DYNAMICS OF NATIONAL DEBT ACCUMULATION AND ECONOMIC PERFORMANCE

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ABSTRACT

Many countries have run persistent budgets deficits in recent years. This has led to a dramatic growth in national debts and a concern that this trend could lead to "debt overhang" and bankruptcy. The present paper investigates the dynamics of debt accumulation effect on income growth with focus on three different groups of countries in Sub-Saharan Africa. For low income countries that are benefiting from debt relief, it appears important to understand more how the reduction of external debt and debt service affect growth. Our results suggest that low levels of external debt are associated with higher economic growth rates.

KEY WORDS: National debt, debt overhang, dynamics of debt accumulation, economic growth.

INTRODUCTION

There has been in recent years among citizens of various countries increased apprehension from the issue of national debt accumulation and its consequences on economic growth. The necessary outcome of persistent deficit financing might be a nation's debt so large that its interest payments exceed national income. If a country's debt level is predicted to surpass the country's reimbursement ability, then anticipated debt service can only be a rising function of the country's output level. This becomes a catch 22 in the sense that proceeds from domestic investment are rather diverted toward foreign creditors instead of accruing national income through reinvestment. Further more, for low income countries, high external debts can reduce the government's incentive to carry out structural and fiscal reforms, since the strengthening of the fiscal position could intensify pressures to repay foreign creditors (Clements et al, 2003). This is highly sensitive for low income countries where there is urgency in meeting structural reforms in order to achieve higher economic growth.

Most African countries have received large amount of loans over the years at highly prohibitive interest rates. This stock accumulation of debt so large has increased countries inability to pay back with the consequence of driving away potential lenders and investors.

Krugman (1988) defines this situation as "debt overhang". This happens when expected repayments on external debt falls short of the contractual value of the debt to the point of harshly hampering the economic performance of the debtor country. The debt overhang concept implies that when external debt grows large, investors lower expectations of return in anticipation of higher and progressively more distortionary taxes needed to repay the debt. Also, new domestic and foreign investment is discouraged to the point of slowing capital-stock accumulation and factor productivity growth (Patillo et al, 2004). After many low income countries rapidly accumulated debt in late 1980s and 1990s, it was recognized that providing aid largely in form of loans had led to excessive debt burden, particularly in sub-Saharan Africa. This realization was one of the factors leading to the introduction of the Heavily Indebted Pour Countries (HIPC) initiative in 1996, the enhanced HIPC initiative in 1999, and the Multilateral Debt Relief Initiative (MDRI) in 2006. The intention was to ease the debt burden. Countries could redirect resources to critical social expenditures, public investment and recreate a new fiscal and debt space that can be used to pave the foundation for satisfactory durable growth while keeping debt sustainable. The fundamental question to know whether or not debt relief can boost growth in poor countries. At what extent does external debt have a negative impact on economic growth to expect debt relief such as the initiatives described above to be effective? These are questions that can be answered by analyzing the dynamics of debt accumulation and income growth in defining the debt/growth relationship useful in assessing the effectiveness of HIPC Initiative in enhancing growth. Although, there has been extensive inquiry on the effect of external debt on growth, few studies have focused on low income African countries. The emerging markets economies experiment where most of the research has focused must be interpreted with prudence in evaluating debt/growth in low-income countries.

This paper examines the incidence of external debt on growth in three separate countries sub groups in sub-Saharan Africa. Based on their respective GDPs the last few years, countries were clustered as upper middle income, lower middle income, and low income in an attempt to extract potential differences. The rest of the paper is organized as follows. Section two summarizes theory and previous related literature on external debt and growth. Section three describes the data, the estimation methodology, and the model before discussing the results. Section four concludes and reflects on the policy implications of the findings.

THEORY AND RELATED LITERATURE REVIEW

Past literature and especially the most recent recognize that not all foreign loans discourage investment and growth. The objective of the debt sustainability framework designed by the World Bank and the International Monetary Fund (African Consultative Group, meeting April, 2007) is to help low income countries "to mobilize the financing they need to meet their development needs while mitigating the risks of an excessive debt build-up". At low level of debt, additional borrowing could foster growth, to the extent that the

new borrowing enhances the country's productive capacity and add to capital accumulation. At higher economic growth, a country should be able to service its debt better. However as both debt and capital grow, additional return to investment may head in opposite direction because when the debt-service cost rises this will discourage foreign and domestic investment (Krugman, 1988, Sachs, 1989). These are the consequences of debt overhang which in addition to depressing investment increase uncertainty. Private investors who face uncertainty may prefer to wait (Serven, 1997). There is ambiguity as to the action the government might take to meet its debt-service obligations. Oaks and Wijnbergen (1995) conclude that a rapid accumulation of debt lead to an increasing capital flight, should the private sector fear imminent devaluation and /or increases in taxes to service the debt.

Patillo et al. (2002, 2004) conducted an empirical study on the relationship between total external debt and the growth rate of GDP for developing countries in general using a large dataset of 61 countries over the period 1969-98. They found a negative impact of high debt on growth and two sources of growth. The negative effect was stronger on capital accumulation than on total productivity growth for these two sources of growth as tested in that study. These findings were also true for net present value of debt levels 35-40 percent of GDP and or 160-170 percent of exports. For high-debt countries, doubling debt reduced output growth by 1% and reduced both capital accumulation and total factor productivity growth by less than 1%. A test of presence of nonlinearity between debt and growth was also conducted. They found a backward bending growth curve with a debt/growth positive relationship at low levels of national debt and negative relationship at high levels. This leads to conclude that the effects of debt-overhang are likely to occur only after a threshold level has been reached. Comparing industrialized countries to developing countries, Schclarek (2004) found that for industrialized countries there was no significant relationship between gross government debt and economic growth. He separates total debt into public external debt and private external debt in comparing their respective incidence on growth. While the study did show that the negative relationship between growth and debt for developing countries was strongly driven by the incidence of public external debt, private external debt was not a significant factor. Empirical studies have also shown that external debt can crowd out private investment or alter the composition of public spending (Clements et al. 2003). High debt service can raise interest rate through increased budget deficits. To finance these budget deficits, the government may crowd out credit available to the private investment causing a decrease in economic growth. Other studies of nonlinear effect of debt on growth include Fosu (1999), Elbadawi et al. (1997), Deshpande (1997) and Chowdhury (2001). In their studies, they found indication of debt overhang hypothesis. In contrast, Savvides (1992) finds that the ratio of debt to GNP has no statistically significant effect on growth and Djikstra and Hermes (2001) conclude that there is no empirical evidence of debt-overhang hypothesis, at best, the last is inconclusive. Surprisingly, Cohen (1997) finds that the probability of debt rescheduling significantly lowers growth.

The objective of this study is to add to the existing literature and help shed more light in an area where there are many gaps to still fill because of mixed results reached. For

low income countries that are benefiting from debt relief, it appears important to understand more how the reduction of external debt and debt service affect growth.

ESTIMATION METHODOLOGY, DATA, MODEL AND DISCUSSION

Dynamics of National Debt

The dynamics of national debt are examined following Livernois et al, 1996 approach.

Let's *D (t)* represent the value of debt at time *t* and *Y (t)* represent the dollar value of national income or GNP at time *t*. All variables are denominated in real dollars and therefore abstracting from inflation. If we assume that the deficit is a constant proportion of national income at any point in time, then the change in debt is just the deficit. The differential equation that describes the behavior of the debt can be written as follows:

$$\dot{D}=bY \quad b>0 \tag{1}$$

Should the value of *b* fall in the range 0.03 to 0.07, this means that deficits are about 3% to 7% of the size of national income. We also assume that national income grows over time according to the following differential equation:

$$\dot{Y}=gY \tag{2}$$

Where *g* is a positive constant representing the growth rate of national income. Both (1) and (2) are models of debt accumulation. In order to test the implications of the model for the long run ratio of interest payments to national income, we need to solve these equations. We can for instance rewrite equation (2) as

$$\frac{\dot{Y}}{Y}=g$$

Integrating both sides gives

$$\ln Y(t)+c_2=gt+c_2$$

Which we can rewrite as

$$Y(t)=c_1e^{gt}$$

Where $c_1 = e^{C1-C2}$. Let assume the initial time is $t_0 = 0$ and the initial values of income and debt are Y_0 and D_0, respectively, we require $Y(0) = Y_0 = c_1$

The solution to the initial-value problem for equation (2) is

$$Y(t) = Y_0 e^{gt} \tag{3}$$

Substitution of this solution into (1) gives

$$\dot{D} = bY_0 e^{gt}$$

Integrating both sides give

$$D(t) = bY_0 \frac{e^{gt}}{g} + c_2$$

Since $D(0) = D_0$ the value c_2 must be set to $(D_0 - \frac{b}{gY_0})$ the solution becomes

$$D(t) = D_0 + \frac{b}{g} Y_0 (e^{gt} - 1)$$

The national debt $D(t)$ grows without limit in this model. Our concern is with the country to meet its interest obligations on the debt. If we assume a constant interest r and calculate the ratio of interest payments $[rD(t)]$ to national income $Y(t)$

$$\frac{rD(t)}{Y(t)} = r\frac{D_0 + bY_0(e^{gt} - 1)/g}{Y_0 e^{gt}}$$

Let's $z(t)$ be $rD(t)/Y(t)$ as the share of national income absorbed by interest payments on national debt. Simplifying produces

$$z(t) = r\frac{D_0}{Y_0}e^{-gt} + r\frac{b}{g}(1-e^{-gt}) \tag{4}$$

Because equation (4) gives the ratio of interest payments to national income at any point in time, our interest is to determine whether this ratio converges to a finite limit less than 1. In other words, interest payments never become as large as national income. From equation (4), z *(t)*, the ratio of interest obligation to income converges to a finite limit as $t \to \infty$. To see this, let's take the limits of the two terms on the right-hand side as $t \to \infty$, keeping in mind that e^{-gt} goes to 0 as $t \to \infty$. We obtain

$$\lim_{t\to\infty} z(t) = r\frac{b}{g} \tag{5}$$

Interest expenditure on the debt can now converge to a useful steady percentage of national income equal to *rb/g*. If rb/*g* <1, then if a government for ever runs a deficit which is a predictable constant proportion of a rising national income, the impact on the economy of the consequential debt converges to a constant share of the national income. Therefore, the economy will always be able to meet its debt obligations and insolvency will never occur. On the contrary, if *rb/*g >1, then the process converges to a finite limit where the interest expenditure exceed national income. The economy would be destined to experience insolvency if it continued to run deficits. Because $\dot{D} = bY$ and $\dot{Y} = gY$, the ratio of the increase in debt to the increase in income, $\dot{D} / \dot{Y}$, is just *b/g*. Therefore, for every dollar increase in national income, debt increases by *b/g*. Suppose *b/g* = 0.5, then for every dollar increase in national income, debt increases by 50 cents. In this case, income is growing faster than debt so the ratio of debt to income will always be less than unity. On the other hand, suppose that *b/g* = 1.6. Then, every dollar increase in income leads to a $1.60 increase in debt. Debt is now growing faster than income, so the ratio of debt to income will definitely exceed unity eventually. In this case, interest on the debt could also exceed national income if the interest rate is high enough.

Some typical values for the ratio *b/g* in tables 1, 2 and 3 are calculated from *Africa Development Indicators 2006* of the World Bank for three representatives of each sub-group as defined in the present study. The Democratic Republic of Congo (DRC) represents the lower income countries, Angola, the lower middle and Botswana the upper middle. The results suggest that most African countries borrowed heavily from abroad in the 1970s and 1980s with the objective of meeting their effort of industrialization challenge. For the DRC, the decade of the 1980s was characterized by very high *b/g* values with the year 1982 setting the record (*b/g* = 176.32). Then every dollar increase in GDP led to an overwhelming $178.32 increase in debt for that year. The rest of the 1980s decade in DRC saw more

moderate but still high *b/g* values ranging from 1.23 to 18.08. Three years (1985, 1986 and 1988) showed negative b/g values.

Table 1: Dynamics of National Debt Accumulation for DRC (lower income country) from 1981-2007.

Year	%Δ D(.00)	% ΔY (.00)	*b/g*
1981	0.074	0.06	1.23
1982	0.264	0.0015	176.32
1983	1.047	0.0813	12.87
1984	0.5752	0.0318	18.08
1985	0.1242	-0.049	-2.53
1986	0.1406	-0.053	-2.65
1987	0.0913	0.007	13.04
1988	0.1937	-0.053	-3.65
1989	0.0218	0.004	5.45
1990	0.0904	0.021	4.3
1991	-0.0068	0.023	-0.29
1992	-0.0155	-0.004	3.875
1993	0.0603	0.014	4.31
1994	-0.0203	0.055	-0.36
1995	0.1834	0.0046	39.86
1996	0.2326	0.047	5.025
1997	0.222	0.026	8.538
1998	-0.035	0.004	-8.75
1999	0.138	-0.012	-11.5
2000	0.094	-0.065	-1.44
2001	0.00007	-0.084	-0.0008
2002	-0.047	-0.105	0.44
2003	-0.034	-0.134	0.25
2004	0.041	-0.039	-1.05
2005	0.035	0.007	5
2006	-0.082	-0.01	8.2
2007	-0.07	-0.056	1.25

For the last, the negative signs came from a decline in GDP rather than a decline in outstanding debt. For instance, a *b/g* = -2.53 means for every dollar decline in GDP, the outstanding debt went up $2.53 in 1985. No data was available for Angola in the 1970's and 1980's because of post-independence civil war conflict. Botswana, a high middle income country, exhibited very moderate *b/g* values ranging from .80 to 3.98. Toward the end of the decade (1988, 1989), negative *b/g* values are attributable to decline in the borrowing rate unlike in the DRC earlier where negative *b/g* came from fading GDP in the 80's. For instance, a *b/g* = -5.31 in 1988 means that for every dollar increase in GDP in Botswana, debt declined by $5.31.

Table 2: Dynamics of National Debt Accumulation for Angola (lower middle income country) from 1991-2007.

Year	%Δ D(.00)	% ΔY (.00)	*b/g*
1991	1.35	-0.064	-22
1992	0.887	0	0
1993	0.189	0.042	4.5
1994	2.432	0.0599	40.6
1995	0.3763	0.0349	10.74
1996	0.3485	0.0279	12.49
1997	0.2446	0.079	3.09
1998	0.068	0.056	1.21
1999	0.09	0.0039	23.07
2000	0.074	-0.003	-24.66
2001	0.019	-0.0119	-1.59
2002	0.063	-0.069	-1.095
2003	0.029	-0.247	-0.117
2004	0.0342	0.035	0.97
2005	0.031	0.104	0.29
2006	-0.044	0.112	-0.29
2007	-0.041	0.079	-0.52

The 1990s came as the decade of structural adjustments, a macroeconomic house cleaning operation for poor countries around the

globe. This is reflected in the dynamics of national debt in the three representative countries studied. In DR Congo, the *b/g* values in the 1990's range from a positive high of 39.86 and a low of 3.875. The encouraging sign was that two out of three of the negative *b/gs* were from a decline in the borrowing rate and only one came by way of a waning GDP. For the rest of the years, moderation in debt accumulation appeared to be the trend when compared to the decade before. It was however unclear whether this was the result of pressures from structural adjustments imposed by donors or simply the effect of a persistent economic decline in the DRC that had excluded the country from the global credit market.

In Angola, while economic growth in the 1990's ranged from 0% to 8%, national debt accumulation was very high. The ratio of debt to income was way above unity. The range for *b/g* values was between 0 and 40.6. The only negative value was from economic decline in 1991. Angola is wealthy from oil and diamonds exports and considered to have sustainable debt. The majority of the $10 billion is owed to countries involved in the cold-war era decades of war. In the 1990's, Botswana showed a positive trend in its ratio of debt to income. Clearly toward the end of the decade of the 1990's, very healthy *b/gs* of .08 and .10 indicated that income or GDP was growing faster than the debt so the ratio of debt to income was less than unity. Finally, the decade of the 2000's was a clear cut for describing in a distinct manner the relationship between debt and income based on the country classifications as set in this study. While the low income country DRC exhibited negative growth throughout the decade with the exception of 2005 (.7%), its ratios of debt to income were at best moderate compared to the 1980's. The country underwent political unrest for democratic reforms early 1990s before slumping into a war from invading foreign armies in 1996. The low levels of debt observed during that period are mostly due to the country's failed state status and inability therefore to engage in any capital inflow including contracting loans. The low middle income country Angola shows negative growth in early 2000s. But by mid and late 2000s, there is a sudden turnaround in economic growth ranging from 7 to 11%; *b/g*s were negative the last two years of the study with a trend toward lower borrowing rates. Botswana, the high middle income country on the other hand shows a strong

leaning toward negative ratios of debt to income throughout the 2000s- a clear sign of a strong will to control its debt.

CONCLUSION

The present paper explores the dynamics of debt accumulation effect on income growth with focus on three different groups of countries in Sub-Saharan Africa. One country representative in each group was chosen. Our results suggest that low levels of external debt are associated with higher economic growth rates. There is sufficient evidence to support in this study that soaring level of debt through time can depress economic growth. The case of the DRC as compared to Botswana indicates that negative ratio of debt to GDP is the most recent trend for low-income countries that are serious about controlling debt, provided that this negative ratio does not originate from declining growth rate, but rather from declining debt rate through time. On the policy side, the effects of aid and debt relief to low income countries in Africa will indeed affect the ratio of debt to income in a way that foster economic growth only if applied to each country in the context of its own specific macroeconomic determinants of growth. Additional research could further evaluate other indirect channels through which debt can affect growth. For instance, can debt have an indirect effect on growth through crowding-out of public investment? It is more likely that debt service may achieve this even if the stock of public debt itself does not appear to depress public investment.

Table 3. Dynamics of National Debt Accumulation for Botswana (Upper income country) from 1981-2007.

Year	%Δ D(.00)	%Δ Y (.00)	*b/g*
1981	1.028	0.258	3.98
1982	0.456	0.263	1.73
1983	0.183	0.228	0.8
1984	0.276	0.088	3.13
1985	0.086	0.088	0.97

Table 3. Dynamics of National Debt Accumulation for Botswana (Upper income country) from 1981-2007.			
Year	%Δ D(.00)	%Δ Y (.00)	*b/g*
1986	0.171	0.106	1.61
1987	0.213	0.12	1.77
1988	-0.76	0.143	-5.31
1989	-0.09	0.121	-0.74
1990	0.252	0.119	2.11
1991	0.087	0.09	0.96
1992	0.318	0.121	2.63
1993	0.279	0.131	2.129
1994	-0.012	0.085	-0.14
1995	0.195	0.071	2.74
1996	0.151	0.082	1.84
1997	0.143	0.118	0.82
1998	0.017	0.194	0.08
1999	0.014	0.13	0.1
2000	0.088	0.067	1.31
2001	0.065	0.074	0.88
2002	-0.057	0.029	-1.96
2003	-0.027	0.019	-1.52
2004	-0.029	0.036	-0.8
2005	-0.082	0.044	-1.86
2006	-0.078	0.055	-1.42
2007	-0.161	0.068	-2.41

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Appendix 1 Sub-group lists of Countries	
Upper Middle Income	**Lower Middle Income**
Botswana	**Angola**
Equatorial Guinea	Cameroon
Mauritius	Cape Verde
Mayotte	Congo Republic
Seychelles	Lesotho
South Africa	Namibia
	Swaziland
Lower Income	
Benin	Malawi
Burkina Faso	Niger
Burundi	Nigeria
Cote d'Ivoire	Rwanda
Democratic Republic of Congo, DRC	Sao Tome and Principe
Eritrea	Senegal
Ethiopia	Sierra Leone
Gambia	Somalia
Ghana	Sudan
Guinea	Tanzania
Guinea-Bissau	Togo
Kenya	Uganda
Liberia	Zambia
Madagascar	Zimbabwe

Appendix 2. Debt to GDP Ratios %