THE IMPACT OF PUBLIC DEBT ON PRIVATE INVESTMENT IN NIGERIA: EVIDENCE FROM A NONLINEAR MODEL

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Abstract

This study examined the impact of public debt on private investment in Nigeria over the period 1981 – 2012. Data were sourced from the CBN statistical Bulletin, 2012. Private investment as a ratio of GDP (PINV) was regressed on external debt (XD), external debt squared (XDsqr), Domestic debt (DB), domestic debt squared (DBsqr) and private consumption expenditure as a percentage of GDP (PCXR) using the instrumental variable technique of estimation and bootstrapping technique for the computation of normal based standard errors for the turning points. The results show that: DB has a linear and positive impact on PINV; XD has a U-shaped impact on PINV; and PCXR has a negative impact on PINV. All the variables were statistically significant at 1% level except for the DB turning point that was statistically not significant at all. The XD turning point was estimated to be 124.69 percent and was statistically significant at the 1% level. The study therefore concludes that: the impact of domestic debt on private investment in Nigeria is linear and positive; and (ii) the impact of external debt on private investment in Nigeria is U-shaped. The study therefore recommends that, for Nigeria to benefit from government external borrowings such funds should be large enough compare to her GDP and should be invested in productive ventures.

Keywords: public debt, external debt, domestic debt, private investment, nonlinear model, turning point, bootstrapping, instrumental variable

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1. Introduction

The aim of every government is to achieve the macroeconomic goals of low and stable domestic prices, high and sustained aggregate demand, low and acceptable level of unemployment, high and sustainable economic growth amongst others. To achieve these goals government often rely on the use of a mix or either of monetary and fiscal policy. Whereas the former involves government effort to directly control the movement and direction of monetary aggregates such as credit facilities the latter involves the collection of taxes and government spending. When government spending exceeds its revenue the government is said to be running deficit budgeting. To finance this deficit government use at least one of four ways which include: (i) money printing; (ii) running down foreign exchange reserves; (iii) borrowing abroad; and (iv) borrowing from the domestic economy. The method chosen to finance government deficit affects resource allocation and by implication macroeconomic activities. The focus of this study is on financing public deficit through domestic and external borrowing.

One form of financing public deficit is the issuance of domestic debt instruments. This is usually intermediated by the banking system. While government domestic borrowing is often thought of as a way to avoid both inflation and external crises, it carries its own dangers if excessively used. By definition, government borrowing reduces the credit which would otherwise be available to the private sector, putting pressure on domestic interest rates. Where interest rates are controlled, domestic borrowing still leads to credit rationing and crowding out of private sector investment. If the economy is well integrated with international capital markets, then government domestic borrowing will tend to push the private sector into borrowing more abroad.

A good indicator of a country’s ability to repay its debt is the debt-to-GDP ratio. The Nigeria’s domestic debt as a share of GDP which fluctuated around 5.45% and 65.58% between 1970 and 1992 hardly
went below three digits between 1993 and 2012 and stood at a record high of 735.47% in 2012 (CBN, 2012). The possibility is that debt would have been increasing faster than GDP within this period and this portends difficulties for the economy as the available resources may not be enough to repay the debt thus debt repayment may be deferred to the future. In the midst of this the country has not fared well in major macroeconomic indicators. For instance GDP which had negative growth (-1.8%) in 1981 though, increased and reached a record high of 10% in 1988 has declined since then but reached 9.6% in 2003 and stood at 6.6% in 2012. Also, inflation rate which was at its lowest level of 1.6% in 1971 increased rapidly reaching a record high of 72.8% in 1995. Although the situation has improved since then, inflation in Nigeria has hardly gone below two digits and stood at 12% in 2012. Also, private consumption expenditure as a share of GDP which peaked at N206607.34M in 2010 has declined since then and stood at N153878.43M in 2012. Nigeria’s external debt share of GDP which was 19.61% in 1981 reached a record high of 161.71% in 1993 and fluctuated around 5.63% and 6.11% between 2006 and 2011 (CBN, 2007a, 2007b and 2012). The above statistics depicts an opprobrious economic situation. More importantly, this has been in the midst of government’s efforts to increase the level of wellbeing of the people through job creation and other palliatives thus raising puzzles. Consequently, several studies have been carried out, but with much focus on external debt and only a few asked questions about domestic debt. Again, though there has been overwhelming evidence that the debt-GDP ratio has a nonlinear impact on macroeconomic variables (Cecchetti, et al. 2011; Checherita and Rother, 2010; Minea and Parent, 2012 and Egert, 2012) studies specific to Nigeria have often times used linear models to examine this relationship, thereby giving the impression that debt, if found negative (positive) is bad (good) from the first naira drop and there is nothing (everything) to be desired of it. This may not be true if the nonlinear relationship holds. Therefore, this study examined the impact of domestic and external debts on private investment in Nigeria with specific focus on the debt turning points (nonlinear relationships).

2. Literature Review

2.1 Theoretical Underpin

The theoretical discuss on the growth-debt nexus has bordered on two key theories viz the Ricardian Equivalence and the Keynesian proposition.

The Ricardian equivalence proposition states that for a given path of government consumption, the timing of taxes, or equivalently, the accumulation and decumulation of public debt, does not affect private consumption. In a closed economy, it therefore also leaves the interest rate, investments and output unchanged. If this proposition holds, the scope of fiscal policy as a stabilization tool of the economy will be very limited. This is in a sharp contrast to the basic Keynesian perspective. From the Keynesian viewpoint, a tax reduction/public debt accumulation in one period increases private consumption and therefore affects other macroeconomic variables such as output and unemployment. Following the famous work of Barro (1974), the equivalence proposition received a renewed consideration. Barro argued that the private sector’s holding of government bonds does not represent net wealth to the households, and therefore has no effect on private consumption. This stand has received support by other papers displaying the equivalence result, but there are also contributions to the literature which favor the Keynesian prediction (Becker, 1995).

The conventional view of public debt (Elmendorf and Mankiw, 1999), holds that in the short-run output is determined by demand and fiscal deficits (or higher public debts) has a positive effect on disposable income, aggregate demand, and overall output. This positive effect experienced in the short-run is likely to be large when actual output is far below capacity. Elmendorf and Mankiw (1999) stated that things are the same in the long-run. If Ricardian Equivalence does not hold, the decrease in public savings brought about by a higher budget deficit will not be fully compensated for by an increase in private savings. As a result, national savings will decrease, resulting in lower total investment, either at home or abroad. Lower investment at home will have a negative effect on GDP, as it will lead to a smaller capital stock, higher interest rate, lower labor productivity and wages. Lower foreign investment (or higher foreign inflows), instead, will have a negative effect on foreign capital income and will thus lower the country’s future GNP. This negative effect of an
increase in public debt on future GDP (or GNP) can be amplified by the presence of distortionary taxes.

2.3 Empirical Literature

A large number of empirical works have found that the relationship between debt and growth is non-linear and characterized by the presence of a threshold above which debt starts having a negative effect on economic growth. Non-linearity and threshold effects could arise from the presence of debt overhang (Krugman, 1988; Sachs, 1989). Checherita-Westphal et al, (2012) developed a theoretical model in which, over the business cycle, debt can only be issued to finance public investment and the optimal level of public debt is determined by the public to private capital ratio that maximizes economic growth. With such a set-up, they showed that the level of debt that maximizes economic growth is a function of the output elasticity of the capital stock. Checherita-Westphal et al (2012) used the model to estimate the optimal debt ratios for various subsamples of OECD countries and found values that range between 43 and 63 percent of GDP. However, Greiner (2012a) showed that the results of Checherita-Westphal et al, (2012) are driven by their assumption that the deficit is equal to public investment at each point in time. According to Greiner (2012a), in such a set-up, debt is completely irrelevant and the non-linear relationship between debt and growth is given by the growth-maximizing tax rate. He then showed that allowing for a more general debt policy leads to a monotone and negative relationship between public debt and steady-state growth. Greiner (2011, 2012b) also argued that the effect of debt on growth depends on the presence of rigidities in the economy.

In particular, Greiner (2011) showed that, in a model with no rigidities and elastic labor supply, public debt has a negative effect on labor supply, investment, and economic growth. In the presence of wage rigidities and unemployment, instead, public debt has no effect on the allocation of resources and can even have a positive effect if it is used to finance productive investment.

Greiner (2012a) concluded that there is no well-specified model that can generate an inverted U-shaped relationship between debt and growth. Non-linearities may arise if there is a tipping point above which public debt suddenly become unsustainable (Ghosh et al, 2012, provide a formal model).

It is also possible that high levels of debt pose constraints on a country’s ability to conduct countercyclical policies, and thus increase output volatility and reduce economic growth (Ramey and Ramey, 1995). However, the relationship between debt and the ability to conduct countercyclical policies is more likely to depend on the composition of public debt than on the level of public debt (Hausmann and Panizza, 2011; De Grauwe, 2011). This suggests that countries with different debt structures and monetary arrangements are likely to start facing problems at very different levels of debt.

Reinhart and Rogoff’s (2010b; 2010a) showed that high levels of debt are negatively correlated with economic growth, but that there is no link between debt and growth when public debt is below 90 percent of GDP. Reinhart and Rogoff (2010b) illustrate this threshold effect by collecting annual data on debt and output growth for 20 advanced economies over 1946-2009 and splitting their sample into four groups: (i) country-years for which public debt is below 30 percent of GDP (443 observations); (ii) country-years for which public debt is between 30 and 60 percent of GDP (442 observations); (iii) country-years for which public debt is between 60 and 90 percent of GDP (199 observations); and (iv) country-years for which public debt is above 90 percent of GDP (96 observations). Next, they compute median and average GDP growth for each group and show that there are no large differences among the first three groups, but that average and median GDP growth are substantially lower in the fourth group. In particular, Reinhart and Rogoff (2010b) show that in the high debt group median growth is approximately 1 percentage point lower and average growth is nearly 4 percentage points lower than in other groups.

Cecchetti, Mohanty and Zampolli (2011) considered the question “When does debt go from good to bad?” using dataset that includes the level of government, non-financial corporate and household debt in 18 OECD countries from 1980 to 2010 and showed that beyond a certain level, debt is a drag on growth. For government debt, the threshold is around 85% of GDP. The immediate implication is that countries with high debt must act quickly and decisively to address their fiscal problems. The longer-term lesson is that, to build the fiscal buffer required to address extraordinary events, governments should keep debt well below the estimated thresholds. They also showed that when corporate debt goes beyond 90% of GDP, it becomes a drag on growth. And for
household debt, they reported a threshold around 85% of GDP.

Checherita and Rother (2010) investigated the average impact of government debt on per-capita GDP growth in twelve euro area countries over a period of 40 years starting from 1970. They found a non-linear impact of debt on growth with a turning point—beyond which the government debt-to-GDP ratio has a deleterious impact on long-term growth—at about 90-100% of GDP. Their results further suggested that the negative growth effect of high debt may start from levels of around 70-80% of GDP, which calls for even more prudent indebtedness policies. They also showed that the annual change of the public debt ratio and the budget deficit-to-GDP ratio are negatively and linearly associated with per-capita GDP growth. The channels through which government debt (level or change) is found to have an impact on economic growth rate are: (i) private saving; (ii) public investment; (iii) total factor productivity (TFP) and; (iv) sovereign long-term nominal and real interest rates.

Minea and Parent (2012) examined the relationship between debt and growth by using the Panel Smooth Threshold Regressions model originally proposed by Gonzalez et al, (2005). Using this approach, that allows for a gradual change in the regression coefficient when moving from one regime to the other, Minea and Parent (2012) showed that public debt is negatively associated with growth when the debt-to-GDP ratio is above 90 percent and below 115 percent. However, they also found that the correlation between debt and growth becomes positive when debt surpasses 115 percent of GDP. While Minea and Parent’s (2012) results suggest the existence of complex non-linearity, which may not be captured by models that use a set of exogenous thresholds.

Egert (2012) extends the time coverage of the Reinhart and Rogoff (2010b) sample back to 1790. He found a small negative correlation between debt and growth and, using an endogenous threshold model, some evidence of a non-linear relationship between debt and growth.

However, the estimated endogenous debt-to-GDP thresholds are generally much lower than 90 percent. In addition, Egert (2012) mentioned that the presence and the level of the thresholds are not robust to small changes in country coverage, data frequency, and changes in the assumptions on the minimum number of observations included in each regime.

On the other hand almost all the studies with specific reference to Nigeria have used linear models without testing the nonlinearity of the relationship. Wosowei (2013) examined the relationship between fiscal deficit and macroeconomic performance in Nigeria over the period 1980 to 2010. Using the OLS and found that fiscal deficits though negative had no significant effect on output growth. Amassoma (2011) examined the causal nexus between external debt, domestic debt and economic growth in Nigeria between 1970 and 2009 using a Vector Autoregressive (VAR) and a Vector Error Correction (VEC) models. They found that whereas there was no long-run relationship between domestic debt and economic growth external debt and economic growth showed a long-run relationship. Amassoma also found a bi-directional causality between domestic debt and economic growth and a unidirectional causality from economic growth to external debt in Nigeria. Oke and Sulaiman (2012) examined the impact of external debt on the level of economic growth and the volume of investment in Nigeria between 1980 and 2008. It was found that there exists a positive relationship between external debt, economic growth and investment.

Adofu and Abula (2010) who examined the relationship between domestic debt and economic growth in Nigeria for the period 1986 – 2005 found a negative relationship between domestic debt and economic growth. Kehinde, and Awotundun (2012) who examined the contribution of the total debt portfolio to real sector growth in Nigeria using a linear regression model showed that debt portfolio was negatively related to real sector growth in Nigeria. Uma, et al (2013) examined the influence of total domestic debt, total external debt cum servicing of external debt from 1970-2010 on the economic development of Nigeria and showed that total domestic and total external debts are inversely related to real gross domestic product, a proxy for economic development, but were statistically not significant. Umaru, et al (2013) investigated into the relationship between economic growth, external debt and domestic debt in Nigeria for the period 1970-2010 using the OLS method they showed that external debt had a negative impact on economic growth while domestic debt impacted positively on economic growth.
Ajao and Ogiemudia (2012) examined the effect of foreign debt management on sustainable economic development with emphasis on Nigeria over the period of 1979‒2009. The results showed a positive relationship between external debt and economic development in Nigeria, and a negative relationship between debt servicing and GDP. Further results revealed that external debt stock and debt servicing had a mix delay effect on the Nigerian economy. Emmanuel (2012) focused on the impact of public debt on economic growth in Nigeria. He showed that the joint impact of debt on economic growth is negative and quite significant in the long-run but become positive in the short-run. This was attributed to incompetent debt management. Paiko (2012) examined the impact of government expenditures on private investment and also how the financing of budget deficit have not only affected the performance of private investment but also how it crowds out private investment in Nigeria. His findings revealed a negative relationship between deficit financing and investment. Ajayi and Oke (2012) investigated the effect of external debt burden on economic growth and development in Nigeria and showed that external debt burden had an adverse effect on the nation’s income and per capital income.

Anayochukwu (2012) examined the causal relationship between inflation and fiscal deficits in Nigeria, covering the period 1970-2009, using an autoregressive distributed lag (ARDL) model and the Granger-causality test and found that causality runs from fiscal deficit to inflation and not the other way round. A negative and significant relationship between growth in fiscal deficit as percentage share of GDP and inflation was also found. Onwioduokit (2012) investigated the causal relationship between inflation and fiscal deficit in Nigeria from 1970 to 1994 and found that although fiscal deficit causes inflation, there was no feedback between inflation and fiscal deficit. They however showed that feedback existed between inflation and fiscal deficit deflated by the GDP. Also a structural model of inflation was estimated which revealed that, it takes about two years for fiscal deficit to impact on inflation in Nigeria. Ezeabasili, Mojekwu and Herbert (2012) also examined the relationship between fiscal deficits and inflation in Nigeria, using data over 1970–2006, their results revealed a positive but statistically not significant relationship between inflation and fiscal deficits in Nigeria. There was also no strong evidence linking past levels of fiscal deficits with inflation in Nigeria. Rather, a positive long run relationship between money supply and inflation was reported.

This study following the line of reasoning of Cecchetti, et al (2011), Checherita and Rother (2010), Minea and Parent (2012) and Egert (2012) argued that the relationship between private investment and debt may not necessarily be linear and by being specific to Nigeria departs from their study.

3. Methodology

3.1 Model Specification

The relationship between public debt and private consumption expenditure in Nigeria is presented following the quadratic production function. The mathematical specification is presented as:

\[ PINV = f(DB, XD, PCXR) \]  

(1)

The structural model can therefore be written as:

\[ PINV = \beta + \delta_1 DB_t + \delta_2 (DB)^2_t + \delta_3 XD_t + \delta_4 (XD)^2_t + \delta_5 PCXR_t + u_t \]  

(2)

where: DB = domestic debt outstanding as a percentage of GDP; XD = external debt as a percentage of GDP; PCXR = Private consumption expenditure percentage share of GDP; PINV = private investment share of GDP; subscript, t = current time; and \( u_t \) = stochastic error term.

After estimation, the debt-GDP ratio turning point, \( tp \) is estimated using the following formula:

\[ tp = \frac{-a}{2b} \]  

(3)

where \( a \) is the coefficient on the linear term and \( b \) is the coefficient on the quadratic term.

This method had been used by Checherita and Rother (2010) but in a panel data fixed – effects regression in their study of the average impact of government debt on per-capita GDP growth in twelve euro area countries over a period of 40 years starting from 1970.
3.2 Estimation Technique, Procedure and Justification

Equation (2) is estimated using the instrumental variable technique. This technique involves: (i) regressing PCXR on all the right hand variables in equation (2); (ii) retrieving the estimated values of PCXR to instrument for PCXR; and (iii) estimating equation (2) with OLS but using the estimated values of PCXR as instrument for PCXR. This is to mitigate the endogeneity bias that may rise due to the fact that variables explaining PCXR may also influence PINV. In addition, since the turning point is a non-linear combination (the ratio) of two estimated coefficients—debt and debt squared—multiplied by a scalar(-½), the normal distribution 95% confidence intervals (CI) estimated for each coefficient cannot be used to compute its CI. The study thus used the bootstrapping approach to assess the statistical uncertainty surrounding the turning point estimates. This method is commonly applied to compute the standard error of nonlinear functions for which it is too complex to analytically compute the variance (Vance, 2006).

Bootstrapping provides a way of estimating standard errors and other measures of statistical precision (Efron, 1979; Efron and Stein, 1981; Efron, 1982; Efron and Tibshirani, 1986; Efron and Tibshirani, 1993; Davison and Hinkley, 1997; Guan, 2003; Mooney and Duval, 1993; Poi, 2004; and Stine, 1990). It provides a way to obtain such measures when no formula is otherwise available or when available formulas make inappropriate assumptions (Cameron and Trivedi, 2009).

3.3 Data Sources

Data for this study were drawn from the Central Bank of Nigeria Statistical Bulletin, 2012 edition and Annual Reports for various years.

4. Results and Discussion

The empirical results for this study are presented on table 1. The results showed the relationship between public debt and private investment in Nigeria over the period 1981 – 2012. As expected DB and XDsqr showed positive signs while DBsqr, XD and PCXR showed negative signs. This means that the relationship between PINV and DB is inverted U-shaped while that between PINV and XD is U-shaped. The DB turning point is 79950 percent and XD turning point is 124.69 percent of GDP. Specifically, an initial 1 percent increase in DB increases PINV by 0.1599 percent until DB reaches a threshold of 79950 percent, when a further 1 percent increase leads to 0.000001 percent decrease in PINV but the turning point was statistically not significant. Also, an initial 1 percent increase in XD retards PINV by 67.4 percent until XD reaches a threshold (turning point) of 124.69 percent, when a further 1 percent increase leads to 0.27 percent increase in PINV. The XD turning point was statistically significant at 1% level. These results imply that the domestic debt – private investment nexus in Nigeria is linear and positive but that of private investment and external debt is nonlinear but inverted U-shaped. Unless external debt reaches 124.69 percent of GDP its impact on the level of investment expenditure in Nigeria is negative (external debt starts to have positive impact on the level of investment in Nigeria when it reaches a threshold of 124.69 percent of GDP). This is a serious policy formulation issue. For external debt to have a positive impact on private investment in Nigeria some substantial amount must be borrowed and invested otherwise the impact of external debt on private investment will always be negative. Also, increasing PCXR by 1 percent reduces PINV by 0.04 percent and this is statistically significant at the 1% level, implying that consumption expenditure is a drag on investment. R-squared of 0.2909 indicates that about 29 percent of variation in private investment expenditure is explained by public debt and consumption expenditure and the overall regression was statistically significant at the 1% level as indicated by the F-statistic of 6.99 with p-value of 0.0005, implying that the regression has a strong explanatory power.
Table 1: Instrumental Variables (2SLS) Empirical Results

<table>
<thead>
<tr>
<th>PINV</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>t-Statistic</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB</td>
<td>0.1599</td>
<td>0.0773331</td>
<td>2.07</td>
<td>0.049</td>
</tr>
<tr>
<td>DBSqr</td>
<td>-0.000001</td>
<td>0.000000009</td>
<td>-1.34</td>
<td>0.191</td>
</tr>
<tr>
<td>XD</td>
<td>-67.3992</td>
<td>15.94334</td>
<td>-4.23</td>
<td>0.000</td>
</tr>
<tr>
<td>XDsrq</td>
<td>0.270258</td>
<td>0.0771279</td>
<td>3.50</td>
<td>0.002</td>
</tr>
<tr>
<td>PCXR</td>
<td>-0.04228</td>
<td>0.0124977</td>
<td>-3.38</td>
<td>0.002</td>
</tr>
<tr>
<td>Constant</td>
<td>4758.217</td>
<td>698.8267</td>
<td>6.81</td>
<td>0.000</td>
</tr>
<tr>
<td>DB – Turning point</td>
<td>79950</td>
<td>88912.26</td>
<td>0.74</td>
<td>0.459</td>
</tr>
<tr>
<td>X D – Turning point</td>
<td>124.6942</td>
<td>22.43526</td>
<td>5.56</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Source: Author’s Computation

5. Conclusion and Recommendation

The major conclusions that can be drawn from this study are that: (i) the impact of domestic debt on private investment in Nigeria is linear and positive; (ii) the impact of external debt on private investment in Nigeria is nonlinear but U-shaped. Unless external debt as a ratio of GDP reaches some threshold value that is large enough for meaningful investment the impact of external debt on private investment in Nigeria will always be negative; and (iii) The Recardian equivalence proposition does not hold in the case of Nigeria.

The study therefore recommends that, for Nigeria to benefit from government external borrowings such funds should be large enough compared to her GDP and should be invested in productive ventures.

REFERENCES


