

3-1-2006

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### Recommended Citation

Amin, Aloysius Ajab & Audu, Isa, (2006). External Debt, Investment and Economic Growth: evidence from Nigeria. *Economic and Financial Review*, 44(1), 99-136.

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# External Debt, Investment and Economic Growth: Evidence from Nigeria

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Aloysius Ajab Amin & Isa Audu\*

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*This paper studies the impact of external indebtedness on Nigeria's economic performance. We find supportive evidence for the crowding out and debt overhang hypotheses in Nigeria. Based on these results, the paper concludes that the prospects of resolving the debt crisis in Nigeria will depend on deeper debt relief, diversification of export base and substantial direct foreign investment. Debt relief will enable the country to use the lean foreign exchange earnings to procure the badly needed inputs for the industrial sector and upgrading of infrastructures. However, without a stable political and macroeconomic environment, efforts at reducing the external debt burden may not be very successful.*

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**Keywords:** External Debt, Economic Growth, Public Investment, Nigeria

**JEL Classification Numbers:** F34, F43, H54, H63

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## I. Introduction

There is a widespread recognition in the international community that excessive foreign indebtedness of many developing countries remains a major impediment to their stability and growth. Developing countries have contracted large amount of debts, often at highly concessional interest rates particularly in the 1970s. The hope was that these loans would put them on faster development path through higher investment and faster growth. But as debt service ratios reached very high levels in the 1980s, it became clear that for many of these countries, debt repayment would constrain economic performance in their countries. More importantly, it would be virtually impossible to repay back these loans and leave reasonable resources to support the domestic economy.

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\* This paper was written before Nigeria secured the substantial debt cancellation from the Paris Club of Creditors in 2005 under the Policy Support Instrument (PSI). The views expressed herein do not represent the views of the institution to which the authors are affiliated. The authors acknowledge the comments and suggestions of anonymous reviewers. All remaining errors are the authors' responsibility

Attempts to cope with the debt crisis through the adoption of IMF-supported programmes proved unsuccessful in alleviating the excruciating debt problem. The Although, Structural Adjustment Programme (SAP) had some benefits like for instance easier access to foreign exchange, significant improvement in non-oil exports as a result of export incentives and improvement in Government revenue. However, SAP have invariably resulted in increasing unemployment, low capacity utilisation, galloping inflation, high incidence of poverty, unsustainable fiscal deficit and further escalation of debt, among others. The Highly Indebted Poor Countries (HIPC) Initiative formulated by the IMF/World Bank has also fallen short of what is required to re-establish the conditions for sustained economic growth. The fiscal burden of debt servicing is inimical to economic growth and, is, in fact, an important reason for the failure of SAP to restore economic growth in many of the debt distressed countries.

The international community reacted to this development by coming up with plans to ensure that these indebted countries secure some relief. Such efforts as the Brady Plan, the Trinidad/Naples Terms, the Mauritius Mandate and the HIPC Initiative were all put forward to address what has now become the debt crisis. It is a global crisis because any massive default will rock the international financial system to its very foundations and, possibly, lead to a worldwide depression.

Several factors, both domestic and external, were advanced as reasons for the deteriorating African debt crisis. High among them was excessive borrowing by LDCs in the 1970s, the oil price shocks of 1973/74 and 1979/80 and worsening terms of trade. Other factors affecting the debt burden include rising world interest rates resulting from monetary contractions in some advanced countries and exchange rates fluctuation. Inappropriate domestic macroeconomic policies and political instability also played a major role in retarding the debtor nations' ability to grow out of debt burden, creating uncertainty, which compounds the problem of business planning and production (Iyoha, 1999). Ever since, the issue of external debt and its servicing has remained a topical subject dominating discourse on the international political economy.

The main objective of this study is to examine the impact of Nigeria's external indebtedness on public investment and economic growth from 1970-2004. This study is encouraged by the fact that no known study has explicitly modeled the interaction between external debt, public investment and economic growth in Nigeria by employing

the cointegrating modeling techniques. Previous studies in Nigeria generally analyzed the impact of external indebtedness by particularly concentrating on total/private investment or savings level rather than assessing the impact of debt overhang on economic growth and public investment.

The paper is divided into six sections. After the introduction, section 2 examines Nigeria's macroeconomic performance in the last 34 years (1970-2004); section 3 examines the genesis, trend, magnitude and structure of Nigeria's external debt. Section 4 reviews relevant literature. Section 5 provides models specification, empirical analysis and interpretation of results. Finally, section 6 gives the policy implications, recommendations and conclusion.

## **II. Macroeconomic Performance**

The Nigerian economy has passed through various phases of development in the last 34 years (1970 – 2004). The analysis of the performance of the economy would, therefore, be divided into three distinct periods: (i) 1970-1980, (ii) 1981-1994 and (iii) 1995-2004.

In the period 1970-1980, the Nigerian economy enjoyed remarkable growth. This period was characterized by massive inflow of foreign exchange earnings mainly from crude oil exports. Nigeria's financial credibility in the international markets was not in doubt. For the greater part of the 1970s, domestic and direct foreign investment was at an impressive level. These helped to sustain real GDP growth at reasonably high levels. The economy recorded an average growth rate of 5.0 per cent per annum during the period. On the external sector, the country enjoyed favorable balance of payments position owing to the significant boost from oil exports even though non-oil exports became virtually extinct. The sector sustained an average current account surplus of 1.5 per cent of GDP during the period, while gross international reserves averaged the equivalent of about seven months of imports. By 1980, the country's external debt was only US\$8.9 billion or 13.9 per cent of GDP, and the debt service ratio was a modest 0.7 per cent.

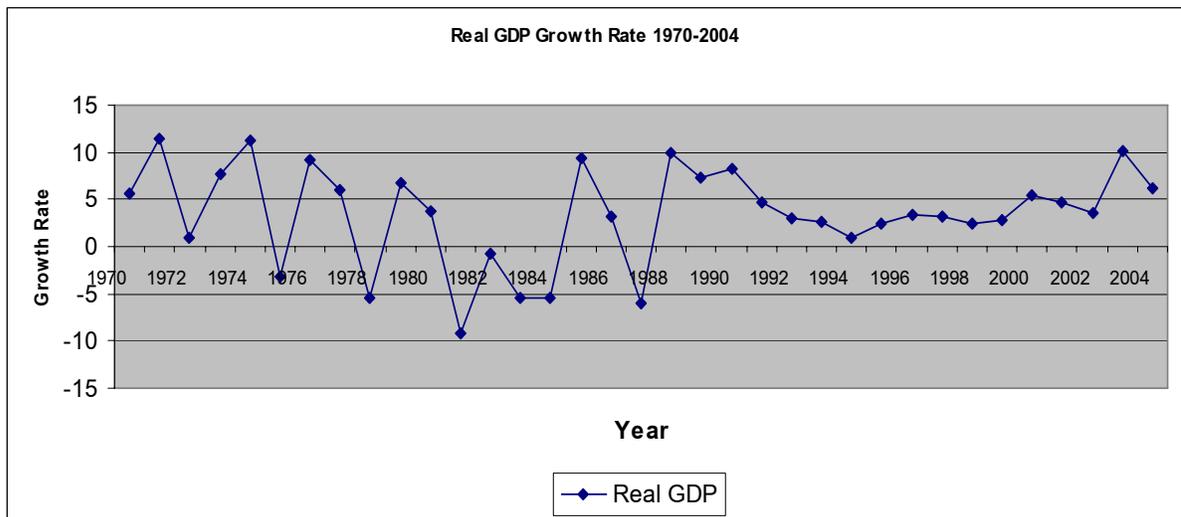
The inflation rate during this period average 14.6 per cent, although, there were three periods in which the inflation rate was over 20 per cent. The exchange rate as shown by the index of the market rate (1995=100) was generally over-valued, with the resulting

cheapening of imports while penalizing domestic production and exports. In other words, overvaluation of the naira enhanced its purchasing power vis-à-vis other international currencies.

In the period 1981-1994 Nigeria witnessed serious economic downturn and macroeconomic aggregates showed unsatisfactory performance. Specifically, between the period 1981 and 1984 the rate of economic growth measured by the rate of growth of real GDP, recorded negative growth rates. The GDP achieved its best performance in 1988, but declined thereafter. It should be pointed out that the real GDP has been growing at a decreasing rate since 1988 when it grew at 10.0 per cent; thereafter, the figures continued to decline with the exception of 2003 when the economy achieved another 9.6 per cent GDP growth rate (see table 1). The sharp drop in the real GDP growth rate in the period 1989 to 1994 indicated quite clearly that the GDP growth rate was not self-sustaining (see figure 1).

The economy also witnessed double-digit inflation during the period under review, with the exception of 1990 when the composite consumer price index grew by 7.5 per cent. Specifically, the inflation rate was 57 per cent in 1994 (see table 1).

Figure 1: Real GDP Growth Rate



Source: Central Bank of Nigeria (CBN) Annual Report (various issues), World Bank (2002) African Data Base, CD-ROM, Washington D. C.

Thus, the objective of securing a non-inflationary growth was not reasonably attained. The crisis in the oil market, which in turn adversely affected industrial performance, and the long-standing neglect of agriculture accounted for the decline. The fiscal operations of the government were consistently in deficit while the balance of payments remained under intense pressure. The external reserves fell to US\$1,041.4 million in 1983-the lowest level in ten years. At this level, external reserves could only support 1.05 months of imports, a situation which improved only marginally to 2.8 months of imports in 1985. The improvement in the reserves position in 1985 was very artificial, as there was an ample evidence to show that external trade arrears had accumulated. There was a dramatic jump in external debt from US\$10,667.7 million in 1981 to US\$29,428.8 million in 1994 or 175 per cent increase in just 13 years. The debt service ratio rose correspondingly from 4.8 per cent in 1981 to 19.5 per cent in 1994. To reverse the worsening economic fortunes in terms of declining growth rate, galloping inflation, worsening balance of payments, escalating debt burden and increasing/unsustainable fiscal deficits, among others, government introduced austerity measures in 1982. Due to the unimpressive impact of these measures, an extensive structural adjustment programme was put in place with emphasis on demand management to address the issues of expansionary and inflationary policies in August 1986.

During the period 1995 to 2004, the performance of the Nigerian economy was rather mixed. In the sub-period 1995 to 1998 the various macroeconomic aggregates moved in the right direction. GDP growth rose from 2.4 per cent in 1995 to 3.4 per cent in 1996. The fiscal deficit/GDP ratio which was negative for most of the years, showed a positive rate of 0.1 per cent in 1995. The rate of inflation which was about 72.8 per cent in 1995, declined to about 29.3 per cent in December 1996. The exchange rate remained stable for over twenty months, interest rates had been decapped and the external sector experienced less pressure. However, debt stock trended upward to US\$32,584.8 million in 1995 before it dropped to US\$28,060.0 million and US\$27,087.8 million in 1996 and 1997, respectively. The external reserves increased from US\$1,410.0 million in 1995 to US\$4,080.0 million in 1996. These favorable economic fundamentals resulted from the curtailment of wasteful expenditure, attainment of relative stability in the foreign exchange market and the re-establishment of a favourable macroeconomic environment. Nonetheless, the economy witnessed unprecedented corruption, mismanagement and

international isolation due to alleged human right abuses (CBN, 1993 Perspective of Economic Policy Reforms).

However, after six years under the democratic experiment, the economy is still groaning under the strains of past events. GDP per capita has been on the decline. In 2004, it was estimated at US\$300 compared to US\$316 in 1996 and far below its peak of over US\$1000 achieved in the 1980s. The fiscal deficit/GDP ratio, which showed a positive rate of 6.3 per cent in 2000, recorded a negative rate of 8.9, 2.8 and 3.0 per cent in 2002, 2003 and 2004 respectively. The GDP growth, which averaged below 3.0 per cent between 1995 and 1999, took an upward turn in 2000 to 2004 increasing from 3.9 per cent in 2000 to 4.7, 4.6, 9.6 and 6.6 per cent in 2001, 2002, 2003 and 2004, respectively. However, on the average this is slightly short of the government target of 6.0 per cent. It is important to stress that because Nigeria's population is growing at about 3.0 per cent per annum, this improvement in GDP growth made little impact on the overall standard of living in the country (CBN Annual Reports and World Bank African Data Base 2003).

Average inflation rate more than doubled to 18.9 per cent in 2001, from about 7.0 per cent in 2000, but declined to 15.0 per cent in 2004. In addition, the naira depreciated against the US dollar, from an average of ₦80/US\$1 in 1996 to ₦133.5 in 2004 at the official foreign exchange market. Similarly, the average parallel market rate and bureaux de change rates depreciated from ₦85/US\$1 in 1995 to ₦140.8/US\$1 in 2004 (CBN Annual Report 2004).

### **III. Genesis, Trends, Magnitude and Structure of Nigeria's External Debt**

#### **Genesis of Nigeria's External Debt**

The origin of Nigeria's external debt dates back to 1958 when a sum of US\$28 million was contracted for railway construction. Between 1958 and 1977 the resort to foreign borrowing was minimal, as debts contracted during the period were the concessional loans from official sources such as the World Bank and Nigeria's major trading partners (i.e. bilateral and multilateral sources). These debts did not exert much pressure on the economy because the interest charged on them was generally low, with longer repayment

period from ten to forty years and this constituted about 78.5 per cent of the total debt stock. Moreover, the country had a comfortable external reserve as a result of the unprecedented inflow of foreign exchange receipts from crude oil exports. Nigeria was then able to lend to the International Monetary Fund (IMF) in 1974 under the oil facility. In fact, Nigeria was regarded as “under-borrowed” in relations to the absorptive capacity of the economy.

With the emergence of oil glut in 1978, however, Nigeria’s revenue from the oil sector declined and it became expedient to borrow to support the balance of payments and to finance projects. This led to the promulgation of Decree No. 30 of 1978, limiting the external loans the federal government could raise to ₦5.0 billion (US\$7.7 billion). Faced with serious deterioration in the foreign exchange position, the Nigerian authorities were forced to raise the first “jumbo loans” of US\$1 billion from the International Capital Market (ICM) in 1978. It was probably the largest Euro loan ever obtained by an African country. The loan had a repayment period of eight years, including a grace period of three years. The loan was used to finance various medium - long- term projects most of which did not yield any revenue many years after repayment on the project had commenced. The importance of these loans was that the profile of Nigeria’s foreign debt was completely altered. Before this time, the bulk of Nigeria’s loans was sourced from bilateral and multilateral institutions, which by their nature, were development oriented with generous conditions in terms of maturities, low and fixed interest rate and long grace period. In contrast, ICM loans are generally of less favorable terms.

Another characteristic of the "jumbo loan" was that it attracted a floating interest rate, which was linked to the London Inter Bank Offered Rate (LIBOR). The effect of this was that it made planning more difficult since the expected stream of debt service payments could not be calculated with certainty. Thus, at the end of 1979, the level of total debt drawn and outstanding had increased two-fold from the level of US\$3.1 billion in 1977 to US\$6.2 billion in 1979. But this was comfortable at 37.1 per cent of exports and 8.1 per cent of GDP. It is important to stress that the single act of borrowing from Euro markets by the Obasanjo-led military administration opened the floodgates for the imprudent borrowing by state governments. Consequently, the share of loans from bilateral and

multilateral sources declined substantially while borrowing from private sources at higher interest rates and stiffer conditions increased considerably.

The recovery of the oil market in 1979, with oil prices rising to an all-time high of US\$40.00 a barrel in 1980/81, gave a notion of a buoyant economy. Consequently, some deflationary measures put in place in 1978 were relaxed by the second republic administration. But a new consumption pattern that favored imported goods emerged. The import substitution industrialization strategy that was being pursued then also depended heavily on imported raw materials and appreciated exchange rates. Besides indiscriminate and excessive importation, there were also cases of over-invoicing and non-shipment of actual goods for which letters of credit had been established (Africa's Debt Crisis, NES Selected Paper for the 1994 Annual Conference).

However, the oil boom was short-lived and when it collapsed in the early 1980s the economy immediately suffered considerable strains. The production and consumption pattern that emerged in the era of oil boom could not be sustained in the face of declining foreign exchange earnings in the 1980s. Rather than address the problem of declining foreign exchange revenue, both the federal and state governments embarked on massive external borrowing from the International Capital Market (ICM). Thus, pressure mounted on the various sectors of the economy resulting in huge imbalance in government finances, low external reserves, deficits in the balance of payments and accumulation of trade arrears in respect to both insured and uninsured trade credit. Today, the country is under the burden of an unprecedented debt crisis. Thus, during the period 1980-1983, the debt position almost doubled from US\$8.9 to US\$17.7 billion, an increase of almost US\$9 billion or 98.8 per cent in only three years.

The reality and magnitude of Nigeria's debt problem did not dawn on her until 1982 when foreign creditors refused to open new lines of credit due to the country's inability to settle her import bills. This resulted in the accumulation of trade arrears amounting to US\$9.8 billion between 1983 and 1988. It then became necessary for Nigeria to seek relief by refinancing the trade arrears. The first refinancing exercise, which was in 1983, converted outstanding letters of credits worth US\$2.1 billion. In 1984, the government refinanced the remaining trade arrears especially those contracted through open account and bills for collection by the issuance of promissory notes worth US\$4.8 billion. Since

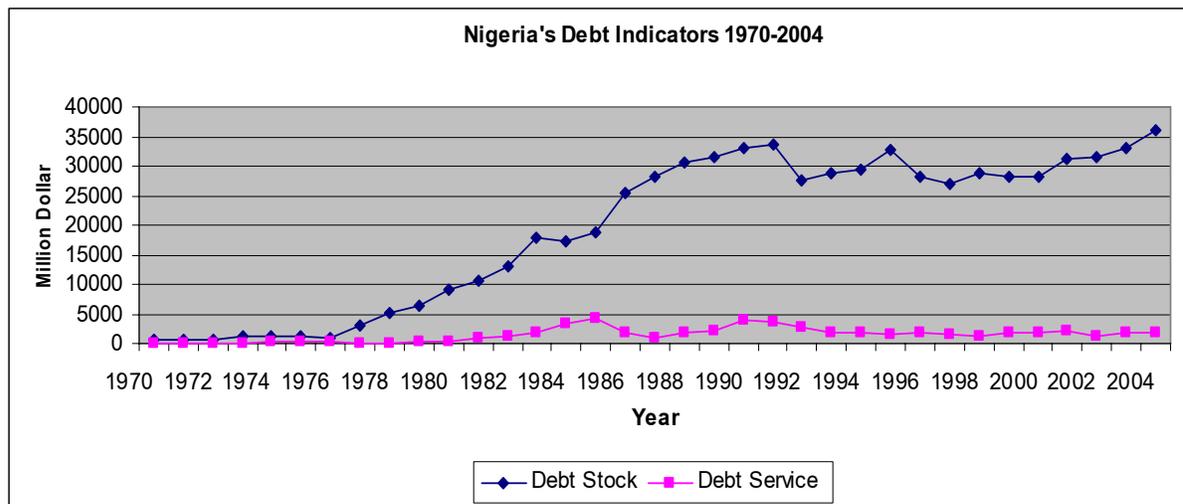
then, Nigeria has signed six other restructuring agreements; three with the London Club in 1987, 1989, and 1991. Apart from the promissory notes agreement, which has a repayment period of 22 years, the various rescheduling arrangements provided temporary debt relief. Indeed, the debt stock increases with every Paris Club rescheduling. With some agreements running concurrently, there was a bunching of maturities. While the London Club deal, which was closed in 1992, reduced the stock of debt by US\$3.8 billion, the Paris Club rescheduling increased the debt stock with capitalization of amounts rescheduled. Consequently, the dual problem of external debt service burden and debt overhang emerged.

### **Trends, Magnitude and Structure of Nigeria's External Debt**

In absolute terms, the total external debt stock rose from a meagre US\$567 million in 1970 to US\$5,091 million in 1978. Between 1979 and 1985, it increased further from US\$6,216 million to US\$18,904.0 million. It stood at US\$25,574.0 million in 1986, and peaked at US\$33,730.0 million in 1991. Thus, between 1985 and 1991, the debt stock increased by US\$14,826.0 million or 78.4 per cent in just six years. During this period, the increase has been astronomical due to the indiscriminate resort to external borrowing ostensibly to finance projects coupled with the crash in international oil price in 1982 ( World Bank African Data Base, 2003).

With the debt buy- back arrangement and the issuance of collateralized par bonds to the London Club of creditors in 1992, the debt stock dropped from US\$33,730.0 million in 1991 to US\$27,564.0 million in 1992. This changed in a significant way the structure of Nigeria's external debt. However, by 1993, 1994 and 1995 the debt stock trended upward to US\$28,718.2, US\$29,428.9 and US\$32,584.8 million, respectively. The debt stock then dropped to US\$28,060.0 and US\$27,087.8 million in 1996 and 1997, respectively. This was mainly because new loans were not contracted after the reconciliation exercise conducted in 1995 to ascertain the genuineness of some external claims. However, by 2003 and 2004, it had moved upward again, recording a total outstanding balance of US\$32,916.8 and US\$35,944.6 million, respectively (see figure 2 below).

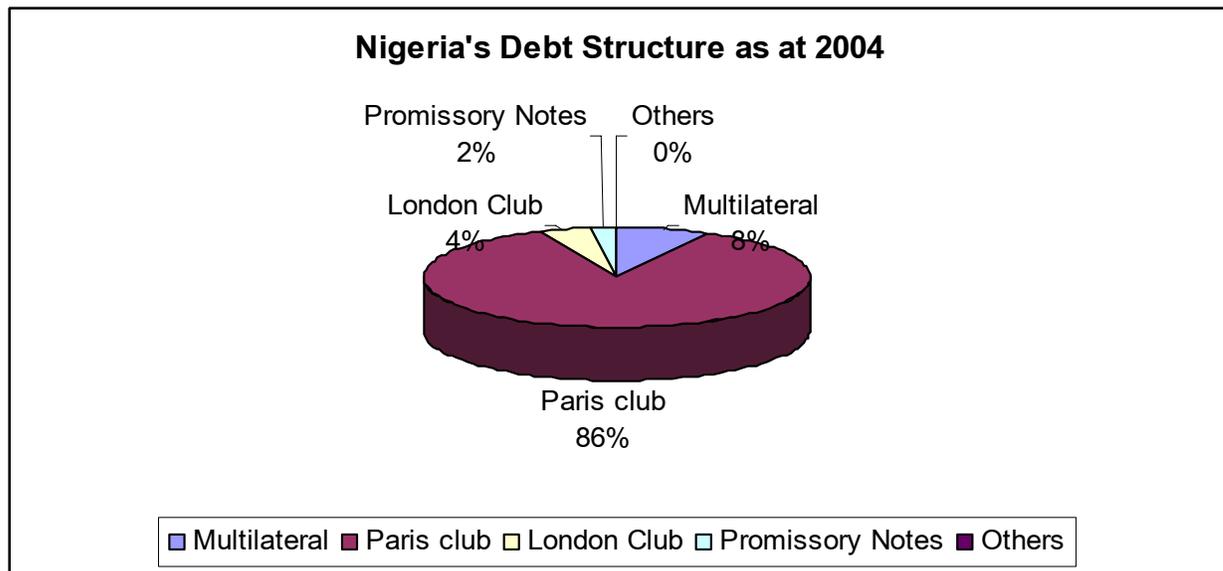
Figure 2: Nigeria's Debt Indicators



Source: CBN Annual Report and Statement of Account (various issues)

Nigeria's external debt stock has witnessed changes, both in structure and quantum. Over the years, the classification of Nigeria's debt by source as at the end of December 2004 showed that \$30.8 billion or 86.0 per cent is owed to the Paris Club of Creditors while indebtedness to multilateral sources amounted to \$2.8 billion or 8.0 per cent. Outstanding Promissory notes constitute 2.0 per cent or \$0.7 billion. Debt obligations to the London Club amounted to \$1.4 billion or 4.0 per cent. Other bilateral (non-Paris Club) accounted for the balance of \$47.5 million. Paris Club is the main source of Nigeria external debt and the most problematic. The debt continued to rise due to accumulation of payment arrears and default in interest payments. The arrears and interest are capitalized and added to the debt stock, further aggravating the debt burden (see figure 3).

Figure 3: Nigeria's Debt Structure



Source: CBN Annual Report and Statement of Account (various issues), Federal Ministry of Finance-Nigeria

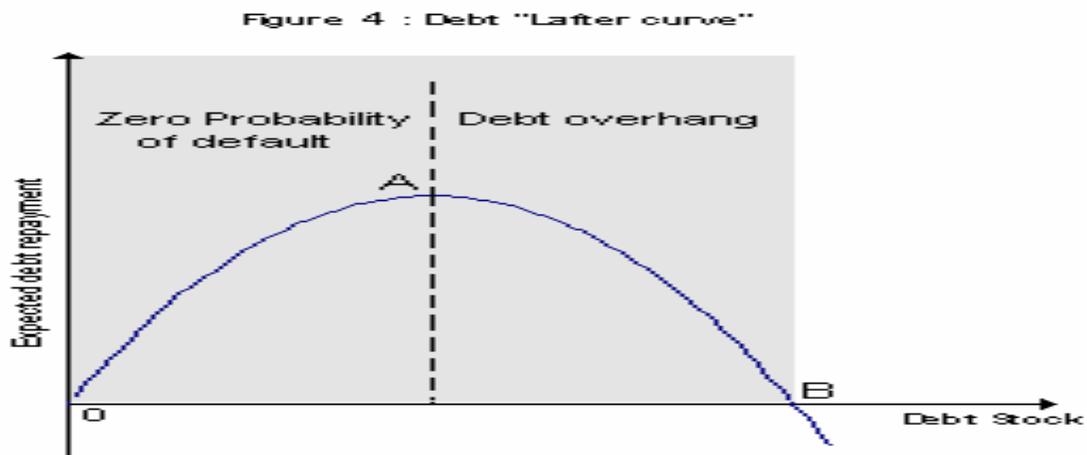
#### IV. Literature Review

Several studies have critically examined the problem of debt burden. The theoretical and empirical literature include the two-gap model by McKinnon (1964) and Green and Khan, (1990). "Liquidity trap, weak and strong debt overhang hypothesis" postulated by Claessen and Diwan (1990), and the concept of "debt Laffer curve" used by Krugman (1989), etc.

##### Theoretical Literature

The dual-gap analysis illustrates the role of foreign capital in the development process. The role of capital here is that it permits developing countries to invest more than they can save domestically. This proposition is made by the two-gap model (McKinnon, 1964 and Green and Khan, 1990). They noted that the volume of savings in developing countries was too low on account of the low income and, therefore, domestic saving should be supplemented by foreign resources to boost investment and increase the rate of economic growth. Provided that such funds are effectively utilised, then the country may succeed in boosting the rate of growth of its GDP and will be able to service debt conveniently. Foreign borrowing can contribute significantly to economic growth if the main constraint to growth is the foreign exchange.

Krugman (1989) and Froot and Krugman (1989) conceptualized the model of debt overhang of developing countries by applying the theory of "Laffer Curve"<sup>6</sup> to obtain a relationship between debt stock and the levels of expected repayment (i.e., debt Laffer Curve). The theory presupposes that larger debt stocks tend to be associated with lower probabilities of debt repayment. The curve sloped like an inverted U-shaped, graphs expected repayment as a function of the face value of the outstanding debt (Figure 4).



Source Author: Krugman (1989)

On the upward-sloping or "good" side of the curve, an increase in the face value of the debt service leads to an increase in repayment up to the "threshold" level, while along the "wrong side" of the curve (i.e. down-ward sloping) an increase in the face value of the debt reduces expected repayment. In a sense, debt relief, through debt service or debt stock reduction, becomes a rational choice for both creditors and debtors, when a debtor is said to be on the "wrong side" of the laffer curve.

When a country opens up to foreign capital and starts borrowing, the impact of debt on growth is likely to be positive (moving from zero indebtedness to point A in figure 4), but as debt ratio increases beyond point A, additional debt eventually slows growth. Thus, point A can be considered as the growth-maximizing level of debt. When debt reaches point B, however, the overall contribution of debt to growth turns negative. The

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<sup>6</sup> Laffer curve is an illustration of the thesis of an American Economist, Arthur Laffer, who postulated that there exists some tax rate, which maximizes government tax revenues. In this case, it was proposed that taxes above the optimal rate discourage production and, hence, result in lower revenue.

concept of debt Laffer curve is essentially an approach used in debt reduction mechanism.

Claessens and Diwan (1990) classified debt overhang into three different degrees: “liquidity trap, weak debt overhang, and strong debt overhang”. A “weak” debt overhang exists where the outstanding debt is so large that the situation cannot be resolved simply by issuing further financing or new money for the country. The situation can only be improved by using commitment mechanism to ensure allocation of loans for investment.

In the case of a “strong” debt overhang, the debtor postpones the implementation of profitable investment projects until at least part of the debt is forgiven. The leaders of the debtor country have no incentives to participate in extensive structural adjustment program because the benefits of increased growth would end up in creditor’s pocket while the short-term cost would rest solely on the debtor’s shoulders. Provision of large amount of liquidity cannot improve the debt overhang problem. Thus, the resolution of a strong debt service overhang calls for debt and debt service reduction, commitment to large investment program, commitment to structural economic adjustment and provision of new money in that order.

Lastly, debt overhang is considered as liquidity trap, if external debt accumulation is not too large, but the indebted country has to struggle with having to allocate scarce financial resources between consumption, investment and external transfer to service existing debt. Since extensive cut-down in funds used for consumption are politically hard to make, then consumption expenditure takes a larger share of the debtor country’s income, driving down investment and discouraging future output. Thus, the resolution of illiquidity effect of a debt overhang calls for injections of substantial new money facilities. It also calls for commitment to structural economic adjustment. Overall, the review of the theoretical literature on external debt and growth suggests that there are several channels through which heavy debt burden impedes growth.

### **Empirical Literature**

Much empirical literature exists on the interactions between external debt, investment and economic growth in cross-sectional analysis. The economic growth-debt relationship in developing countries is studied mainly by using OLS estimation methods

(e.g. Borensztein, 1990; Iyoha, 1999; Chowdhury (1994). However, most of the empirical evidence on debt overhang has been rather mixed, but many of the studies find debt variables to be significantly and negatively correlated with investment or growth. Borensztein (1990) using data for the Philippines found that the debt overhang hypothesis was largely valid. Deshpande (1997) also came out with similar result from his study of the experience of 13 severely indebted countries. Greene and Villanueva (1991) also found evidence of the debt overhang hypothesis for 23 developing countries. Elbadawi (1996) confirmed the debt overhang hypothesis for 99 developing countries. Furthermore, Iyoha (1999) provides empirical support for the debt overhang hypothesis for Sub-Saharan Africa (SSA).

In contrast, Cohen (1993) rejected the debt overhang theory, arguing instead, that the important debt problem is crowding out of investment caused by debt service payments. Warner (1992) also arrived at a similar conclusion as Cohen in his study of 13 heavily indebted countries. Similar results were corroborated by Degefe (1992) in Ethiopia. Generally, empirical studies on the subject are not conclusive.

Most of the empirical literature on the relationship between external debt overhang and economic growth and investment show negative effects. The studies that have shown favorable effects of external debt are rare. They include World Bank (1988) study for the period 1980-86 and Chowdhury (1994) for Bangladesh, Indonesia and South America.

## **V. Model Specification, Empirical Analysis and Interpretation of Results**

The specification of the models are based on the empirical work of Elbadawi (1996) and Were (2001) which are largely derived from the neoclassical framework. The work of Elbadawi and Were are some of the recent studies that captures the effect of both current debt flows and the effect of past debt accumulation (known as debt overhang) as well as liquidity effect of annual debt service payments on economic growth and investment. Similarly, their works are some of the few studies that largely focused on a cross section of low income countries. However, our models are augmented with some debt overhang variables to the equations to determine the significance of the direct impact of debt overhang on economic growth and investment. Besides these variables, the models also incorporate policy fundamental and shock variables since there are so many channels

through which indebtedness works against growth. The dependent variable is real GDP growth rate (GDPGR). The explanatory variables have been identified as ratio of external debt to GDP ( $EDTGDPT_t$ ), which should stimulate growth. This is because reasonable levels of current debt inflow that help to finance productive investment are expected to enhance growth. Past debt accumulation lagged one period ( $EDTGDPT_{t-1}$ ), as a measure of debt overhang, debt service to export ( $DSE_t$ ) captures the “crowding out” effects. A dummy variable is also introduced as a proxy for political stability (GCRI), and takes the value of 0 for stability and 1 for instability in the growth model. The functional relationships are specified as follows:

### Growth Equation

$$GDPGR_t = f(EDTGDPT_t, EDTGDPT_{t-1}, DSE_t, GPUIV_t, GPUIV_{t-1}, FDIGDP_{t-1}, HCD_t, FISBAL_{t-1}, INF_t, REER_t, GCRI_t)$$

Where

$GDPGR_t$	=	Real GDP growth rate.
$EDTGDPT_t$	=	Ratio of total external debt to GDP.
$EDTGDPT_{t-1}$	=	Ratio of external debt to GDP lagged one period, as a measure of debt overhang.
$DSE_t$	=	Total debt service as ratio of export, is expected to capture the crowding out of total investment.
$FISBAL_{t-1}$	=	Lagged fiscal balance in percentage of GDP
$GPUIV_t$	=	Public investment- GDP ratio.
$GPUIV_{t-1}$	=	Public investment - GDP ratio lagged one period to reflect the effect of past investment.
$FDIGDP_t$	=	Private foreign investment-GDP ratio.
$HCD_t$	=	Gross secondary school enrolment rate (proxy for the quality of Human capital)
$INF_t$	=	Inflation rate (reflects macroeconomic instability).
$REER_t$	=	Effective real exchange rate (reflects credibility of policies)
$GCRI_t$	=	Dummy variable for political stability.

### Public Investment Equation

The real GDP growth rate is included in the public investment equation in order to allow for the possible existence of “investment accelerator effect”. The functional relationship is consequently specified as follows:

$$GPUIV_t = f(EDTGD P_t, EDTGD P_{t-1}, DSGDP_t, RESM_t, AIDGNI_t, FISBAL_{t-1}, INT_t, REER_t, FDIGDP_t, GDPGR_{t-1}, GPUIV_{t-1})$$

Where,

- DSGDP<sub>t</sub> = Total debt service in percent of GDP (reflects the crowding out effect of debt service on public investment).
- RESM<sub>t</sub> = Foreign reserve as a ratio of imports.
- AIDGNI<sub>t</sub> = Foreign aid in percent of gross national income.
- INT<sub>t</sub> = Interest rate (to capture interest rate effect on investment.)
- GDPGR<sub>t-1</sub> = Real GDP growth rate (captures investment accelerator principle)

Other variables are as already defined.

### Correlation Results

The objective of this section is to show whether and how strongly these pair of variables are related. The summary of the correlation matrix are presented in table below.

	LGDPGR	LEDTGDP	LGPIV	LDSE	LDSGDP	LFDIGDP	FISBAL	LINF	LREER	LHCD	GCRI
LGDPGR	1.000	-0.572	-0.495	-0.634	-0.497	-0.397	0.654	-0.687	-0.562	-0.549	-0.336
LEDTGDP		1.000	0.315	0.395	-0.469	-0.542	-0.503	-0.223	0.557	0.245	
LGPIV			1.000								
LDSE				1.000							
LDSGDP					1.000						
LFDIGDP						1.000					
FISBAL							1.000				
LINF								1.000			
LREER									1.000		
LHCD										1.000	
GCRI											1.000

The correlation matrix presented in table above confirms the time series evidence in the literature, suggesting a negative correlation between economic growth (GDPGR) and external debt (LEDTGDP) in Nigeria. Growth is also negatively correlated with other debt service ratios. On the contrary, public investment (LGPIV) is positively correlated to external debt.

### Time Series Properties

Recent developments in econometrics have shown the limitations of traditional modeling construct in empirical analysis. The outcome of such generating series (i.e. working with non-stationary variables) leads to spurious regression results from which

further inference may be meaningless. Unit root and cointegration tests are important tests that are often used to circumvent the inherent limitations of traditional models. To this effect, the Augmented Dickey-Fuller (ADF) tests are used to test for the stationarity of the series so as to be sure that we are not analyzing inconsistent and spurious relationships. The tests show that the variables Real GDP growth rate (GDPGR), interest rates (INT), fiscal balance in percent of GDP (FISBAL) and private foreign investment/GDP ratio (LFDIGDP) are stationary (integrated of order zero) at 5% level of significance. The rest of the variables were found to be stationary after differencing once. The variables are, therefore, integrated of order I (1).

### ADF Unit Root Test Results

Variable	ADF Tests Statistics	5% Critical Value	Level
GDPGR	5.2834	3.5578	I(0)
LEDTGDP	5.7823	3.5629	I(1)
LDSE	6.1224	3.5629	I(1)
LDSGDP	7.6963	3.5629	I(1)
LGPUIV	6.4338	3.5629	I(1)
LHCD	5.4012	3.5629	I(1)
INT	4.1960	3.5578	I(0)
LINF	11.9801	3.5629	I(1)
LREER	4.5780	3.5629	I(1)
FISBAL	4.3940	3.5629	I(0)
LRESM	12.1002	3.5629	I(1)
LAIDGNI	4.2703	3.5629	I(1)
LFDIGDP	4.7398	3.5577	I(0)

The next step after finding out the order of integration of the variables was to establish whether the non-stationary variables are cointegrated<sup>7</sup>. To establish this, the Johansen test was used. The test indicates the presence of five and six cointegrating equations (vectors) in the two models at 5% level of significance. This result confirms the existence of a long run equilibrium relationship between the variables (see annexes 1a and 1b).

<sup>7</sup> The concept of cointegration implies that if there is a long-run relationship between two or more non-stationary variables, deviation from this long-run path are stationary. Variables may move apart in the short-run but be brought together by market forces, government policy or both. So variables are said to be cointegrated if they are affected by the same long-run influence.

Having established cointegration in the two models, growth and public investment equations were re-specified to include an Error Correction Term (ECM).

$$D(GDPGR_t) = \alpha_0 + \alpha_1 D(LEDTGDP_t) + \alpha_2 D(LDSE_t) + \alpha_3 D(LGPUIV_t) + \alpha_4 D(LFDIGDP_t) + \alpha_5 D(LHCD_t) + \alpha_6 D(LINF_t) + \alpha_7 D(LREER_t) + \alpha_8 (GCRI_t) + \alpha_9 D(LEDTGDP_{t-1}) + \alpha_{10} D(LGPUIV_{t-1}) + \alpha_{11} D(FISBAL_{t-1}) + \alpha_{12} ECT_{t-1} + U_{1t} \quad (1)$$

We have the following *a priori* signs:

$$\alpha_2, \alpha_6, \alpha_8, \alpha_9, \text{ and } \alpha_{11} \leq 0, \text{ and } \alpha_1, \alpha_3, \alpha_4, \alpha_5, \alpha_7 \text{ and } \alpha_{10} \geq 0$$

$$D(LGPUIV_t) = \beta_0 + \beta_1 D(LEDTGDP_t) + \beta_2 D(LDSGDP_t) + \beta_3 D(LRESM_t) + \beta_4 D(LAIDGNI_t) + \beta_5 D(LFDIGDP_t) + \beta_6 D(INT_t) + \beta_7 D(LREER_t) + \beta_8 D(FISBAL_t) + \beta_9 D(GDPGR_{t-1}) + \beta_{10} D(LEDTGDP_{t-1}) + \beta_{11} ECT_{(t-1)} + U_{2t} \quad (2)$$

We hypothesize the following signs:

$$\beta_2, \beta_6, \beta_8, \text{ and } \beta_{10} \leq 0, \text{ and } \beta_1, \beta_3, \beta_4, \beta_5, \beta_7, \text{ and } \beta_9 \geq 0$$

### Granger Causality Test

Granger proposed the causality concept in 1969: the variable  $Y_{2t}$  is the cause of  $Y_{1t}$ , if the predictability of  $Y_{1t}$  is improved when the information related to  $Y_{2t}$  is incorporated in the analysis. The basic principle of Granger causality analysis is to test whether past value help to explain current value. Maddala (1998) indicates that if two variables are cointegrated, there must be at least one direction of causality between investigated variables. Our objective is to investigate whether observation of a variable like public investment (LGPUIV) is potentially useful in anticipating future movements in GDP growth rate (GDPGR), and to test Granger causality between LGDPUIV and LEDTGDP, and between GDPGR and external debt (LEDTGDP).

### Interpretation of Granger Causality Result

Test for causal relationship between public investment (LGPUIV), GDP growth rate (GDPGR) and external debt for the period 1979-2004 is shown in annex 2. The results indicate that we can reject the null hypothesis that public investment does not Granger cause GDPGR and that LGPUIV does not Granger cause external debt (both at 5% level of significance). With regard to the relationship between external debt and GDPGR, the

analysis shows that we cannot reject the null hypothesis that external debt do not Granger cause GDPGR, indicating that there is no evidence of Granger causality between external debt and GDPGR in the case of Nigeria.

### Estimation Results

The results of the models obtained below used ordinary least square (OLS) technique on time series data covering 1970-2004. The econometrics computer software package, E-views (version 4.0) was used for the estimation.

### Growth Equation

The estimated results for the growth equation are presented below:

Dependent Variable: D(GDPGR)			
Variable	Coefficient	t-Statistic	Probability
C	2.181585	2.575794	0.0196
D(LEDGTGDP)	0.053554	0.032759	0.9742
D(LDSE)	-4.923255	-4.839725	0.0002
D(LGPIV)	3.706496	2.410126	0.0276
D(LFDIGDP)	-1.500176	-3.380285	0.0036
D(LINF)	-1.690784	-2.418853	0.0271
D(LREER)	7.949880	3.625443	0.0021
D(LHCD)	-18.93489	-3.260327	0.0046
GCRI	-2.450915	-2.412374	0.0274
DLEDGTGDP(-2)	5.044408	2.832718	0.0115
DLGPIV(-1)	-1.130598	-0.876809	0.3928
DFISBAL(-1)	-0.428443	-3.871655	0.0012
ECM(-1)	-1.751680	-9.473445	0.0000
R-squared	0.926435	F-statistic	17.84062
Adjusted R-squared	0.874506	Prob(F-statistic)	0.000000
Durbin-Watson statistic	1.855843		

### Results for Public Investment Equation

The regression estimates for the public investment equation are presented below. The evaluations of the results are also discussed below.

Dependent Variable: D(LGPUIV)			
Variable	Coefficient	t-Statistic	Probability
C	0.018898	0.277232	0.7848
D(LEDGTDP)	-0.302245	-1.294962	0.2117
D(LDSGDP)	0.193980	2.105787	0.0495
D(LRESM)	0.078930	0.847027	0.4081
D(LAIDGNI)	-0.552004	-2.488590	0.0228
D(LFDIGDP)	0.129973	2.423560	0.0261
D(INT)	0.018063	1.173675	0.2558
D(LREER)	-0.471518	-2.220070	0.0395
D(FISBAL)	-0.024264	-2.223478	0.0392
DLEDGTDP(-1)	-0.029510	-0.125300	0.9017
DGDPGR(-1)	0.028391	2.211118	0.0402
DGPUIV(-1)	0.033130	0.205981	0.8391
ECM(-1)	-0.733695	-2.587835	0.0186
R-squared	0.739206	F-statistic	4.251658
Adjusted R-squared	0.565343	Prob(F-statistic)	0.002962
Durbin-Watson statistic	1.918196		

### Other Diagnostic Tests

The outcome of the diagnostic tests is satisfactory. A value with a corresponding probability greater than 5% is an indication of good result. The results of the test further suggest that the model is well specified and robust for policy analysis (see annex 3). In addition to the above tests, the CUSUM and CUSUM of Squares stability tests were performed in order to establish the reliability and stability of our model. The graphs show that the parameter movements are within the critical lines at the 5% level of significance, indicating stability of the model (see annex 4).

### Interpretation of Results

#### Growth Equation

Several of the variables considered in the determination of the growth regression output were found to be statistically significant and with t-statistics greater than two in absolute terms, namely, LDSE, LGPUIV<sub>t</sub>, LFDIGDP<sub>t</sub>, LINF<sub>t</sub>, LREER<sub>t</sub>, LHCD<sub>t</sub>, GCRI<sub>t</sub>, LEDTGDPT<sub>(t-1)</sub>, and FISBAL<sub>(t-1)</sub>. The rest of the variables LEDTGDPT<sub>t</sub> and LGPUIV<sub>(t-1)</sub> are not statistically significant. Similarly, all the variables have the hypothesized sign, except LEDTGDPT<sub>(t-2)</sub>, LFDIGDP<sub>t</sub>, LHCD<sub>t</sub> and LGPUIV<sub>(t-1)</sub>.

The regression results of the error correction model (ECM), in the growth equation support our hypotheses by confirming the existence of crowding out and import

compression hypotheses in Nigeria. This means that debt servicing pressure in the country has had a significant adverse effect on the growth process. However, the coefficient of past debt accumulation ( $LEDTGDP_{t-2}$ ) relates positively to economic growth, thus contradicting the prescription of the debt overhang hypothesis in Nigeria. This result was not expected. However, the explanation for the positive relationship could be found in the structure of public finance in Nigeria. In the past the need for foreign borrowing by Nigeria was minimal, as debt contracted by the country were concessional debt from official sources such as the World Bank and Nigeria's trading partners. These debts did not exert much pressure on the economy because the interest charged on the loans was generally low, with longer repayment period. Moreover, these loans and grants financed a lot of consumption and investment expenditure in many sectors of the economy, notably education, health, transport and communication etc. Nonetheless, the country had comfortable external reserves as a result of the unprecedented inflow of foreign exchange from oil exports.

The results further revealed some evidence in support of a positive relationship between current capital inflow in Nigeria and economic growth ( $LEDTGDP_t$ ), but that support is not robust. Perhaps the results could point to the impact of external resources in the Nigerian growth process and suggest that Nigeria depends heavily on external resources. These results are consistent with the findings from similar studies (e.g Elbadawi, 1996, Were, 2001).

Fiscal balance as a per cent of GDP (lagged one period), inflation rate, and human capital development negatively affects economic growth while the real effective exchange rate is positively related to economic growth. Political instability negatively affects economic growth, as the dummy variable introduced to capture political instability had a negative sign.

The lagged error correction term ( $ECM_{t-1}$ ) has the expected negative sign (-1.75) and highly significant. The negative value supports our earlier findings of the cointegrating relationship between the variables. The coefficient indicates speed of adjustment of around -1.75 which is relatively high. This implies that following short-run disequilibrium, 175% of the adjustment to the long-run takes place within one period. The coefficient of determination relating to the goodness of fit, measured by the  $R^2$

indicates that 92% of the variations in GDP growth rate are explained by the independent variables during the period of the study. The F-statistics of 17.84 with a corresponding low probability of 0.00000 is a clear indication that the model is well specified. The Durbin-Watson statistics of 1.85 indicates that autocorrelation is not a problem in our specification.

### **Public Investment Equation**

The result shows that the variables  $LDSGDP_t$ ,  $LAIDGNI_t$ ,  $LFDIGDP_t$ ,  $LREER_t$ ,  $FISBAL_t$ , and  $GDPGR_{t-1}$  are found to be statistically significant. The remaining variables are not statistically significant. All the variables have their hypothesized sign, except  $LEDTGDP_t$ ,  $LDSGDP_t$ ,  $LAIDGNI_t$ ,  $LINT_t$  and  $LREER_t$

In the public investment equation, past debt accumulation ( $LEDTGDP_{t-1}$ ) negatively affects public investment. This outcome is expected and revealed some evidence in support of the debt overhang hypothesis in Nigeria. However, that support is not robust in the model. On the other hand, debt service ratio ( $LDSGDP$ ) is positively related to investment, thus contradicting the prescription of crowding out hypothesis in Nigeria. This result was unexpected. The sign of this variable is an aberration. However, the structure of the economy might have accounted for the aberration. Crude oil dominated the country's export; and if a significant proportion of the debt service is linearly related to oil exploration through the joint venture operations, and given that oil exports and investment/economic growth are highly correlated, then the outcome is not surprising. The more debt obligations the oil companies and the Nigerian National Petroleum Corporation (NNPC) settled the more creditworthy the sector becomes, hence the more vibrant the sector and the economy. It is also plausible to argue that debt service ratio for Nigeria has been relatively small compared to other low-income highly - indebted countries. This is because of the country's determination not to spend beyond 30.0 per cent of its earnings on debt service. The results further suggest that GDP growth rate is positively related to public investment through the accelerator mechanism and this supports the a priori expectation that the rate of growth of GDP should be positively related to investment. The results also show that private foreign investment is a key determinant of public investment confirming the complementarity's hypothesis in production.

The lagged error correction term ( $ECM_{t-1}$ ) has the expected negative signed (-0.73) and statistically significant at 1 level %. The result confirms the existence of long run relationship between the dependent and explanatory variables. The coefficient of the error term indicates a speed of adjustment of around -0.73. This suggests that following short-run disequilibrium/deviation, 73% of the adjustment to the long-run take place within one period either by market mechanism, government intervention or a combination of both. The R-squared ( $R^2$ ) of 0.74, which measures goodness of fit, indicates that 74% of the systematic variations of public investment in Nigeria is explained by the explanatory variables during the period of the study. The overall F-statistics of 4.25 with a low probability of less than 5%, gives clear evidence that the equation is well fitted. The Durbin-Watson statistics of 1.91 indicates the absence of autocorrelation in our specification.

## **VI. Policy Implications, Recommendations and Conclusion**

### **Policy Implications**

The heavy debt burden that confronts Nigeria has adversely affected the level of economic performance. Though kept below 20.0 per cent, the level of debt service payments still remains large. This means that the resources that would have been used for investment are diverted to meeting debt service obligations. The debt servicing and the adjustment policies required to address the debt burden have also worsened social welfare in the area of education, health, communication, etc. The most serious implication of debt overhang is that, it has reduced the amount of foreign exchange available to finance the importation of raw materials and capital goods needed for rapid economic development. This means that the debt burden has denied the industrial and agricultural sectors the needed inputs, holding back new investments and even the maintenance of capital stock. The import compression effect, which arose from the decline in foreign exchange earnings from the levels in the 1970's and early 1980's, and the need to meet debt service obligations, led to a reduction in commitments to development projects. For most of the 1980's and part of the early 1990's, real GDP growth was negative.

The pursuance of improved macroeconomic policies, which is an essential condition to cope with the pressures of debt and debt service, has caused a decline in living standards

because of debt build-up, arrears on debt, debt-service and external commercial payments, thus stretching the supply of foreign exchange to the limit. The accumulation of arrears arose over the years because of the inadequate financial provision of external debt service. Such arrears on debt service obligations increased to about \$19.0 billion at the end of 2002 and accounted for about 60.3 per cent of the total indebtedness during the period. These have impaired or worsened Nigeria's credit ratings in the international market as the country was classified as the third most risky country in terms of credit rating in 1994. The country could no longer attract the needed foreign capital to augment domestic savings. It also made the rescheduling of Nigeria's debt difficult by the Paris Club of Creditors. This is because the country is perceived by the creditors to possess the capacity to service its debt beyond what is currently paying. This illusion has eroded the confidence of both domestic and potential foreign investors.

### **Policy Recommendations**

Based on the above policy implications, the study provides the following policy recommendations for consideration.

- Nigeria must press for substantial debt reduction in the external debt stock, in order to achieve sustainable growth and economic development. Debt forgiveness or interest write-offs are recommended rather than temporary debt relief.
- The need to expand the country's productive capacity base is also quite apparent. In this regard, the promotion of non-oil exports in order to increase the exports earnings of the country should be encouraged; specifically, the revitalization of agriculture is recommended. This effort should be consolidated through backward integration.
- Greater emphasis must be placed on maximizing the concessionary assistance from multilateral institutions as well as encouraging foreign direct investment. Borrowing, especially from commercial creditors, could be considered only after detailed feasibility studies on the social and commercial viability of the project have been undertaken and should not be guaranteed by government. As long as investments maintain commercial net worth by paying interest and principal regularly, borrowing will not constitute a problem.

- Government should curtail its extra-budgetary activities and reduce its expenditure. In other words, there should be fiscal discipline.
- The country should be stabilized politically in order to attract foreign direct capital in the form of direct and portfolio investment. If there is no political stability, private investors will relocate their enterprises or simply wait for the instability to dissipate.

### **Conclusion**

In conclusion, we have seen the interaction between external debt, investment and economic growth. We also acknowledge the fact that Nigeria is a developing country with great potential for rapid growth. However, we realize that this could not be possible without adequate investment. Thus, given the capital inadequacy of the nation both in terms of foreign exchange and domestic savings, one option is to obtain foreign financing to bridge these gaps. But, if foreign borrowing is to be resorted to, such funds must be invested in productive activities; that is the marginal efficiency of investment or internal rate of return must be higher than the cost of capital.

Finally, Nigeria still has a chance of overcoming her external debt problems by cultivating the right policies such as trade liberalization, tax reforms, favorable investment climate, etc and, through deeper debt relief/debt cancellation. The debt relief will enable the country to use the lean foreign exchange earnings to procure the badly needed inputs for industries and infrastructures; this would help in restoring investment, financial solvency and promoting economic growth.

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**Appendix****Table 1: Selected Economic Indicators 1970-2004**

Table 1								
SELECTED ECONOMIC INDICATORS 1970-2004								
Year	GDPGR	Inflation Rate	Exch.Rate	CAB/GDP(%)	EDT/GDP	EDT/EXPORTS	TDS/EXPORTS	External Reserves(\$)
1970	5.70	13.80	0.7143		11.50	68.20	4.50	156.58
1971	11.47	15.60	0.6955		6.50	36.30	1.80	281.38
1972	0.98	3.20	0.6579		6.70	33.90	3.00	243.58
1973	7.64	5.40	0.6579		7.20	34.90	3.00	377.98
1974	11.16	13.40	0.6599		4.30	13.90	1.80	3,452.30
1975	-3.22	33.90	0.6159		4.10	14.30	3.10	3,583.70
1976	9.18	21.20	0.6265		2.10	8.60	3.50	3,286.30
1977	6.09	15.40	0.6466		6.30	26.60	0.90	2,814.50
1978	-5.49	16.60	0.6060		9.10	48.20	1.00	1,298.90
1979	6.84	11.90	0.5957		8.10	37.10	1.40	3,059.80
1980	3.71	9.90	0.5464		13.90	34.40	0.70	5,462.00
1981	-9.25	20.90	0.6100		17.80	59.80	4.80	2,441.60
1982	-0.82	7.70	0.6729		26.40	108.00	9.50	1,043.30
1983	-5.40	23.20	0.7241		50.80	171.50	17.80	224.40
1984	-5.40	39.60	0.7649		61.60	146.30	29.10	710.10
1985	9.40	5.50	0.8938		66.60	144.20	31.80	1,657.90
1986	3.20	5.40	2.0206		126.50	503.00	38.70	2,836.60
1987	-0.60	10.20	4.0179		120.80	374.60	12.90	7,504.59
1988	10.00	38.30	4.5367		134.30	446.40	28.50	5,229.10
1989	7.30	40.90	7.3916		132.50	401.30	27.50	3,047.62
1990	8.30	7.50	8.0378	7.4	117.40	246.10	28.30	4,541.45
1991	4.73	13.00	9.9095	-3.9	123.50	275.30	29.20	4,487.00
1992	2.98	44.60	17.3000	-0.9	88.70	246.10	24.40	713.00
1993	2.65	57.20	22.0468	-2.8	143.90	310.20	17.90	1,330.10
1994	1.02	57.00	218861	-5.7	139.80	349.90	19.50	1,658.80
1995	2.44	72.80	70.3632	-9.4	121.30	290.50	13.80	1,441.00
1996	3.40	29.30	69.8449	8.5	89.00	194.90	11.60	4,074.70
1997	3.16	8.50	71.7505	1.2	78.50	187.10	9.80	7,581.20
1998	2.36	10.00	84.4000	-11.5	94.20	337.70	14.20	7,100.00
1999	2.80	6.60	91.8000	1.2	83.80	226.20	13.40	5,450.00
2000	5.40	14.50	101.6500	15.71	68.10	163.80	14.90	9,910.40
2001	4.70	16.50	111.9400	5.18	61.20	174.00	14.60	10,415.60
2002	4.60	12.20	120.9700	1.29	72.00	191.40	17.40	7,681.10
2003	9.60	23.80	129.3600	15.17	61.10	145.62	15.10	7,467.78
2004	6.60	10.00	133.5000	16.63	59.20	158.37	12.74	16,955.02

**Annex 1(A): Johansen Cointegration Test for Growth Equation**


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Series: GDPGR LEDTGDP LDSE LGPUIV LFDIGDP LREER LINF FISBAL LHCD GCRI

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Lags interval (in first differences): 1 to 1

Hypothesized		Trace	5 Percent	1 Percent
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value
None **	0.999877	655.7342	212.67	226.40
At most 1 **	0.967174	376.5775	175.77	187.31
At most 2 **	0.950274	270.6654	141.20	152.32
At most 3 **	0.910929	177.6272	109.99	119.80
At most 4 **	0.760024	102.6591	82.49	90.45
At most 5	0.596840	58.41544	59.46	66.52
At most 6	0.365367	30.25434	39.89	45.58
At most 7	0.297488	16.15839	24.31	29.75
At most 8	0.149695	5.212512	12.53	16.31
At most 9	0.005968	0.185564	3.84	6.51

\*(\*\*) denotes rejection of the hypothesis at the 5%(1%) level

Trace test indicates 5 cointegrating equation(s) at both 5% and 1% levels

**Annex 1(B): Johansen Cointegration Test for Public Investment Equation**

Series: LGPUIV LEDTGDP LDSGDP GDPGR LRESM LAIDGNI LFDIGDP INT LREER FISBAL

Lags interval (in first differences): 1 to 1

Hypothesized		Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
No. of CE(s)	Eigenvalue			
None **	0.995198	448.5296	212.67	226.40
At most 1 **	0.903172	283.0282	175.77	187.31
At most 2 **	0.873241	210.6488	141.20	152.32
At most 3 **	0.842210	146.6193	109.99	119.80
At most 4 *	0.603888	89.37805	82.49	90.45
At most 5 *	0.534149	60.67025	59.46	66.52
At most 6	0.417013	36.98964	39.89	45.58
At most 7	0.346788	20.26235	24.31	29.75
At most 8	0.203683	7.060895	12.53	16.31
At most 9	1.28E-05	0.000397	3.84	6.51

\*(\*\*) denotes rejection of the hypothesis at the 5%(1%) level

Trace test indicates 6 cointegrating equation(s) at the 5% level

Trace test indicates 4 cointegrating equation(s) at the 1% level

**Annex 2: Result of Granger Causality Test**

Pairwise Granger Causality Tests

Sample: 1970 2004

Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability
LGPIV does not Granger Cause GDPGR	32	4.46042	0.04342
GDPGR does not Granger Cause LGPIV		2.89356	0.09964
LEDTGDP does not Granger Cause GDPGR	32	0.03614	0.85055
GDPGR does not Granger Cause LEDTGDP		0.10859	0.74413
LEDTGDP does not Granger Cause LGPIV	32	1.00469	0.32447
LGPIV does not Granger Cause LEDTGDP		4.77686	0.03707

*Probability is the critical probability (acceptance probability)*

*The null hypothesis  $H_0$  is accepted as soon as probability is higher than 5%*

**Annex 3: Summary of Diagnostic Tests****Summary of Diagnostic Tests for Growth Equation (1)**

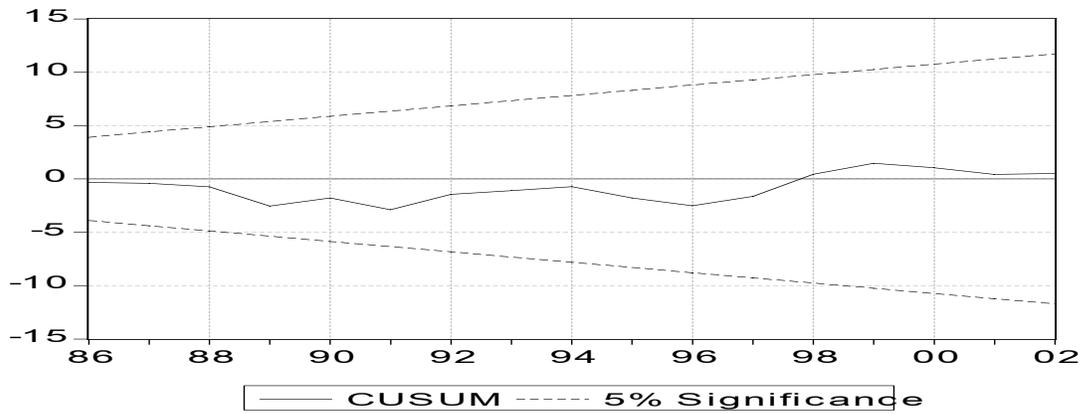
Test	F-Statistics	Probability
<i>Jack-Bera Normality</i>	<i>0.51</i>	<i>0.77</i>
<i>Breusch-Godfrey</i>	<i>0.11</i>	<i>0.73</i>
<i>White Heteroskedacity</i>	<i>0.23</i>	<i>0.99</i>
<i>RAMSEY Reset</i>	<i>0.05</i>	<i>0.82</i>

**Summary of Diagnostic Tests for Public Investment (2)**

Test	F-Statistics	Probability
<i>Jack-Bera Normality</i>	<i>0.86</i>	<i>0.65</i>
<i>Breusch-Godfrey</i>	<i>0.03</i>	<i>0.85</i>
<i>White Heteroskedacity</i>	<i>0.40</i>	<i>0.94</i>
<i>RAMSEY Reset</i>	<i>0.26</i>	<i>0.61</i>

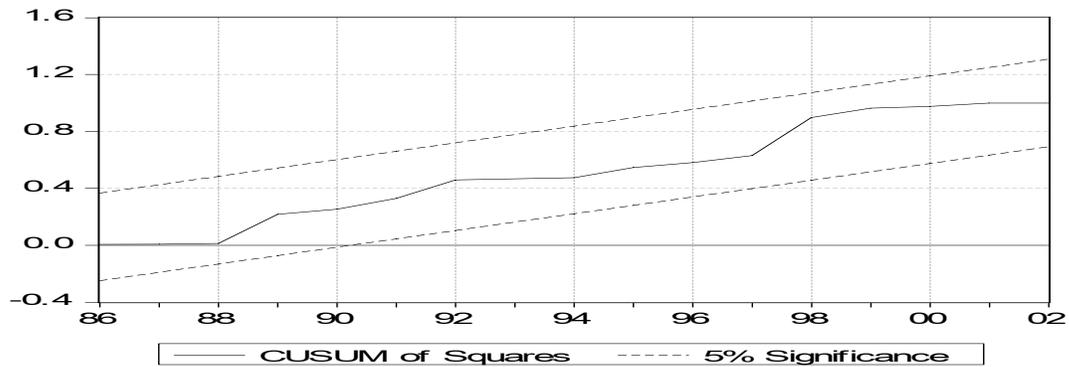
**Annex 4: CUSUM and CUSUM of Square Stability Test**

i) *CUSUM and CUSUM of Squares stability for Growth Equation (1)*



*We conclude that the ECM model is stable*

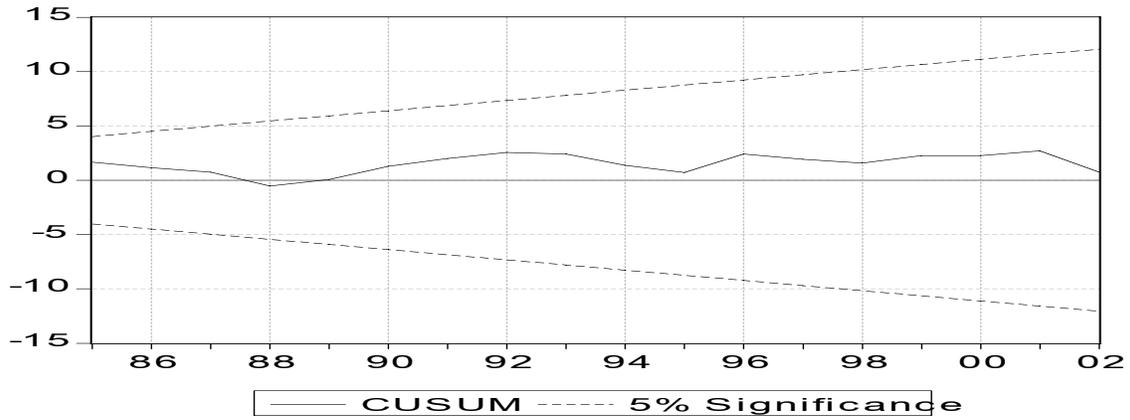
**CUSUM of Squares Test**



*We conclude that the ECM is stable*

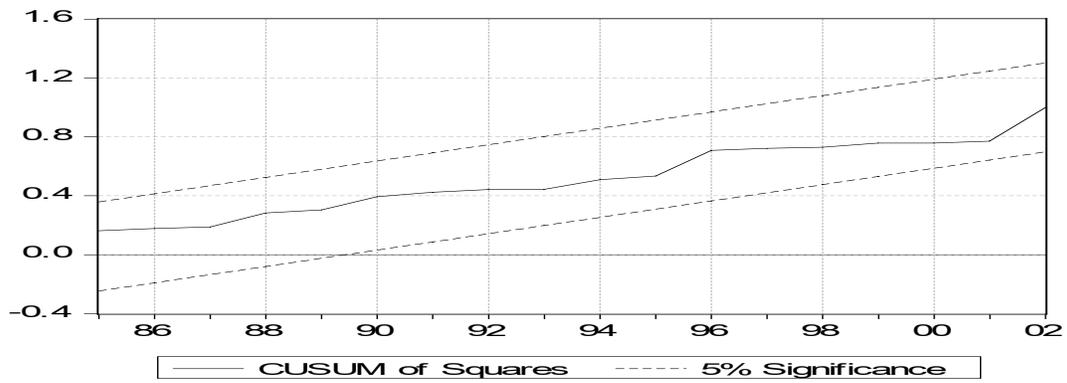
ii) *CUSUM and CUSUM of Squares stability for Public Investment Equation (2)*

**CUSUM Test**



*We conclude that the ECM model is stable*

**CUSUM of Squares Test**



*We conclude that the ECM is stable*