

External Debt and its Impact on Investment in Sub-Sahara Africa

by

Ivy Wamambo

Student number: 4308653

Major paper presented to the

Department of Economics of the University of Ottawa

In partial fulfillment of the requirements of the M.A. Degree

Supervisor: Professor Nasser Ary Tanimoune

ECO7997

Ottawa, Ontario

Table of contents**PAGE**

I.	Introduction -----	1
II.	Review of Literature -----	4
	A. Theoretical framework -----	4
	B. Review of two Quantitative studies -----	7
	C. Composition and Magnitude of the SSA debt-----	11
	D. Debt Servicing in SSA-----	16
	E. Investment in the SSA region-----	19
III.	Background of the SSA countries -----	22
	A. The historical origin of the debt crisis-----	22
	B. Characteristics of the SSA countries-----	25
IV.	Empirical analysis -----	31
	A. Model specification-----	31
	B. Data-----	34
	C. Descriptive statistics -----	35
	D. Methodology-----	36
	E. Discussion of empirical results-----	38
V.	Conclusion -----	44
	Appendix-----	48.

List of Tables and Figures

	page
Figure 1. The Debt Laffer Curve	6
Figure 2. Composition of External Debt	12
Table 1. Potential Access To External Flows By Type	13
Table 2. SSA's External Debt Stock, Debt Service and Net Transfers on debt.	15
Table 3. SSA's Debt Burden Indicators as percentages.	17
Figure 3. Gross Fixed Capital Formation	21
Table 4. Classification of the SSA countries	26
Figure 4. GDP per Capita Growth (Annual %)	27
Figure 5. Gross Domestic Savings	28
Table 5. Descriptive Statistics	35
Table 6. Shazam results on pooled OLS on non-linear of debt equation	39
Table 7. E-Views Common Effects Results	40
Table 8. E-Views Fixed Effects Results.	42

ABSTRACT

The debt crisis affects most countries all over the world. Sub-Sahara Africa has been the hardest hit region where the situation is worsened by low growth levels, low revenues, restrictive trade policies and macroeconomic instability. There is definitely a need of better understanding of the debt overhang crisis if one is to come up with strategies of dealing with the crisis. This paper analyses the origin, magnitude, composition and structure of 43 Sub-Sahara African countries' external debt and its impact on investment. Most of the external debt is mainly official from multilateral and bilateral sources. An econometric analysis may be able to shed light on the relative strength of the linkages between investment and external debt. Based on results from pooled OLS on both common and fixed effects, using a panel data for the period 1990-2005, the study indicates that external debt has a negative impact on investment. In line with a recent study by Clements, Bhattaryacha and Nguyen (2003), the paper also examines the non-linearity effect between debt and investment. Conclusively, aggressive measures are to be undertaken if the region is to eliminate the debt crisis.

List of Abbreviations

ADB: African Development Bank

EEC: European Economic Community

IBRD: International Bank of Reconstruction and Development

IDA: International Development Association

IFC: International Finance Corporation

IMF: International Monetary Fund

GDP: Gross Domestic Product

GFCF: Gross Fixed Capital Formation

HIPC: Heavily Indebted Poor Countries

SSA: Sub- Sahara Africa

WB: World Bank

WDI: World Development Indicators

I. Introduction

As many Sub-Sahara Africa (SSA) countries progress through towards the end of this decade, virtually most or all of them are faced with the demise of ever existing external debt levels. This in turn has a negative impact on the investment environment of these countries. Dozens of these countries seem to have been stuck for almost three decades in this persistent debt trap from which they are not recovering. Even in the presence of initiatives such as debt cancellation, debt restructuring, debt rescheduling, debt reduction and foreign aid, there seems to be a slight improvement in investment because these measures do not necessarily extinguish the debt trap.

The presence of external debt itself is not necessarily the huge problem, but how it is maintained is more important. Some economists argue that it is the ability to maintain stable or constant debt service payments which make an economy efficient. Therefore in analyzing the magnitude of the SSA debt problem, another important parameter to focus on besides outstanding debt is the scheduled service profile relative to the capability of the economy to meet that schedule. International institutions such as International Monetary Fund (IMF) and the World Bank (WB) argue that a country is debt sustainable when it is able to meet its current and future debt service obligations in full, without recourse to debt rescheduling or accumulation of arrears, (IMF and WB 2007).

In more general circumstances, external debt sustainability, by its nature, requires the need to pursue a time-consistent path that will allow the debt-servicing burden overtime as a minimum to enhance investment. The simplest test of sustainability over the medium term is that the rate of return on investment should exceed the opportunity cost of the funds, with the real

interest. The path to sustainability may however depend on a number of other conditions such as the initial stock of debt, the availability of concessional funds and possibly the level of aid, the growth of income, exports and fiscal revenues (Belloc and Petrova, 2002).

Most of the external funds are meant to boost the domestic resource of the developing countries and thereby improve investment and possibly enhance economic growth. The SSA countries borrow debt with the intention to finance investment mainly in human and physical capital. The funds are devoted to a wide range of infrastructure such as education, employment, transport, agriculture, energy and electricity, housing and trade. Other countries also borrow more external funds as a way of improving their debt service payments. Foreign borrowing is usually a resort to lack of money and could also be used as a way of channeling private capital abroad by simply re-exporting the funds as private assets.

In a perfect world, the funds borrowed by SSA countries would be used to finance these investments with high returns and this would not only make the countries better off, but also generate resources necessary to repay the debt. What makes these external funds to not meet their intended goals is blamed on economic activity problems in the SSA countries such as the absence of well-designed and efficiently administered debt management strategies, inflationary monetary policies, inappropriate fiscal and exchange rate policies, too much state intervention, high government expenditures, balance of payment pressures and underdeveloped managerial and institutional infrastructure (Krumm, 1985).

It could also be argued that other external shocks that are beyond the control of African policy makers such as terms of trade shocks, political conflicts, wars and natural catastrophes could lead to external debt problems of the SSA countries. Some also argue that increased

protection among developed countries notably in the European Economic Community (EEC) and the US through imposing high tariffs to the developing world, and the failure of the ministrations of the structural adjustment programs could be some of the reasons behind external debt burden in the SSA region (Onimode, 1989).

For almost twenty years, the standard interpretation of the debt crisis was that SSA countries needed more stabilization and structural adjustment programs. Hence external debt sustainability could also be argued to be manageable if the SSA countries are able to identify and articulate their own policies and programs, (Loser 2003). They should be able to implement, monitor and evaluate the external fund projects that are undertaken with proper planning and budgeting.

There are a number of common elements to the response of the debt crisis and also the response to the private and official creditors which are mainly the WB, IMF, International Bank of Reconstruction and Development (IBRD), International Development Association (IDA) and Africa Development Bank (ADB). Nevertheless, there are wide differences across the SSA countries themselves in terms of the composition of their external debts, how they deal with creditors, and where they devote most of their external funds to. This variation will largely shape the way in which the debt situation is handled in the SSA countries.

This paper intends to study the impact of external debt stock and debt service on gross fixed investment in the SSA region. The study makes an analysis based on the most recent period in relation to other studies such as Leonce (2000), Bhattarya, Clements and Nguyen (2003). It also attempts to include all of the countries but excludes Somalia and Namibia due lack of data on the principal variable, Gross Fixed Investment and the primary variable, External debt. 43

countries are included for the time period 1990-2005. Investigation is carried out through pooled ordinary least squares (OLS) regression assuming both common and fixed effects for the countries included. The empirical analysis will also estimate five related equations so as to determine the separate effects of external debt stock and debt service on investment. Two equations with debt service will be analyzed both with and without aid, since countries eligible for aid are required to meet certain levels of debt service. Two other equations will analyze the effect of external debt stock and its non-linearity effects. The last equation will analyze the effect of both debt service and external debt on investment. The rest of this paper is organized into four sections. Section II provides a review of literature. Section III discusses the background of the SSA countries. Section IV describes the empirical analysis and, Section V concludes the paper.

II. Review of Literature

Some authors have gone as far as separating the effects of external debt between private investment and public investment due to the differences in the definition of public and private investment between the countries I will focus on total gross investment only. I will highlight on two papers that have researched on total investment. This review of literature provides the theoretical framework-the Debt Laffer curve, review of two quantitative studies, composition and magnitude of debt, debt servicing and investment in SSA.

A. Theoretical Framework - The Debt Laffer curve

The theoretical literature on the relationship between investment and external debt in SSA has mainly concentrated on the disincentive effects of the debt overhang, even though it is likely that liquidity constraint on investment maybe much more important. Krugmann 1988, defined debt overhang as a situation in which the future repayment capacity on external debt falls

short of the contractual value of debt. Debt overhang characterizes a situation in which future debt burden is perceived to be so high that it acts as a disincentive to current investment.

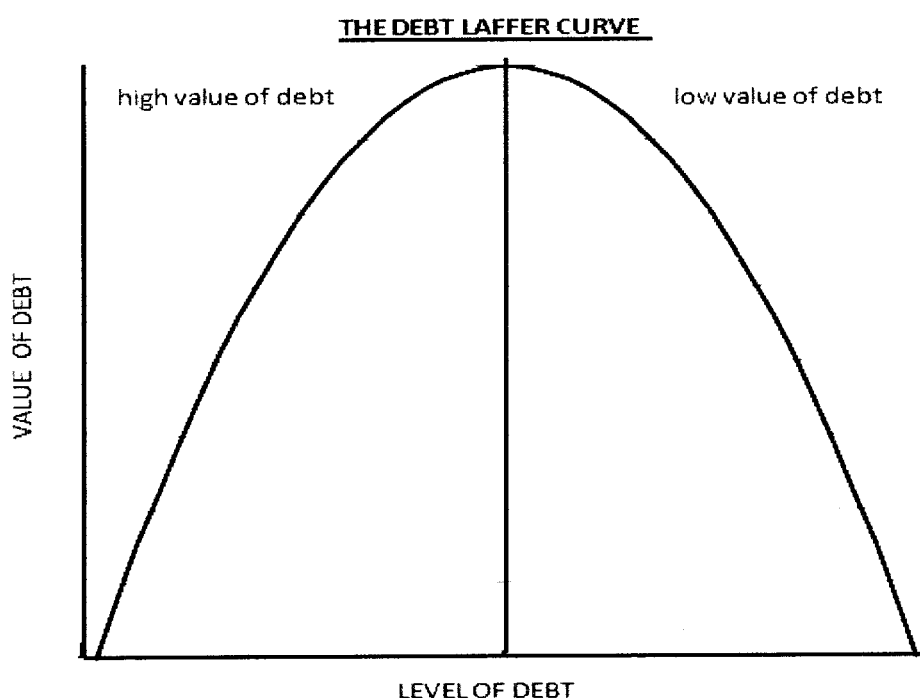
The debt burden or debt overhang affects SSA countries' investment in a number of ways. Firstly, it forces countries already faced with foreign exchange constraints to commit resources to repaying loans, rather than investing in key infrastructure and productive activities. Second, governments face serious constraints internally to meet the local currency requirements for debt service and most often resort to borrowing from the banking system and crowd out private investors. Thirdly, it acts like a high marginal tax rate on the country lowering the return on investment, as investors think that proceeds of any new projects will be taxed away to service pre-existing debt thus providing a disincentive to domestic capital formation.

Countries that suffer from debt overhang will have no net resources flows, because any new loan that might be issued would be worth less than its nominal value and no new creditor will be willing to lend when a loss is certain. Hence, the main cost associated with debt overhang is debt service which comprises the liquidation of principal and accumulated interest as represented by a contractual fixed charge on a country's income, savings and foreign exchange reserves.

To explain more the relationship between debt and investment that has been highlighted in the theoretical framework, I use the Debt Laffer curve as indicated by Cohen 1993. The relationship can be represented as a kind of Laffer curve, Fig 1. If countries' debt levels are expected to exceed their repayment ability with some probability in the future, expected debt is likely to be an increasing function of the countries' investment level.

Theoretical literature suggests that external borrowing has a positive impact on investment up to a certain threshold level, beyond this level, however its impact is adverse. The key question is, at what level debt becomes a debt overhang. Borensztein (1990), argues that this is easy to find it in a theoretical model with the help of convenient assumptions, as compared to finding it in the data. Countries that suffer from debt overhang maybe on the wrong side of the Debt- Laffer curve.

Fig1.



The Debt-Laffer curve shows that along the left or good side of the curve, increases in the face value of the debt are associated with increases in the debt repayment, while more increases in the face value of debt lower expected repayment on the right or wrong side of the curve. Since the peak of the curve is the point where large debt stocks begin to act as a steep marginal tax on investment, this may relate to the point which debt begins to have a negative impact on

investment. The above Debt-Laffer curve is meant to show a non-linear relationship between debt and investment.

B. Review of two quantitative studies

The present study differs from the two studies in that the first one distinguished between financial and non-financial factors hence it used more diversified variables. The second study concentrated on mainly public investment instead of total or private investment.

The first paper by Ndikumana Leonce was titled, “Financial Determinants of Domestic Investment in SSA: Evidence from Panel Data 2000”. The aim of this paper was to study the role of non-financial factors and financial factors such as external debt in determining domestic investment in SSA. The study hypothesized that financial development facilitated the channeling of resources from savers to the highest return investment activities by increasing the funds available for investment, and thus minimizing the liquidity constraints faced by entrepreneurs. The study also carried out an indirect test by investigating whether the response of investment is larger among countries with more developed financial systems.

The author also supported other studies especially on the SSA region, which argue that in general there is a negative relationship between external debt and domestic investment. They argue that high debt levels can depress investment through debt overhang, credit rationing and uncertainties in the macroeconomic environment, black market activities which rise in the presence of chronic trade deficits, inappropriate monetary and exchange rate policies and shortages of foreign currency.

The author's econometric analysis was based on a reduced form investment model. The study included 30 SSA countries over 1970-95, following a standard practice in panel data analysis the model was specified as a dynamic serial correlation. Most of the data used were from the WB's World Development Indicators, 1997. Statistics on black market premia were from various issues of Picks currency year book and World currency year book.

The model was specified as follows:

$$I_{it} = \beta I_{i,t-1} + \delta FIN_{i,t-1} + \Gamma X_{i,t-1} + \Gamma EDT_{i,t-1} + \mu_{it}$$

Where I_{it} is the logarithm of investment as a percentage of GDP for country i at time t . The variables were entered in logarithms, except for the growth rate of real GDP so as to directly yield coefficients' elasticities on investment in regards to respective explanatory variables and to capture non-linearities in the relationships. FIN was a composite indicator of financial development which included financial development indicators such as liquid liabilities, credit to the private sector and credit provided by the banks. The vector X, included a list of control variables, consisting of growth rate of real per capita GDP, government consumption, interest rate, international trade flows, inflation, and the black market premia. Vector EDT, represented external debt.

The model was estimated as a fixed effects model. The equation was also specified as an error-component model with time-invariant components and the second order autoregressive process components and was be modified to be :

$$I_{it} = \beta I_{i,t-1} + \delta FIN_{i,t-1} + \Gamma X_{i,t-1} + \Gamma EDT_{i,t-1} + \alpha_i + \mu_{it}$$

$$\text{Where } v_{it} = \rho v_{it-1} + \varepsilon_{it}$$

The results indicated a positive relationship between domestic investment and the four indicators of financial development. The results that they obtained were qualitatively similar for total domestic investment and private investment, with stronger effects of financial factors on private investment than total investment. Their findings also suggested that high financial development is a predictor of future levels of domestic investment. The results postulate that domestic investment is positively associated to real per capita GDP growth (the accelerator effect). External debt, public sectors borrowing from the domestic financial system, the black market premia and inflation negatively affect domestic investment. Hence the 30 SSA countries in this study were on the bad side of the Debt-Laffer Curve. The author could not find enough evidence of a negative effect of government consumption on investment as theory would suggest. The interest rate affected domestic investment in some periods.

The second study that I will highlight was done by Benedict Clements, Rina Bhattacharya and Toan Quoc Nguyen (2003), titled "External Debt, Public Investment and Growth in low-income countries". Their study attempted to fill in the gap in literature concerning impact of external debt on public investment in low income countries, since so many studies have concentrated mainly on total investment and private investment.

The empirical analysis in their paper used data for 55 countries, 34 of them from the SSA region. The countries were classified as eligible for the IMF's poverty reduction and growth facility (PRGF). Their data covered from the period 1970-99. External debt and Gross Public Investment statistics were drawn from the WB's GD Network Growth Database. Data on debt service payments from the GDI database (WB), supplemented with data from the WB's WDI data. Data on the net present value of debt were taken from the website of William Easterly.

In their empirical analysis of public investment the equation was specified as :

$$\text{PUBINV} = \beta_1 + \beta_2 \text{LYRPC} + \beta_3 \text{AIDGNI} + \beta_4 \text{URBAN} + \beta_5 \text{OPEN} + \beta_6 \text{DEBTSERY} + \beta_7 \text{EXTDEBT} + \beta_8 \text{EXTDEBT} + v$$

Where PUBINV = public investment in percent of GDP

AIDGNI = foreign aid in percent of GNI

URBAN = the urbanization ratio

DEBTSERY = total debt service in percent of GDP

LYRPC = real per capita GDP

OPEN = openness indicator

EXTDEBT= one of the four indicators of stock of external debt measured in natural logarithms.

The model was estimated using fixed effects and system of general method of moments (GMM). The fixed effects provided consistent estimates in the presence of country specific effects that are correlated with explanatory variables in the model.

Their paper hypothesized that reductions in external debt service could also provide an indirect boost to growth through its impact on public investment. They reported results using total debt service as a percent of GDP rather than as a share of exports, arguing that this is the most intuitively appealing measure of how debt affects general government decisions regarding the appropriate level of public investment.

Their empirical estimates indicated that the stock of external debt has no significant impact on public investment. This implies that prospective debt service payments for the public sector do not deter public investment in the short run. They therefore suggested that public investment is driven more by the current fiscal position and the availability of resources, rather than factors that affect fiscal sustainability over the longer term. Their results provided support

for a non-linear relationship between investment and debt service as shown by the Debt-Laffer Curve (Fig 1) and supported the hypothesis that higher debt service “crowds out” public investment with the crowding out effect intensifying as the ratio of debt service to GDP rises.

C. Composition and Magnitude of the SSA debt

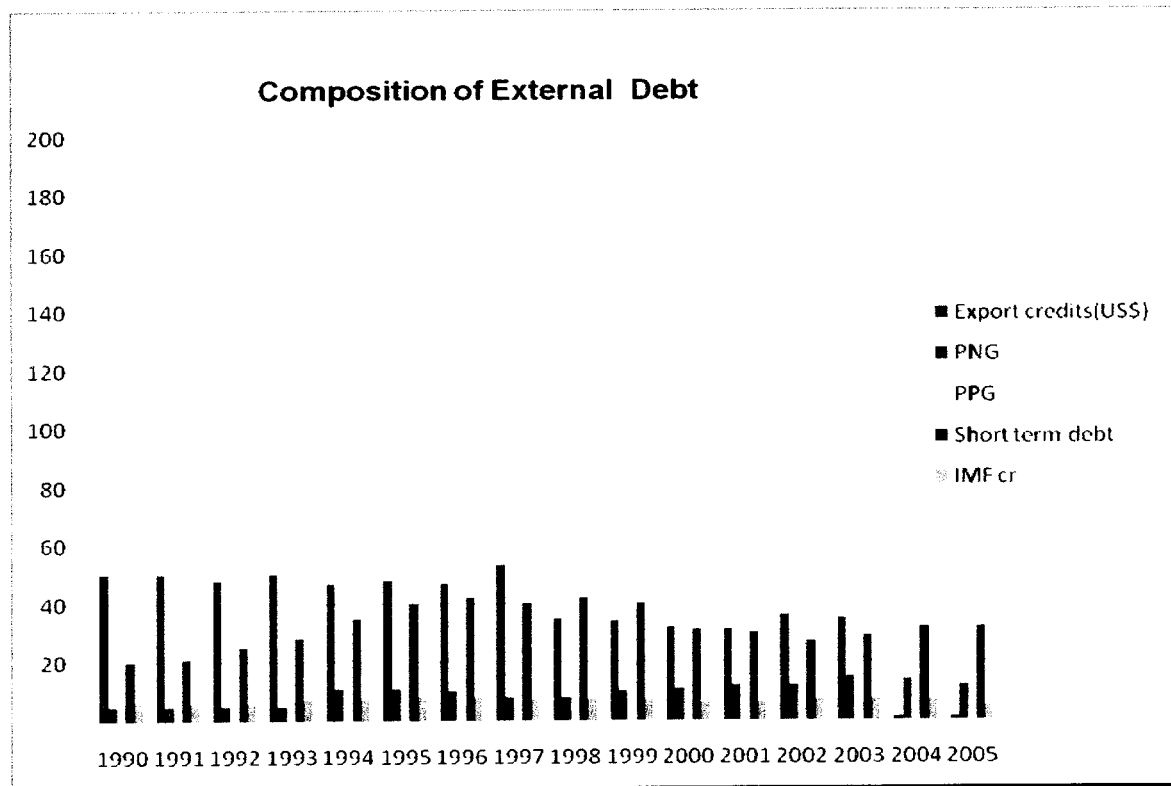
The composition of external debt is an important factor in debt analysis since it has a direct bearing on the processes of debt repayment, servicing, rescheduling and relief. The choice of instruments available to the borrowing countries is wide. There are two main sources of foreign financing. Official: bilateral and multilateral institutions; and private sources which have been oriented mainly through the efforts of the international financial institutions such as International Finance Corporation (IFC) of the WB.

During the last four decades the five major types of external finance have been: concessional official development assistance which includes public guaranteed long term debt; non-concessional bilateral official which comprises private non-guaranteed long term debt and officially guaranteed finance from export credit agencies; non-concessional multilateral development bank lending; and short term commercial bank lending without an external guarantee and the use of IMF credits.

Fig 2 shows the composition of external debt in SSA. Low income countries depend heavily on the financial support of these institutions. The Public and publicly guaranteed long term debt (PPG) is the most important source of external finance in SSA reaching more than \$US140 million over the years 1990-2005 and reaching its highest in 2004 at more than \$US180 million.

Commercial bank lending has been the third major source of external financing after PPG and Export Credits since its credit is characterized by harder terms, shorter grace periods and high interest rate. Private non-guaranteed debt is the fourth major important source. It covers pressures on foreign exchange resources. IMF credit has been the least used throughout the years except for 2004 and 2005 where export credits were lower. Different objectives between the creditors, debtors and the multilateral institutions have made the task of the debt-crisis management particularly difficult adding to the risky consequences of borrowing in SSA economies.

Fig 2.



Source: Author's Computation from GDF TABLES 2007

The concessional terms differ between the type of creditor and instrument. Creditors such as the IMF usually lend money for short periods. Mostly a year or eighteen months and they intercept their guidelines with banking principles so as to make sure that the loan principal and interest are repaid. WB lends structural adjustment loans for longer periods, above 5 years. Though the financing maybe available from bilateral and multilateral sources, much of the credit is generally not quickly disbursed and usually comes at a substantial cost in terms of policy conditionalities.

Table1.

Potential access to external flows by type, 2000

Types of Country Groups	Private			Official				
	FDI	Commercial banks	Suppliers buyers credits	Official export credits	Multilateral non-concessional	Bilateral concessional	Multilateral concessional	Official grants
Oil producers ^a	Yes	Yes	Yes	Yes	Yes	No	No	No
Mineral exporters ^b	Yes	Yes	Yes	Yes	No	No	No	No
Diversified economies ^c	Yes	Yes	Yes	Yes	No	No	No	No
Agricultural exporters ^d	No	No	No	Yes	Yes	Yes	Yes	No
Other developing countries ^e	No	No	No	No	No	No	Yes	Yes
Sahelian countries ^f	No	No	No	No	No	No	Yes	Yes
Small economies ^g	No	No	No	No	No	No	Yes	Yes

a . Nigeria, Gabon, Angola, Congo, Cameroon.

b . Botswana, Zaïre, Zambia, Liberia, Sierra Leone, Guinea.

c . Zimbabwe, Mauritius, Kenya, Swaziland.

d . Uganda, Sudan, Tanzania, Cote d'Ivoire.

e . Benin, Burundi, CAR, Chad, Ethiopia, Mozambique, Rwanda, Somalia, Togo.

f . Senegal, The Gambia, Mali, Chad, Mauritania, Burkina, Niger.

g . Comoros, Cape Verde, Djibouti, Guinea Bissau, Sao Tome, Equatorial Guinea, Seychelles.

source: Africa External Finance in the 1990s, WB

The source of external debt of SSA countries can be shown by the type of economy or major export, (Table 1) above. Five oil exporting countries have access to mainly multilateral non-concessional, official export credits, suppliers and buyers of credits, commercial banks and private Foreign Domestic Investment (FDI). The same applies to mineral exporters such as Zaire, Botswana, Liberia, Sierra Leone and Guinea and diversified economies such as Zimbabwe, Mauritius, Kenya and Swaziland, except for multilateral non-concessional.

Agriculture exporters such as Uganda, Sudan, Tanzania and Cote d'Ivoire have access to a wider range including multilateral concessional, bilateral concessional, multilateral non-concessional and official export credits. Sahelian countries such as Senegal, Gambia, Mali, Chad, Mauritania, Burkina Faso, Niger and small economies such as Comoros, Cape Verde, Djibouti, Guinea-Bissau, Sao Tome, Equatorial Guinea and Seychelles only have access to multilateral concessional in loans. This is also the same case with other developing countries such as Benin, Burundi, CAR, Chad, Ethiopia, Mozambique, Rwanda, Somalia and Togo (Husain and Underwood 1991).

The definition of long term debt by the WB consists of public and publicly guaranteed long term debt (PPG), private non-guaranteed long term debt (PNG), the use of IMF credits, export credits and estimated short term debt. This also refers to the sum of total debt outstanding that is owed to creditors in the categories of IBRD, IDA and other multilateral, bilateral, suppliers, commercial banks, bonds, and lenders of IMF credit with obligations of maturities greater than one year.

Table 2: SSA's External Debt Stock, Debt Service and Net Transfers on debt.

Year	External debt (million US \$)	Debt service (million US \$)	Net transfers on debt (million US \$)	Principal arrears on Long term (US \$m)	Concessional debt/ Total debt (%)
1990	176567.00	149397.00	1731.65	17770.19	33.08
1991	183058.50	154034.90	-1106.42	21610.30	34.41
1992	182403.00	151035	545.12	25056.92	36.15
1993	194446.50	150490.70	2337.93	31914.03	35.78
1994	220929.10	177479.70	-2167.36	35306.61	34.31
1995	235283.40	196032.40	2214.76	41223.64	34.36
1996	230961.90	190021.20	-2711.19	40567.18	35.85
1997	220151.40	171970	-305.50	30554.94	37.62
1998	227727.20	170026	-6267.78	42904.51	39.2
1999	214308.00	166325.70	-5608.94	38150.92	39.22
2000	211212.60	172670.10	-4533.83	25040.37	39.08
2001	203158.00	166303.70	-5887.74	27207.52	39.31
2002	211670.50	176832.00	-3320.20	24639.43	42.81
2003	230707	193813.00	-608.86	27322.28	49.34
2004	237767.70	197615.00	1152.54	27439.40	50.13
2005	214840.70	176743.30	-3348.36	24685.61	49.29
2006	172773.40	134332.20	1834.55	25738.14	..

Source: WB Tables 2007

Table 2, shows the amount of total external debt, debt service, net transfers on debt and principal arrears on long term debt in SSA for the period 1990-2006. The amount of total external debt has been increasing steadily until 2004 at almost \$US24 million except for 2005 and 2006 were it decreased to \$US172773.40 million in 2006. Debt stock has been rising mainly as a result of capitalization of unpaid interest arrears and amortization.

D. Debt servicing in SSA

As pointed out earlier, the main cost associated with foreign borrowing and accumulation of debt is debt service. Comprehensive data of the total debt servicing commitments of all the SSA countries are not readily available. However some fairly reliable estimates are available (Table 2). The figures on the recent debt servicing would vastly underestimate the actual burden if they exclude scheduled servicing that was not met. When the necessity of arrears repayment is taken into account, the debt service picture may be even dismal. Debt service amounts have been fluctuating between \$US 197615 million to \$US 172773 million in the period 1990-2006. Were as principal arrears on long term debt were very high in 1998 at \$US 42904 million and in 2006 they were \$US 25738million.

The ability of a country to meet its debt service obligations is reflected by the ability to attract new capital inflows, the growth rate of the economy and, in particular exports, the ability to surrender foreign exchange so as to service the debts and the terms and conditions under which the debts were contracted. Widely used measures in terms of the debt service burden are the ratio of the balance on the current account (net exports of goods and services and net unilateral transfers) to debt service payments (interest and maturing portion of external debt).

Table 3: SSA's Debt Burden Indicators as percentages.

Year	EDT/XGS	TDS/XGS	EDT/GDP	TDS/GDP	INT/GDP	INT/XGS
1990	220.76	13.6	0.582943	0.493241	1.750238	7
1991	238.95	13.21	0.58672	0.49626	1.675222	7
1992	231.61	12.76	0.581833	0.481773	1.462322	6
1993	252.12	9.43	0.660929	0.538714	1.140911	4
1994	282.46	14.99	0.779923	0.626538	1.67402	6
1995	253.11	15.9	0.73398	0.580339	1.673345	6
1996	221.74	14.58	0.680015	0.530031	1.704547	6
1997	207.78	14.9	0.624321	0.487685	1.35948	5
1998	241.65	15.1	0.689019	0.538641	1.499029	5
1999	212.79	13.45	0.651997	0.506017	1.422791	5
2000	178.42	11.41	0.618221	0.505407	1.313829	4
2001	176.67	12.07	0.607005	0.496888	1.123386	3
2002	177.29	10.93	0.604489	0.505	0.989736	3
2003	153.43	8.48	0.530194	0.445409	0.838365	2
2004	124.62	6.73	0.44851	0.37277	0.687938	2
2005	88.97	8.8	0.34547	0.284209	1.326422	3

source: GDF Tables, WB 2007

Notes on debt burden indicators:

EDT – Total External Debt

GDP– Gross Domestic Product

XGS – Exports of goods and services

INT– Interest Rate

TDS – Total debt service

Other measures of the debt burden in terms of external debt are the ratio of external debt to exports and the rate of growth of external debt relative to the rate of growth in exports or GNP, (Abdullah 1984). For external debt the safe thresholds for highly debt-intolerant countries can be as low as 15% to 20% of GNP (Kenneth. S. Rogoff). In general, the ability to attract capital inflows is diminished and funds available for investment will be reduced where higher debt service payments are involved.

Rising debt service ratios reduce the availability of resources for initiating investment and growth. Debt service payments may be made at the expense of foregoing a number of investment projects and efforts to meet basic human needs. SSA economies are usually faced with stagnating exports due to a fall in their dollar export prices, therefore rising debt service payments may entail recurring payment defaults and drain the already scarce resources of foreign exchange needed to import production inputs. Both the internal and external transfer constraints on debt service may be severe, but the internal transfer is worsened by the growing depreciation of local currencies. Both the ratios between external debt to exports (EDT/XGS) and the ratio of total debt service to exports (TDS/XGS) were very high in 1998 at 241.65% and 15.1% respectively. However both have been decreasing steadily to around 88.97% and 8.8% respectively, (Table 3).

The essential condition for a country to be able to service its debt in the long term is that the rate of return on the money borrowed abroad should be at least as great as the cost of borrowing money. Thus the rate of economic growth in real terms should be as great as the real rate of interest on debt (Lomax, 1986). The rate of GDP growth has been around 3% for most SSA countries whereas, the ratio of interest on foreign borrowing to Gross Domestic product (INT/GDP) has been decreasing steadily from 1,75 in 1990 to 0,68 in 2004, (Table 3). The debt structure of a country may be assessed according to other criterion such as solvency and liquidity. It may be possible for a country with different and unusual structure to be able to satisfy this criterion and yet have exports increasing less quickly than GDP. The solvency concept itself gives no indication as to the correct absolute levels of these ratios.

In servicing the external debt, most countries may be put in extremely distressed fiscal positions. The result is severely compressed development budgets and a shrinking fiscal base. As the size of external debt increases, there is growing uncertainty about the credibility and sustainability of reforms and policies that the governments will resort to in order to meet debt servicing obligations and this constitutes a potential threat to investment (Mkandawire and Soludo 1999). Investment tends to have an irreversible nature implying that installed capital is seldom put to productive use in economic activities at least not without a substantial cost. With this in mind, private investors, foreign and local investors will be reluctant to commit large expenditures on fixed investments or are content with short term investment activities when they are uncertain about the economic environment.

E. Investment in SSA region

Investment is defined by the WDI tables as consisting of gross fixed capital formation (GFCF) plus net changes in the level of inventories (WB country desks). GFCF is meant very specifically as business investments in capital that are non-financial or external finance that is converted into goods and services. It comprises of outlays by the public sector and the private sector.

Investment, appropriate physical capital accumulation, is critical to the growth of the SSA economies. Heavy debt burdens prevent countries from investing in their productive capacity. Disincentives to investment arise for reasons largely related to investors' expectations about the economic policies required to service debts. The channels through which debt affects investment may differ, given the differences in the structure of the economies and the public and private sectors across the SSA countries. For some countries the sum of gross private investment

and gross public investment does not add up to GFCF due to statistical discrepancies. These considerations then suggest that empirical estimates of how much debt affects investment across these countries are likely to be different.

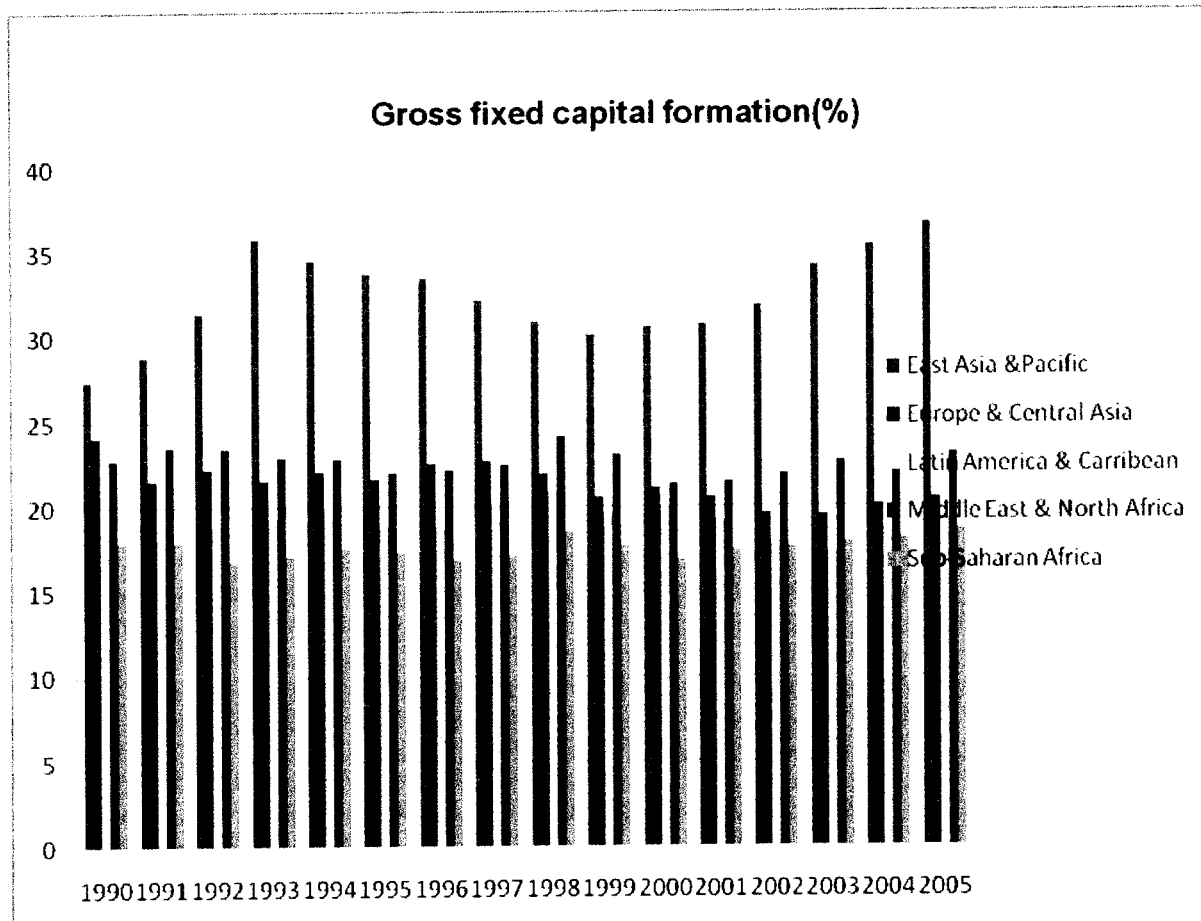
In this analysis, private investment refers to new physical capital bought by firms and households that augments future production ability of the economy. The main types of investment are fixed business such as manufacturing plants, warehouses, office buildings and inventory investment, which is change in a firm's stock of inputs, other equipment, unfinished products and finished products that have not yet been sold. Whereas public investment refers to public physical capital such as building of roads, ports, schools, hospitals, etc. It is the net investment (gross total investment adjusted for capital depreciation), that really shows whether the economy's capital stock is rising or falling (Mshomba 2000).

While the empirical analysis will make no distinction between public and private investment, there is an emerging appreciation that the two complement each other private investment is more efficient and productive than public investment. Information on the breakdown of total investment into its private and public components is not readily available from the standard national accounts. Whereas it maybe available, there maybe differences in the relative importance of public and private investment and the concepts may not be precise.

In SSA, it is widely recognized that GFCF has not been increasing substantially and remains severely depressed across the region. As can be seen in Fig 3, GFCF as a percentage of GDP for SSA has been the lowest throughout the years 1990-2005 as compared to other regions such as East Asia and Pacific, Europe and Central Asia, Latin America and North Africa and Middle East. Investment tends to be riskier in SSA countries. The net risk-adjusted returns

maybe lower, which could explain why capital continues to flow in the opposite direction, Boyce 1992.

Fig 3.



source: WB Tables 2007

III. Background of the SSA countries

It is important that this section be highlighted preliminary to the empirical analysis. The section describes the background by reviewing the historical origin of the debt crisis in SSA and the characteristics of the SSA countries. This enables to shed light on some of the reasons for the accumulation of debt, low economic growth and investment in the SSA region.

A. The historical origin of the SSA debt crisis

The notable stages started around the post war-lending approach to developing countries during the first United Nations Development decade. During the period between the late 1960s and early 1970s, the following stylized facts emerged: transitory commodity price booms, expanded access to private financial and other trade credit and public expenditure expansion with financing contributions from the above, (Krumm 1985).

The international commodity price boom was one of the stimuli to the expansion of external debt in the 1970s. The response in most African countries was to increase their public expenditures particularly in the infrastructure sector. The commodity price boom was followed by a sharp bust in 1974 and again after 1977. However when this happened the governments were unable to cut back expenditure programs and there was recourse to even further external borrowing. It was the view that they would be able to improve their credit worthiness due to the cyclical nature of export commodity prices which may sometimes not be able to finance public expenditure.

It is also at this particular period that the countries were hit by the first oil price shock. The oil-exporting countries experienced an initial sharp rise in oil prices in 1972-73. This was tackled partly by resorting to external financing as external debt rose rapidly in Congo and Gabon in the mid 1970s. As was the case of commodities, the governments were responded by expanding public expenditures through the external finance. When the oil prices normalized the African governments continued with their pace of investment programs. The oil price hikes not only forced oil importers to become more dependent on borrowing, they also created what is called the OPEC surpluses. This surplus was circulated through the international banking system. The Euromarkets became an important source of financing for a number of countries which had never borrowed in it before, such as Senegal, Togo, Kenya, Zambia as well as the oil-exporting countries such as Gabon and Nigeria.

During the second oil price shock hit in the late 1970s, most countries were poorly positioned to absorb it, given their higher level of debt and its less concessional structure as well as the limited progress made in adjusting economies after the first oil shock and the commodity boom. Thus by the end of the 1970s the total external debt grew almost fifteen fold. Unlike the first oil shock when export commodity price booms offset some of the balance of payment difficulties of the oil importers, the second shock was not accompanied by any such offset. Rather, the world recession starting in the late 1970s and extending into the early 1980s contributed to a decline in export earnings. Major commodity prices continued to decline prompted by the recession from the industrialized countries.

The breakdown of the Bretton Woods system of the fixed exchange rate towards the end of the 1970 decade and the Mexican default in the 1980s also exacerbated the situation for some

key high-debt countries. The IMF became increasingly involved afterwards by participating in debt negotiations and providing estimates of debt of indicators. That is where most of the currently used estimates originated such as the ratio between debt service payments to exports which measures which the ability to payback and the ratio between external debt stock to gross national income which measures the level of external indebtedness or the debt overhang.

The early 1980s was also characterized by a hike in real interest rate in industrial countries. International interest rates rose from low and sometimes negative levels in the 1970s to over 8% in the early 1980s. The high interest impact is felt immediately through loans carrying variable interest rates, primarily international bank lending and through short-term loans. The countries mainly affected were Senegal, Malawi, Niger, Kenya, Liberia, Zimbabwe, Ivory Coast and Mauritius. This scenario made the countries more susceptible to borrowing on the assumption of a turnaround of commodity prices. The new loans were used to finance huge oil bills.

For project financing during this period, the distinctions between banks, suppliers of credit and official export promotion agencies were not easy as all of them began putting more coordinated project packages. The export credit agencies also played a big part in the debt revolution of the SSA countries. Export credits were loans mainly for the purposes of trade and were not represented by a negotiable instrument. The majority of the export credit was either directly extended through official bilateral agencies or officially guaranteed by export credit agencies and could be converted to official credit in the event of arrears or rescheduling.

While the pervasive debt servicing problem did not emerge until the 1980s, it is important to note difficulties that already existed from the previous periods. In addition to

countries with established and persistent payments difficulties, for example, Central Africa Republic, Chad, Guinea, Congo, Ghana and Mali, substantial arrears accumulation and/or rescheduling became necessary through the Paris and London Clubs rescheduling. The capitalization of unpaid interest arrears and amortization from the rescheduling had started to push the debt stock upward in many African countries. This was then a major factor in the disruptions of private and official lending as the SSA countries faced increasing difficulties to service their debts.

The period as of the late 1980s and early 1990s was characterized by continually declining commodity prices and deterioration of the terms of trade. Which means, during that period, most of the export credit was converted to official credit. African economies then became even more prone external indebtedness and their underlying credit worthiness was negatively affected. Almost all SSA countries in the beginning of the 1990s had become dependent on external finance for securing imported intermediate inputs and ensuring smooth running of the economy which brings us to the examination of the composition and magnitude of SSA debt.

B. Characteristics of the SSA countries

There are 48 SSA countries. 34 of these countries are low-income countries. Only 5 countries are classified as upper middle income, 8 are classified as lower middle income and 33 of these countries are classified as severely indebted countries, also known as the Heavily Indebted Poor Countries, (HIPC) by the WB, (Table 4). Despite this, there are wide divergences in initial conditions and in resource endowments. At one extreme are the poor Sahelian countries such as Senegal, Gambia, Mali, Chad, Mauritania, Niger and Burkina Faso and at the other extreme are countries such as Botswana and Mauritius, where good economic policies and

management have made a difference between other countries. Nigeria, Cameroon, Kenya, Cote d' Ivoire are countries where the potential for expanding is promising. Only four countries are classified as diversified economies (Kenya, Mauritius, Swaziland, and Zimbabwe).

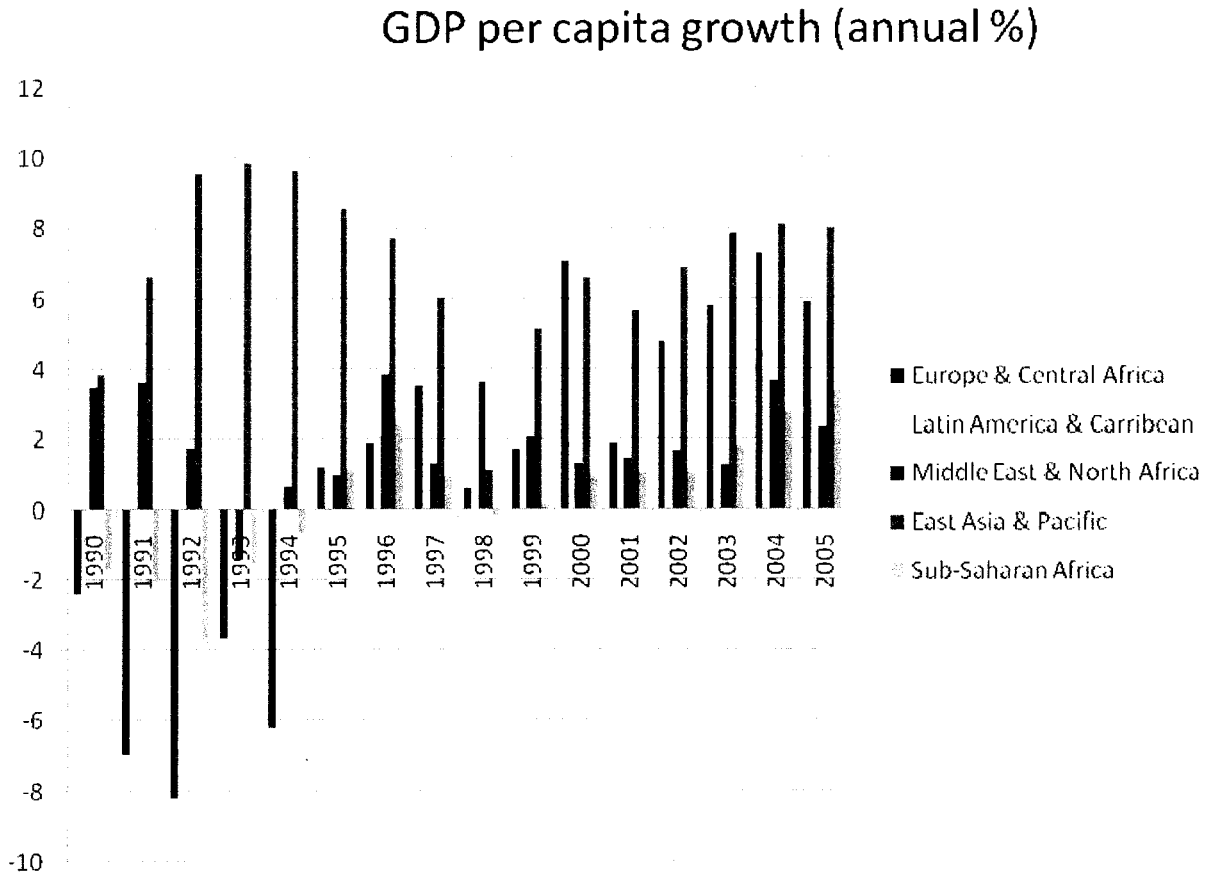
SSA regional economic disaster has been well documented. The fundamental causes of the SSA's economic crisis are complex. Some lie in history, in the colonial experience with the fragmentation of the continent into over 50 countries.

Table 4. Classification of the SSA countries

	<u>Low income</u>	<u>Lower Middle Inc</u>	<u>Upper Middle Inc</u>	<u>HIPC</u>
Angola		x		
Benin	x			x
Botswana			x	
Burkina Faso	x			x
Burundi	x			x
Cameroon		x		x
Cape Verde		x		
Central Africa Republic	x			x
Chad	x			x
Comoros	x			x
Congo		x		x
Congo Dem	x			x
Cote D'Ivoire	x			x
Djibouti		x		
Equatorial Guinea				
Eritrea	x			x
Ethiopia	x			x
Gabon			x	
Gambia	x			x
Ghana	x			x
Guinea	x			x
Guinea-Bissau	x			x
Kenya	x			
Lesotho		x		
Liberia	x			x
Madagascar	x			x
Malawi	x			x
Mali	x			x
Mauritania	x			x
Mauritius			x	
Mozambique	x			x
Namibia		x		
Niger	x			x
Nigeria	x			
Rwanda	x			x
Sao-Tome& Principe	x			x
Senegal	x			x
Seychelles			x	
Sierra-Leone	x			x
Somalia	x			x
South Africa			x	
Sudan	x			x
Swaziland		x		
Tanzania	x			x
Togo	x			x
Uganda	x			x
Zambia	x			x
Zimbabwe	x			

Source: WB Tables 2007

Fig 4

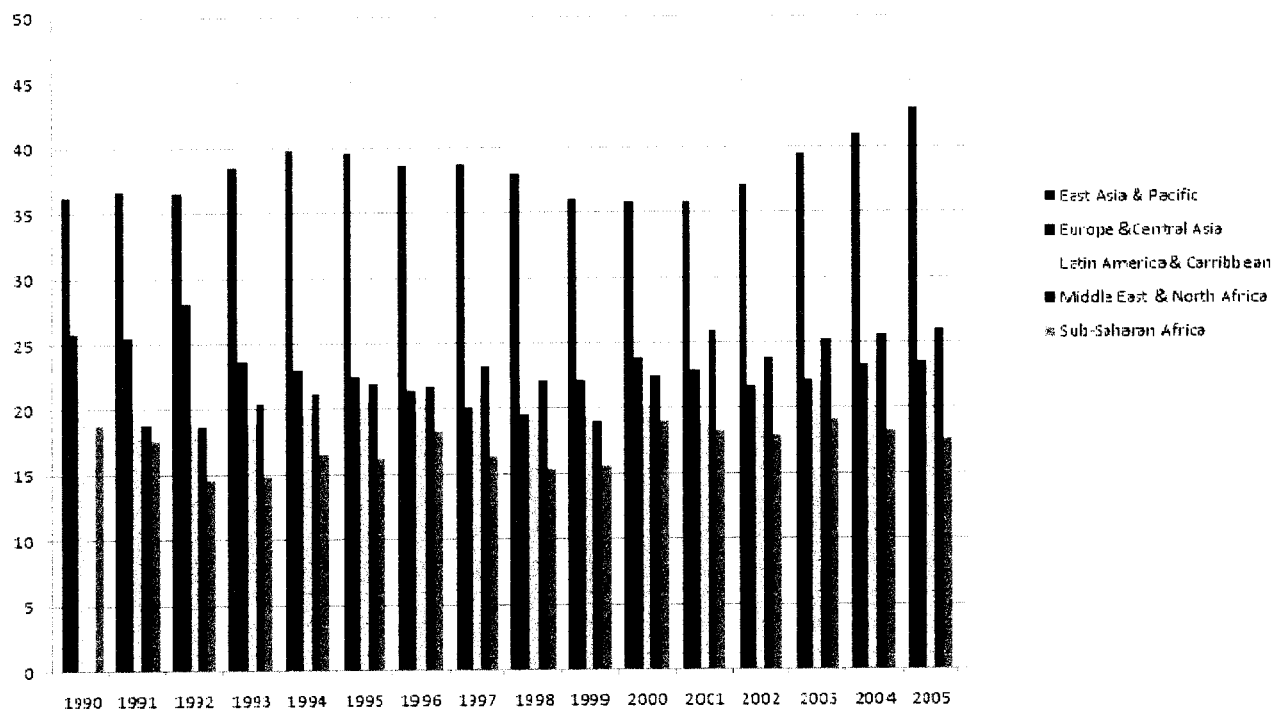


source: Author's Computation, WB Tables 2007

Africa had a healthy and fairly independent economic system before colonialism (Geda, 2000). Some causes lie in nature, such as the proneness to droughts and other reasons could be its own domestic performance. The countries generally have slow growth (Fig 4) and sometimes negative, considerable poverty problems and economic weaknesses. In particular the region is characterized high foreign debt levels, low saving as compared to other regions, (Fig 5) and investment ratios, severe trade account deficits as well as bad conditions of the current accounts.

Fig 5

Gross Domestic Savings(%)



source: Author's Computation, WB Tables 2007

The SSA developing countries tend to be capital scarce and hence have numerous unsatisfied investment needs with a potential return that is higher than the international interest rate. Their economies are usually revenue constrained and they have no direct control over the large portions of government expenditure that is financed by foreign creditors and donors. This makes SSA debt a bigger burden as compared to other highly indebted regions.

Among the causes of a disappointing trade performance some special features can be distinguished. The main feature of this trade is the export of primary commodities and imports of manufactured goods. SSA countries have a history of relying heavily on a limited range of primary products as exports, usually one or only a few commodities for their export revenue mostly from agriculture or mining. For example, Nigeria relies on oil and Botswana relies on diamonds. This has detrimental effects in times of low export earnings.

Exports play an extremely important role in SSA's economic performance and most of the constraints posed by SSA's trade relate to export commodities, which account for more than 80 percent of the region's total export earnings (Onimode, 1989). Oil is particularly important. About half of the total regional GDP for SSA countries comes from the oil exporting countries. Export revenues are very crucial as they are partly used to service debt payments and accruals to creditors through payment of interest and principal on the debt which inhibits incentives for investment.

As long as the export growth rates are higher than the interest rate on external debt, the SSA countries' ability to pay back funds improves and they are also able to service the debt without sacrificing any of their own national resources. For many countries, a single mineral or agricultural crop is responsible for more than 50 percent of their export revenue (Mshomba 2000). The world prices of these commodities are very volatile, any sharp decreases or wild swings in commodity prices or output can have a detrimental effect on the producers of the commodity and the economy as a whole. Sachs 1999 however argues that when commodity prices are increasing more rapidly than the rate of interest on international loans, countries can

service their debt through fresh borrowing while simultaneously reducing the ratio of debt to exports.

The SSA countries have limited access to private financial flows and are regarded as unable to sustain the rules of international financial and capital markets, which also means that they are credit-rationed. For them to be able to borrow on the international capital, the relationship between the stock of debt and the level of debt service is expected to be consistent and predictable (Serieux and Samy, 2001). Hence these economies generally face liquidity constraints in terms of meeting shortfalls in budgetary financing and foreign exchange earning. The economies are then completely integrated into an international system of markets in which they operate as dominated partners, as they have no control over the market. They are the most vulnerable to externally generated shocks and crises as compared to other regions.

The HIPC is by far the single most important action put in place by the donor community to handle the external debt of developing countries including the SSA. Following its launch in 1996, it was further enhanced in 1999 following the G7 Summit in Cologne, Germany. The rich countries committed themselves to write off about £113 billion, (\$100 billion US) of the poorest countries. It was intended to reduce the debt to a level that would make it sustainable and provide an exit from serial rescheduling at Paris Club. About 45 low income countries were eligible, 26 of them from SSA. However, the fact that many graduated HIPCs are experiencing rising debt burdens suggests a need for better understanding of sustainable debt levels.

IV. Empirical analysis

This section provides the model specification, data, descriptive statistics, methodology and discussion of the estimation results.

A. Model specification

It would be difficult to apply the theoretical models of investment such as the neoclassical flexible accelerator model that were formulated by Jorgenson (1967) and Tobin's q theory to analyze investment in SSA. Jorgenson combined the user cost of capital (interest rate, depreciation and price of capital goods and the accelerator effect to explain investment behavior. Tobin related the market value of the firm with its replacement cost in making investment decisions meaning that investment will be worthwhile as long as the value of the firm in the stock market is higher than the cost of acquiring the firm in the product market.

Direct application of the two models to the SSA countries would be difficult because of the scarcity of data on key variables such as wage rates, capital stock and stock market prices. Assumptions such as a perfectly competitive market, full employment, little or no government intervention and absence of liquidity constraints would be incompatible for these countries and thus make the models less relevant.

In this section I choose the simple accelerator model which provides a useful framework for empirical estimates of the determinants of investment in SSA countries because it does not require estimates of capital stock, wage rates and stock market prices (Fry 1989). As already set out in the introduction the purpose of the paper is to explain the impact of external debt and debt

service on investment. Hence the analysis will estimate five standard equations of investment which are based on the following equation:

$$\text{INVGDP} = f(\text{EDTGDP}, \text{DEDTGDP}, \text{TDSEXP}, \text{GDPGR}, \text{INFL}, \text{POPGR}, \text{TRADEGDP}, \text{AIDGDP})$$

(+) (-) (+) (+) (-) (+) (+) (+)

Investment, INVGDP, the dependent variable is postulated to be a function of the following independent variables; stock of external debt EDTGDP, the square of stock of external debt DEDTGDP, total debt service TDSEXP, trade TRADEGDP, inflation INFL, population growth POPGR, aid AIDGDP and gross domestic product growth GDPGR. The expected signs are in the parentheses as shown below the above equation.

The five standard equations are as follows:

1. Stock of debt equation

$$\text{INVGDP} = \beta_0 + \beta_1 \text{EDTGDP} + \beta_2 \text{GDPGR} + \beta_3 \text{INFL} + \beta_4 \text{POPGR} + \beta_5 \text{TRADEGDP} + \beta_6 \text{AIDGDP} + \varepsilon$$

2. Equation with non-linear effect of debt

$$\text{INVGDP} = \alpha_0 + \alpha_1 \text{EDTGDP} + \alpha_2 \text{DEDTGDP} + \alpha_3 \text{GDPGR} + \alpha_4 \text{INFL} + \alpha_5 \text{POPGR} + \alpha_6 \text{TRADEGDP} + \alpha_7 \text{AIDGDP} + \varepsilon$$

3. Standard equation of debt service

$$\text{INVGDP} = \theta_0 + \theta_1 \text{TDSEXP} + \theta_2 \text{GDPGR} + \theta_3 \text{INFL} + \theta_4 \text{POPGR} + \theta_5 \text{TRADEGDP} + \theta_6 \text{AIDGDP} + \varepsilon$$

4. Standard equation of debt service without aid

$$\text{INVGDP} = \rho_0 + \rho_1 \text{TDSEXP} + \rho_2 \text{GDPGR} + \rho_3 \text{INFL} + \rho_4 \text{POPGR} + \rho_5 \text{TRADEGDP} + \varepsilon$$

5. Equation of stock of debt and debt service

$$\text{INVGDP} = \eta_0 + \eta_1 \text{EDTGDP} + \eta_2 \text{TDSEXP} + \eta_3 \text{GDPGR} + \eta_4 \text{INFL} + \eta_5 \text{POPGR} \\ + \eta_6 \text{TRADEGDP} + \eta_7 \text{AIDGDP} + \varepsilon$$

The theoretical framework in Section 2 provided the main motivation for the five equations. Inflation, GDPGR and POPGR are used as annual rates whereas debt service, trade, aid and investment are used as ratios of GDP. GDPGR captures the accelerator effect in line with the simple accelerator model. I will instead use total debt service as a ratio of exports, TDSEXP, because exports play an important role in generating revenues that are going to be partly used in debt servicing. The square of the stock of external debt, DEDTGDP is meant to capture non-linearity effect, if it exists. These relative values are more comparable for the countries and represent a true picture of their performances.

The intuition behind the expected negative effect of debt service, TDSEXP and external debt, DEDTGDP on investment is that they crowd out credit available for investment thereby preventing countries from investing in their productive capacities. However external debt stock is expected to have a positive effect only up to a certain level hence the intuition of a positive effect on EDTGDP. The intuition behind the expected positive impact of economic growth on investment is that these are complementary variables were an improvement in one of them leads to the improvement of the other. Economies that enjoy higher relative rates of growth generally succeed in attracting foreign investment.

Inflation is meant to reflect on macroeconomic stability. Annual inflation rates are hypothesized to have a strong and unambiguously negative impact on investment in SSA. The intuition behind the expected negative effect of inflation is that high and unpredictable inflation distorts the

information content of relative prices, reduces the value of money and increases the riskiness of longer term investment. The intuition behind the expected positive effect of population growth on investment is a higher population symbolizes an increase in the number of investors which also improves economic growth. The intuition behind the positive effect of aid on investment is that aid boosts funds available for investments. The intuition behind a positive effect of trade is higher exports than imports provide more funds used to service debt and accrues to creditors and enables payment of interest and principal on the debt which inhibits incentives for investment.

Estimation on the five different equations will provide variable magnitudes of effects on each specific equation. I chose to use only common variables. Many variables such as lending rates, interest rates and real exchange rates are potentially relevant for explaining investment. These factors and others such as human capital and political factors are not included in the analysis because they are difficult to quantify and there is no universal definition for them in the SSA region.

B. Data

The data consists of 43 unbalanced panels due to incomplete information on some of the countries. The panels consist of COUNTRY, YEAR, INVGDP, EDTGDP, DEDTGDP, GDPGR, INFL, POPGR, TRADEGDP and AIDGDP. The data is analyzed from 1990 to 2005. There is no selection of countries as I attempt to include all of them. Two countries, Somalia and Namibia are excluded due to lack of data on the principal variable INVGDP and the primary variable, stock of external debt EDTGDP.

The main data source for the variables INVGDP, GDPGR, INFL, POPGR, TRADEGDP and AIDGDP is World Development Indicators online database 2007. The main data source for

the variables EDTGDP and DEDTGDP is Global Development Finance online database 2007. The two sources are more consistent, homogenous and have more complete sets of data as compared to other sources such as Africa Development Bank statistics and the United Nations database.

Table 5.

C. Descriptive Statistics on the variables

<u>Variable</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Average</u>
INVGDP	113.58%	-23.76%	20%
EDTGDP	1598.20%	0%	128.78%
DEDTGDP	25542.51%	0%	413.58%
TDSEXP	135.30%	0.46%	15.89%
GDPGR	106.28%	-60.69%	3.53%
INFL	26772.02%	-24.08%	127.51%
POPGR	10.21%	-8.14%	2.40%
TRADEGDP	237.99%	10.83%	73.28%
AIDGDP	184.85%	-0.28%	15.86%

source: Author's computation, WDI & GDF 2007 tables

The above table shows the average Investment rate as a percentage of GDP at 20% for the SSA countries. Total external debt stock is 128.78% of GDP. This exceeds by far exceeds K. Rogoff's safe thresholds of 15% to 20% of GDP, showing that the countries are faced by a debt overhang crisis. Total debt service as a percentage of exports is averaged at 15.89%. Trade and Aid as percentages of GDP are averaged at 73.28% and 15.86% respectively. The average inflation rate for the SSA countries is 127.51%. While population growth rate and GDP growth rate are averaged at 2.4% and 3.53% respectively.

D. Methodology

In this section I discuss the econometric methods for the estimations of the models specified above. The existence of both cross-sectional and time series components makes panel data estimation a more flexible, informative and analytical method because it can answer questions not possible either from a cross-section context or with a pure time series. Panel data methods also have increased precision of regression estimates, the ability to control for individual fixed effects and the ability to model temporal effects without aggregation bias. There however could be problems that are associated with panel data such as attrition and non-randomness of the sample. Attrition refers to a reduction in strength in panel data.

Since the cross-section comprises of almost all the countries in the SSA region the fixed effects model is more appropriate for the estimation of the data. Differences between the countries can be viewed simply as parametric shifts in the classical regression function. Thus the fixed effects model or the classical regression function for the equations above can be specified as:

$$Y_{it} = \alpha_i + X'_{it}\beta + \mu_{it}$$

This model includes country specific effects, α_i which are constant over time and marginal effects, β for X_{it} common across i and t . Y_{it} then represents the dependent variable INVGDP for country i , in year t and X_{it} represents all the independent variables EDTGDP, DEDTGDP, GDPGR, INFL, POPGR, TRADEGDP and AIDGDP for the country i , in year t . This model is also called the Least Squares Dummy Variable model. It takes into account unobserved heterogeneity between the countries.

However in the case were $\alpha_i = \alpha$ there is no unobserved heterogeneity, and the model becomes

$$Y_{it} = \alpha + X'_{it}\beta + \mu_{it}$$

and can be estimated by pooling all the data and applying OLS to the pooled data. This is the simplest approach to the estimation. The cross-section effects α_i are either fixed or common hence the other method that I will use is common effects.

The other widely used method for panel estimation is the random effects (error components model) where

$$\mu_{it} = \alpha_i + \varepsilon_{it}$$

which means that the country specific effects are part of the error term. In this case generalized least squares would be used to estimate the data. However random effects is more appropriate in situations where the cross-section is drawn from a larger population is not considered to be exhaustive of all the full cross-section which are the SSA countries in this case. This makes the fixed effects model more appropriate for the estimation of the data.

It also known that heteroscedasticity is common in cross-section data just as is autocorrelation with time series data. The problem of heterogeneity has to be considered given that the countries are heterogeneous with respect to their revenue sizes, population, natural resources and other institutional variables. Another common problem in the five standard equations to be estimated is the possibility of the dependent variable INVGDP being simultaneously determined with the independent variables.

This refers to a situation where variables such GDPGR are not exogenous but endogenous and thus could be simultaneously determined with investment which gives rise to the problem of autocorrelation. This should be minimized by using relative ratios of the variables as mentioned

in the model specification. The main assumption of the fixed effects model is that the country specific effects α_i are correlated with the explanatory or independent variables, X_{it} .

Another important assumption of the fixed effects model is that there has to be homoscedasticity and no autocorrelation. If this is violated, the results in the classical regression function will be inconsistent and inefficient. In an effort to correct this I estimate the data using White's heteroscedasticity variance-covariance matrix estimator. This is a more flexible method because it works even if the source of heteroscedasticity is not known. White's estimator also minimizes autocorrelation. There could however be problems that are inherent in the estimation itself such as inclusion of irrelevant variables or omission of relevant variables. The variables that are selected in this estimation are simply motivated by previous literature and the availability of data.

E. Discussion of the estimation results

In this section I present the results and interpret them. The acceptable level of significance is 15%. In estimating the data I used shazam software. However almost all the variables in all the five equations were insignificant as shown on Table 6. The table shows results for one equation: non-linearity effect of debt equation.

Equation with non-linear effect of debt

$$\begin{aligned} \text{INVGDP} = & \alpha_0 + \alpha_1 \text{EDTGDP} + \alpha_2 \text{DEDTGDP} + \alpha_3 \text{GDPGR} + \alpha_4 \text{INFL} + \alpha_5 \text{POPGR} \\ & + \alpha_6 \text{TRADEGDP} + \alpha_7 \text{AIDGDP} + \varepsilon \end{aligned}$$

Table 6: Shazam results on pooled OLS on non-linear debt equation.

<u>Variable</u>	<u>Common effects</u>	<u>Fixed Effects</u>
EDTGDP	-0.1062 (0.8750)	0.5148 (0.6070)
GDPGR	0.401 (0.9510)	-0.25142 (0.7580)
DEDTGDP	-(0.3840) (0.6570)	-0.106 (0.3600)
INFL	0.2133 (0.0140)	0.287 (0.0070)
TRADEGDP	0.9644 (0.0000)	0.946 (0.0000)
POPGR	94300 (0.9480)	0.541 (0.5960)
AIDGDP	0.2666 (0.6820)	0.7412 (0.3780)
CONSTANT	-30950 (0.1080)	

source: Author's Computation from Shazam :Values in parentheses represent p-values.

The results are for both common effects and fixed effects. Except for TRADEGDP all the variables are insignificant at over 30%.The p-values are shown in the parentheses below the coefficient estimates. As can be seen from the table almost all of them are above 15% level of significance. Shazam did not seem to have read the data properly, I then used E-views software to estimate all specification for the common and fixed effects which presented better results except of the expected sign on the non-linear effect.

Interpretation of Common Effects results

Table 7.

<u>Specification</u>	<u>E- Views Common Effects Results</u>				
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
EDTGD	-0.008756 (0.0485) (-1.9770)	-0.034504 (0.0008) (-3.3562)			0.001593 (0.7798) (0.2798)
DEDTGD		0.0051 (0.0022) (3.0682)			
TDSEXP			0.0000738 (0.5628) (0.5777)	0.000197 (0.0878) (1.7104)	-0.11211 (0.0000) (-4.5033)
GDPGR	0.356597 (0.0000) (4.5201)	0.346606 (0.0000) (4.3479)	0.337451 (0.0063) (2.7440)	0.32123 (0.0065) (2.7340)	0.325605 (0.0090) (2.6200)
INFL	-0.0000683 (0.2087) (-1.2584)	-0.0000891 (0.8855) (-0.1441)	0.0000968 (0.8899) (0.1385)	0.000101 (0.8792) (0.1520)	0.000366 (0.5791) (0.5550)
POPGR	-0.482446 (0.0450) (-2.0084)	-0.34046 (0.1549) (-1.4240)	-0.624255 (0.0163) (-2.4094)	-0.606018 (0.0107) (-2.5610)	-0.558659 (0.0286) (-2.1949)
TRADEGDP	0.151683 (0.0000) (9.3779)	0.147486 (0.0000) (8.7165)	0.140129 (0.0000) (7.7292)	0.131772 (0.0000) (7.2707)	0.129849 (0.0000) (6.9515)
AIDGDP	0.177776 (0.0000) (5.8966)	0.174441 (0.0000) (6.2570)	0.132341 (0.0000) (4.3959)		0.16045 (0.0001) (3.9099)
CONSTANT	0.071518 (0.0000) (5.7802)	0.089762 (0.0000) (5.8217)	0.082338 (0.0000) (5.3324)	0.106978 (0.0000) (7.7687)	0.100769 (0.0000) (6.2356)
R²	0.400274	0.408522	0.316413	0.289012	0.332578
F- statistic	74.41832	65.91059	41.8898	44.47042	38.5116
Prob(F-statistic)	0	0	0	0	0

Source: Author's Computation from E-Views: Values in parentheses are p-values & t-statistics respectively .

The results in Table 7 above, assume that the countries have common effects. According to R², which is a standard measure of the goodness of fit of regression model, 40% of the explanatory variables are determined in the model where external debt is included and 30% when debt service is considered. Since the value of the Prob(F-statistic) is zero, the overall significance of the specifications is valid. The t-statistics did not reveal any distinction in the heterogeneity of

the countries. Specification 1, suggests that external debt, negatively affects investment providing some support to the debt overhang hypothesis. Specification 2, also shows the negative relationship between external debt and investment, however the variable DEDTGDP did not reveal an exact non-linear relationship as depicted by the Debt Laffer curve. One possible reason could be that the countries were not separated into homogeneous subsamples such as middle and low income countries. Specification 3, shows that total debt service is positively related to investment. It is however insignificant. In specification 4, it becomes significant by excluding AIDGDP.

In order for countries to be eligible for AID, they have to meet certain levels of debt service required by the donor countries or institutions. Including both external debt EDTGDP and total debt service TDSEXP in specification 5, shows that external debt is positively related to investment whereas debt service is negatively related to investment and highly significant. In the entire specifications population growth rate negatively affects investment. Inflation is highly insignificant when considering gross fixed investment whereas: GDPGR, TRADEGDP and AIDGDP are positively related to investment and highly significant.

The findings suggest that economic growth, GDPGR is the main driver of investment followed by aid and trade which are also very critical for the investment environment. GDPGR contributes at least an average of 33% of investment, aid contributes at least 16% of investment and trade contributes an average of 15% of investment. The magnitude and sign on inflation shows that it does have some significant negative effect on investment. There is no set rule as to the adequate level of debt. However the ratios on EDTGDP should decline or at least stabilize if investment is to increase.

Interpretation of Fixed Effects results.

The results below assume that the countries have specific effects. These results are better than common effects results since at least 70% of the explanatory variables are determined in the specifications, as shown by the coefficient of determination R^2 . The specifications are overall significant given the value of zero of Prob(F-statistic). However the fixed effects t-statistics do not provide any conclusions to the heterogeneity of the countries.

Table 8.

<u>E- Views Fixed Effects results</u>					
<u>SPECIFICATION</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
EDTGDP	-0.00395 {0.6397} {0.4684}	-0.01933 {0.1362} {1.4922}			0.0076 {0.4574} {0.7437}
DEDTGDP		0.002823 {0.1920} {1.3060}			
TDSEXP			0.0000562 {0.4513} {0.7538}	0.000273 {0.0136} {2.4758}	0.003541 {0.8909} {0.1372}
GDPGR	0.11306 {0.0289} {2.1893}	0.108637 {0.0353} {2.1092}	0.10942 {0.0825} {1.7399}	0.111832 {0.0893} {1.7025}	0.117518 {0.0447} {2.0124}
INFL	0.00017 {0.3084} {1.0194}	0.000184 {0.2845} {1.0713}	0.0033 {0.0007} {3.4123}	0.003286 {0.0008} {3.3850}	0.003164 {0.0006} {3.4667}
POPGR	-0.48245 {0.0450} {2.0655}	0.43343 {0.0272} {2.2144}	0.33645 {0.0522} {1.9460}	0.336431 {0.0543} {1.9286}	0.300277 {0.0852} {1.7247}
TRADEGDP	0.159676 {0.0000} {4.5800}	0.159926 {0.0000} {4.6200}	0.149936 {0.0025} {3.0337}	0.149747 {0.0024} {3.0523}	0.147977 {0.0048} {2.8300}
AIDGDP	0.062572 {0.1612} {1.4027}	0.073338 {0.1101} {1.6001}	-0.014993 {0.7517} {-0.3165}		-0.0229 {0.6461} {-0.4594}
R ²	0.697531	0.698416	0.699251	0.69914	0.699639
F- statistic	288.266	240.8463	232.9679	293.3806	193.7227
Prob(F-statistic)	0	0	0	0	0

source: Author's Computation from E-Views: Values in parentheses show the p-values

The fixed effects of specific countries are provided for one specification, Specification 5 in the appendix. The fixed effects results are somewhat consistent with common effects results in terms of expected signs. Total external debt still has a negative effect but however it becomes insignificant in specification 1 and 5 when assuming country specific effects. The fixed results do not show an evidence of non-linear relationship in specification 2 but indicate that the countries are on the bad side of the debt laffer curve. Total debt service is insignificant in specification 3 and 5. However when AIDGDP is excluded in specification 4, TDSEXP becomes significant at 1% level of significance.

When considering country specific effects, trade, TRADEGDP is very essential for investment as shown by the results. TRADEGDP is significant at 0.5% level of significance. It accounts for 15% of investment as shown by the coefficient values in all specifications. GDPGR has a positive relationship with and has a significant influence on investment. GDPGR is significant at 3% level when considering external debt and significant at 8% level when considering debt service.

POPGR has a positive relationship with investment and is significant at 8% level of significance. The fixed effects results suggest population growth rate is the main driver, accounting for at least 33% of investment as shown in the results by the value of the coefficients. Inflation is significant only when considering debt service in specification 3, 4 and 5. The rest of all the results from both fixed and common effects for all specifications such the standard errors and D-W statistics are provided in the appendix.

V. Conclusion

The main purpose of the paper was to investigate the extent of the relationship between external debt, debt service and investment. Debt appears to have a non-linear relationship effect on investment. My results do not allow me to precisely estimate such a non-linear relationship given the large differences of experiences across the 43 countries overtime. The above results should be treated with caution given that the panel data sets are incomplete.

Other potential variables would have been included in the analysis. There could also be difficulties with the model itself as it does not identify any mechanism through which expectations affect investment demand. A possible alternative would have been to estimate different groups of the countries such as middle income and low income. When considering the variables included in the specification, the countries are homogeneous in population growth rates and GDP growth rate. They are however heterogeneous in aspects such as inflation, aid, trade.

The results of a negative relationship between investment and total external debt are the same as those obtained in a previous study by Ndikumana (1999). Their results indicated that debt service, debt stock, the black market premia and inflation are negatively related to investment. However their respective coefficients or elasticities of investment, were -0.064, -0.089, -0.022, and -0.031 respectively. They also found out that trade flows were positively related to investment. The main difference between their results and this study is the emphasis on financial indicators such as credit and hypothesized that financial development leads to more investment in the future. Given the fact that they used many variables which may have complex interactions in their estimation, they concluded that their results were suggestive. The second quantitative paper by Bhattaryacha, Clements and Nguyen decided to focus mainly on public

investment as they argued that debt service mainly affects public investment rather than private or total investment. Their results are somewhat similar to the present study providing support for the hypothesis that debt service crowds out public investment and the relationship becomes non-linear as the debt-service to GDP ratio increases.

In all the results for the fixed effects and common effects in the present study, investment is mainly determined by trade, population and gross domestic product in line with the accelerator effect as shown by the high coefficient values in the results. However, regardless of which specification, inflation does not seem to be the major determinant of investment. These results are in line with recent findings of a high level of macroeconomic stability since the mean inflation rate of the SSA countries is 127.21%. Inflation tends to destabilize low income countries only when it reaches over 40%.

If SSA countries are to be able to control the persistence of the debt crisis, debt service must be brought in line with available external resources such as export revenues. In light of the background, composition, historical origin and the circumstances under which much of the debt of SSA countries were incurred and in recognition of the mistakes of the borrowers and lenders much of this debt is illegitimate. Thus the cause of the external debt trap faced by the SSA countries can be blamed on both internal factors such as macroeconomic instability and external factors. A favorable investment climate requires among other things export diversification, low trade barriers, reductions in quantitative restrictions, pursuing prudent macroeconomics that allow for controlled borrowing and improving debtor and creditor relations in debt negotiations and the ability of the SSA economies to articulate effective strategies on the management of the debt crisis.

References

- Arkorie, A.N.C., (1993), "External Disturbances, Domestic Policy Responses and Debt Accumulation in Nigeria", University of Wisconsin La-Crosse, *World Development* 21(10): 1621-1631
- Bhattacharya, R., Clements, and B., Nguyen Q. T., (2003), "External Debt, Public Investment and Growth in Low-Income Countries", IMF Working Paper 249, Fiscal Affairs Department, International Monetary Fund.
- Borensztein, E., (1990), "Credit Rationing, Debt Overhang and Investment", International Monetary Fund, *Journal of Development Economics* 32: 315-335.
- Bouton, L., and Sumlinski, A.M., (1999), "Trends in Private Investment in Developing Countries", International Finance Corporation, The World Bank.
- Charemza, W. W., and Deadman, F. B., (1992), *New Directions in Econometric Practice: England*, Edward Elgar publishing limited.
- Cohen, D., (1993), "Low Investment and Large LDC Debt in the 1980s", *The American Economic Review*.
- Devarajan, S., Easterly, W. R., Pack, H., (2002), "Low Investment is not the Constraint on African Development", New York University and *Center for Global Development*, The World Bank
- Eisner, R., (1980), "Total Income, Total Investment and Growth", American Economic Association, *The American Economic Review* 70(2): 225-231.
- Feder, G., Just, R., and Ross, K., "Projecting Debt Servicing Capacity of Developing Countries", University of Washington School of Business Administration, *Journal of Financial and Quantitative Analysis* 16(5): 651-669.
- Fosu, A., (1996), "The Impact Of External Debt on Economic Growth in Sub-Sahara Africa", *Journal of Economic Development*.
- Geda, F. A., (2003), "The Historical Origin of the African Debt Crisis", *Eastern Africa Social Science Research Review*, 19(1): 59-89.
- Green, W. H., (200), "An Econometric Analysis", New Jersey, Prentice Hall, Fourth Edition.
- Hadjimicheal, M. T., and Ghura, D., (1995), "Public Policy and Private Savings and Investment in Sub-Sahara Africa: An Empirical Investigation", IMF Working Paper.
- Husain, I., and Underwood, J., (1991), "African External finance in the 90s", The International Bank for Reconstruction and Development, The World Bank.
- Iyoha, M. A., (1997), "External Debt and Economic Growth in Sub-Sahara Africa: Policy Simulations", *Nigerian Economic and Financial Review*.

Kochendorfer, L. G., and Pleskovic, B., (2005), "Investment Climate, Growth, and Poverty", Berlin Workshop Series, The World bank.

Krumm, K.,(1985), "External Debt of Sub-Sahara Africa: Origins, Magnitudes and Implications for Actions", The World Bank.

Lomax, D. F., (1986), "The Developing Country Debt Crisis", Palmgrave Macmillan.

Loser, C.M., (2003), "External Debt Sustainability: Guidelines for Low and Middle Income Countries", *The Inter-American Dialogue*. The International Monetary Fund.

Mkandawire, T., and Soludo, C. C., "Our Continent, Our Future: African Perspective on Structural Adjustment", Conseil Pour Le Development De La.

Mshomba, R.E., "Africa in the Global Economy", Lynne Reinner Publishers.

Oshikoya, T. W., (1994), "Macroeconomic Determinants of Domestic Private Investment in Africa: An Empirical Analysis", *Economic Development and Cultural Change*, 42(3): 573-596

Romer, D.,(1999), "Macroeconomics", Fourth Edition.

Sachs, J.D., (1989), "Developing Country Debt and The World Economy", *An NBER Project Report*, The National Bureau of Economic Research,

Sachs, J.D., (2002), " Resolving the Debt Crisis of Low Income Countries", Brookings Paper on Economic Activity, Harvard University.

Samy, Y., and Serieux, J., (2001), "The Debt Service and Growth: Evidence From The Low Income Countries, The North-South Institute.

Serven, L., and Solimano, A., (1992), "Debt Crisis, Adjustment Policies and Capital Formation in Developing Countries: Where Do We Stand", *World Development* 21(1):127-140.

Sioum, Admasu. (2002), "Private Investment and Public Policy in Sub-Saharan Africa: An Empirical Analysis", Working Paper Series No. 356, Institute of Social Studies.

Warner, A. M., (1992) "Did the Debt Crisis Cause the Investment Crisis", *The Quarterly Journal of Economics*, 107(4): 1161-1186.

Were, M., (2001), "The Impact of External Debt on Economic Growth and Private Investments in Kenya", Kenya Institute of Public Policy Research and Analysis.

World Bank: World Bank E-Library

<http://devdata.worldbank.org.proxy.bib.uottawa.ca/dataonline/old-default.htm>.

Global Development Finance: GDF Online

<http://devdata.worldbank.org.proxy.bib.uottawa.ca/apponline/old-default.asp?app=gf>

APPENDIX

Cross Section Identifiers: List of SSA Countries

AGO - ANGOLA	MOZ - MOZAMBIQUE
BDI - BURUNDI	MRT - MAURITANIA
BEN - BENIN	MUS - MAURITIUS
BFA - BURKINA FASO	MWI - MALAWI
BWA - BOTSWANA	NER - NIGER
CAF - CENTRAL AFRICA REPUBLIC	NGA - NIGERIA
CIV - COTE D'IVOIRE	RWA - RWANDA
CMR - CAMEROON	SDN - SUDAN
COG - CONGO	SEN - SENEGAL
COM - COMOROS	SLE - SIERRA LEONE
CPV - CAPE VERDE	STP - SAO TOME & PRINCIPE
ERI - ERITREA	SWZ - SWAZILAND
ETH - ETHIOPIA	SYC - SEYCHELLES
GAB - GABON	TCD - CHAD
GHA - GHANA	TGO - TOGO
GIN - GUINEA	TZA - TANZANIA
GMB - GAMBIA	UGA - UGANDA
GNB - GUINEA BISSAU	ZAF - SOUTH AFRICA
KEN - KENYA	ZAR - CONGO DEMOCRATIC REPUBLIC
LSO - LESOTHO	ZMB - ZAMBIA
MDG - MADAGASCAR	ZWE - ZIMBABWE
MLI - MALAWI	

Assumptions of the Classical Regression Function (CRF)

The CRF can be represented as $Y_{it} = \alpha_i + X'_{it}\beta + \mu_{it}$.

Assumption 1

The above regression function is linear in parameter β .

Assumption 2

$E(\mu) = 0$. Intuitively this means that on average, the effect of the dependent variable Y of omitted variables and other random factors is assumed to be zero.

Assumption 3

The observations in Y are stochastic or statistically independent of one another.

Assumption 4

X is a nonstochastic matrix of all independent variables in the regression, where as Y is a univariate stochastic variable with a certain probability distribution and finite mean and variance.

Assumption 5

$E(\mu^2/X) = \sigma^2$ (i.e. homoskedasticity- every observation has the same variance Heteroscedasticity arises when the error terms have different variances such that the variance-covariance matrix of the error term ϵ_{it} has the following form:

$$\sigma^2 I = \begin{bmatrix} \sigma^2_1 & 0 & \dots & 0 & 0 \\ 0 & \sigma^2_2 & \dots & 0 & 0 \\ 0 & 0 & \dots & \sigma^2 & 0 \\ 0 & 0 & \dots & 0 & \sigma^2_{i3} \end{bmatrix}$$

Assumption 6

$E(\mu_i \mu_j/X) = 0$ (i.e. no autocorrelation)

Assumption 7

$\mu/X \sim N(0, \sigma^2 I)$. for one fixed combination of X_{it} the variable Y is normally distributed.

Pooled Regressions: Common Effects

Specification 1

Dependent Variable: INVGDP_?

Method: Pooled Least Squares

Date: 11/04/07 Time: 16:15

Sample: 1990 2005

Included observations: 16

Number of cross-sections used: 45

Total panel (unbalanced) observations: 676

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.071518	0.012373	5.780224	0.0000
EDTGDP_?	-0.008756	0.004429	-1.976970	0.0485
GDPGR_?	0.356597	0.078892	4.520068	0.0000
INFL_?	-6.83E-05	5.43E-05	-1.258385	0.2087
TTRADEGD_?	0.151683	0.016175	9.377876	0.0000
POPGR_?	-0.482446	0.240212	-2.008418	0.0450
AIDGDP_?	0.177776	0.030149	5.896632	0.0000
R-squared	0.400274	Mean dependent var	0.200367	
Adjusted R-squared	0.394896	S.D. dependent var	0.113306	
S.E. of regression	0.088139	Sum squared resid	5.197080	
F-statistic	74.41832	Durbin-Watson stat	0.752732	
Prob(F-statistic)	0.000000			

Specification 2

Dependent Variable: INVGDP_?

Method: Pooled Least Squares

Date: 11/04/07 Time: 16:21

Sample: 1990 2005

Included observations: 16

Number of cross-sections used: 45

Total panel (unbalanced) observations: 676

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.089762	0.015419	5.821671	0.0000
EDTGDP_?	-0.034504	0.010281	-3.356220	0.0008
GDPGR_?	0.346606	0.079717	4.347935	0.0000
DEDTGDP_?	0.005100	0.001662	3.068217	0.0022
INFL_?	-8.91E-06	6.19E-05	-0.144094	0.8855
TTRADEGD_?	0.147486	0.016920	8.716521	0.0000
POPGR_?	-0.340460	0.239095	-1.423956	0.1549
AIDGDP_?	0.174441	0.027879	6.257002	0.0000
R-squared	0.408522	Mean dependent var	0.200367	
Adjusted R-squared	0.402324	S.D. dependent var	0.113306	
S.E. of regression	0.087596	Sum squared resid	5.125608	
F-statistic	65.91059	Durbin-Watson stat	0.755020	
Prob(F-statistic)	0.000000			

Specification 3

Dependent Variable: INVGDP_?

Method: Pooled Least Squares

Date: 11/04/07 Time: 16:26

Sample: 1990 2005

Included observations: 16

Number of cross-sections used: 43

Total panel (unbalanced) observations: 550

White Heteroskedasticity-Consistent Standard Errors & Covariance

Cross sections without valid observations dropped

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.082296	0.015433	5.332409	0.0000
TDSEX_?	7.41E-05	0.000128	0.577669	0.5637
GDPGR_?	0.337398	0.122959	2.743986	0.0063
TTRADEGD_?	0.140095	0.018126	7.729186	0.0000
POPGR_?	-0.624304	0.259114	-2.409379	0.0163
INFL_?	9.68E-05	0.000699	0.138507	0.8899
AIDGDP_?	0.132341	0.030106	4.395891	0.0000
R-squared	0.316413	Mean dependent var	0.200695	
Adjusted R-squared	0.308859	S.D. dependent var	0.107728	
S.E. of regression	0.089560	Sum squared resid	4.355359	
F-statistic	41.88980	Durbin-Watson stat	0.648577	
Prob(F-statistic)	0.000000			

Specification 4

Dependent Variable: INVGDP_?

Method: Pooled Least Squares

Date: 11/04/07 Time: 16:24

Sample: 1990 2005

Included observations: 16

Number of cross-sections used: 43

Total panel (unbalanced) observations: 553

White Heteroskedasticity-Consistent Standard Errors & Covariance

Cross sections without valid observations dropped

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.106978	0.013770	7.768709	0.0000
TDSEX_?	0.000197	0.000115	1.710413	0.0878
GDPGR_?	0.321230	0.117495	2.733998	0.0065
TTRADEGD_?	0.131772	0.018124	7.270681	0.0000
POPGR_?	-0.606018	0.236634	-2.560997	0.0107
INFL_?	0.000101	0.000663	0.152012	0.8792
R-squared	0.289012	Mean dependent var	0.200545	
Adjusted R-squared	0.282513	S.D. dependent var	0.107459	
S.E. of regression	0.091023	Sum squared resid	4.531980	
F-statistic	44.47042	Durbin-Watson stat	0.601045	
Prob(F-statistic)	0.000000			

Specification 5

Dependent Variable: INVGDP_?

Method: Pooled Least Squares

Date: 11/04/07 Time: 16:30

Sample: 1990 2005

Included observations: 16

Number of cross-sections used: 43

Total panel (unbalanced) observations: 549

White Heteroskedasticity-Consistent Standard Errors & Covariance

Cross sections without valid observations dropped

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.100769	0.016160	6.235627	0.0000
EDTGDP_?	0.001593	0.005693	0.279757	0.7798
TDSEX_?	-0.112110	0.024895	-4.503332	0.0000
GDPGR_?	0.325605	0.124278	2.619964	0.0090
INFL_?	0.000366	0.000660	0.554987	0.5791
TTRADEGD_?	0.129849	0.018679	6.951459	0.0000
POPGR_?	-0.558659	0.254521	-2.194946	0.0286
AIDGDP_?	0.160450	0.041037	3.909924	0.0001
R-squared	0.332578	Mean dependent var	0.200793	
Adjusted R-squared	0.323942	S.D. dependent var	0.107802	
S.E. of regression	0.088638	Sum squared resid	4.250432	
F-statistic	38.51160	Durbin-Watson stat	0.676334	
Prob(F-statistic)	0.000000			

Pooled regressions fixed effects

Specification 1

Dependent Variable: INVGDP_?

Method: Pooled Least Squares

Date: 11/04/07 Time: 16:33

Sample: 1990 2005

Included observations: 16

Number of cross-sections used: 45

Total panel (unbalanced) observations: 676

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EDTGDP_?	-0.003949	0.008431	-0.468380	0.6397
GDPGR_?	0.113060	0.051641	2.189325	0.0289
INFL_?	0.000171	0.000168	1.019389	0.3084
TTRADEGD_?	0.159676	0.034864	4.579982	0.0000
POPGR_?	0.399149	0.193241	2.065548	0.0393
AIDGDP_?	0.062572	0.044608	1.402703	0.1612
R-squared	0.697531	Mean dependent var	0.200367	
Adjusted R-squared	0.673334	S.D. dependent var	0.113306	
S.E. of regression	0.064760	Sum squared resid	2.621121	
F-statistic	288.2660	Durbin-Watson stat	1.204795	
Prob(F-statistic)	0.000000			

Specification 2

Dependent Variable: INVGDP_?

Method: Pooled Least Squares

Date: 11/04/07 Time: 16:57

Sample: 1990 2005

Included observations: 16

Number of cross-sections used: 45

Total panel (unbalanced) observations: 676

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EDTGDG_?	-0.019325	0.012951	-1.492196	0.1362
GDPGR_?	0.108637	0.051507	2.109167	0.0353
DEDTGDG_?	0.002823	0.002161	1.305980	0.1920
INFL_?	0.000184	0.000172	1.071273	0.2845
TTRADEGD_?	0.159926	0.034616	4.620010	0.0000
POPGR_?	0.433430	0.195732	2.214406	0.0272
AIDGDP_?	0.073338	0.045833	1.600119	0.1101
R-squared	0.698416	Mean dependent var	0.200367	
Adjusted R-squared	0.673768	S.D. dependent var	0.113306	
S.E. of regression	0.064716	Sum squared resid	2.613452	
F-statistic	240.8463	Durbin-Watson stat	1.207465	
Prob(F-statistic)	0.000000			

Specification 3

Dependent Variable: INVGDP_?

Method: Pooled Least Squares

Date: 11/04/07 Time: 16:59

Sample: 1990 2005

Included observations: 16

Number of cross-sections used: 43

Total panel (unbalanced) observations: 550

White Heteroskedasticity-Consistent Standard Errors & Covariance

Cross sections without valid observations dropped

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TDSEX_?	5.62E-05	7.46E-05	0.753813	0.4513
GDPGR_?	0.109420	0.062887	1.739939	0.0825
TTRADEGD_?	0.149936	0.049424	3.033691	0.0025
POPGR_?	0.336450	0.172896	1.945961	0.0522
INFL_?	0.003300	0.000967	3.412277	0.0007
AIDGDP_?	-0.014993	0.047368	-0.316533	0.7517
R-squared	0.699251	Mean dependent var	0.200695	
Adjusted R-squared	0.670436	S.D. dependent var	0.107728	
S.E. of regression	0.061844	Sum squared resid	1.916172	
F-statistic	232.9679	Durbin-Watson stat	1.244461	
Prob(F-statistic)	0.000000			

Specification 4

Dependent Variable: INVGDP_?

Method: Pooled Least Squares

Date: 11/04/07 Time: 16:59

Sample: 1990 2005

Included observations: 16

Number of cross-sections used: 43

Total panel (unbalanced) observations: 553

White Heteroskedasticity-Consistent Standard Errors & Covariance

Cross sections without valid observations dropped

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TDSEX_?	0.000273	0.000110	2.475778	0.0136
GDPGR_?	0.111832	0.065688	1.702460	0.0893
TTRADEGD_?	0.149747	0.049061	3.052292	0.0024
POPGR_?	0.336431	0.174447	1.928556	0.0543
INFL_?	0.003286	0.000971	3.385001	0.0008
R-squared	0.699140	Mean dependent var		0.200545
Adjusted R-squared	0.671139	S.D. dependent var		0.107459
S.E. of regression	0.061624	Sum squared resid		1.917742
F-statistic	293.3806	Durbin-Watson stat		1.247830
Prob(F-statistic)	0.000000			

Specification 5

Dependent Variable: INVGDP_?

Method: Pooled Least Squares

Date: 11/04/07 Time: 17:00

Sample: 1990 2005

Included observations: 16

Number of cross-sections used: 43

Total panel (unbalanced) observations: 549

White Heteroskedasticity-Consistent Standard Errors & Covariance

Cross sections without valid observations dropped

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EDTGDP_?	0.007600	0.010219	0.743680	0.4574
TDSEX_?	0.003541	0.025811	0.137206	0.8909
GDPGR_?	0.117518	0.058398	2.012370	0.0447
INFL_?	0.003164	0.000913	3.466740	0.0006
TTRADEGD_?	0.147977	0.052289	2.829964	0.0048
POPGR_?	0.300277	0.174100	1.724744	0.0852
AIDGDP_?	-0.022896	0.049835	-0.459429	0.6461
R-squared	0.699639	Mean dependent var		0.200793
Adjusted R-squared	0.670145	S.D. dependent var		0.107802
S.E. of regression	0.061914	Sum squared resid		1.912826
F-statistic	193.7227	Durbin-Watson stat		1.249684
Prob(F-statistic)	0.000000			

FIXED EFFECTS FOR SPECIFICATION 5

AGO--C	-0.049131
BDI--C	0.028801
BEN--C	0.082807
BFA--C	0.131658
BWA--C	0.106019
CAF--C	0.044104
CIV--C	-0.016016
CMR--C	0.092143
COG--C	0.032839
COM--C	0.055392
CPV--C	0.142116
ERI--C	0.188881
ETH--C	0.125525
GAB--C	0.109015
GHA--C	0.084965
GIN--C	0.081736
GMB--C	0.014469
GNB--C	0.117045
GNQ--C	0.332758
KEN--C	0.074910
LSO--C	0.296205
MDG--C	0.050845
MLI--C	0.121108
MOZ--C	0.148018
MRT--C	-0.006239
MUS--C	0.057941
MWI--C	0.033390
NER--C	0.026541
NGA--C	0.068186
RWA--C	0.103678
SDN--C	0.049832
SEN--C	0.053649
SLE--C	-0.005399
STP--C	0.124365
SWZ--C	-0.074324
SYC--C	0.032686
TCD--C	-0.005685
TGO--C	0.043189
TZA--C	0.109107
UGA--C	0.103587
ZAF--C	0.072293
ZMB--C	0.034994
ZWE--C	0.114215

