8.0</td>
<td>8.0</td>
<td>11.0</td>
<td>20.0</td>
<td>-10</td>
<td>0.0</td>
</tr>
<tr>
<td>Senegal</td>
<td>0.1</td>
<td>0.6</td>
<td>-0.1</td>
<td>0.6</td>
<td>0.9</td>
<td>2.1</td>
<td>-42</td>
<td>0.1</td>
</tr>
<tr>
<td>Togo</td>
<td>0.05</td>
<td>-0.09</td>
<td>0.05</td>
<td>0.00</td>
<td>0.27</td>
<td>0.28</td>
<td>-4</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>6.65</td>
<td>8.51</td>
<td>-8.25</td>
<td>9.6</td>
<td>14.77</td>
<td>31.28</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$\Delta E$ is change in a country’s emission between the two periods. $V_{df}$ is conversion efficiency.

Source: Extracted from Kojima and Bacon (2009).

Figure 1: Graphs of Anthropogenic Sulfur Dioxide Emissions and GDP per capita of Selected ECOWAS in Gigagrams of SO₂ and 2000 U.S. Dollars respectively.

Figure 2: Sources of SO₂ in Selected ECOWAS Countries.
Figure 3: Box Plot of Anthropogenic Sulfur Dioxide Emissions of ECOWAS and Industrial Countries in Gigagrams of SO$_2$

Figure 4: Graphs of Carbon Dioxide Emissions and GDP per capita of Selected ECOWAS Countries

Figure 5: Graphs of Carbon Dioxide (kt) and GDP per capita of Selected ECOWAS Countries
Figure 6: Decomposition Analysis between 1994-1996 and 2004-2006 (Million tonnes of CO₂)

Figure 7: Population Density and Democracy Level of Selected ECOWAS Countries
Table 2: Definition of Variables and Sources of Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP per capita (GDPPC)</td>
<td>GDP per capita (constant 2005 US$)</td>
<td>The World Bank, World Development Indicators, 2013</td>
</tr>
<tr>
<td>Sulfur Dioxide (SO₂)</td>
<td>Sulfur Dioxide measured Gigagrams of SO₂. This variable enters the estimable equation in form of concentrations.</td>
<td>Smith, et.al.’ 2011</td>
</tr>
<tr>
<td>Carbon Dioxide (CO₂)</td>
<td>The CO₂ variable is measured in metric tons per capita/per annum. This variable enters the estimable equation in per capita form.</td>
<td>The World Bank, World Development Indicators, 2013</td>
</tr>
<tr>
<td>Democracy (DEM)</td>
<td>Polity2 indicator to examine the extent to which democracy level and stock have significant, independent effects on SO₂ and CO₂ emissions.</td>
<td>Polity IV, Marshall, M.G. and K. Jaggers (2010). Polity IV contains, amongst many other variables, yearly composite indicators measuring both &quot;institutionalized democracy&quot; and &quot;autocracy&quot;. A summary &quot;polity&quot; measure is then defined as the difference between the democracy and autocracy scores, with 10 indicating &quot;strongly democratic&quot; and –10 indicating “strongly autocratic” Farzin and Bond (2006).</td>
</tr>
<tr>
<td>Population Density (POD)</td>
<td>People per sq. km of land</td>
<td>The World Bank, World Development Indicators, 2013</td>
</tr>
<tr>
<td>Openness (OPN)</td>
<td>Trade (% GDP)</td>
<td>The World Bank, World Development Indicators, 2013</td>
</tr>
</tbody>
</table>

All independent variables are lagged by one year, except for democracy stock, which is lagged by two years (to separate it from the stock variable). Source: Marshall, M.G. and K. Jaggers Polity IV (2010).
Table 3: West African Countries Covered in the Study for the Two Environmental Indicators (marked)

<table>
<thead>
<tr>
<th>Country</th>
<th>Benin</th>
<th>Burkina Faso</th>
<th>Cote d’Ivoire</th>
<th>Ghana</th>
<th>Liberia</th>
<th>Mali</th>
<th>Niger</th>
<th>Nigeria</th>
<th>Senegal</th>
<th>Sierra Leone</th>
<th>Togo</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO₂</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>CO₂</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

Sources: *World Development Indicators* (World Bank, 2013), Smith, et.al. (2011)

Table 4: Quadratic FE, RE and OLS estimates for ECOWAS countries (SO₂ as dependent variable)

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>FE</th>
<th>RE</th>
<th>OLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-75.86(-3.20)</td>
<td>-85.89(-3.77)</td>
<td>-85.89(-4.01)**</td>
</tr>
<tr>
<td>GDPPC</td>
<td>25.02(3.20)**</td>
<td>28.31(3.75)**</td>
<td>28.31(3.99)**</td>
</tr>
<tr>
<td>GDPPC²</td>
<td>-1.20 (3.06)**</td>
<td>-2.25(-3.84)**</td>
<td>-2.25(-3.84)**</td>
</tr>
<tr>
<td>Hausman Test</td>
<td>0.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed Red. Test</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.16</td>
<td>0.11</td>
<td>0.11</td>
</tr>
<tr>
<td>Turning Point</td>
<td>$5,650</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>276</td>
<td>276</td>
<td>276</td>
</tr>
</tbody>
</table>

**Indicates significance at 5%. Figures in parentheses denote t-statistics**

Table 5: Cubic FE, RE and OLS estimates for ECOWAS countries (SO₂ as dependent variable)

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>FE</th>
<th>RE</th>
<th>OLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>102.92(0.36)</td>
<td>-16.71(-0.06)</td>
<td>-16.71(-0.07)</td>
</tr>
<tr>
<td>GDPPC</td>
<td>-63.72(-0.45)</td>
<td>-6.03(-0.05)</td>
<td>-6.03(-0.05)</td>
</tr>
<tr>
<td>GDPPC²</td>
<td>12.66(0.54)</td>
<td>3.42(0.16)</td>
<td>3.42(0.17)</td>
</tr>
<tr>
<td>GDPPC³</td>
<td>-0.80(-0.62)</td>
<td>-0.31(-0.26)</td>
<td>-0.31(-0.28)</td>
</tr>
<tr>
<td>Hausman Test</td>
<td>0.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed Red. Test</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.16</td>
<td>0.11</td>
<td>0.11</td>
</tr>
</tbody>
</table>

*Figures in parentheses denote t-statistics*
Table 6. Augmented Parsimonious Quadratic FE, RE and OLS estimates for ECOWAS countries
(SO\textsubscript{2} as dependent variable)

<table>
<thead>
<tr>
<th></th>
<th>FE</th>
<th>RE</th>
<th>OLS</th>
<th>FE</th>
<th>RE</th>
<th>OLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-45.39(-3.04)</td>
<td>-35.79(-2.47)</td>
<td>-35.79(-2.17)**</td>
<td>-12.79(-0.74)</td>
<td>-8.05(-2.93)**</td>
<td>-6.82(-3.41)**</td>
</tr>
<tr>
<td>GDPPC</td>
<td>5.77(2.17)**</td>
<td>5.90(2.23)**</td>
<td>5.90(2.08)**</td>
<td>3.59(1.61)**</td>
<td>11.49(2.13)**</td>
<td>11.49(1.75)**</td>
</tr>
<tr>
<td>GDPPC\textsuperscript{2}</td>
<td>-0.01(-3.24)**</td>
<td>-0.19(-3.48)**</td>
<td>-0.19(-3.42)</td>
<td>-0.58(-1.64)***</td>
<td>-0.74(-1.68)***</td>
<td>-0.74(-1.93)***</td>
</tr>
<tr>
<td>DEM</td>
<td>0.06(1.67)</td>
<td>0.02(1.51)</td>
<td>0.02(1.33)</td>
<td>-0.59(-2.29)**</td>
<td>0.12(1.67)***</td>
<td></td>
</tr>
<tr>
<td>PG</td>
<td>-0.51(-4.37)**</td>
<td>-0.59(-5.47)**</td>
<td>-0.59(-4.81)**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POD</td>
<td>4.25(21.53)**</td>
<td>2.96(19.79)**</td>
<td>2.96(17.40)**</td>
<td>4.22(20.35)*</td>
<td>2.13(16.56)*</td>
<td>2.31(13.62)*</td>
</tr>
<tr>
<td>OPN</td>
<td>0.51(4.88)**</td>
<td>0.21(2.09)**</td>
<td>0.21(1.84)**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDPPC*DEM</td>
<td></td>
<td></td>
<td></td>
<td>0.11(2.49)**</td>
<td>-0.03(-1.62)***</td>
<td>-0.03(-1.66)***</td>
</tr>
<tr>
<td>Hausman Test</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed Red Test</td>
<td>0</td>
<td></td>
<td></td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R\textsuperscript{2}</td>
<td>0.74</td>
<td>0.6</td>
<td>0.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE</td>
<td>0.97</td>
<td>1.11</td>
<td>1.11</td>
<td>0.64</td>
<td>0.48</td>
<td>0.64</td>
</tr>
<tr>
<td>F-stat</td>
<td>12.55**</td>
<td>58.45*</td>
<td>58.45*</td>
<td>11.13**</td>
<td>51.73*</td>
<td>51.73*</td>
</tr>
</tbody>
</table>

*, ** and *** Indicate significance at 1%, 5% and 10% respectively. Figures in parentheses denote t-statistics

Table 7. Quadratic FE, RE and OLS estimates for ECOWAS countries (CO\textsubscript{2} as dependent variable)

<table>
<thead>
<tr>
<th></th>
<th>FE</th>
<th>RE</th>
<th>OLS</th>
<th>FE</th>
<th>RE</th>
<th>OLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.05(-0.87)</td>
<td>-0.07(-1.22)</td>
<td>-0.07(-1.22)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDPPC</td>
<td>0.001(4.34)**</td>
<td>0.001(4.78)**</td>
<td>0.001(4.78)**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDPPC\textsuperscript{2}</td>
<td>-6.74E-07**(3.68)</td>
<td>-7.63E-07**(3.74)</td>
<td>-7.63E-07**(3.63)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hausman Test</td>
<td>0.11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed Red Test</td>
<td>0.38</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R\textsuperscript{2}</td>
<td>0.23</td>
<td>0.15</td>
<td>0.15</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Indicates significance at 5%. Figures in parentheses denote t-statistics
Table (8). Cubic FE, RE and OLS estimates for ECOWAS countries (CO₂ as dependent variable)

<table>
<thead>
<tr>
<th></th>
<th>FE</th>
<th>RE</th>
<th>OLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.47(-3.91)</td>
<td>0.50(-4.26)</td>
<td>-0.50(-4.26)**</td>
</tr>
<tr>
<td>GDPPC</td>
<td>0.004(5.11)**</td>
<td>0.005(5.45)**</td>
<td>0.005(5.45)**</td>
</tr>
<tr>
<td>GDPPC²</td>
<td>-7.66E-06**(3.88)</td>
<td>-7.97E-06**(4.02)</td>
<td>-7.97E-06**(4.14)</td>
</tr>
<tr>
<td>GDPPC³</td>
<td>4.29E-09**(4.05)</td>
<td>4.40E-09**(4.28)</td>
<td>4.40E-09**(4.26)</td>
</tr>
<tr>
<td>Hausman Test</td>
<td>0.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed Redundant Test</td>
<td>0.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.26</td>
<td>0.18</td>
<td>0.18</td>
</tr>
<tr>
<td>Turning Point</td>
<td>$4.0475E^{-114}$</td>
<td></td>
<td></td>
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<tr>
<td>Observations</td>
<td>540</td>
<td>540</td>
<td>540</td>
</tr>
</tbody>
</table>

**Indicates significance at 5%. Figures in parentheses denote t-statistics.

Table (9): Augmented Quadratic FE, RE and OLS estimates for ECOWAS countries (CO₂ as dependent variable)

<table>
<thead>
<tr>
<th></th>
<th>FE</th>
<th>RE</th>
<th>OLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.15(-1.95)</td>
<td>-0.11(-1.60)</td>
<td>-0.36(-3.34)**</td>
</tr>
<tr>
<td>GDPPC</td>
<td>0.001(2.79)**</td>
<td>0.001(2.31)**</td>
<td>0.001(4.57)*</td>
</tr>
<tr>
<td>GDPPC²</td>
<td>-3.05E-07(-0.99)</td>
<td>-2.24E-07(-0.74)</td>
<td>-8.94E-07(2.08)**</td>
</tr>
<tr>
<td>DEM</td>
<td>0.003(1.10)</td>
<td>0.002(0.80)</td>
<td>0.03(5.23)*</td>
</tr>
<tr>
<td>DUMCC</td>
<td>0.25(2.66)**</td>
<td>0.02(0.74)</td>
<td>0.02(0.74)</td>
</tr>
<tr>
<td>OPN</td>
<td>-0.004(-3.93)**</td>
<td>-0.003(-3.23)**</td>
<td>-0.003(-3.23)**</td>
</tr>
<tr>
<td>POD</td>
<td>-0.003(5.64)**</td>
<td>0.002(5.86)**</td>
<td>0.002(6.20)*</td>
</tr>
<tr>
<td>PG</td>
<td>0.044(2.36)**</td>
<td>0.06(3.55)**</td>
<td>0.06(3.55)**</td>
</tr>
<tr>
<td>GDPPC*DEM</td>
<td>-7.73(-5.64)*</td>
<td>-6.03E-05(-4.88)*</td>
<td>-6.03(-4.86)*</td>
</tr>
<tr>
<td>Hausman Test</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed Red. Test</td>
<td>0.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.23</td>
<td>0.26</td>
<td>0.25</td>
</tr>
<tr>
<td>F-stat</td>
<td>3.9***</td>
<td>22.31**</td>
<td>22.31**</td>
</tr>
</tbody>
</table>

*, ** and *** Indicate significance at 1%, 5% and 10% respectively. Figures in parentheses denote t-statistics.
## Appendix 1

### Table A1: Selected Studies on the Environmental Kuznets Curve

<table>
<thead>
<tr>
<th>Authors</th>
<th>Time Period</th>
<th>Countries/Cities</th>
<th>Estimation Methods</th>
<th>Other Variables used</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>+Selden and Song (1994)</td>
<td>1973-1975, 1979-1981, 1982-1984</td>
<td>30 countries (22 high-income, 6 middle-income and 2 low-income countries),</td>
<td>Panel data estimators (pooling, fixed and random effect)</td>
<td>Population density and period fixed effect</td>
<td>Inverted U. curve OLS: no results FE:$8916-8709 ; RE:$10500 (1985 USD). Although find EKC, the authors believe the total emission will not decrease in very long term, as most of the population are living in the relatively poor countries</td>
</tr>
<tr>
<td>+Carson et al. (1997)</td>
<td>1990</td>
<td>US</td>
<td>OLS for cross-country data</td>
<td>Population density, percentage of urban population</td>
<td>Monotonically decreasing relationship. It is more interesting to see percentage change instead</td>
</tr>
<tr>
<td>Reference</td>
<td>Time Period</td>
<td>Countries/Regions</td>
<td>Methodology</td>
<td>EKC Characteristics</td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
<td>------------------</td>
<td>-------------</td>
<td>---------------------</td>
<td></td>
</tr>
<tr>
<td>De Bruyn et al. (1998)</td>
<td>1960-1993</td>
<td>4 countries, Netherlands, UK, USA and Western Germany</td>
<td>OLS</td>
<td>Composition changes, energy price, economic growth path, EKC does not generally fit for all countries, each country has its own technological, structural, energy price and economic growth path, so specific emission situation</td>
<td></td>
</tr>
<tr>
<td>Perman and Stern (1999)</td>
<td>1960-1990</td>
<td>74 countries (25 developed and 49 developing countries)</td>
<td>Unit Roots and cointegration</td>
<td>Each country has its EKC curve, monotonically increasing</td>
<td></td>
</tr>
<tr>
<td>Dinda et al. (2000)</td>
<td>1979-1982, 1983-1986 and 1987-1990</td>
<td>39 cities in 33 countries. 6 low-income, 11 middle-income and 16 high-income countries</td>
<td>OLS and least absolute error method</td>
<td>Sectoral composition (capital abundance, K/L), growth rate and time effect, distinguishing site characters (commercial, residential, etc.)</td>
<td></td>
</tr>
<tr>
<td>Bartosczuk et al. (2002)</td>
<td>1960-1996</td>
<td>Developed European countries</td>
<td>Agent based model</td>
<td>Per capita CO2 emissions, GDP per capita</td>
<td>Hesitant agreement with EKC. Turning points vary</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$101166</td>
</tr>
<tr>
<td>Study</td>
<td>Time Period</td>
<td>Sample Size</td>
<td>Methodology</td>
<td>Determinants of Emission</td>
<td>EKC Shape and Turning Point</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------</td>
<td>-------------</td>
<td>------------------------------------------------------------------------------</td>
<td>--------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Focacci (2005)</td>
<td>1975-1997, except India 1970-1997</td>
<td>Brazil, India, China</td>
<td>Macroeconomic indicators, CO2 emissions levels, per capita GDP, energy intensity</td>
<td>EKC doesn't hold true for developing countries</td>
<td></td>
</tr>
<tr>
<td>Vehmas et al. (2007)</td>
<td>1980-2000</td>
<td>EU countries</td>
<td>Linking analysis, Domestic extraction (DE), Direct Material Input (DMI), Domestic Material Consumption (DMC), Physical Trade Balance (PTB)</td>
<td>Some support for the existence of the EKC.</td>
<td></td>
</tr>
<tr>
<td>Song et al. (2008)</td>
<td>1985-2005</td>
<td>China (29 Provinces)</td>
<td>Dynamic OLS and within OLS, GDP per capita, waste gas emissions per capita, solid wastes generated per capita, waste water</td>
<td>Inverse U-shape between per capita pollution and per capita GDP for waste gas emissions (turning point: 29017 yuan)</td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Period</td>
<td>Country/Countries</td>
<td>Methodology</td>
<td>Emission Source</td>
<td>Turning Point Details</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>----------------</td>
<td>--------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>+++Kunnas and Myllyntaus (2010)</td>
<td>1950-2001</td>
<td>Finland</td>
<td>Generalised least squares (GLS)</td>
<td>per capita GDP, SO2 emissions per capita</td>
<td>Inverted U-shape curve, with a turning point of $13000, at 37kg.</td>
</tr>
</tbody>
</table>
| ++Borhan and  
| Ahmed (2012) | 1996-2006 | Malaysia | Two stage least squares (2SLS) | Biochemical Oxygen demand (BOD), Cadmium (CD), Arsenic (AS) | The EKC relationship is found to exist for BOD and GDP per capita. |
| ++Kohler (2013) | 1960-2009 | South Africa | ARDL, Granger causality tests, Impulse response (IR) | commercial energy use per capita, foreign trade | Long-run: energy consumption, income, foreign trade, squared income all CO2. IRV: income has no effect on CO2. |
| ++Shahbaz et  
| al. (2013) | 1980-2010 | Romania | ARDL bounds | Energy emissions per capita, energy consumption per capita | Confirms EKC in both long-run and short-run. |

Abstracted from:


++ Inglesi-Lotz, R. and J. Bohlmann (2014). Environmental Kuznets curve in South Africa: To confirm or
DOES MONEY SUPPLY GROWTH CAUSE INFLATION IN THE WEST AFRICAN MONETARY ZONE?

Hassan O. Ozekhome

Abstract

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.

Keywords: Money supply growth, Inflation, Macroeconomic convergence, WAMZ, Panel data

JEL Classification: E51, E52, C13
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 Saborowoski, 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

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The Gambia</td>
<td>27.5</td>
<td>16.5</td>
<td>17.3</td>
<td>20.4</td>
</tr>
<tr>
<td>Ghana</td>
<td>29.9</td>
<td>37.6</td>
<td>32.5</td>
<td>33.3</td>
</tr>
<tr>
<td>Guinea</td>
<td>30.5</td>
<td>34.1</td>
<td>30.5</td>
<td>31.7</td>
</tr>
<tr>
<td>Nigeria</td>
<td>23.5</td>
<td>44.2</td>
<td>32.8</td>
<td>33.6</td>
</tr>
<tr>
<td>Sierra-Leone</td>
<td>25.7</td>
<td>21.2</td>
<td>19.8</td>
<td>22.2</td>
</tr>
<tr>
<td>Zonal Ave</td>
<td>27.4</td>
<td>30.7</td>
<td>26.6</td>
<td></td>
</tr>
</tbody>
</table>

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 sanding 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

<table>
<thead>
<tr>
<th></th>
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</tr>
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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 percent. 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 yields 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, etal., 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 feedback 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 Ghanian 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 objectives 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 macroeconomic 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 shown 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

\[ P = f (MSG, GRGDP) \]

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:

\[ P = f (FD, EXR, OILP, GRGDP) \]

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:

\[ P = f (MSG, FD, EXR, OILP, GRGDP) \]

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:

\[ P = f (MSG, FD, EXR, INT, OILP, GRGDP) \]

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:

\[ CPI_{it} = \alpha_0 + \alpha_1 CPI_{i,t-1} + \alpha_2 MSG_{i,t} + \alpha_3 FD_{i,t} + \alpha_4 EXR_{i,t} + \alpha_5 INT_{i,t} + \alpha_6 OILP_{i,t} + \alpha_7 GRGDP_{i,t} + \epsilon_{it} \]  

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 \(\varepsilon\) 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 R² and F-value) are used to choose between the Pooled OLS and fixed effect model.

The specification for the pooled-OLS is:

\[ y_{it} = \alpha_{it} + \beta_t x_{it} + \epsilon_{it} \]  

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

The fixed effect estimator allows \( \alpha_{it} \) 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.

\[ y_t - \bar{y}_t = \beta(x_t - \bar{x}_t) + (e_t - \bar{e}_t) \]  

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:

\[ Y_{it} = f(X_{it}, \beta_i) + \delta_i + \gamma_t + \epsilon_{it} \]  

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

\[ Y_{it} = X_{it}' \beta \delta_i + \gamma_t + \epsilon_{it} \]  

Where \( Y_{it} \) is the dependent variable, \( i = \) entity, \( t = \) time; \( X_{it} \) is a -vector of regressors; \( \beta \) is the coefficient vector of the explanatory variables; and \( \epsilon_{it} \) are the error terms for \( i = 1, 2, \ldots, M \) cross-sectional units observed for dated periods \( j = 1, 2, \ldots, T \). 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 counties 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

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

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 multicollinearity is not a considered problem in the model to be estimated.

Table 4: Correlation Matrix

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

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

<table>
<thead>
<tr>
<th>Test</th>
<th>INF</th>
<th>MSG</th>
<th>FD</th>
<th>EXR</th>
<th>INT</th>
<th>GRGDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fisher-PP</td>
<td>28.420**</td>
<td>44.105**</td>
<td>22.203*</td>
<td>38.711*</td>
<td>40.272**</td>
<td>60.043***</td>
</tr>
<tr>
<td>Fisher-ADF</td>
<td>42.18**</td>
<td>55.152***</td>
<td>40.104**</td>
<td>54.086***</td>
<td>50.240**</td>
<td>47.281**</td>
</tr>
</tbody>
</table>

*** 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 it 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 is based on the fixed effect, which is interpreted and relied on for policy perspectives.
Table 6: Inflation and its Explanatory Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pooled OLS</th>
<th>Panel Fixed Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.031</td>
<td>0.244</td>
</tr>
<tr>
<td></td>
<td>0.894</td>
<td>1.470</td>
</tr>
<tr>
<td>CPI(-1)</td>
<td>0.043</td>
<td>0.177*</td>
</tr>
<tr>
<td></td>
<td>(1.764)</td>
<td>(1.802)</td>
</tr>
<tr>
<td>MSG</td>
<td>0.296*</td>
<td>0.293**</td>
</tr>
<tr>
<td></td>
<td>(1.944)</td>
<td>(2.081)</td>
</tr>
<tr>
<td>FD</td>
<td>0.117</td>
<td>0.251</td>
</tr>
<tr>
<td></td>
<td>(0.831)</td>
<td>(2.311)**</td>
</tr>
<tr>
<td>EXR</td>
<td>0.252**</td>
<td>0.212**</td>
</tr>
<tr>
<td></td>
<td>(2.184)</td>
<td>(2.274)</td>
</tr>
<tr>
<td>INT</td>
<td>-0.021*</td>
<td>0.094</td>
</tr>
<tr>
<td></td>
<td>(-0.932)</td>
<td>(1.501)</td>
</tr>
<tr>
<td>OILP</td>
<td>0.140</td>
<td>0.115*</td>
</tr>
<tr>
<td></td>
<td>(1.572)</td>
<td>(1.871)</td>
</tr>
<tr>
<td>GRGDP</td>
<td>-0.471**</td>
<td>-0.412***</td>
</tr>
<tr>
<td></td>
<td>(2.262)</td>
<td>(2.912)</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.21</td>
<td>0.72</td>
</tr>
<tr>
<td>Durbin-Watson</td>
<td>1.38</td>
<td>1.70</td>
</tr>
<tr>
<td>F-statistics</td>
<td>7.25**</td>
<td>24.30***</td>
</tr>
<tr>
<td>Hausman Test</td>
<td></td>
<td>10.32 (0.03)</td>
</tr>
<tr>
<td>Mean VIF</td>
<td>1.82</td>
<td></td>
</tr>
<tr>
<td>Breusch-Pagan LM Test</td>
<td>4.09 (0.06)</td>
<td></td>
</tr>
</tbody>
</table>

*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 $R^2$ 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-shorts 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 significant 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 a priori 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 Chi² = 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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RÔLE DES INSTITUTIONS DANS LES FLUX D'IDE ENTRANTS EN GUINÉE

BAGAGA Mamoudou¹

Résumé

Au lendemain de la transition démocratique, les autorités guinéennes ont misé davantage sur les flux entrants d’investissements directs étrangers (IDE) en tant que source alternative de financement de l’économie. Or, les résultats escomptés restent nettement inférieurs au potentiel du pays au regard de sa richesse en ressources naturelles. Selon plusieurs analystes, ces flux iraient dans des économies structurées dotées d’institutions politiques fortes et crédibles qui permettraient de réduire le risque de perte d’investissements en faveur des investisseurs. Ainsi, l’objectif de cette contribution est d’analyser l’influence des institutions, mesurée par la démocratie, la corruption, la stabilité du gouvernement et l’influence de l’armée dans l’administration, sur l’attractivité des flux entrant d’IDE en Guinée. Une approche par le modèle à correction d’erreur de type ARDL, découlant d’une tentative de modélisation théorique, nous a permis de confirmer le rôle catalyseur des institutions de qualité sur les flux d’IDE à long terme, en plus d’autres variables pertinentes telles que l’investissement domestique privé, le risque de change, l’existence des ressources naturelles et la dette extérieure. C’est pourquoi, toute recommandation concernant les politiques d’attraction des IDE en Guinée devrait nécessairement prendre en compte le rôle important des facteurs institutionnels.

Abstract

The Guinean authorities, in the aftermath of the democratic transition, have placed more emphasis on foreign direct investment (FDI) inflows as an alternative source of financing the economy. However, the expected results remain well below the country's potential, given its natural resources endowment. According to several analysts, these inflows would generally go into well-structured economies with strong and credible political institutions, to reduce the risk of investors losing their investment. Thus, the objective of this study is to analyze the effect of the institutions, measured by democracy, corruption, the stability of the government and the influence of the army in the administration on FDI inflows attraction into Guinea. Employing an ARDL error-correction model approach, we confirm the catalyst role of good institutions on long-term FDI inflows, as well as other relevant variables such as private domestic investment, exchange rate risk, the existence of natural resources and external debt. Therefore, we recommend that any measure or policy regarding FDI attraction in Guinea, should take into account the significant role of institutional factors.

Mots clés : Investissement Direct Etranger, Institutions, ARDL.
Classification JEL : E02, E22, F21

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INTRODUCTION

En dépit des potentialités énormes qu’elle regorge, la Guinée est longtemps restée sur un sentier de croissance économique faible autour d’une moyenne annuelle de 2% sur la période 1999-2014, comparé à un niveau de 5% pour l’Afrique Subsaharienne sur la même période. Sa faible attractivité durant les 30 dernières années y jouerait un rôle, réduisant ainsi drastiquement ses sources de financement extérieur nécessaires à tout processus de développement. Or, les investissements directs étrangers (IDE), étant la composante la plus stable des leviers de financement (FMI, 2009), a été nettement en dessous de son niveau potentiel en Guinée. Ils sont estimés en moyenne à 365 millions de dollars EU sur la période 2011-2015, tandis que la moyenne de l’Afrique était de 1 236 millions de dollars EU et celle de la CEDEAO de 907 millions EU, quoi que l’année 2016 ait totalement changé la donne avec des flux de plus de 1 668 millions de dollars EU. En plus d’augmenter le stock d’investissement domestique, ils permettraient des effets d’entraînement sur les producteurs locaux à travers une concurrence accrue, des transferts de technologie et une incitation aux exportations (Chen & al, 2004). D’où la question de savoir, quelles sont les motivations des investisseurs étrangers ?


Depuis les années 2000, nous assistons à un regain d’intérêt du rôle des institutions dans les phénomènes économiques, avec notamment les travaux d’Acemoglu et al. (2002, 2012). Les institutions sont devenues un outil indispensable de tout acteur économique, particulièrement des investisseurs privés. D’après North (1990), « les institutions sont appréhendées comme des règles du jeu qui encadrent les actions des individus […] ». Des lors que les règles du jeu sont bien définies et respectées par tous, les couts de transaction s’en trouveront amoindris. Or pour ce qui est de la Guinée, de plus en plus d’observateurs s’appesantissent sur la forte corruption, les défaillances du système judiciaire, en plus de la faiblesse des infrastructures pour justifier la très faible attraction du pays, en dépit de multiples incitations dans le code minier (OMC, 2011). Il devient nécessaire de se demander quelle est alors la place qu’occupe le cadre institutionnel dans l’explication de cette faible attractivité de la Guinée, en matière d’IDE ?

Selon la théorie de la « capacité institutionnelle » de Wilhelms & Witter (1998), les institutions politique, juridique et législative sont à même de produire des règles capables d’attirer les IDE. Elles permettent

2 Les IDE sont motivés par la volonté d’acquérir un intérêt durable dans une entreprise qui est résidente ailleurs. La notion d’intérêt durable implique l’existence d’une relation de long terme (i.e. la possession directe ou indirecte d’au moins 10 % des droits de vote de l’entreprise) entre l’investisseur et l’entreprise dans laquelle on investit, et l’exercice d’une influence significative sur la gestion de cette dernière (OCDE, 2008).

3 La démocratie, le respect de la loi, l’absence de la corruption, etc. ne sont qu’une manifestation d’un bon cadre institutionnel.
également de stimuler les autres déterminants des IDE tels que les variables socio-culturelles, le capital humain et les marchés financiers. Des institutions de qualité matérialisées par l’instauration du respect des droits de propriété et la réduction considérable de l’asymétrie d’information entre les investisseurs potentiels et les niches à exploiter, entraînent une ruée des investisseurs vers les opportunités de marché. Ceci en raison du faible risque d’expropriation, de la crédibilité des engagements des gouvernements, du faible niveau de la corruption et de la rareté des violences politiques. Ce dernier assure une allocation efficace des ressources notamment des flux d’IDE.


**Profile des IDE en Guinée**

**Déficit des IDE dans un cadre institutionnel faible**

Au lendemain de la crise financière qui a vu une contraction drastique des flux mondiaux des IDE, on note une reprise des activités des multinationales dans le monde. Bien que jugée moins attractive par rapport aux autres régions du monde, l’Afrique a vu ses IDE augmenter au fil des années depuis 2008 passant la barre des 50 milliards de dollars EU du fait particulièrement des investissements internationaux et régionaux visant à tirer parti des nouveaux débouchés ou à investir dans les infrastructures. Toutefois, la répartition de ces flux reste très hétérogène et fortement tributaire des ressources naturelles. L’espace SADC occupe la première place avec 30% des flux d’IDE du continent, devant la CEDEAO qui accueille 22,8%4. Cette dernière maintient sa position grâce au Nigéria et au Ghana, favorisé notamment par leur exploitation de pétrole et au dynamisme de leurs économies. La Guinée par contre a été moins présente dans cette attractivité des IDE. Sur la période 2013-2015, elle s’était classée à la troisième position des pays les moins attractifs de la zone CEDEAO derrière la Gambie et la Guinée-Bissau.

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4 SADC : Communauté de développement d’Afrique australe  
CEDEAO : Communauté Économique des États de l’Afrique de l’Ouest
La baisse drastique des flux d'IDE en direction de la Guinée est allée de pair avec l'avènement de l'épidémie de la maladie à virus Ebola (MVE) qui aurait accentuée sa non-attractivité, en plus de la baisse des cours des matières premières. En effet, sur la période 2013-2015, la moyenne annuelle des IDE enregistrés n’a été que de 86 millions de dollars EU, largement en dessous de la moyenne de l’Union qui était de 768 millions de dollars EU sur la même période, bien qu’il y ait une très nette augmentation en 2016 (1 669 millions de dollars EU). Pourtant, la hausse de ces flux a été historique en 2011 avec un pic de 956 millions de dollars EU jamais atteint auparavant, avant de descendre à 606 millions de dollars EU en 2012. Cette situation résulterait probablement de la confiance retrouvée auprès des investisseurs suite à la tenue des élections présidentielles de 2010 et aux mesures incitatives amorcées par le régime en place. D’ailleurs, ce manque de confiance durant la période de la transition démocratique justifierait la forte contraction des flux d’IDE. Ils sont passés de 141 millions de dollars EU en 2009 à 101 millions de dollars EU en 2010, contre 386 millions de dollars EU et 382 millions de dollars EU, respectivement en 2007 et 2008.

Par ailleurs, les évolutions des indicateurs de la qualité des institutions de la Guinée ne sont pas réconfortantes. De ce fait, l'indicateur composite de risque institutionnel a toujours été dans la zone "très haut risque", soit un score inférieur à 50/100 à l'exception de la période 1998-2004 ; pendant que la plupart des destinations privilégiées des IDE en Afrique (Ghana, Botswana, etc.) et dans le monde (Chili, Malaisie, Chine, etc.) présentent des indicateurs favorables (plus de 65/100). A un niveau plus désagrégé, nous remarquons que la corruption s’est accentuée continuellement depuis le début des années 1990. De même, l’indice de Perception de la Corruption de « Transparency International » classait la Guinée 139ème sur 167 en 2015. Après une forte instabilité des gouvernements durant la période 1986-1994, la courbe s’est considérablement inversée jusqu’en 2000 avant de baisser tendanciellement. Cependant, les autres indices comme la démocratie, l'influence des militaires dans les gouvernements et le respect de la loi et de l’ordre ont fluctué autour de moyennes constantes.

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5 L’Union fait référence à la CEDEAO.
6 Données ICRG.
**Des IDE orientés vers le secteur minier**


**Tableau 1 : Répartition des flux d’IDE entrants en Guinée (en millions dollars EU)**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Secteur minier</strong></td>
<td>205.17</td>
<td>337.57</td>
<td>1654.94</td>
</tr>
<tr>
<td><strong>Autres secteurs</strong></td>
<td>2.85</td>
<td>26.82</td>
<td>13.90</td>
</tr>
<tr>
<td>dont</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Télécommunications</td>
<td>1.12</td>
<td>0.19</td>
<td>0.00</td>
</tr>
<tr>
<td>Banques</td>
<td>1.73</td>
<td>5.98</td>
<td>4.98</td>
</tr>
<tr>
<td>Assurances</td>
<td>0.00</td>
<td>0.01</td>
<td>6.85</td>
</tr>
<tr>
<td>Industries</td>
<td>0.00</td>
<td>20.63</td>
<td>2.07</td>
</tr>
<tr>
<td><strong>TOTAL DES FLUX D’IDE</strong></td>
<td>208.02</td>
<td>364.39</td>
<td>1668.84</td>
</tr>
</tbody>
</table>

**Source : BCRG**
Toutefois, ces progressions quasi régulières des volumes des IDE cachent des disparités profondes en ce qui concerne leur ventilation dans les différents secteurs de l’économie guinéenne avec une surreprésentation du secteur minier (environ 95% des flux d’IDE). Cette situation découle du fait que la Guinée a un fort potentiel minier qui pourrait faire d’elle un Hub de l’industrie extractive en Afrique. Les investissements étrangers dans les mines sont passés d’une moyenne annuelle de 205 millions de dollars EU sur la période de 2008 à 2010 à une moyenne de 338 millions dollars EU entre 2011 et 2015. Ceci est l’œuvre de grands groupes miniers présents en Guinée avec des poids relativement différents. La compagnie Rio Tinto a occupé la première place des investissements ces dernières années avec des parts de plus en plus importantes (de 48 à 62%). D’ailleurs, elle projetait à moyen et long terme la réalisation d’un gigantesque projet d’exploitation du Mont Simandou avec son partenaire Chinacol (China Aluminum Corporation), soit le plus grand projet d’investissement Greenfield jamais réalisé en Afrique. Le coût des infrastructures était estimé à près de 20 milliards de dollars EU, soit le triple du PIB annuel de la Guinée.

Les activités d’investissement des autres multinationales ont varié suivant les sous-périodes considérées. En effet, sur la période 2008-2010, les compagnies SEMAFO (Société d’ Exploration Minière en Afrique de l’Ouest), SAG (Société Anglo Gold Ashanti) et SMD (Société Minière de Dinguiraye) se sont activées respectivement à hauteur de 15%, 13% et 9% en moyenne annuelle. Entre 2011 et 2015, c’est plutôt les entreprises multinationales SMFG (Société des Mine de Fer de Guinée) et SEMAFO qui se sont illustrées avec des parts respectives de 18% et 6%. En plus de celles-là, d’autres compagnies minières longtemps présentes sur le territoire guinéen continuent de faire des investissements quoique de moindre envergure par rapport aux nouvelles. C’est le cas de la CBG (Compagnie des Bauxites de Guinée), de la SMD et de Bellzone Mining entre autres. Toutefois, la CBG a fait exception en 2016 avec des investissements massifs de près de 63 millions de dollars EU pour son programme d’expansion. Au cours de la même année, l’on a assisté à un grand boom suite à l’entrée de la compagnie minière sud-africaine Alliance Mining Corporation dans le marché guinéen avec un montant de 1 413 millions de dollars EU représentant 85% des flux totaux d’IDE enregistrés en 2016.

Graphique 3 : Répartition des flux d’IDE dans le secteur minier

Source : BCRG

7 Ce projet est en veille pour plusieurs raisons, dont la baisse du prix du fer sur le marché mondial et le contentieux avec l’État guinéen.
**Institutions et attractivité des IDE : Approches empiriques**

Le rôle de la théorie des institutions dans l’explication des phénomènes économiques continue de s’imposer dans les publications actuelles. La diversité des approches en matière d’institution favorise une prolifération des manières de rendre compte des fondements institutionnels des évolutions des IDE. Plusieurs indicateurs de la qualité des institutions sont utilisés dont l’état de droit, la qualité de la bureaucratie et la stabilité du gouvernement. Toutes ces études ont tendance à différer en termes d’approches et de zones géographiques considérées.

Bénassy-Quéré & al. (2005) montrent que l’efficience publique (incluant le système de taxation, la facilité de créer une entreprise, l’absence de corruption, la transparence, le droit des contrats, la sécurité des droits de propriété, l’efficience de la justice, les normes prudentielles et la concurrence des marchés) est un déterminant clé des IDE entrants. Ces auteurs ont utilisé un modèle de gravité bilatéral composé de 52 pays développés et pays en développement pour l’année 2001 par la méthode des Doubles Moindres Carrées Ordinaires (DMCO) pour corriger les problèmes de multicollinéarité et d’endogénéité. Cette étude reste toutefois limitée en raison de la non-prise en compte des différentiels de développement qui risquent de biaiser les résultats en faveur des pays riches.

C’est pourquoi, dans une étude réalisée en 2002, Dunning fait une distinction entre Pays développés et pays en développement. Il conclut que dans les pays industrialisés, les facteurs tels que les politiques gouvernementales, la bonne gouvernance et les infrastructures adaptées sont devenues plus importantes dans le choix des investisseurs étrangers. Cependant, les IDE vers des pays en développement exigent encore des déterminants économiques traditionnels tels que la taille du marché, le niveau de revenu, le volume de la main d’œuvre qualifiée, la stabilité macroéconomique, etc. Par contre, dans les pays de l’Europe centrale et de l’est (CEE), Tintin (2013) trouve qu’il n’existe pas de preuve empirique que les institutions (liberté économique, l’état de fragilité, les droits politiques et les libertés civiles) attirent les IDE sur une période de 1996 à 2009. Une analyse plus fine (désagrégation des IDE en secteurs primaire, manufacturier et tertiaire) permet de voir que seuls les IDE dans le secteur manufacturier sont conditionnés par une bonne qualité institutionnelle.


En Afrique, la majorité des études s’accordent sur un effet positif entre la qualité des institutions et les IDE. En effet, Fiodendji (2006) sur un échantillon de 40 pays d’Afrique subsaharienne couvrant la période 1980 à 2002 montre que la qualité des institutions mesurée par l’efficacité gouvernementale, le niveau de la corruption, le rôle de la loi et de la démocratie est apparue positive et statistiquement significative. L’on en déduit donc qu’une bonne qualité institutionnelle peut exercer un effet d’attraction.
sur les mouvements des flux de capitaux. Il conclut en préconisant qu'un pays qui souhaite attirer les IDE doit améliorer son efficacité dans la gestion de ses affaires qui se traduit non seulement par l'habileté du gouvernement à formuler et à mettre en place des politiques favorables aux IDE, mais aussi à développer la compétence des administrateurs civils, la qualité des services publics et surtout à améliorer la crédibilité du gouvernement vis-à-vis de son engagement dans ses politiques.

Asiedu (2003) partant des données de panel pour 22 pays d'Afrique subsaharienne sur la période 1984-2000 conclut que la stabilité macroéconomique, l'efficacité des institutions, la stabilité politique, le faible degré de corruption et un bon cadre réglementaire ont un impact positif sur l'IDE. Plus important encore, un tel résultat ne saurait corroborer que l'Afrique pourrait simplement attirer davantage les IDE en favorisant le renforcement des institutions et en faisant des réformes institutionnelles importantes, même si elle n'est pas naturellement douée. Enfin, en plus de la corruption, l'absence de stabilité autant politique qu'économique constituent les plus grandes craintes des multinationales désirant investir en Afrique selon Sachs and Sievers (1998).

Méthodologie, Résultats et Discussions

Modèle théorique
La rareté des formalisations théoriques sur le rôle des institutions dans l'attractivité des IDE nous a amené à construire un modèle théorique à partir du modèle de Feng & Chen (1997). Initialement, ce modèle a été appliqué au cas des investisseurs privés domestiques. En raison de la proximité dans la décision d'investir de ces derniers avec les investisseurs étrangers, nous l'avons adapté au cas de notre étude.

On suppose qu'il existe deux groupes de pays (A et B). Le premier groupe se caractérise par de « bonnes institutions », pendant que le second dispose d'institutions défaillantes. L'idée est que le rendement des IDE dans un meilleur cadre institutionnel est supérieur à celui obtenu ailleurs. Par conséquent, les investisseurs étrangers préféreront y investir.

\[ r_B = r_A - \tau \] (1.1)

où \( r_A (r_B) \) est le rendement des IDE dans les pays ayant de bonnes (respectivement, mauvaises) institutions et \( \tau \) est la prime liée aux bonnes institutions. Cette dernière est positive lorsque les institutions sont de bonne qualité, et est nulle ailleurs. Sa distribution suit une loi de probabilité quelconque de moyenne \( \tau > 0 \) et de variance \( \sigma^2 \):

\[ \tau \sim \mathcal{L}(\tau, \sigma^2) \] (1.2)

Initialement, on suppose qu'il y a un total de \( N \) investisseurs étrangers dans les deux groupes de pays et chacun dispose d'une unité de capital. Ils peuvent prendre la décision de quitter un pays ou d'y rester en fonction du rendement attendu. Tout investisseur entrant ou sortant subit un coût \( \epsilon \) qui peut être lié à un désavantage informationnel du marché vis-à-vis de ses concurrents locaux, ou lié à une perte des investissements réalisés lorsque l'on décide de se retirer du marché. On suppose que cette variable suit une loi normale\(^8\) de moyenne \( \bar{\epsilon} \) et de variance \( \sigma^2 \):

\[ \bar{\epsilon} \sim \mathcal{N}(\bar{\epsilon}, \sigma^2) \]

---

\(^8\) En vertu des propriétés asymptotiques de la loi normale.
Les taux de change dans les deux groupes de pays sont $e_A$ et $e_B$. Dans un souci de simplification, on fera abstraction des régimes de change. Toutefois, la valeur des investissements dépend négativement des variations des taux de change dans chaque groupe de pays ($\sigma_{eA}$ et $\sigma_{eB}$).

La valeur d’un IDE dans un pays ayant un bon cadre institutionnel est de :

$$V_A = r + \tau - \varepsilon - \sigma_{eA}$$

Par contre, la valeur d’un IDE dans les pays dotés d’institutions faibles est de :

$$V_B = r - \lambda \varepsilon - \sigma_{eB}$$

où $\lambda \in [0,1]$ : est un coefficient qui permet de capter l’ampleur des incitations dans les pays ayant de mauvaises institutions. Ces pays font recours à ces techniques dans le but d’attirer les IDE, à défaut de se doter d’un cadre institutionnel adéquat. Ces incitations peuvent se faire sous la forme de réduction d’impôts, d’exemptions liées aux frais des importations de produits intermédiaires, d’octrois de terre et des installations sur les sites, etc. Une valeur proche de 0 indique la présence de fortes incitations ; et une valeur tendant vers 1 est le signe d’une quasi-absence des politiques d’incitations.

Ainsi, l’investisseur décidera de rester dans un environnement ayant une bonne performance institutionnelle si :

$$V_A > V_B$$

Après arrangement, on obtient on déduit la valeur critique du coût d’entrée/sortie de l’investisseur :

$$\varepsilon < \frac{\tau - (\sigma_{eA} - \sigma_{eB})}{1 - \lambda} \quad (1.7)$$

$$\varepsilon^c = \frac{\tau - (\sigma_{eA} - \sigma_{eB})}{1 - \lambda} \quad \text{avec} \quad \sigma_e = \sigma_{eA} - \sigma_{eB} \quad \text{...} \quad (1.8)$$

$$\frac{d\varepsilon^c}{d\tau} = \frac{1}{1 - \lambda} > 0, \quad \frac{d\varepsilon^c}{d\lambda} = \frac{\tau - \sigma_e}{(1 - \lambda)^2} > 0, \quad \frac{d\varepsilon^c}{d\sigma_e} = -\frac{1}{1 - \lambda} < 0 \text{ ...} \quad (1.9)$$

où $\varepsilon^c$ est la valeur critique du coût d’entrée/sortie de l’investisseur.

En partant de l’équation (1.7), le montant total des IDE restants dans un pays disposant de « bonnes institutions » est de :

$$i^*(\varepsilon) = N \int_{-\infty}^{\varepsilon^c} f(\varepsilon) \, d\varepsilon$$

$$i^*(\tau) = N \int_{-\infty}^{\varepsilon^c} \frac{1}{\sigma_e \sqrt{2\pi}} e^{-\frac{(\varepsilon - \tau)^2}{2\sigma_e^2}} \, d\varepsilon \quad \text{...} \quad (1.10)$$

À partir de (1.9), l’effet marginal de la qualité des institutions peut être calculé comme suit :
Il ressort de l’équation (1.9) que les institutions affectent positivement le volume des investissements directs étrangers dans une économie donnée. En effet, lorsque la qualité des institutions s’améliore dans le groupe A, le coût-seuil d’entrée/sortie se relève. Ce qui aura pour conséquence une augmentation des IDE dans ces pays. Par contre, comme le suggère l’équation (1.9), les efforts en matière d’incitations (baisse de λ) dans certains pays du groupe B réduisent ce coût-seuil. Il en résulte une migration du volume des investissements des firmes étrangères vers ces pays. De même, une fluctuation plus importante des taux de change dans les pays A (relativement aux pays B) y réduit les IDE.

Dans une optique de tester empiriquement l’équation (1.10), nous retiendrons une forme linéaire qui peut être obtenue par la méthode des développements limités au voisinage d’un point quelconque. Cette forme est largement utilisée dans les travaux empiriques (Busse & Hefeker, 2007) :

\[ i_t^* = a_i + b \tau_t + c'X_t + \epsilon_t \quad ...................... \quad ...................... \quad ...................... \quad ...................... \quad ...................... \quad (1.12) \]

Ou \( i_t^* \) représente les IDE, \( \tau \) les institutions et \( X \) la matrice des variables de contrôle et \( \epsilon \) le terme d’erreur.

### Données et modèle empirique

#### Source des données

Les données de cet article couvrent la période 1986-2015 et sont principalement issues de trois bases de données dont celles du CNUCED pour les flux d’IDE entrants, de Political Risk Services Group pour la qualité des institutions (indice global de risque politique, démocratie, stabilité du gouvernement, respect de la loi et de l’ordre, corruption et influence militaire dans la politique) et le risque de change, de la Banque Mondiale (WDI) pour l’investissement public, l’investissement privé, le proxy de la disponibilité des ressources naturelles et le stock de la dette extérieure. En dehors des variables institutionnelles qui sont mensuelles, toutes les autres variables sont annuelles. Compte tenu de la nécessité d’uniformiser les séries et la nature de ces variables mensuelles (indices), une moyenne arithmétique sur 12 mois a été appliquée sur l’ensemble des données institutionnelles. En dehors des variables institutionnelles, le reste des variables sont en pourcentage du PIB. Ainsi, après avoir log-linéarisé toutes les variables, nous chercherons à tester les équations des déterminants des flux d’IDE en Guinée, notamment le rôle de différentes mesures de la qualité des institutions. Le choix des variables de contrôle est basé exclusivement sur la littérature existante et les spécificités de la Guinée.

#### Modèle empirique : Estimations et tests statistiques

En raison de l’existence d’une relation de long terme entre les IDE et ses déterminants, nous avons envisagé comme cadre méthodologique de notre analyse un modèle de cointégration de type ARDL développé par Pesaran & Shin (1999) et Pesaran & al. (2001). Ce modèle possède principalement deux avantages sur les premières générations de modèle à correction d’erreur. Il reste valable en présence d’une mixité des ordres d’intégration I(0) et I(1), et d’un faible échantillon contrairement aux modèles...

\[ \Delta y_t = \alpha_0 + \alpha_1 x_{t-1} + \beta_1 y_{t-1} + \sum_{i=0}^{k} \alpha_{2i} \Delta x_{t-i} + \sum_{i=1}^{k} \beta_{2i} \Delta y_{t-i} + \varepsilon_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2.1) \]

En isolant la variable « institution », l’équation des déterminants des IDE aura la forme suivante :

\[ \Delta ide_t = \alpha + \beta. ide_{t-1} + \varphi. inst_{t-1} + \Theta'. X_{t-1} + \sum_{i=1}^{k} \theta_i \Delta ide_{t-i} + \sum_{i=0}^{k} \mu_i \Delta inst_{t-i} + \sum_{i=0}^{k} \Psi'_i \Delta X_{t-i} \]

\[ + \varepsilon_t \quad (2.2) \]

Où \( \beta \) représente le terme de correction des erreurs (EC) qui doit être négatif ; \( \mu_i \) et \( -\frac{\varphi}{\beta} \) sont respectivement les coefficients de court terme et de long terme de la qualité des institutions (l’indice global des institutions, la démocratie, la stabilité du gouvernement, le respect de la loi, la corruption, et l’intrusion des militaires dans la vie politique), \( \Psi'_i \) et \( -\frac{\Theta'}{\beta} \) sont respectivement les vecteurs des coefficients de court terme et de long terme des variables d’intérêt (Investissement public, investissement privé, exploitation des ressources naturelles et niveau d’endettement) ; \( \alpha \) est la constante, et \( \varepsilon \) est le terme d’erreur.

Afin de valider nos estimations par la méthode des Moindres Carrées Généralisées (MCG), nous avons exécuté les tests de stationnarité de Dickey Fuller Augmenté (DFA) et de Phillips-Perron (PP), de critères d’information d’Akaike et Schwarz, d’autocorrélation des erreurs de Breush-Godfrey, de spécification de Ramsey, et de cointégration ou « Bounds test de Pesaran & al. (2001) ». En effet, nous avons trouvé que toutes les variables présentent une racine unitaire en niveau et sont stationnaires en différence première au seuil de 1% quel que soit le test utilisé (DFA ou PP), à l’exception de l’investissement privé qui est stationnaire en niveau au seuil de 5%. 
Pour déterminer le nombre optimal de retards, nous avons estimé l’équation (2.2) par la méthode des MCO avec \( k = 1, 2, \ldots \). Toutes les régressions ont été faites sur les mêmes périodes et nous avons constaté que les termes de retard de la variable \( \Delta i_d e \) sont non significatifs. Pour éviter une prolifération des paramètres à estimer, nous avons réestimé les régressions sans ce terme de retard (Pesaran et al., 2001).

Le tableau 3 donne ainsi les critères d’information d’Akaike (AIC) et Schwarz dénommé Critère d’information bayésien (BIC). L’ordre de retard optimal ainsi obtenu pour toutes les régressions est \( k = 0 \), sauf pour la régression incluant la stabilité du gouvernement comme variable de qualité des institutions.

Les différents tests de Breusch-Godfrey, réalisés sur les six équations des IDE par la méthode des MCO, confirment l’existence d’autocorrélation des erreurs aux seuils de confiance de 1%, 5% et 10%. En effet, pour quatre des six équations (Institution, Démocratie, Corruption et Militaire), l’ordre de corrélation est de 6, tandis que les ordres sont de 4 et 8 pour respectivement les équations de Gouvernement et Loi.
De même, le test de spécification de Ramsey sur toutes les équations conclue au seuil de 10% l’absence de variables omises ou de problème de spécification.

**Tableau 5 : Test de spécification RESET de Ramsey**

<table>
<thead>
<tr>
<th>Institution</th>
<th>Démocratie</th>
<th>Gouvernement</th>
<th>Loi et ordre</th>
<th>Corruption</th>
<th>Militaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>0,24</td>
<td>0,44</td>
<td>2,55</td>
<td>1,91</td>
<td>4,53**</td>
<td>2,25</td>
</tr>
<tr>
<td>4,03**</td>
<td>3,41*</td>
<td>3,48</td>
<td>2,24</td>
<td>4,13**</td>
<td>2,83*</td>
</tr>
<tr>
<td>4,04**</td>
<td>2,28</td>
<td>3,48</td>
<td>1,64</td>
<td>2,78*</td>
<td>1,89</td>
</tr>
<tr>
<td>4,02**</td>
<td>2,85*</td>
<td>5,54*</td>
<td>2,55*</td>
<td>3,30*</td>
<td>2,82*</td>
</tr>
<tr>
<td>3,84**</td>
<td>3,14*</td>
<td>34,47</td>
<td>2,39</td>
<td>2,99*</td>
<td>2,93*</td>
</tr>
<tr>
<td>2,22*</td>
<td>2,63*</td>
<td>4,47</td>
<td>2,78*</td>
<td>2,63*</td>
<td>2,59*</td>
</tr>
<tr>
<td>2,87</td>
<td>2,63</td>
<td>3,86</td>
<td>2,71*</td>
<td>2,28</td>
<td>2,51</td>
</tr>
<tr>
<td>2,64</td>
<td>2,37</td>
<td>3,37</td>
<td>2,4</td>
<td>2,37</td>
<td>2,67</td>
</tr>
<tr>
<td>2,35</td>
<td>2,11</td>
<td>3,00</td>
<td>2,38</td>
<td>2,11</td>
<td>2,69</td>
</tr>
<tr>
<td>2,78</td>
<td>2,04</td>
<td>2,70</td>
<td>2,19</td>
<td>2,68</td>
<td>2,46</td>
</tr>
</tbody>
</table>

**Ho : Absence de corrélation sérielle**

*** p<0,01 ** p<0,05 * p<0,1

*Source : Auteur*

Nous avons corrigé les problèmes liés à l’autocorrélation sérielle des erreurs en réestimant nos équations à l’aide de la méthode des MCG. Ainsi, des tests de restriction de Wald ont été effectués pour vérifier la relation de cointégration entre les différentes variables. En raison de la faiblesse de la taille de l’échantillon, nous comparons les coefficients de Fisher obtenus à ceux sur la table de Narayan (2005). En considérant la table « Avec constante et Sans tendance » à 30 observations, nous remarquons que toutes les statistiques de Fisher sont à droite de I(1), ce qui confirme l’existence d’une relation de long terme entre les variables.

**Tableau 6 : Tests de Wald ou "Bounds Test"**

<table>
<thead>
<tr>
<th>Institution</th>
<th>Démocratie</th>
<th>Gouvernement</th>
<th>Loi et ordre</th>
<th>Corruption</th>
<th>Militaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>37,09***</td>
<td>24,73***</td>
<td>26,24***</td>
<td>22,85***</td>
<td>29,30***</td>
<td>18,90***</td>
</tr>
</tbody>
</table>

**Ho : C1=C2=C3=C4=C5=C6=0, pour n=30 et k=5 I(0) : 4,537 I(1) : 6,370**

*** p<0,01 ** p<0,05 * p<0,1

*Source : Auteur*

Il s’agit plus précisément de l’estimateur Newey.
RESULTATS ET DISCUSSIONS

Les différentes estimations ont été réalisées en remplaçant alternativement la variable institution dans toutes les régressions. Ceci pour, d’une part, gagner en degré de liberté compte tenu de la faiblesse de la taille de notre échantillon (1986-2014) et d’autre part, pour réduire le risque de multicolinéarité des variables institutionnelles qui biaiserait nos résultats. Les différentes estimations ont permis de capter les coefficients ou élasticités de court terme et de long terme. Aussi, tout choc sur les flux d’IDE dans une période se resorbe entièrement à hauteur de 73 à 93% l’année suivante. Avec une forte prédominance des relations de long terme, notre étude montre qu’une bonne qualité du cadre institutionnel est un facteur déterminant dans l’attractivité des investisseurs étrangers, en plus d’autres variables.

L’équation initiale (0), estimée sans prise en compte des institutions, montre une influence positive sur les IDE des variables de risque de change, de disponibilité des ressources naturelles et de dette publique à long terme au seuil de 1%\(^{13}\), pendant qu’à court terme seuls les investissements privés exercent une influence significative au seuil de 5%. Cependant, les investissements publics apparaissent non pertinents dans l’explication du volume des IDE. En effet, le dynamisme du secteur privé en Guinée constitue un signal pour les investisseurs étrangers à court terme. Ce résultat est en phase avec ceux obtenus par Ndikumana & Verick (2008) qui se sont intéressés à la relation bidirectionnelle entre les IDE et les investissements privés domestiques en Afrique subsaharienne de 1970 à 2015. Ces auteurs ont conclu qu’un niveau élevé d’investissement privé domestique est un signal pour des taux de rendement élevés. De plus, les investisseurs étrangers supposent que les investisseurs domestiques ont une plus grande information sur le climat des affaires dans les pays en développement (Lautier & Moreaub, 2012). La volatilité du taux de change nominal de la monnaie guinéenne a été un handicap pour l’attractivité du pays comme l’indiquent les résultats de nos estimations. Boualam (2008) a abouti à la même conclusion en Algérie. Pour elle, l’instabilité du taux de change induite par un régime de change flottant est défavorable à l’IDE, même si elle empêche le taux de change réel de s’apprécier.

Cependant, deux autres résultats en contradiction avec la majeure partie de la littérature empirique émergent de notre étude. Le premier est l’influence positive des ressources naturelles sur les IDE. Ceci infirme les conclusions d’Asiedu (2013) sur 99 pays en développement de 1984 à 2011 qui a trouvé un impact négatif. Cependant, nos résultats s’expliquent par le fait que les investisseurs étrangers ont une forte attirance pour les projets miniers en Guinée (IDE de type vertical). Ceci entraînerait à long terme une faible diversification de l’économie guinéenne, laquelle pourrait rendre à son tour le pays plus vulnérable aux chocs extérieurs. Le second résultat assez surprenant est l’influence positive de la dette extérieure sur le niveau des IDE. En effet, la dette étant une source de financement alternative aux IDE, leur forte augmentation conduirait à des risques macroéconomiques assez élevés (Khan, 2007), ce qui constitue un mauvais signal pour les investisseurs étrangers. En Guinée, en raison de l’instabilité du pays depuis 2006 jumelée à une baisse de la confiance des partenaires étrangers, une baisse de la capacité d’emprunt du gouvernement était devenue un miroir d’absence de conditions favorables pour les investisseurs étrangers.

Après la prise en compte des différentes variables des institutions, toutes les six régressions du tableau 6 confirment ces résultats à des seuils de significativité allant de 1% à 10%, sauf le risque de change qui est non significatif pour l’équation (1).

\(^{13}\) Les élasticités de long terme ont été calculées à l’aide de la formule $\frac{\Theta'}{\beta}$. 

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Tableau 7 : Influence à court terme des institutions sur les flux d'IDE entrants en Guinée

<table>
<thead>
<tr>
<th>Variables</th>
<th>(0)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
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<td>(0,59)</td>
<td>(0,60)</td>
<td>(0,18)</td>
<td></td>
</tr>
<tr>
<td>Risque de change</td>
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<td>0,16</td>
<td>0,15</td>
<td>0,15</td>
<td>0,92**</td>
<td>0,15</td>
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<td>(0,14)</td>
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<td>Investissement privé</td>
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<td>2,49**</td>
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<tr>
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<td>(0,77)</td>
<td>(1,16)</td>
<td>(1,06)</td>
<td>(1,01)</td>
<td>(1,86)</td>
<td>(0,88)</td>
<td>(0,44)</td>
</tr>
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<td>-0,82*</td>
<td>-0,16*</td>
<td>-0,47</td>
<td>-0,81**</td>
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<td></td>
<td>(0,66)</td>
<td>(0,54)</td>
<td>(1,25)</td>
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<td>(0,33)</td>
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<td>Ressource naturelle</td>
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<td>0,58</td>
<td>0,77</td>
<td>0,78</td>
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<td>(1,20)</td>
<td>(1,49)</td>
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<td>(1,83)</td>
<td>(4,41)</td>
<td>(1,59)</td>
<td>(1,37)</td>
</tr>
<tr>
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<td>0,45</td>
<td>0,42</td>
<td>-0,55</td>
<td>10,25**</td>
<td>0,01</td>
<td>-0,02</td>
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<tr>
<td></td>
<td>(0,59)</td>
<td>(1,17)</td>
<td>(0,81)</td>
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<td>(2,83)</td>
<td>(0,57)</td>
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<tr>
<td>Observations (n)</td>
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<td>28</td>
<td>28</td>
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<td>27</td>
<td>28</td>
<td>28</td>
</tr>
</tbody>
</table>

Les écart-types sont dans les parenthèses *** p<0,01 ** p<0,05 * p<0,1

**Source : Auteur**

**Note :** Pour cette variable, les coefficients ont été obtenus en additionnant les coefficients des variables en différence première avec leurs termes de retard. Les écarts-type résultent à leur tour de la racine carrée de la somme des variances des coefficients des variables considérées précédemment.
<table>
<thead>
<tr>
<th>Variables</th>
<th>(0)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
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<td>0,64*</td>
<td>0,90*</td>
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<td></td>
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<td></td>
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<tr>
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<td>0,45***</td>
<td>0,49**</td>
<td>0,35**</td>
<td>0,52**</td>
<td>0,26*</td>
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</tr>
<tr>
<td>Observation (n)</td>
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<td>27</td>
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<td>28</td>
</tr>
</tbody>
</table>

Les écart-types sont dans les parenthèses *** p<0,01, ** p<0,05, * p<0,1

Source : Auteur

Les régressions (1) et (2) exhibent une absence de significativité des variables Loi et Ordre et Corruption quel que soit l’horizon considéré. Ce résultat n’est pas surprenant, pour la première variable, en raison de sa quasi-constance dans toute notre période d’étude. En théorie une baisse de la corruption fausse l’environnement économique et financier ; réduit l’efficacité du gouvernement et des entreprises en aidant les gens à assumer des postes de pouvoir par favoritisme plutôt que par les compétences ; et, enfin mais non des moindres, introduit une inhérente instabilité dans le processus politique. Un niveau élevé d’attractivité du marché (en raison des ressources naturelles) atténue l’impact négatif de la corruption sur les investissements de recherche de rente (Brouthers & al, 2008).

L’équation (3) permet de voir qu’une amélioration de la démocratie est conjuguée avec une baisse de l’attractivité du pays avec une semi-élasticité de long terme de - 1,37. Ce résultat qui paraît surprenant peut trouver appui sur l’analyse d’O’Donnell (1978) selon laquelle les investisseurs et les régimes autocratiques (donc anti démocratiques) partagent souvent une relation confortable. En raison de
l'intérêt des dirigeants politiques dans les avantages économiques des IDE, les autocrates protègent les capitaux étrangers de la pression populaire par une augmentation des salaires, une protection plus forte du travail, et une taxation moindre du « capital-friendly »15. L'équation (4) montre que la stabilité du gouvernement, permettant de capter à la fois la capacité du gouvernement à mener à bien son/son programme (s) déclaré(s), et sa capacité à rester au pouvoir, est la seule variable influençant les investisseurs étrangers aussi bien à court terme qu'à long terme avec des semi-élasticités de 1,34 et 0,64. De même dans l'équation (5), une baisse de la participation de l'armée à la vie politique a favorisé une hausse des IDE en Guinée à long terme. Ainsi, un accroissement de cet indice de 2 points (sur une échelle de 6 points) a permis d'augmenter les flux d'IDE entrants d'environ 2% à long terme. La forte présence de l'armée dans les gouvernements respectifs a impliqué des distorsions des différentes politiques du gouvernement, avec augmentations injustifiées du budget de la défense au détriment des autres allocations budgétaires, bénéfiques à l'attraction des IDE.

Lorsque nous considérons l'équation (6), il en ressort que l'indice global de la qualité des institutions influence positivement les montants enregistrés des IDE en Guinée. Une amélioration de cet indice de 10 points aurait conduit à un accroissement des IDE de 3,5% à long terme. En effet, une amélioration de la qualité des institutions, sous forme de respect des droits de propriété et de réduction des asymétries d'information, se traduit par une baisse considérable des coûts de transactions favorable aux IDE. Bénassy-Quéré & al. (2005) a confirmé cette intuition sur 52 pays développés et pays en développés par le biais d’un modèle de gravité pour l’année 2001. Bien que la relation empirique Institution-IDE soit moins robuste sur les données des pays africains, quelques rares études confirment une relation positive. C’est le cas d’Asiedu (2003) qui a utilisé des données de panel de 22 pays d’Afrique subsaharienne sur la période 1984-2000. L’auteur en a conclu que l’efficacité des institutions, la stabilité politique, le faible degré de corruption et un bon cadre réglementaire ont un impact positif sur les IDE. De même, sur des données de la Guinée, Diallo (2007) a utilisé un modèle à correction d’erreur et a trouvé que les droits politiques sont un facteur déterminant des flux des IDE entrants en Guinée.

CONCLUSIONS ET RECOMMANDATIONS

L'objectif de cet article était d’analyser les déterminants institutionnels de l'attractivité des IDE en Guinée. A cette fin, après avoir développé un modèle théorique inspiré par Feng & Chen (1997), nous avons estimé six variables du rôle des institutions (le respect de la loi et de l’ordre, la corruption, la démocratie, la stabilité du gouvernement, l’influence des militaires dans l’administration et un indice global de la qualité des institutions récapitulant 12 dimensions des institutions16) dans les flux d’IDE à l’aide d’un modèle de cointégration de type ARDL sur la période 1986-2014. Trois résultats majeurs ressortent de notre analyse. D’abord, les investisseurs étrangers sont beaucoup plus tournés vers le long terme que le court terme. C’est pourquoi, toute politique d’attraction des IDE en Guinée doit davantage se focaliser sur des politiques de long terme (i.e. des politiques structurelles).

Ensuite, le rôle des facteurs institutionnels est très important dans l’attractivité de la Guinée en matière d’IDE. Ce résultat est en phase avec ceux trouvés dans la plupart des études de la littérature empirique. Sur des données de l’Afrique subsaharienne, Asiedu (2003) a confirmé le rôle prépondérant du cadre institutionnel, tels que la stabilité macroéconomique, l’efficacité des institutions, la stabilité politique et le faible degré de corruption sur le niveau des IDE enregistrés. Au vu de ces résultats, un certain nombre de recommandations de politiques économiques s'imposent. L’Etat doit veiller à la stabilisation et à l’application du principe de continuité de l’administration en dépolitisant au maximum les fonctions administratives et en limitant l’influence des militaires dans le gouvernement. Aussi, il doit promouvoir

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15 C’est du capital orienté vers la production et le profit. Il doit être distingué du « capital-unfriendly » qui répond plus à une logique de création d'emploi.

16 Voir la base de données ICRG de l’indice de risque politique.
le respect des droits de propriété notamment par la démocratie. Il est nécessaire que l’exécutif facilite la mise en place de commission d’enquête parlementaire pour statuer sur d’éventuels cas de contrats douteux. Les gouvernants doivent mieux analyser le contenu des incitations financières et fiscales octroyées aux firmes multinationales pour ne pas plomber l’industrie locale. Enfin, il importe aussi d’élaborer des codes des investisseurs clairs, simples et faciles à mettre en œuvre.

Enfin, la prise en compte d’autres variables de contrôle a permis de voir une batterie d’indicateurs comme baromètre des investisseurs étrangers. Il s’agit des investissements privés domestiques, du risque de change, de la disponibilité des ressources naturelles et du niveau de la dette extérieure qui agissent tous positivement sur les IDE. De ce fait, l’Etat doit faciliter et accompagner les activités des entreprises locales notamment par la création d’un fonds de garantie pour les PME par exemple. Également, la Banque centrale doit tâcher à stabiliser le franc guinéen par une politique monétaire appropriée, et la réglementation des opérations de change. Bien qu’il y ait une attractivité du pays par les ressources naturelles, il importe de réduire considérablement la dépendance aux ressources naturelles par une plus grande diversification de l’économie de la Guinée, gage d’une attraction des IDE de marché plus propice aux externalités positives. Pour cela, les recettes minières devraient être utilisées pour financer les infrastructures publiques. De même, les contrats miniers doivent être soumis à des conditionnalités comme la construction de routes, d’hôpitaux, l’octroi de bourses et l’emploi pour les populations riveraines. Enfin, même si la dette extérieure a été un miroir pour les investisseurs en Guinée dans une période exceptionnelle (2006-2010), son utilisation excessive risquerait de donner un mauvais signal à d’autres investisseurs potentiels.
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