PRIVATE INVESTMENT AND PUBLIC POLICY IN SUB-SAHARAN AFRICA: AN EMPIRICAL ANALYSIS

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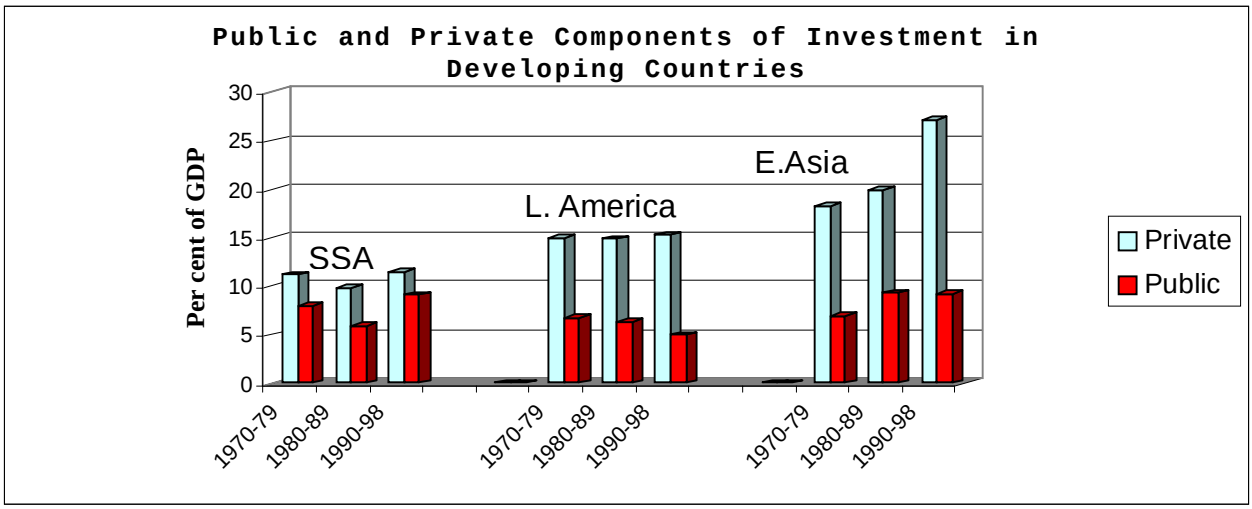
1. INTRODUCTION

The robustness of investment in explaining cross-country differences in growth performance has been a well-identified empirical fact (Levine and Renelt, 1992). In fact the essence of the theories of growth can be characterized by their underlying presumption about the role of capital accumulation in economic growth. For Harrod (1939) higher growth in output was achievable by increasing the rate of capital formation (investment) given a fixed capital-output ratio. In Solow's model (Solow, 1957), rich countries are rich because they have large physical capital stock per person, but increasing the rate of investment (saving) only has a short lived effect on growth rate of per capita income which tends to zero in the steady state. Long-term growth in per capita income thus depends exclusively on exogenously determined technical progress. The so-called new growth theories tend to broaden the concept of capital to include human capital, skill, and technology, some of which are not subject to diminishing returns of marginal productivity (Romer, 1986). In one simple instance, investment in new machinery and equipment can enhance learning by doing with a spillover effect (externality) on other firms hence implying a long-term relationship between investment and growth in per capita income.

Though they defining the role of capital, these growth theories do not seem to be interested in the public and private components of investment. Recent studies have shown that private investment is more efficient and productive than public investment (Serven and Solimano,1990; and Kahn and Reinhart,1990). Differences even among developing regions in terms of the level and growth rate of per capita income seem to be associated more with differences in private than public investment rates. Figure 1 below offers some support for this contention. Interest in private investment also grew over time because of its sensitivity to policy environment relative to public investment. Experience elsewhere also shows that foreign investment, a good predictor of successful integration into the global economy, follows rather than lead domestic private investment.

Figure-1



Structural adjustment programs therefore aimed at giving greater role for the private sector in the economy through liberalization and privatization measures. Despite two decades of strenuous effort to undertake these programs the response in private investment has so far been very dismal. Already in the early 1990s the World Bank has recognized the failure of macroeconomic adjustment to revive investment rates in developing countries (except East Asia), the very thing that was hoped to sustain growth. (World Bank, 1990; Serven and Solimano, 1991).

These developments further accentuated interest in the determinants of private investment in developing countries. While existing studies in this area are still deemed to be very limited, a recent review by Rama (1993) underscored a clear regional imbalance in such studies. He noticed a major focus on Latin American countries and poor coverage of the situation in Africa. This paper further elaborates this shortcoming by providing critical review of the empirical literature in terms of both the lack of focus on Sub-Saharan Africa as well as of comprehensiveness in the investment models tested by those few studies that limited their scope to this region. The objective of this paper is therefore to analyze the relative importance of the determinants of private investment in Sub-Saharan Africa by including a relatively large number of countries observed over a fairly long period of time and using a comprehensive set of explanatory variables.

The paper attempts to refine the use of standard regressors entering investment models for developing countries and proceeds to understand investment behavior in the region by including proxies for two important sources of uncertainty, namely, macroeco-

nomic and socio-political instability. The paper underscores that investment in Sub-Saharan Africa is responsive to changes in aggregated demand in accordance with the accelerator hypothesis. While public investment significantly complements private ventures in the region, the paper shows that liquidity constraints take clear precedence among standard determinants of investment. On the other hand available data does not substantiate the widely accepted independent disincentive effect of debt overhang on African investors once the effect of debt service is taken into account. Ironically, the reduction in debt service burden promised by the HIPC initiative is very unlikely to improve private investment rates in the region because of the restrictions imposed on the use of resources that would be released by the initiative. The volatility of the terms of trade and the real exchange rate also appear to be very important sources of business uncertainty where as objective measures of socio-political instability provide imprecise explanation for the variation of investment rates across countries and over time in SSA.

Finally the paper concludes that further fiscal discipline and monetary stringency could no longer be effective policy tools to revive private investment in SSA. The cost to investors in terms of poor infrastructure and liquidity constraints far out weighs the benefit they derive from stable macroeconomic environment such policies aspire to achieve. Global development goals including targets for poverty reduction, demand substantial build-up of productive capacity in the region which could be challenged by financial considerations and poor performance of exports. The paper points out that PRSPs do not offer ingenious solution to such constraints despite the critical role they play in determining private investment, which ultimately sustains growth.

The paper is organized as follows. The first two sections of the next chapter are devoted to reviewing the development of the theoretical framework on investment behavior focusing mainly on the modifications made to the neoclassical flexible accelerator model in an effort to accommodate the institutional and macroeconomic peculiarities of developing countries. Chapter III explains the nature of the data and offers some stylized facts based on simple statistical associations between private investment and the theoretically suggested determinants. In Chapter IV we develop formal econometric models to be estimated. The random effects Feasible Generalized Least Squares (FGLS) technique is used on a panel data set for 33 Sub-Saharan African Countries over the period 1970-98. We also

use the recently popularized *Quantile Regression* models to characterize the conditional distribution of private investment at different percentiles including the median. The estimation results are discussed in Chapter V. Chapter VI attempts to use the estimation results to shed light on public policy issues implied by the global targets of halving poverty by the year 2015 in the context of the HIPC/PRSP framework. There we show the enormity of the targets and critically look at the adequacy of the new framework to meet the challenges ahead. Conclusions are provided in Chapter VII alongside key policy implications.

2. THE THEORETICAL FRAMEWORK.

2.1 Basic Investment Theories

The decision to invest is a central subject in the analysis of economic behavior mainly because it determines the accumulation of productive capacity and hence the future growth path of an economy. Earlier observations also showed that investment is one of the most volatile components of the economy adding interest and challenge for theories that attempt to explain investment behavior. The oldest and most familiar explanation came from the theory of user cost of capital where by the firm maximizes its market value by adjusting its capital stock to a point where the marginal value product of capital equals the market interest rate. This theory is underpinned by diminishing marginal product of capital in a convex production function which postulates demand for investment goods to decline with an increase in interest rate (the user cost of capital). Extensions to the user cost were easily made by incorporating fiscal incentives like taxes on profits and investment tax credits to make it more realistic.

User cost theory however says little or nothing about what determines the marginal value product of capital. A major reason behind the volatility of investment is arguably the uncertainty that surrounds its expected profitability. How expectations are formed is however a contentious issue in economics. On a more formal basis, shifts in investor expectations are supposed to be founded on economic fundamentals including observed shifts in technology, consumer demand, opinion surveys and the like. They could also occur for inexplicable attitudes of pessimism or optimism affecting economic agents throughout the economy. Keynes (1936) was the most prominent of those who subscribed to the latter notion and he attributed fluctuations in investment to "animal spirits" of investors than to a

meticulous calculation of future streams of profit weighted by their respective probability of occurrence.

The rest of the literature on investment behavior seems to have developed through formulation of theoretical models for empirical investigation. The accelerator model is the simplest of them in which the firm is assumed to keep a stable relationship between the capital stock it desires to maintain and the level of output. A key implication of this model is that investment (change in capital stock) is driven by change in aggregate demand. Notwithstanding the obvious critique on its neglect of the cost of capital and issues of profitability, the accelerator model often better explains investment patterns than sophisticated models.

The neoclassical flexible accelerator model suggested by Jorgenson (1967) combines the user cost of capital (interest rate, depreciation and price of capital goods) and the accelerator effect to explain investment behavior. Subject to lags and costs involved in adjusting the capital stock, a competitive firm in the neoclassical model is supposed to realize only a portion of the desired capital stock in the current period. It is also important to note that the firm in the neoclassical model is assumed to operate under perfectly competitive product and factor markets which implies inter alia absence of liquidity constraints (to adjust capital stock) and a general equilibrium situation with full employment.

Another popular and yet equivalent investment model is Tobin's *q* theory, (Tobin, 1969) which relates the market value of the firm with its replacement cost as a guide for investment decision. In its simplest form, this theory postulates 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 (its machinery and equipment) in the product market.

2.2 Investment Models for Developing Countries

The theoretical models highlighted above were essentially formulated to analyze investment behavior of firms in industrial economies with none of them so far decisively proved to be superior to the other. Direct application of these models (except the simple accelerator model) to understanding investment behavior in developing countries was all the more difficult for two reasons. The first is technical and relates to scarcity of data on key variables such as wage rates, capital stock, real interest rates and stock market prices.

The second one relates to the incompatibility of the institutional and structural peculiarities of developing countries with the underlying assumptions of the basic models such as perfectly competitive markets, little or no government investment and absence of liquidity constraints. These assumptions are hardly tenable in the context of developing countries making the models less relevant.

Earlier studies of private investment in developing countries thus opted to move away from the traditional theories and placed emphasis on the role of financial sector development. They highlighted the fact that financial markets in developing countries are typically repressed and firms are credit rationed constraining their ability to adjust capital to a desired level. More specifically limited access to credit forces firms in developing countries to accumulate enough real balances before initiating investment projects. Mckinnon (1973) and Shaw(1973) provided the theoretical and empirical framework for such analyses and they argued that the level and quality of private investment in developing countries is positively associated with the real interest rate on deposits. This proposition was in contradiction with the neoclassical model where interest rate is treated as the user cost of capital. Evidence in support of the Mckinnon-Shaw thesis was however generally missing and mixed at best. Nonetheless studies along this line alerted subsequent researchers to incorporate availability of credit as a determinant of private investment in developing countries instead of relying only on interest rates which are administratively controlled.

Lacking the privilege of a fully-fledged theoretical model applicable to their context, the empirical literature on the determinants of private investment in developing countries tended to start off with the neoclassical model and attempt to reformulate it by incorporating variables (often on an ad hoc basis) that are supposed to have strong association with investment. Such studies are essentially exploratory in nature and often based on reduced form cross-country regressions rather than a (theoretical) model based firm level analysis. The rest of this section is devoted to the assessment of modifications made to the basic accelerator model and the most important empirical findings thereof.

In recognition of the high import content of intermediate and capital goods in developing countries as well as the universality of devaluation in adjustment programs, the real exchange rate is often included in the investment model. In the long run, real devaluation is expected to lead to an increase in investment in the traded goods sector and a de-

crease in the non-traded goods sector with ambiguous overall effect (Agenor and Montel, 1996). In the short run, an expected real devaluation under restricted capital mobility and high import content of capital goods is supposed to lead to an investment boom as the expected depreciation leads to a switch to foreign goods. Such a boom must also subside after the actual devaluation due to the associated increase in cost of imported goods.

The sharp fall in investment rate in many developing counties following the debt crisis of the early 1980s also led to the inclusion of debt burden as a key deterrent of private investment. Debt overhang is expected to discourage investors as they anticipate confiscatory taxes to finance debt service in the future, hence making the expected returns on projects uncertain. Many empirical studies have found negative association between private investment and debt overhang as proxied by debt to GDP ratio (Serven 1998, Greene and Villanueva,1991). Others like Borensztein (1990) however argued that it is credit unworthiness associated with debt overhang that really matters for investment than the disincentive effect of mounting debt to GDP ratio. In their externally constrained investment model for developing countries, Fitzgerald et al.(1992) included debt service (as ratio to GDP) in their model and found a statistically significant negative coefficient for the 22 developing countries in their sample. The coefficient for the African sub-sample (only three countries) was negative but not statistically significant, which the authors attributed to dominance of concessional loan in African countries.

Since public investment in developing countries assumes a relatively larger role than in industrial counties, it becomes important to take account of its complementarity and substitutability with private investment. In theory, crowding in and crowding out effects of public investment could take place at the same time and, a priori, the net effect on private investment is indeterminate. The crowding out effect of public investment in developing countries however may not be felt through higher taxes and/or increased interest rates as in industrial countries; rather it is likely to take one or all of the following three forms. First, limited market size in many developing counties implies public investment in productive sectors may displace private ventures, causing what we call a *real crowding out*. Second, financial crowding out may take place as both agents run for the same and often limited credit pool. And finally financing public investment through domestic and/or foreign borrowing could crowed out private investment through its effect on inflation and

debt accumulation which render the business environment uncertain. Crowding in effects of public investment in developing countries may also not appear through the accelerator channel as in developed countries but rather through the long run efficiency (profitability) effects of its infrastructural component on private investment. (Fitzgerald et al., 1992).

Empirical studies almost always include public investment in private investment models for developing countries and most have found evidence in support of the crowding in effect. Blejer and Khan (1984) estimated an investment model in which the crowding in infrastructural component of public investment is captured by its time trend and the crowding out effect by the deviation from this trend. They found a significant positive coefficient on the former and a significant negative coefficient on the latter suggesting that non-infrastructural components of public investment have crowding out effect. On the other hand, B. Balasa (1988) and P. Lauman (1990) have found negative association between public and private investment. Results also tend to be sensitive to model specification, choice of period and country group. Oshikoya (1994) found strong complementarity for middle income African countries and not so for low-income countries.

A rapidly expanding recent literature on investment decision has focussed attention on the irreversible nature of part or all of fixed investment (Dixit and Pindyck, 1994). When investment is hard to reverse, instability and uncertainty create a value to waiting for more information so as to avoid getting stuck with unprofitable and irreversible project(s). The basis for this theory lies in the asymmetry of the adjustment cost of capital stock, i.e. most investment projects are easily done than undone making downside risks costlier than positive shocks. Under such condition, the optimal investment policy seeks balance between the value of waiting (which is the present value of future streams of returns in case they fall short of the user cost of capital) and the cost of waiting (which is the net present value of returns forgone by waiting for a project which would turn out successful anyway). The literature points out that the value of waiting could be considerably large particularly when uncertainty is high, suggesting that uncertainty can become a major obstacle for investment.

The empirical literature on the new approach to investment has lagged well behind the theoretical development. Available studies attempt to approximate uncertainty by including the volatility of the relevant variable, usually relative prices, and estimate the in-

vestment model. The assumption is that high volatility increases the threshold marginal profitability of capital below which investors will be in a range of inaction, i.e. no significant investment or disinvestment. Most of the empirical studies are limited to industrial countries at the firm level and limited effort has been made to study the impact of uncertainty for developing countries. Serven (1998) included the volatility of the real exchange rate, the terms of trade, black market premium and inflation in his model on top of other fundamental regressors for 84 developing countries. He found a statistically significant negative association between the volatility of the terms of trade and inflation though the coefficient on the latter was very small. Rather surprisingly the coefficient on the real exchange rate volatility was positive and significant while that on the volatility of black market premium was practically zero. Hadjimichael and Ghura (1995) included the variability of inflation and the real exchange rate for 32 African countries and found significant negative effect on private investment.

The important policy implication that comes out of the new investment theory and the empirical studies is that the stability and predictability of the incentive framework is at least as important for private investment as the level of the incentives themselves. It should be noted however that the new theory is mute regarding the long-term impact of uncertainty on private investment.

Uncertainty is however not confined to volatility of macroeconomic variables. Political instability and social unrest are also potential sources of uncertainty with comparable and at times highly detrimental impact on private investment. There are two important mechanisms through which socio-political factors could influence private investment in developing countries. The more fundamental one relates to extreme cases of instability that lead to changes in the rules of the game and threatens investors of their property rights. The other and perhaps the most common one refers to the unpredictability of the political environment say due to repeated changes of government or officials of key government institutions which undermines the responsiveness of private investors to economic incentives or reform measures. The basic idea is that investors may not regard government policy under political instability as credible, hence creating a value for waiting.

It is however not clear how to disentangle the endogenity associated with the incredibility of reform measures which leads to a self-fulfilling cycle of policy reversal, low

investment and political instability. Reform measures that lack investor credibility are doomed to failure and the economy may get stuck with low investment equilibrium trap with unstable political environment. Severn (1998) suggested that external intervention to restore investor confidence, such as provision of sufficient external finance and reduction of debt overhang could be more effective in such circumstances.

More recent views on uncertainty tend to focus on institutional quality as it relates to contract enforcement, bureaucratic red tape, corruption and the like as important determinants of private investment. According to this view, objective measures of political instability and social unrest (like coups and revolutions) though easy to observe, may not capture the actual (subjective) uncertainty business people encounter everyday. For this reason objective measures of political instability may not have significant impact on private investment once institutional factors are controlled for (Knack and Keefer, 1995). Brunette et al. (1997), for instance indicated that crude measures of political instability based on number of coups would characterize Thailand with high political uncertainty while interviews with business people suggested that the coups do not affect the credibility of the institutional framework as they expect no major swings in policy. Their study was based on a survey of the private sector from 3000 firms in 58 countries. While such subjective approach certainly refines the measurement of uncertainty, it is highly constrained by cost considerations.

Proxies for political instability are widely used in cross-country growth models than investment. In few investment models where they have been included their explanatory power is very limited. Serven (1998) included for instance seven indicators of political instability in an investment model for developing countries, none of which were statistically significant, and only three of them bear the expected negative sign. The author speculated that poor media coverage of news in developing countries might be part of the reason for such a result. Hadjimichael and Ghura (1995) also found a positive and statistically insignificant association between private investment and an index of political and civil liberty for 32 African countries during the period 1986-92.

2.3 Empirical Studies on Sub-Saharan Africa

Until this point we have not emphasized the literature focusing on Sub-Saharan Africa. Most of the studies highlighted above include a widely diverse group of developing countries ranging from the high performing East Asian countries to the low growth and low investment countries in Africa. It is common to find Sub-Saharan Africa fitting either the lower or upper end of the distribution depending on the variable of choice. Although cross country studies of this sort have their own contributions to the understanding of economic phenomena, drawing policy lessons from them could be very tricky because of the wide heterogeneity of countries. Average statistical associations from such regression models may not be good indicators of the situation in countries that consistently belong to one end of the distribution. Even when average relationships are supposed to hold, setting priorities among key explanatory variables is very likely to change significantly should the regressions be run on specific sub-groups. The study by Fitzgerald et al. (1992) reveals that this is the case by running a Chaw test which is significant for specifications with different country groups .

More importantly, earlier studies typically included only few African countries mainly because of data limitations; Green and Villanova (1991), Fitzgerald et al. (1992) and, Serven and Solimano (1991), each has three or four African countries in their sample. One might thus wonder if the average relationships identified for a large group of developing countries, often with few African countries, would hold for a group only of Sub-Saharan African countries. The study by Serven (1998) includes by far the largest number of SSA countries (40 of them) in a model that includes 84 developing countries. However the model uses contemporaneous values of the regressors, which raises the problem of simultaneity, while the use of some variables like domestic credit rather than credit to the private sector makes the results less useful for policy analysis.

Though there are a handful of studies which focused exclusively on SSA, one finds lack of comprehensiveness in the specification of the investment models. For instance, the study by Oshikoya (1994), apart from considering only eight African countries of which six are in SSA, included the standard regerssors and does not control for measures of uncertainty be it macroeconomic or socio-political. Similarly, Leonce (2000) included 31 SSA countries but focused essentially on financial determinants of private investment.

Whether the standard explanatory variables retain their expected signs and significance once macroeconomic and socio-political instability are controlled for thus becomes an important question. The study by Hadjimichael and Ghura (1995) includes proxies for economic and political uncertainty in a model for SSA counties but considers a short (1986-92) period making it difficult to establish a long-term relationship.

Most of the studies go only a little beyond identifying the statistical associations and provide little systematic analysis of the policy options and challenges facing policy makers in developing countries. This is very crucial given the limited institutional capacity in developing countries to undertake reform measures. Identifying the most significant determinants of private investment and singling out those that fall within the domain of public policy intervention will help improve effectiveness of reform measures by concentrating available institutional resources. This paper therefore analyses private investment behavior in a relatively large sample of exclusively Sub-Saharan Africa countries by including a comprehensive set of explanatory variables observed over a relatively longer period of time. It attempts to provide efficient estimates using appropriate panel data estimation techniques on 33 countries from the region during the period 1970-98. The estimation results are used to provide insight on public policy choices under practical considerations of designing poverty reduction strategies.

3. THE DATA AND SOME STYLIZED FACTS

3.1 The Data

The major data source for macroeconomic variables in this study is the *World Bank's World Development Indicators 2000.* An effort has been made to fill missing values by using alternative sources like the *World Bank's African Development Indicators 2000.* We also used William Easterly's online database especially to fill missing data on private investment. The IMF International Financial Statistics was used for data on credit to government and the private sector. Inconsistency is to be expected in using such diverse data sources but the underlying trends exhibit similar pattern though values may vary; and extreme observations have been omitted. Even using several data sources, it should be recognized that the panel remains unbalanced, as often is the case.

Private investment is generated by deducting the public component of Gross Domestic Fixed Investment (GDFI) which implies that it includes investment by public enterprises. Directly measured private investment could be obtained for few countries in our sample from the International Financial Corporation (IFC) database but this was not used to avoid heterogeneity within this particular series. Our source for indicators of socio-political instability is the Cross-National Time Series Data Archives from Banks (1994). We also used the online database published by Freedom House for data on political and civil liberty. For political and civil liberty, countries are ranked from 1 to 7 with higher values indicating lack of freedom.

3.2 Stylized Facts

During the period 1970-98, private investment in Sub-Saharan Africa was about 11% of GDP on average. This figure compares unfavorably with average private investment rates in East Asia (24%) and Latin America (16%) during the same period. Our interest in this paper is however on what explains differences in private investment within Sub-Saharan Africa and across time. While the econometric models will handle much of this, it is important to look at the differences in the macroeconomic and political environment of countries whose private investment rates are below and above the sample average. For the sake of analysis we will refer to the countries that invest above the sample average as High Investment (HI) counties and the others as Low Investment (LI) countries. (See Annex 1 for a list of countries in both sub-groups). We complement this approach by the use of formal correlation coefficients between private investment and its major determinants for the entire sample. Tables 1 and 2 below provide a succinct summary of this analysis.

During the past three decades, the average private investment rate in the high investment (HI) sub-group of countries was about 16.4% of GDP, which is more than twice the average for low investment countries (7.3%). Table 1 also shows that there is much difference in investment rates across countries than over time. Not surprisingly real per capita income in the HI group of countries was nearly four times higher than the other sub-group showing a much wider difference than private investment itself. Equally important was the variation in growth performance of per capita income in the two sub-groups. While the LI countries experienced a 0.05% annual average decline in per capita income during the past

three decades, the HI counties have achieved a modest 1.97% average growth. This preliminary evidence in support of the accelerator effect is also supported by the statistically significant positive correlation between private investment and the level and growth rate of per capita income for the entire sample.

A stable macroeconomic environment is a familiar component of enabling conditions for investment to which Table 1 lends some support. Inflation in LI countries (i.e. 17.7%) was 7 percentage points higher than the average for the HI sub-group, a situation that has persisted throughout the period under review.

Table 1: Summary of Macroeconomic Indicators for 33 Sub-Saharan African Countries

	1970-1998		**1970-79**		**1980-89**		**1990-98**	
	LI	HI	LI	HI	LI	HI	LI	HI
Domestic Investment (% of GDP)	15.7	26.2	16.9	25.9	15.1	25.7	15.3	27.1
Private Investment (% of GDP)	7.3	16.4	8.0	15.6	5.9	16.4	8.0	17.5
Public Investment (% of GDP)	8.5	11.0	8.8	10.9	9.2	10.5	7.4	11.7
Per Capita GDP (1995 Cons. US$)	419.0	1526.6	407.8	1423.8	438.5	1564.1	406.8	1592.2
Per Capita GDP Growth (%)	-0.05	1.97	0.94	4.16	-1.0	1.2	0.14	0.54
Budget Surplus (% of GDP)	-4.7	-3.6	-5.4	-4.7	-4.7	-3.8	-4.4	-2.5
Credit to Government (% of GDP)	9.0	5.1	5.4	5.2	12.6	9.2	8.4	0.2
Credit to Private Sector (% of GDP)	1.7	2.8	2.3	3.5	1.5	2.4	1.4	2.5
Inflation (%)	17.7	10.6	11.7	10.0	19.9	11.3	20.3	10.4
Debt Service Ratio (%)	18.2	14.6	8.9	8.0	23.5	18.5	20.1	16.8
Debt Stock (% of GDP)	418.7	236.1	107.0	118.5	404.2	283.8	698.4	291.6
Export (% of GDP)	24.1	35.1	24.6	33.5	23.3	35.8	24.6	36.2
Terms of Trade Index	124.5	110.2	143.8	115.9	131.2	113.8	101.4	101.4
Inflation Variability	0.08	0.06	0.08	0.06	0.08	0.05	0.07	0.05
Terms of Trade Variability	15.5	9.8	15.4	9.2	15.0	9.6	16.0	10.8
Real Excha. Rate Variability	0.15	0.13	0.08	0.08	0.17	0.14	0.18	0.16
GDP Growth Variability	4.37	4.34	4.8	5.9	4.3	4.4	3.99	2.65

Source: Author's Computation based on Data Sources Mentioned Above

The standard neoclassical explanation for high inflation in developing countries is the existence of large budget deficit financed through domestic bank borrowing. Table 1 however shows a mixed report in this regard. While the level of fiscal deficit in both groups of countries showed very little differences, it is clear that governments in the LI sub-group financed a large part of it from domestic sources than governments of the HI

sub-group. Accordingly, the stock of outstanding credit to government in the LI group was twice the size of the other group in terms of ratio to GDP. Table 2 also shows that inflation and credit to government have significant negative correlation with private investment, indicating that government borrowing could have a crowding out effect both through inflation and credit rationing.

Throughout the period under consideration, countries with above average rates of private investment were also the ones with higher public investment rates. This might be considered as a preliminary support to the widely shared view of complementarity between public and private investment. On the other hand it can also be observed that public investment exceeds, albeit marginally, private investment rates in the LI sub-group while private investment takes clear dominance in the HI group. There seems therefore at this early stage a trace of both crowding in and crowding out effects of public investment in the region. The pair wise correlation coefficient in Table 2 however shows positive and statistically significant association between public and private investment for the whole sample.

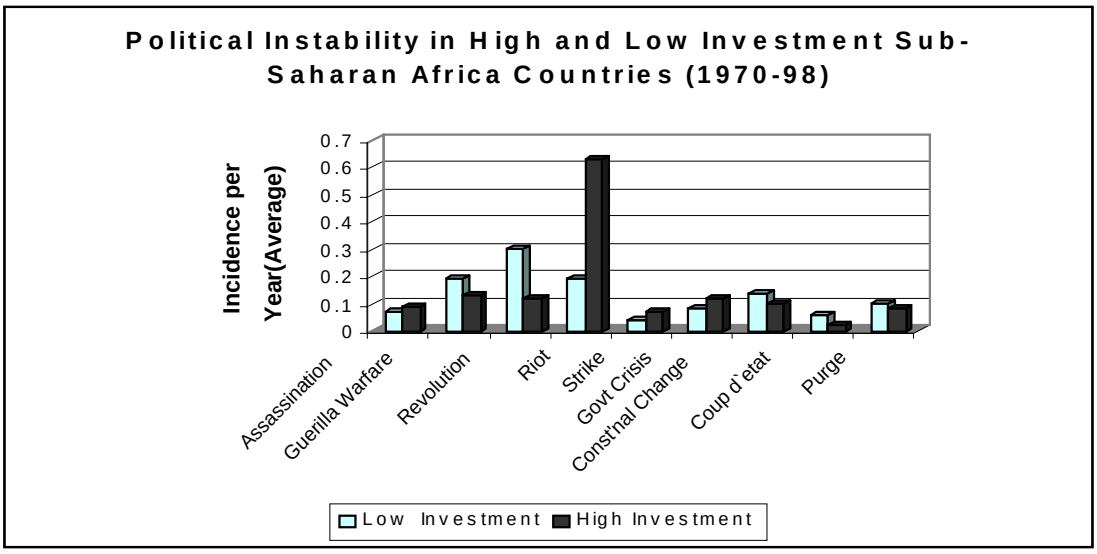
Regarding credit to the private sector, our data does not tell how much of it goes for investment purposes. Table 1 also shows that credit to private sector is very small (less than 3% of GDP on average) and shows little difference among the two groups of counties. Despite these limitations however credit to private sector happens to have a positive and statistically significant correlation with private investment as indicated in Table 2. Perhaps more important may be the downward trend in credit to private sector in Sub-Saharan Africa. Private agents both in the high and low investment sub-groups have borrowed less in the 1990s than in the 1970s relative to GDP. This is a rather disturbing development in view of the fact that African governments have in the mean time reduced their credit intake mainly in compliance with targets set in Adjustment Programs. This situation waters down the relevance of the crowding in and out debate, at least in the financial aspect, and shows that less credit by government does not automatically translate into more credit to (by) the private sector. Perhaps this might be one of the missing links between reform measures and their expected outcome.

Turning to external factors, Table 1 shows that LI countries in our sample are the ones with larger debt burden expressed in terms of both debt to GDP ratio and debt service ratio. It is interesting to note that debt service ratios (payments of principal and interest due

as ratio of export earnings) which were less than 10% and nearly equal for both groups of countries in the 1970s, nearly tripled for the LI countries in the 1980s while nearly doubled for the HI group. The 1990s witnessed a moderate reduction in debt service ratios of both sub-groups reflecting some of the ongoing debt relief schemes accompanying reform programs. Debt to GDP ratio has been rising in both sub-groups but more so in the low investment countries. The latter saw their debt stock climb to an average of 116% of GDP in the 1990s up from about 27% in the 1970s. One would thus expect negative statistical association between private investment and indicators of debt burden. Table 2 however shows the expected negative and significant correlation between private investment and debt service ratio but a non-significant positive association with debt to GDP ratio.

As pointed out in the theoretical framework, there is growing conviction that private investors are more responsive to the variability (and hence the uncertainty) associated with the incentive system rather than the level of the incentives per se. Following convention this paper considered four proxies of business uncertainty, i.e., the standard deviations of the terms of trade, inflation and per capita GDP growth, and the coefficient of variation of the real exchange rate. According to the reports in Table 1, LI countries are very likely to encounter relatively larger swings in the terms of trade and real exchange rates, pointing to a potential negative impact. Both sub-groups of countries however faced practically equal magnitudes of volatility in inflation and growth rates of per capita income. Table 2 shows a significant negative correlation between private investment and the volatility in the terms of trade and real exchange rate, with the other two not being significant. In general there is a preliminary support to the negative impact of uncertainty on investment in our sample justifying the inclusion of the proxies in the model.

Figure-2



A rather mixed report emerges from figure 2 above regarding socio-political instability and its association with private investment. It indicates that revolutions, government crisis, constitutional change, coups and guerilla warfare are more prevalent in low investment Sub-Saharan African countries than the other group. For instance, guerilla warfare takes place every five year in countries where private investment is below average, while it occurs every seven to eight year in those who invest above average. A revolution takes place every three year and constitutions change every seven year in LI sub-group while the same events happen every eight and ten year, respectively, in the HI sub-group. On the other hand assassinations, riots and strikes seem more likely in the HI countries than the LI ones while purges are nearly equally paced in both groups. Taking the whole sample, correlation coefficients (not reported in Table 2) show significant negative associations only for guerilla warfare and revolutions. The rest, with the exception of riots and strikes, have the expected negative correlation but not statistically significant. Finally the indices of political right and civil liberty as developed by Freedom House indicated significant negative relationship with private investment for our sample which indicates that absence of civil liberties and political right could undermine private investment in the region.

Table-2: Correlation Coefficients

	pvtinv	pcgdp	pcgdgr	pvtcrd	Debtsrv	debtgdp	export	Pub-inv	inflation	Gov't crdt	Tot-Var	RER-Var	Inf-var	Growth-var
Private Investment	1													
Per capita GDP	0.375*	1												
Pc. GDP Growth	0.223*	0.102*	1											
Private Credit	0.220*	0.248*	0.171*	1										
Debt Service	-0.201*	-0.189*	-0.158*	-0.080*	1									
Debt-GDP Ratio	0.026	-0.164*	-0.107*	-0.115*	0.424*	1								
Export	0.410*	0.514*	0.113*	0.155*	-0.169*	0.120*	1							
Public Investment	0.180*	0.163*	0.211*	0.047	-0.179*	-0.061	0.167*	1						
Inflation	-0.101*	-0.103*	-0.051	0.077*	0.177*	0.199*	-0.155*	-0.083*	1					
Gov't Credit	-0.113*	-0.131*	-0.145*	0.009	0.132*	0.132*	-0.105*	-0.224*	0.347*	1				
ToT Variability	-0.076*	-0.030	-0.023	-0.079*	0.070	0.067	0.020	0.037	0.057	0.084*	1			
RER Variablility	-0.077*	-0.059	-0.093*	-0.073*	0.202*	0.256*	-0.084*	-0.068	0.316*	0.102*	0.096*	1		
Inflation Variability	-0.040	-0.012	-0.044	-0.072*	0.087*	0.051	-0.020	0.017	0.121*	0.158*	0.246*	0.038	1	
Growth Variability	0.028	0.032	0.017	0.013	-0.140*	-0.102*	-0.144*	0.038	0.028	0.042	0.022	0.035	0.011	1

Source: Own Computation Based Data Sources Mentioned Above.

Note: * indicates correlation coefficients significant at 5%

4. METHODOLOGY AND SPECIFICATION OF MODEL

It has been argued in Chapter III that the basic theoretical models defined for industrial countries need to be reformulated before they can be applied to the context of developing countries. In this chapter we decide on the specification of such investment models and the estimation methods to be deployed. As already set out in the introductory chapter, one of our objectives in this paper is to see how conventional models tested for a wider group of developing countries (often with very few African countries) explain investment in an exclusively Sub-Saharan context. While this is a general objective the paper also seeks to be more comprehensive by including economic and socio-political uncertainties in the investment model, an aspect not adequately addressed in the few investment models tested for Sub-Saharan Africa.

4.1 Model Specification

To find out if uncertainty has a significant explanatory power on investment behavior in Sub-Saharan Africa and if its inclusion in the model (through several proxies) alters the relative importance of the standard regressors, we will estimate three specifications of a regression model whose estimation method is discussed in section 4.2 below. The first specification will have only the standard explanatory variables, which we call hereafter Specification A. The second one expands Specification A by including measures of macroeconomic instability and we refer to it as Specification B. And finally we expand our model to include proxies for socio-political instability and call this comprehensive model as Specification C.

Specification A is a logical reformulation of the neoclassical flexible accelerator model taking into account the macroeconomic peculiarities of developing countries. The basic accelerator effect in such a model is captured through real per capita GDP (in 1995 US$) and its annual growth rate. The user cost in most investment studies is represented by the real lending rate of commercial banks and the coefficient often turns statistically insignificant. The real interest rate was excluded from our model for a simple reason that experiments on our sample revealed insignificant interest rate effect apart from a huge loss of observations due to the lack of data on this variable. Instead, availability of credit to the private sector was included in the model which is widely recognized to be relevant for investors in developing counties than the administratively fixed interest rates.

Included in Specification A is also public investment to trace the crowding-in and/or crowding-out effect(s). An attempt to separate the financial crowding out effect was made by including government domestic borrowing (flow) which would allow the public investment variable to represent the complementarity effect through provision of infrastructural facilities. The assumption here is that government deficit and hence borrowing is by and large driven by capital expenditure. Among the standard regressors is also debt stock which enters the model together with debt service ratio to figure out if debt stock has an independent disincentive effect on investors in Africa as discussions on debt overhang contemplate. Unlike many other studies this paper includes exports in the model to capture the import capacity of the economy which in turn affects investment both through availability of capita goods and intermediate inputs. Finally Specification A includes period average inflation rate as a measure of overall macroeconomic stability.

In this specification credit to government and the private sector, public investment, debt stock and exports have been normalized by taking their ratios to GDP to minimize heteroscedasticity. Debt service ratio is defined as the actual payment of the principal and interest on foreign borrowing as per cent of export earnings. One common problem in this specification (for that matter, in most of similar models) is the possibility for the dependent variable (private investment) as well as most of the explanatory variables to be determined simultaneously weakening the validity of the estimated coefficients. In an effort to minimize the problem of simultaneity, one period lagged values of the regressors were taken except for private credit and inflation. The contemporaneous values of the latter are deemed more relevant for investment than their first lags.

As already mentioned, Specification B includes proxies for macroeconomic instability. The four macroeconomic volatility measures are the standard deviations of inflation, the terms of trade, and real per capita GDP growth; and the coefficient of variation of the real exchange rate. All of them were generated by taking the sample standard error of the relevant variable during the current and the preceding two years on a moving average basis. Specification C further includes nine proxies for socio-political instability viz., assassinations, guerilla warfare, revolutions, riots, strikes, government crisis, constitutional change, coup d`etat, and purges. All of them are measured annually and their current values are taken in the model. See

annex 4 for the definition of these variables. Specification C also includes annual measures of political right and civil liberty as reported by the Freedom House.

4.2 Estimation Methodology

In this section we discuss econometric methods for the estimations of the models specified above. The econometric analysis of private investment in this paper is based on a panel data set comprising 33 Sub-Saharan African countries observed during the period 1970 - 98. The existence of both cross-sectional and time-series components makes panel data estimation a more flexible and analytically richer method while also demanding advanced techniques of estimation.

One of the widely used estimation methods for panel data is the *Error Components* model with two disturbance terms. These are the time-invariant group specific disturbance term and the usual white disturbance term. This model, which is also referred to as the *Random Effects* model can be expressed as follows:

$$Y_{it} = \alpha + \beta X_{it} + u_i + \varepsilon_{it} \qquad (1)$$

Where $i = (1,2,....N)$ represents the cross-sectional dimension of the data,

$t = (1,2,....T)$ represents the time dimension,

Y_{it} = private Investment (as ratio to GDP) of the i^{th} country at time t,

X_{it} = K regressors entering the model for country i at time t,

u_i = time invariant, country specific disturbance term,

ε_{it} = a normal disturbance term with cross-sectional and time dimensions.

The model is said "random effects" because the error term that characterizes each country is assumed to be randomly distributed but enters the model every year as a constant. A commonly used alternative estimation method is the F*ixed Effects* model which treats the country specific u_i as an estimable constant term. In other words this model treats cross-sectional variations are due to country specific constants terms which can be represented by parallel shifts in the regression function. The fixed effects, also called the *Least Square Dummy Variable* (LSDV) model , can be expressed as follows.

$$Y_{it} = \alpha_i + \beta X_{it} + \varepsilon_{it} \qquad (2)$$

where α_i is the country specific constant term.

Both methods have their own advantages and drawbacks. Consistency in the random effects estimator depends heavily on the assumption of orthogonality (no correlation) of the individual effect (u_i) with the rest of the explanatory variables. The LSDV does not require this assumption for consistency. If the assumption of no correlation holds, however, the random effects out performs the fixed effects model since the latter is not efficient. Both are consistent in this case though. More over, inference in the fixed effects model is restricted to the cross-sectional units in the sample and not otherwise while in the random effects model inference can be made on individuals (countries) outside the sample. While this is not an exhaustive comparison of the two models, a Hausman test could be carried out based on the null hypothesis of orthogonality of the individual effects. Under the null hypothesis, both methods should give consistent estimates that are not systematically different from each other although as said before, the LSDV coefficients are inefficient. This test was carried out for our sample and the test could not reject the null hypothesis. See Table 3 for the *p*-value of the test statistic. Similar results were found by other researchers (Serven, 1998) reassuring that the random effects model is more appropriate for investment analysis in developing countries.

Having decided on the appropriate method, further refinements are required to take into account familiar yet often overlooked estimation problems. It is known that heteroscedasitic disturbances are common problems in cross-sectional analysis as autocorrelation is in time-series studies. Since panel data have both dimensions, one needs to take into account the additional information provided by these features of the data. The random effects model discussed above assumes that the disturbances common to the sample (ε_{it}) are homoscedastic and uncorrelated neither over time nor across countries. Statistical tests indicated the presence of heteroscedatsticity and first order (AR1) auotoregression in the disturbances. Since our panel is unbalanced (with varying number of observations across groups) getting a consistent estimate of the correlation coefficient (ρ) required averaging over cross-sections as the time dimension may be very short in some panels.

Recognizing heteroscedasticity and autocorellation leads us to adopt a random effects Feasible Generalized Least Squares (FGLS) model in which a couple of transformations are undertaken on the variables in equation 1 above before estimation is carried out. The trans-

formation process and the variance-covariance matrix used for FGLS estimation is presented in Annex 2. The final model based on which the three specifications discussed in section 4.1. will be estimated thus looks like the following.

$$Y_{it}^{**} = \beta_1 X_{it,1}^{**} + \beta_2 X_{it,2}^{**} + ... + \beta_k X_{ik,k}^{**} + V_{it}^{**} \qquad (3)$$

where: $V_{it}^{**} = u_i^{*} + \varepsilon_{it}^{**}$

X from 1,2,…,K and $X_1 = 1$ for all i (i.e. β_1 is the constant term).

Note that the double asterisk represents the two-stage transformation carried out for FGLS, first for autocorrelation and then for heteroschedasticity.

The estimation methods discussed above help estimate the mean value of the dependent variable conditional upon the given values of the explanatory variables. There is however a class of models which allow the estimation of equations for the dependent variable at different quantiles in its distribution; the 0.5 quantile being for instance the median. These are *Quantile Regression Models* and are estimated by minimizing the absolute deviation of observations from the quantile of interest unlike minimization of the squared deviations from the mean as in least square estimators. These models are robust to outliers and help detect heteroscedasticity effectively, an advantage over ordinary least square models. More importantly they help characterize the conditional distribution of the dependent variable (in our case private investment) at several percentiles and dig out what ever information is glossed over by estimating the equation only for the mean.

Since quantile regressions are mainly used in cross sectional analysis like household surveys, our investment model will be estimated by pooling over the time dimension. The results are to be used purely for exploratory purpose, to see if macroeconomic variables have varying influence at different levels in the conditional distribution of private investment. Further more we try to estimate such models for the period before and after 1985 to capture any systematic difference in investment behavior following adjustment programs. [1]

[1] See Annex 3 for methodological issues on quantile regression models.

5. DISCUSSION OF ESTIMATION RESULTS

5.1 Results FGLS Estimation

The discussion in Chapter III provided a useful yet preliminary pair wise relationships between private investment in Sub-Saharan Africa and its major determinants. In reality however all of the relevant variables in the model and other unobservable disturbances interact with each other and for policy purposes one needs to know the relative impact of each explanatory variable on private investment once the effects of other variables are taken care of. This is what we do in this section of the paper and Table 3 presents the results of the regression model specified in Chapter IV. The first column shows the coefficients based on Specification A which includes only the conventional determinants of private investment without controlling for uncertainty arising from economic and political factors. The second and third columns provide estimation results based on Specification B and Specification C, respectively.

According to the results in the first column of Table 3, the lagged level of real per capita GDP and its annual rate of growth have a statistically significant positive relationship with private investment in Sub-Saharan Africa. This result corroborates the accelerator hypothesis and is in agreement with the findings of most empirical studies on private investment in developing counties. The result also shows that the growth rate of per capita GDP has a stronger effect on private investment than a dollar increase in the level of per capita GDP. Given the weak growth performance during the past three decades, the coefficient on per capita GDP captures the effect of initial differences in the level of income and, other things being equal, the positive sign suggests that higher income countries will keep on investing more showing no hint of convergence in investment rates (and possibly of future growth rates) in our sample.

It is interesting to observe that credit to the private sector has a significant positive relationship with private investment. Several studies have found similar results for a diversified group of developing counties and it happens to hold for Sub-Saharan Africa equally well. The coefficient can be interpreted as implying that roughly 30% of an increase in credit to the private sector goes to investment purposes. Given the dominance of commercial banking in most of the developing world and SSA, the result indicates that long term investment may not be

served adequately by the current structure of the financial system. And yet the strongest impact in our regression model seems to come from credit supply.

Table-3: FGLS Estimates of Private Investment Model for Sub-Saharan Africa(1970-1998)

	1	2	3	*Column 3 continued*	
Constant	6.052***	6.028***	4.243***	Assassination	2.621*
	(0.69)	(0.771)	(1.58)		(1.428)
Real GDP per capita	0.002***	0.002***	0.003***	Guerilla War-	1.945*
	(0.000)	(0.000)	(0.000)	fare	(1.178)
Real GDP pre capita growth	0.120***	0.06*	0.095***	Revolution	-1.251
	(0.036)	(0.035)	(0.040)		(0.830)
Credit to Private Sector/GDP	0.291***	0.255***	0.323***	Riot	1.098
	(0.081)	(0.072)	(0.095)		(0.597)
Credit to Government/GDP	-0.099***	-0.181***	-0.080	Strike	-0.154
	(0.052)	(0.051)	(0.074)		(2.274)
Public Investment/GDP	0.128*	0.109***	-0.069*	Gov't Crisis	-0.145
	(0.032)	(0.03)	(0.042)		(1.296)
Debt Stock/GDP	0.0183***	0.014***	0.006	Constitutional	-1.200
	(0.005)	(0.005)	(0.007)	Change	(0.949)
Debt Service Ratio	-0.100***	-0.073***	-0.055**	Coups d'etat	0.155
	(0.022)	(0.020)	(0.026)		(1.464)
Export/GDP	0.091***	0.101***	0.102***	Purge	0.589
	(0.019)	(0.019)	(0.026)		(0.842)
Inflation	-0.017	-0.004	0.005	Political Right	0.497
	(0.013)	(0.011)	(0.013)		(0.301)
Terms of Trade Volatility		-0.039***	-0.036**	Civil	-0.022
		(0.014)	(0.018)	Liberties	(0.361)
Real Exchange Rate Volatility		-2.376	-6.203**		
		(2.131)	(2.498)		
Inflation Volatility		-2.416	-6.081		
		(3.481)	(4.89)		
GDP Growth Volatility		-0.026	0.065		
		(0.056)	(0.076)		
Wald test (p-value)	*.000*	*0.000*	*0.000*		
Hausman test (p-value)	*0.969*	*0.995*	*0.963*		
AR(1) autocorrelation (ρ)	*0.48*	*0.395*	*0.50*		
Number of Observations	*677*	*569*	*345*		

Note: Regression does not include South Africa, Liberia and Namibia.

- Symbols ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

The results in column 1 also give support to the complementarity between public and private investment in Sub-Saharan Africa, a result which complies with the findings in many empirical studies. This is an expected outcome given the sever inadequacy of infrastructure in Africa and the fact that governments are the most important providers of these facilities. This

also reassures our observation in Chapter III where countries with above average rates of private investment are also the ones with higher public investment rates. The presumption in such studies is that public investment in developing countries is largely accounted for by spending on infrastructure or at least that it should be so.

It turns however that government borrowing from the domestic banking system undermines private investment in the region indicating the existence of financial crowding out. The magnitude of the crowding out effect is however less than the crowding in effect of public investment and it is significant only at 10% level of significance. Underlying this analysis is the assumption that most if not all of government borrowing is for capital expenditure. Quite interestingly, inflation in Sub-Saharan Africa does not seem to have a significant explanatory power of the variation in private investment across countries and over time though it bears the expected negative sign. In other words, once the financial crowding out effect of government domestic borrowing has been controlled for, its effect on private investment through higher inflation is not statistically important.

Rather unconventional a result based on Specification A is the significant positive association between debt burden as measured by the debt to GDP ratio and private investment. The received wisdom in this regard asserts that debt overhang discourages private investment as investors anticipate higher taxes in the future to finance debt service obligations. As said, some economists believe that it is the associated increase in debt service and the impact on credibility in international financial markets that matters most than the disincentive effect of debt overhang on private investors. By including debt service ratio directly into the investment model, which turns out to bear a significant negative relationship, the positive coefficient on debt stock seems to support the latter view. Its statistical significance also implies that once the effect through debt service has been controlled for, an increase in debt stock (which across time means an inflow of foreign finance) seems to support private investment rather than discourage it. This result has interesting statistical feature in that without debt service in the model, debt stock bears a negative coefficient though not statistically significant.

This result should not be surprising in view of the high import content of capital goods and intermediate inputs in SSA which directly affect private investment. Part of the explanation is also the fact that Africa's historical debt is by and large contracted on concessional

terms from multilateral and bilateral sources. In as far as new loan from the same sources means easing the foreign exchange constraint, private investment will be encouraged. The future however can not be expected to proceed in this fashion. As the region aspires to integrate with the global trading and financial systems, a larger debt stock is very likely to undermine private investment as non-concessional sources of finance demand sound debt positions. In this regard export performance will become more important, as it already is, in achieving higher levels of investment. Exports in our model significantly explain variation in private investment across time and cross-sections, supposedly through its effect on import capacity.

In column 2 we have estimates based on Specification B and we can see that all the measures of macroeconomic volatility have the expected negative sign but only the volatility of the terms of trade seems to have a significant negative impact on investment. The rest of the results are the same as in Specification A except for a decline in the magnitude and level of significance of per capita GDP growth. Column 3 provides results based on our most comprehensive specification and three important observations come out of it. First, none of the socio-political instability indicators significantly explain private investment in Sub-Saharan Africa and only four of the nine proxies have the expected negative sign. These are revolution, government crisis, constitutional change and strikes. The second observation is that all of the macroeconomic uncertainty indicators seem to have the expected negative sign with two of them, volatility of the terms of trade and the real exchange rate, having a statistically significant deterrent effect on investment. Third, the inclusion of the uncertainty indicators in the regression model does not significantly change the relative importance of the conventional determinants of private investment as presented in column 1. The only exception is that of public investment, which turns out to have a crowding out effect; the coefficient is however significant only at 10%. Debt to GDP ratio and government borrowing while retaining their signs also become no longer statistically significant. The rest of the standard regressors, i.e. the level and growth rate of per capita income, credit to the private sector, debt service and exports still have the expected sign and remain statistically significant.

Does the result in column 3 suggest that political instability has no significant deterrent effect on investment? This may seem implausible given the region's reputation for unstable political environment. As pointed out in the theoretical framework, proper measurement

of proxies for socio-political instability and singling out their impact on investment is fraught with important problems. In the first place, inclusion of the political instability indicators has resulted in the loss of nearly 50% of observations (we have included only 17 countries in the model) showing the seriousness of missing observations in these particular proxies. Our panel also does not include the most desperate cases of political instability like Somalia, Republic of Congo, Sierra Leone and Liberia simply because the requisite data are not available particularly during periods when the countries are known to have been in serious trouble, like Somalia in the 1990s. Serven (1998) also noted that media coverage of the incidences of political instability (the major source of such data) shows regional imbalance and Sub-Saharan Africa is possibly the worst of poorly covered regions. Despite all these shortcomings, the results still have some thing to tell. Most of the exclusions represent extreme cases of instability that obstruct daily routines of life and business let alone long term decisions like investment; the policy implications in such cases are rather straight forward. Therefore, barring full blown cases of instability, the regression result in column 3 indicates that uncertainty arising from political instability may not offer a major explanation for the region's poor performance in private investment once the effects of standard regressors and economic uncertainty are controlled for.

We can also notice that the proxies which turn out with the expected negative sign are the ones which are very likely to influence the business environment though they are not significant. Other proxies like assassination, riots and coups do not even have the right sign pointing to the validity of the critique on the potential irrelevance of objective measures of instability for business decision. The study by Serven (1998) which includes measures of cabinet change and war apart from the ones included in this paper also found no significant effect of political instability on private investment for a group of 84 developing countries of which 40 are from Sub-Saharan Africa. As pointed out in the theoretical framework of the paper, including indicators of institutional quality may be much more relevant in explaining investment behavior than the objective measures of political and social unrest.

Turning to macroeconomic uncertainty, we noted that the volatility of the real exchange rate and the terms of trade are the most significant ones while uncertainty due to the volatility of inflation and GDP growth is not so relevant. If this result has any element of truth in it, it indicates that private investment and hence the long-term growth of these economies is

susceptible to macroeconomic shocks arising from the external sector of the economy. And this is consistent with the externally constrained nature of these economies. Real exchange rate devaluation is supposed to give incentive to shift resources from the non-tradable to the tradable sectors of the economy. If this incentive system becomes highly volatile, investors will find it more difficult to decide on which sector of the economy to invest. They will thus wait for more information before committing themselves to an irreversible investment project that has greater chances of being unprofitable. Similarly a volatile terms of trade makes choice between the exportables and importales of the traded goods sector very difficult even if the real exchange rate effect remains predictable and favors the traded goods sector. It is important to note however that the negative effects of macroeconomic uncertainty are short term in nature according to the theoretical literature with their long-term impact not clearly identified. It is possible for investors to have above optimal levels of investment in case they wrongly make investment decisions or below optimal levels if the future turns out favorable.

The inclusion of political and economic uncertainty has turned public investment to have a negative association with private investment. This might be the result of some estimation problem (multicollinearity among the regressors) due to the inclusion of a number of less relevant variables in the model. However it also alerts us to a situation where public investment may not crowd in private investment for reasons of uncertainty say due to political problems. Roads and irrigation structures built in one part of the country may not attract private investors if guerilla warfare or other social tensions discourage private investors from moving to that region.

5.2 Results of Quantile Regression

As already mentioned in section 3.2, quantile regressions allow estimation of linear equations at several quantiles in the conditional distribution of the dependent variable. In this paper we will estimate private investment at three levels, i.e., the 25^{th} , 50^{th} and the 75^{th} percentiles. The 50^{th} percentile is the median while the 25^{th} percentile represents the points above which 75% of the observations lie. We shall first estimate investment equations at the chosen quantiles for the entire sampling period. Then we will estimate the same model for the period before and after 1985 since this is the year structural adjustment programs began to be implemented in most African countries. Results for the entire sampling period are reported under

the first column-head while subsequent column heads of Table 4, respectively , show results for the pre and post reform periods. The standard errors of the coefficients are generated by the *Bootstrapping*[2] technique. Since the problems associated with our socio-political instability indicators becomes more serious when we split our sample into shorter time periods, the quantile regressions will be base on Specification B. This may not create serious problem given the insignificance of their coefficients based on FGLS estimation.

The first column head shows that almost all of the conventional determinants of private investment have the expected sign and many are statistically significant at all quantiles. Taking the whole sampling periods, it appears that debt service significantly suppresses private investment at the 0.25 quantile while its effects is negative but not significant at and above the median. Interestingly credit to the private sector and private investment exhibit a very significant positive association that gets stronger along the distribution of private investment. In fact its coefficient in the highest quantile is more than twice that of the lowest quantile. Despite the possibility that causality may run both ways, this result tells that higher investment rates need to be accompanied by higher levels of credit.

We also note that government credit has a significant crowding out effect which tends to increases with the level of investment. At the 0.25 quantile however its effect is significant only at 10%. On the other hand, public investment does not seem to have significant effect at any level in the conditional distribution of private investment though it bears a positive sign throughout. Regardless of the investment level, the accelerator effect through per capita GDP and its growth rate is quite significant and of practically equal magnitude throughout the chosen quantiles. Similar positive effects are also observed for exports while terms of trade volatility is the only macroeconomic uncertainty indicator that exerts a significant deterrent effect on private investment in the region.

The general lesson we draw from the quantile regression for the whole sampling period is that debt relief measures are very likely to benefit countries with investment rates below the median for the region. Among the variables positively associated with private in-

[2] See Annex 3 on Quantile Regression for an elaboration of this technique.

Table- 4: Quantile Regression Results: Dependent Variable - Private Investment

	1970-98			1970-84			1985-98		
	0.25	**.50**	**0.75**	**0.25**	**.50**	**0.75**	**0.25**	**.50**	**0.75**
Constant	2.850***	4.628***	8.453***	2.733**	5.064***	10.38***	1.225	3.661**	7.780***
	(0.728)	(1.011)	(1.802)	(1.236)	(1.626)	(2.236)	(1.147)	(1.652)	(2.011)
Real GDP Per Capita	0.002***	0.002***	0.002***	0.003***	0.003***	0.003***	0.001***	0.001***	0.001**
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Real GDP Pre Capita Growth	0.092**	0.077*	0.099*	0.162**	0.203***	0.192***	-0.020	-0.030	-0.114
	(0.041)	(0.047)	(0.059)	(0.068)	(0.069)	(0.072)	(0.048)	(0.052)	(0.091)
Credit to Private Sector/GDP	0.134*	0.261**	0.334**	0.325**	0.408**	0.382*	0.113	0.085	0.321*
	(0.105)	(0.113)	(0.165)	(0.164)	(0.157)	(0.229)	(0.107)	(0.141)	(0.179)
Credit to Government/GDP	-0.145**	-0.165**	-0.230**	-0.237**	-0.228*	-0.324*	-0.044	-0.081	-0.201
	(0.063)	(0.081)	(0.098)	(0.109)	(0.133)	(0.180)	(0.068)	(0.095)	(0.128)
Public Investment/GDP	0.010	0.010	0.074	-0.030	-0.128**	-0.204**	0.274***	0.292***	0.254*
	(0.046)	(0.073)	(0.112)	(0.063)	(0.054)	(0.084)	(0.091)	(0.095)	(0.143)
Debt Stock/GDP	0.005	0.011	0.005	0.023	0.044***	0.012	-0.010	-0.001	0.000
	(0.006)	(0.007)	(0.010)	(0.018)	(0.016)	(0.019)	(0.007)	(0.008)	(0.012)
Debt Service Ratio	-0.039**	-0.041	-0.046	-0.038	-0.038	0.007	-0.035*	-0.042	-0.074*
	(0.018)	(0.029)	(0.036)	(0.034)	(0.050)	(0.091)	(0.022)	(0.030)	(0.041)
Export/GDP	0.128***	0.132***	0.120***	0.058	0.114***	0.113***	0.189***	0.164***	0.127***
	(0.024)	(0.031)	(0.030)	(0.044)	(0.035)	(0.042)	(0.027)	(0.034)	(0.037)
Inflation	-0.007	-0.004	-0.024	-0.010	-0.007	-0.025	0.004	-0.023	-0.015
	(0.017)	(0.012)	(0.018)	(0.024)	(0.025)	(0.031)	(0.016	(0.019)	(0.015)
Terms of Trade Volatility	-0.040**	-0.036**	-0.026	-0.046**	-0.037	-0.052	-0.042*	-0.045**	-0.025
	(0.016)	(0.017)	(0.023)	(0.022)	(0.033)	(0.044)	(0.023)	(0.022)	(0.026)
Real Exchange Rate Volatility	-1.323	-1.425	-0.445	-0.776	-8.451	-9.815	-1.417	3.038	2.705
	(2.880)	(3.073)	(3.080)	(5.526)	(6.735)	(8.431)	(3.635)	(3.56)	(3.128)
Inflation Volatility	-0.181	-2.660	-0.825	4.252	-1.855	1.569	-2.259	-1.991	1.435
	(3.256)	(4.302)	(5.667)	(7.604)	(7.800)	(10.632)	(4.007)	(5.611)	(5.659)
GDP Growth Volatility	-0.066	0.029	0.099	0.132	0.111	0.154	-0.027	-0.107	-0.138
	(0.067)	(0.094)	(0.113)	(0.141)	(0.162)	(0.179)	(0.051)	(0.085)	(0.132)
Pseudo R^2	0.240	0.252	0.258	0.281	0.316	0.322	0.276	0.278	0.281
No. of Observations	596			255			341		

vestment, credit flow is the most important one with an increasingly higher degree of importance along the distribution of investment. While inflation may not be a threat for investors, increasing the level of government borrowing for a given rate of public investment has important crowding out effect. However, at the lower end of the distribution of private investment, there seems to be room for more government spending (borrowing) with out deterring private investment. Finally, it is important to note that these results are in agreement with the estimates based on the FGLS estimator and the similarity of the coefficients for the median with the FGLS estimates for the mean (based on Specification B) asserts that the latter were not driven by outliers.

In the second and third columns we attempt to ferret out further information by splitting the sampling period into two. Compared to the results for the entire period, we observe in the second column that per capita GDP exerted stronger accelerator effect prior to 1985 while the coefficient on the level of per capita GDP remained unchanged. Both of these variables are highly significant for all quantiles we are interested in. The period 1970-84 also witnessed a much pronounced statistical association between private investment and credit to the private sector (compared with the overall period) with a degree of association practically equal across the quantiles we considered.

As could be expected, debt burden never posed to be a significant deterrent of private investment during the period 1970-84, neither through debt service nor the disincentive effect of debt overhang. At the median level of investment, debt to GDP ratio even had significant positive impact similar to the FGLS estimates. Public investment also turned out to have been competitive rather than complimentary to private investment prior to adjustment programs especially at the 0.5 and 0.7 quantiles. The latter might partly be associated with the pervasive involvement of government in the production of goods and services instigating a real crowding out on private ventures. This negative effect was not important for the lowest quantile though. During that period government borrowing had significant crowding out effect which was higher than that estimated for the whole period. While exports were significantly and positively associated with all levels of private investment, only investment rates at the 0.25 quantile seem to have been significantly influenced by terms trade volatility prior to 1985. The patterns noticed above seem to be disrupted when turning to the post reform period of 1985-98. For the 25^{th} and 50^{th} percentiles debt to GDP ratio turned out to bear a significant

negative influence though not statistically significant. Debt service exerted significant negative effect for the 0.25 and 0.75 quantiles of the conditional distribution of private investment and not at the median. This points to a basic fact about the debt problem in Africa: that debt service is a problem either to those countries with extremely poor export base (where even concessional loans are hard to service) or to the relatively high investment and high income countries in the region that contracted sizable non-concessional loans from international financial markets making them susceptible to debt service problems following the debt crisis of the early 1980s.

Another peculiar feature of this period is the loss of the strong statistical association private investment has with two of its most important determinants: the growth rate of per capita GDP and credit to the private sector. Both variables become insignificant jointly as well as individually and the coefficient on growth even turned negative at all levels of investment. This is a rather disturbing situation in view of the strong relationship documented for the period prior to 1985.

Looked together, quantile regressions reveal important underlying situations in the region. In undertaking adjustment programs, governments commit themselves to reduce borrowing from domestic banks to meet monetary targets. Since the underlying fiscal deficits take time to correct (a fact shown in Table 1), tight domestic monetary rules necessitate resorting to external financing. It is know that access to concessional finance from international and regional financial institutions was part of the external support to the adjustment process explaining the continued rise in debt stock in SSA during the 1980s and 1990s especially for low investment countries. The mounting external debt was not however accompanied by a recovery in investment and growth making it hardly surprising for debt stock to exhibit a negative statistical association with investment for the post 1985 period. On the other hand, trade liberalization meant that external forces are going to play important role in driving these economies compared to the pre-reform period. The loss of the significant statistical association between aggregate demand and private investment after 1985 is therefore likely to be associated with this situation as domestic demand is being met by competitive foreign products while local firms fail to penetrate external markets; both instances leading to reduced demand for investment.

Interestingly enough, government borrowing no longer crowds out private investment while the crowding in effect of public investment turns out to be very strong for the period 1985-98. This empirical fact reveals the possibility that once the restrictions on private investment (both in terms of the economic activities in which private agents could participate as well as the amount of capital they could invest) are removed through liberalization, private investors begins to face the already existing infrastructural limitations in a more practical way. Additional public investment would thus attract more private investment now than it did before 1985. We have already noticed in section 3.2 that adjustment programs have been effective in substantially reducing financial sectors' claim on government. The fact that government borrowing has insignificant crowding out effect in the post 1985 period indicates that governments in the region may no longer be able to stimulate private investment by further contracting their own borrowing from the banking system. The bottom line is rather the ability and willingness of commercial banks in the region to lend to private investors in a liberalized yet uncertain business environment. This issue will further be elaborated in the following chapter.

6. CONTEMPORARY ISSUES IN PUBLIC POLICY AND PRIVATE INVESTMENT IN SUB-SAHARAN AFRICA

6.1 International Development Goals and Cooperation

One of the objectives of this paper is to use the results of our investment model to shed light on the current macroeconomic and development issues facing policy makers in the region. It is well known that poverty reduction has gained renewed currency in the global development agenda. A consensus seems to be emerging on the idea that growth is necessary but not sufficient for poverty reduction. International financial institutions who once advocated the supremacy of economic growth under liberal policy environment have now embraced the focus on poverty, and a number of recent studies have come out declaring that it is the quality of growth (in terms of human development indicators) that is much more important than the quantity (in terms of GDP) of growth. (See World Bank, 2000b). The international development community also lent support to this effort by sponsoring the first ever comprehensive debt reduction scheme, dubbed the HIPC initiative (debt reduction for Highly Indebted Poor Countries). The objective of the HIPC initiative is to relive the world's poorest

countries of the staggering debt burden so that they will have a fresh start while the resources released from servicing historical debt will be used for the fight against poverty.

The 1995 Copenhagen Declaration and Program of Action of the United Nations also set a global development agenda including among others halving absolute poverty by the year 2015. To achieve this goal these economies need to grow at least by 7% per annum. The international community supports this effort by providing additional financial resources on top of the promised debt reduction. Just as economic growth is only one aspect of the multi-pronged effort to reduce poverty, fixed investment is also one element to achieve growth.

6.2 Implications for Public Policy

Translating the global targets of poverty reduction and GDP growth into a target for investment, which is the object of our analysis, requires the use of the Incremental Output Capital Ratio (IOCR). For our sample of 33 Sub-Saharan African countries, the IOCR for the past three decades was on average 20%. Despite its crudeness the calculated IOCR indicates that the average country in the region should invest about 35% of its GDP to achieve the targeted 7% GDP growth. Given the current level of gross domestic investment in the region (19%), this would mean an increase of 16 percentage points of GDP in investment. Obviously Africa's hope for growth in the 21st century equally lies in improving the productivity of its capital base as in more investment (World Bank, 2000a).

Our aim in this chapter is to sketch the macroeconomic environment accommodating such a huge jump in investment and the implied policy challenges in Sub-Saharan Africa. Several assumptions can be taken as to the public-private partitioning of the additional (16% of GDP) investment. It is legitimate to expect the largest portion to be accounted for by the private sector and for the policy simulation in this exercise we have targeted private investment to increase by additional 10% of GDP. The balance (6%) will be an increase in public investment assuming that more private investment requires supportive infrastructure. Though there are important practical and policy issues surrounding the achievement of the 7% growth target, for our analysis we take it as an input for our model, i.e. as an exogenous variable.

It should be noted from the outset that understanding the full dynamics of an economy as it adjusts to shocks and impulses requires the deployment of full fledged Computable General Equilibrium Models. Using single equation models like ours to analyze a wide spectrum

of policies will be too ambitious. However having robust estimates of key parameters from a fairly comprehensive model would allow one to anticipate the most likely outcomes and policy implications in a particular dimension of the economy, in our case private investment. In fact public policy making has never been based on a precise calculation of targets and instruments and highly sophisticated models which attempt to do so have their own share of inadequacies. Andrew (1967) once noted that:

> " Policy formulation and forecasting often requires quick and dirty estimates of economic parameters. If the policy maker wants to know the size of the accelerator, it is of little help for him to know it is one value for manufacturing, another for utilities…"

An additional 10% of GDP increase in private investment implies that we are targeting at private investment rate of at least 20-21% in the coming couple of decades. We also assumed that public investment would amount to 16% of GDP up from the historical average of about 10%. Based on our 7% GDP growth target and the region's average population growth rate of 3% per annum, our per capita GDP growth rate will be about 4%. Apart from targets for the dependent variable, we already have average values for three statistically significant regressors in our model. Partly because their coefficients were statistically insignificant and partly because they are not directly in the domain of public policy, we will assume that the existing socio-political environment will obtain during the prediction period. Since forecasting error of regression equations increases sharply for values of the regressors further away from the sample mean, we will restrict our projection to the coming five years.

Regarding proxies for macroeconomic uncertainty, we recall that they have been generated by a three year moving average process which means values for the first two year of projection will depend somehow on the sampling period. More important however is the fact that reducing volatility of the terms of trade requires long term solutions in terms of diversifying the export base of the economies. Even with diversified export base, terms of trade volatility depends largely on developments in international markets on which small open economies have little command if any. Therefore, we will take terms of trade shocks exogenous and not subject to public policy at least in the short to medium run. Volatility of real exchange rate is also closely related with the development of the export potential and building adequate international reserves to accommodate fluctuations in foreign exchange demand. In the short to medium term therefore we expect real exchange rate volatility to depend on the region's holding of international reserves which depends both on export earnings and/or for-

eign sources of finance. The other two indicators of macroeconomic uncertainty, volatility in inflation and GDP growth, have statistically insignificant effect on private investment and may not be important areas of focus for public policy. Setting the target level of GDP growth also means no uncertainty in this respect at least technically speaking.

We are thus left with a hand full of variables for our policy discussion; namely, credit to government, credit to the private sector, debt service, external borrowing (debt stock), inflation and exports. In as much as foreign aid improves the import capacity of countries, we can consider it as part of export earnings. Even though the coefficient on public investment turns negative in Specification C after the inclusion of socio-political indicators, for this simulation we uptake its positive coefficient in Specification B. This is purely based on practical considerations regarding the dire importance of infrastructure in the region and the significant positive coefficient we observed in the quantile regression models of the post 1985 period.

Assuming that the envisaged growth in per capita GDP is realized in the first year (say due to accommodating weather condition and external assistance), this sets in the accelerator effect and generates demand for capital services leading to demand for investment goods. Based on the IOCR, we have mentioned that sustaining the target rate of growth requires private investment to increase to about 20% of GDP. On the other hand, analysis of the financial impact of the HIPC initiative for the first 22 countries that reached the Decision Point as of December, 2000 shows that debt to GDP ratios will be slashed by half and debt service ratios will come down to less than 10% of exports(from the current 16% average). (See World Bank, 2001a). If we assume similar reduction of debt stock and debt service ratios for countries in our sample,[3] there are only two additional requirements to be considered to achieve the requisite level of private investment, i.e., credit and exports. By incorporating the above mentioned values into our investment model, one simple scenario indicates that credit to the private sector should roughly increase to at least 10% of GDP (up from the current less than 3% average) and exports have to rise to about 40% of GDP from the historical average of less than 30%. This is quite a substantial amount of increase and it is more so for the low invest-

[3] Of the 41 HIPC countries 36 are in Sub-Saharan Africa and our sample includes 25 of them. Similarly our sample includes 14 of the 22 countries who reached the decision point as of December 2000.

ment sub-group of countries in our sample. It also shows the enormity of the global targets, which in many ways are being proven to remain unattainable.

The exact magnitude of the variables from this heuristic exercise may not be very relevant in itself but the policy message is quite clear. Locking in high growth momentum requires sizable build up of the capital base. And even when demand for investment rises through a positive shock in output for a couple of years, adjusting the capital stock to a desired level can be significantly restrained by liquidity constraints and availability of foreign exchange. The associated increase in public investment is also likely to add to the credit demand from the private sector leading to an inflationary situation, though inflation hitherto has not been a major problem for the region's investment.

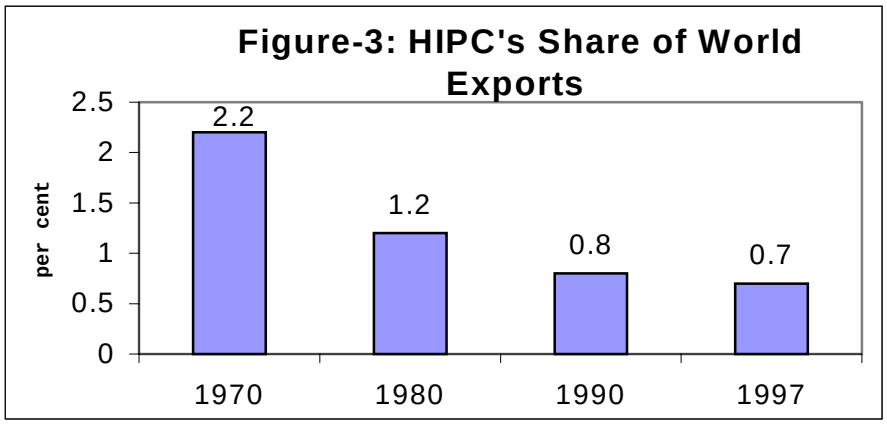
The target levels of credit we pointed out (10% of GDP) are comparable to the private credit to GDP ratios in East Asian and some Latin American countries. Being able to meet such credit demand for private investment without propagating inflation may have important implications on the structure of the financial sector. Our model shows that less than one-third of additional credit goes to investment, the rest going for consumption or to keep business running at the current level of output. Increasing the proportion of credit that goes for investment purposes requires there being specialized banks which can lend for investment purposes. The upside of this strategy is the possibility of achieving the desired level of investment with only moderate increases in total credit, while the resulting increase in production would help mitigate the inflationary pressure. The high risk involved in long term investment projects however implies that such banks will need to be state backed at least at early stages of development in which the region finds itself. On the downside we have the bad experience of specialized banks in the past although those bad loans were mainly related to their lending to public enterprises and not to private investors. Policy makers therefore need to weigh such a strategy with the observation in Chapter III that declining government borrowing since the mid 1980s has not been accompanied by increased borrowing by the private sector. In view of this and the telling experience of the East Asian countries, the current policy debate is not on whether there should be government support or not, but on how to pick the right sectors for support, what form should it take and what control mechanisms (for firms to keep getting support) to deploy.

The relevance of the HIPC initiative for our sample also deserves some discussion since countries in Sub-Saharan Africa are the major beneficiaries of the initiative. Our econometric model suggests that debt service significantly hinders private investment implying that the HIPC initiative potentially contributes to boost investment by easing foreign exchange constraints. There is however a catch to be addressed here. Qualifying for the HIPC initiative inter alia is conditional upon the beneficiaries' commitment to poverty reduction which is expressed by preparing Poverty Reduction Strategy Papers (PRSPs). These are supposedly country owned documents serving as the new framework for international development cooperation with clearly stated goals mainly in terms of social indicators (like education and health). The World Bank and the IMF should endorse the PRSPs before a country is declared to have reached the *Decision Point* at which stage it begins to receive part of the relief package. Once eligible, HIPCs are required to use 2/3 of the resources released through debt cancellation on social sector projects with about 40% going to education and another 25% on healthcare. With out intending to question the desirability of the focus on social development, the conditionality placed on the use of released resources renders the benefits to business from the initiative very insignificant if any. As the HIPC is the most comprehensive debt reduction effort these countries could hope for, its nearly exclusive focus on poverty reduction erodes the possibility to enhance investment by reducing debt service burden. The reduction of debt stock by half is also very unlikely in itself to improve business expectation of higher profit (as suggests in theory) as debt overhang according to our model did not turn out to be a major disincentive for investors in Africa; an observation underscored by other researchers as well. (See Cline, 1995.)

A lasting solution to debt service problems and ensuring debt sustainability ultimately rests on boosting exports. The policy simulation also showed the need to increase exports in Africa by an additional 12 percentage points of GDP to accommodate the target rate of private investment. Such a sharp increase in exports is obviously hard to attain in the short run and a good part of it will have to be acquired in the form of external financial support. The experience of the 1990s was however marked by a secular decline in aid flows to the region which coupled with the eminent global recession makes prospects for more aid even bleaker. More over, the countries and institutions who are expected to increase their donations are the same

creditors engaged in forgiving debt which suggesting potential financial stress from the donors' side. (See GAO, 2000).

This situation places urgency on the need to strengthen exports from the region in terms of volume, quality and diversity. No need to mention that the "miracle" in the East Asian high performing economies was underscored by export push strategies and selective intervention. While the process of preparing and implementing PRSPs will definitely compete for the limited institutional and financial capabilities of the HIPCs, these documents contain no innovative ways to redeem the weakening export positions of these countries. The region however continues to experience a secular loss of global market share even in traditional exports let alone diversifying into non-traditional ones. See figure 3 below. Instead of being addressed as a priority challenge, the task of reversing this trend seems to be increasingly sidelined.



Source: World Bank

Though our objective is not to evaluate the relevance of the HIPC/PRSP framework, some discussion of its implications cannot be avoided since it guides contemporary public policy in the HIPCs. This paper shares the views of those who foresee domestic and foreign borrowing by HIPC governments to increase in the near future as spending levels rise to meet social targets set in PRSPs. The GAO(2000) report for instance, warned that some of the countries might even end up with more public debt by the end of the twenty year program than they started with, jeopardizing the very objective of long term debt sustainability. Killic (2000) also underlined that although the emphasis on poverty reduction is appropriate, a disproportionate focus on social programs could divert attention from improving the business

climate for investors. In as much as the extra public spending on social projects does not help improve the business environment, the resulting crowding out effects on private investment ultimately leads to poor growth performance and another episode of global disappointment, the consequence of which will unduly be born by multitudes of poverty stricken people. The HIPCs will thus need to strike a judicious balance in pursuing poverty reduction strategies without overlooking private investment and exports.

7. SUMMARY AND CONCLUSIONS

In this paper we set out to identify the relative importance of the determinants of private investment in Sub-Saharan Africa through testing different specifications with the ultimate purpose of guiding public policy. Although we have restricted ourselves to a single developing region and used efficient estimation techniques, all conclusions should be understood in view of the unbalanced nature of the panel, problems specific to some variables, and the reduced form of the equations.

Results of the FGLS estimation and the statistical associations noted in Chapter III all indicate that private investment in Africa is responsive to changes in aggregate demand as postulated by the accelerator model. Quantile regressions have however revealed that the accelerator effect has been severely weakened during the period 1985-98 if not lost. This observation poses serious development problems facing the region in the aftermath of adjustment measures. We also saw that the strongest explanation for variation in private investment across the countries in the region and over time comes from differences in credit to the private sector, and approximately 1/3 of increases in credit flow tend to go for investment purposes.

The data supports significant complementarity between public and private investment except for specifications that control for political instability. Interestingly, the complementarity becomes more pronounced in the post adjustment period according to results of quantile regression. This finding indicates that the private sector is beginning to face the already existing infrastructural constraints as liberalization opens up more opportunities for private sector participation. More over the crowding in effect is strong and very significant for investment levels at and below the median which indicates that investment increases with infrastructural services up to a certain level and exhibits wide variation among countries with rela-

tively developed infrastructural network. For the latter set of countries public policy could be focused on other determinants of private investment relative to infrastructure.

FGLS estimates also indicate that for a given level of public investment, increased government borrowing will have a significant crowding out effect. This is quite consistent with what we saw in Chapter III that governments in low investment countries tend to finance a good part of their budget deficit through domestic borrowing relative to the high investment countries. On the other hand we have noted that government borrowing in the region has been on the decline since the mid 1980s. Quantile regression for the post 1985 period also indicated insignificant crowding out effect of government borrowing. This implies that further fiscal discipline may no longer be an effective policy tool to stimulate private investment in the region though its effect was negative taking the entire sampling period. A related observation is that inflation did not show up among the major deterrents of private investment for our sample regardless of the choice of specification. This result is in consonance with the recent findings that inflation tends to destabilize low income countries only when it hits over 40% per annum; and the mean inflation rate in our sample is far below this threshold.

The points highlighted above could be put together to imply that in the road ahead pursuing stringent fiscal and monetary policies to ensure macroeconomic stability could prove a misplaced strategy for Sub-Saharan Africa. This is because capital expenditure often bears the brunt of fiscal discipline thereby undermining the state's ability to provide private investors with adequate infrastructural backing; a factor which has proven to be increasingly important over time. The benefit to private investors in terms of lower and stable inflation is also shown to be insignificant than the more pressing liquidity constraints that might get worsened by tighter monetary policy. Addressing liquidity problems however demands more than short-term macroeconomic adjustment and involves structural elements of the financial sector of African economies. This situation was expounded in Chapter VI where our estimation results, together with inputs from contemporary international development goals and the accompanying international support, were used to analyze the implications for public policy in SSA. Under certain assumptions, the exercise revealed that sustaining the target rates of growth in per capita income (hence to meet targets of poverty reduction) requires nearly doubling of current private investment rates in SSA which in turn necessitates a more than tripling of credit flow to the private sector.

The challenge for policy makers is not just coping with the inflationary pressure that might ensue the suggested huge increase in credit supply but how to make it happen to begin with. In market led economies, governments can do little more than reduce interest rates and their own borrowing from domestic sources to avoid crowding out of the private sector. So far this strategy has not been successful at least in our sample countries suggesting the need for alternative approaches. The paper argued that government supported specialized banks that lend for private investment are still valid candidates as commercial banks under liberalized financial markets are not in a position to adequately serve this purpose because of the perceived risk in lending for long term investment projects. As said, the policy debate now is not on whether there should be government support, but on how to chose sectors for government support, on designing effective ways to administer it and what control mechanisms to use. The East Asian experience reveals that such systems can still be put in place with adequate precautionary measures.

Despite the region's turbulent political environment, proxies for socio-political instability generally provide imprecise guidance about investment behavior. A few proxies (revolution, government crisis, constitutional change and strikes) have the expected negative sign. These are variables which are very likely to lead to changes in the institutional setting, which according to recent theory is more relevant to private investors than objective measures of social unrest like riots, assassination and guerilla.

Regarding the external sector, exports happen to be very robust in explaining differences in private investment with its coefficients remaining highly significant and stable in all of the specifications and time periods considered. FGLS estimates also showed that debt service has a significant negative association with private investment while debt overhang did not. The latter even had significant positive effect in specifications that do not control for political instability. Quantile estimation revealed additional facts that debt burden began to be felt in the post 1985 period (precisely a little earlier) and debt service seems to be a problem at investment rates above and below the median. Apart from reassuring the relevance of foreign exchange rationing these results indicate that investors in countries with very weak export base or those in relatively well off countries who have borrowed from non-concessional sources are the ones who are very likely to suffer from debt service obligations.

We also found out that macroeconomic uncertainty in the region is basically related to volatility in the terms of trade and the real exchange rate. Although theory suggests that their effect on investment is short term, correcting for them is obviously a long-term agenda involving diversification of export base. The results of quantile regression indicate that terms of trade is the most important source of macroeconomic uncertainty and its effect is strong at the median and lower quantiles of the conditional distribution of investment. In summary it can be said that investors in Sub-Saharan Africa are susceptible to shocks arising in the external sector calling for international support in terms of opening up developed country markets for African exports apart from the domestic effort to diversify exports.

We have noted that the HIPC initiative, which has the PRSPs as a major conditionality, holds unprecedented opportunity to reduce debt burden in the region and our model indicates that debt service has significant effect on private investment. Nevertheless, the requirement that HIPCs should use 2/3 of the released resources only on social projects could seriously undermine the potential for businesses (their investment) to benefit form the initiative. Such requirements plus the social targets set in PRSPs will tend to increase consumption levels in the economy with out necessarily creating the capital base to sustain it. In view of the robustness of exports as determinants of private investment, a real cause for concern may even be the narrow scope the PRSP framework offers HIPCs to undertake proactive measures to boost their deteriorating global trading position while attention is being disproportionately focused on the social dimension of the region's development problems. At the minimum, HIPC beneficiaries should be granted greater liberty in using the released resources in accordance to their long term growth objectives. More over a balance should be stricken between direct interventions for poverty reduction on the one hand and ensuring sustainable growth through improving the business environment and external competitiveness on the other.

ANNEXES

Annex-1
List of Countries and Mean Private Investment Rates
1970-98 (per cent of GDP)

Low Investment Countries		High Investment Countries	
Mozambique	1.66	***Mali***	11.79
Burundi	2.03	***Liberia***	12.67
Madagascar	4.14	***South Africa***	13.28
Central Africa	4.29	***Botswana***	13.30
Rwanda	5.55	***Zimbabwe***	13.35
Ghana	5.75	***Cameroon***	13.44
Niger	5.84	***Kenya***	13.99
Zambia	6.51	***Mauritania***	15.49
Ethiopia	6.60	***Tanzania***	16.66
Benin	6.87	***Mauritius***	17.76
Uganda	7.22	***Congo, Rep. Of***	21.78
Gambia, the	8.20	***Gabon***	22.96
Senegal	9.23	***Lesotho***	24.10
Sudan	9.77		
Cote d'Ivoire	9.80		
Namibia	9.94		
Malawi	10.48		
Comoros	10.61		
Togo	10.62		
Nigeria	10.72		

Source: Own Computation Based on World Bank Data

Annex -2
Cross Sectional Heteroskedasticity and Time Wise Autocorrelataion.

A model for panel data with heteroskedastic an autocorrelated residuals can be presented as in the form:

$$Y_{it} = X_{it}\beta + \varepsilon_{it}$$

Where $E(\varepsilon_{it}^2) = \sigma_i^2$ Heteroscedasticity.

$E(\varepsilon_{it}\varepsilon_{jt}) = 0 \quad i \neq j$ No cross-sectional autocorrelation.

$\varepsilon_{it} = \rho\varepsilon_{i,t-1} + u_{it}$ Autocorellation common to all panels.

$u_{it} \sim N(0, \sigma_{ui}^2)$

The variance-covariance matrix of the disturbances Ω i.e. $E(\varepsilon\varepsilon')$ appears as follows:

$$\Omega = \begin{bmatrix} \sigma_1^2 V & 0 & \cdots & 0 \\ 0 & \sigma_2^2 V & \cdots & 0 \\ \vdots & \vdots & & \vdots \\ 0 & 0 & \cdots & \sigma_n^2 V \end{bmatrix}$$

$$V = \begin{bmatrix} 1 & \rho & \rho^2 & \cdots & \rho^{T-1} \\ \rho & 1 & \rho & \cdots & \rho^{T-1} \\ \vdots & \vdots & \vdots & & \vdots \\ \rho^{T-1} & \rho^{T-2} & \cdots & & 1 \end{bmatrix}$$

To arrive at a consistent estimation of Ω we can first run an OLS on equation 1 above and get unbiased and consistent coefficients. The residuals from this regression can be used to estimate a consistent coefficient of correlation ρ .

$$\hat{\rho} = \frac{\sum e_{it} e_{i,t-1}}{\sqrt{\sum e_{it}^2}\sqrt{\sum e_{i,t-1}^2}} (t = 2,3,...,T)$$

We use the $\hat{\rho}$ to transform equation 1 as follows to correct for autocorrelation.

$$Y_{it}^* = \beta_1 X_{it,1}^* + \beta_2 X_{it,2}^* + ... + \beta_{it,k}^* + u_{it}^* \qquad (2)$$

Where $Y_{it}^* = Y_{it} - \hat{\rho} Y_{i,t-1}$

$$X_{it,k}^* = X_{it,k} - \hat{\rho} X_{i,t-1,k}$$

$t = 2,3,.....,T$
$i = 1,2,.....,N$
$k = 1,2,.....,K$

Equation 2 allows us to have unbiased estimate of σ_i^2 from observations that are at least asymptotically non-autoregressive; this transformation is very important since autoregressive residuals will render the estimated variance biased. After running OLS on equation 2, the residuals can be used to estimate the variance of u_{it} as follows:

$$S_{ui}^2 = \frac{1}{T-K}\sum_{t=1}^{T}\hat{u}_{it}^2$$

Since $\sigma_{ui}^2 = \sigma_i^2(1-\hat{\rho}^2)$ it follow that $S_i^2 = \frac{S_{ui}^2}{1-\hat{\rho}^2}$

Finally we transform equation (2) by dividing both sides of the equation by S_{ui} giving the ultimate equation to be estimated, i.e.

$$Y_{it}^{**} = \beta_1 X_{it,1}^{**} + \beta_2 X_{it,2}^{**} + ... + \beta_{it,k}^{**} + u_{it}^{**} \qquad (3)$$

Where; $Y_{it}^{**} = \frac{Y_{it}^{*}}{S_{ui}}$ $\quad X_{it,k}^{**} = \frac{X_{it,k}^{*}}{S_{ui}}$ and $u_{it}^{**} = \frac{u_{it}^{*}}{S_{ui}}$

Annex-3
Quantile Regression

Quantile regressions are estimated in such a way that the sum of absolute deviations of observations from the regression line is at the minimum. The quantile regression model can be expressed as:

$$Y_i = \beta_\theta' X_i + u_\theta \text{ with } Quant_\theta(Y/X) = \beta' X_i$$

Where: β_θ' and X_i are a $1\times k$ and $k\times 1$ vectors respectively.

$Quant_\theta(Y/X)$ denotes the θth conditional quantile of Y given X.

u_θ represents random disturbances.

$i = (1,2,...,n)$

The coefficient vector β_θ is obtained by minimizing the following equation

$$\min_{\beta} \sum_{i=1}^{n} [Y_i - \beta_\theta X_i] w_i$$

Where w_i is a multiplier which takes a value of 2θ if $\hat{u}_\theta \succ 0$, or 2(1-θ) otherwise. This system is set up as a linear program system and estimated by linear programming techniques.

The standard errors of the coefficients in quantile regression are obtained using Bootstrap sampling technique. This technique involves iterative calculation of the desired statistic, say the mean, from a random sample of identical size taken from the available dataset (which is supposed to represent the population) and obtain the standard error of the statistic by applying the usual formula for standard error. If one draws *k* bootstrap samples from a dataset and generate a *k* different values of the statistic, i.e., θ_i^* *(* i=1,2,…,k) , the standard error is estimated as follows:

$$s = \sqrt{\frac{1}{1-k}\sum_{i=1}^{k}(\theta_i^* - \bar{\theta}^*)^2}$$

Where: $\bar{\theta}^* = \frac{1}{k}\sum_{i=1}^{k}\theta_i^*$

In this paper the standard errors were generated by using 100 iterations.

Annex-4
Definition of Proxies for Socio-Political Instability.

1. *Revolution*: The number of any illegal or forced change in the top governmental elite, any attempt at such a change, or any successful or unsuccessful armed rebellion whose purpose is independence from the central government.
2. *Riots*: The number of any violent demonstration or clash of more than 100 citizens involving the use of physical force.
3. *Purges*: The number of any systematic elimination by jailing or execution of political opposition with in the rank of the regime or opposition.

4. *Guerrilla Warfare*: The number of armed conflicts, sabotage, or bombings carried on by independent bands or irregular forces and aimed at the overthrow of the existing regime.
5. *General Strikes*: The number of any strikes of 1000 people or more industrial or service workers that involve more than one employer and that is aimed at national government policy or authority.
6. *Assassination*: The number of any politically motivated murder or attempted murder of a high government official or politician.
7. *Major Constitutional Changes*: The number of basic alterations in a state's constitutional structure, the extreme case being the adoption of a new constitution that significantly alters the prerogatives of the various branches of government. Constitutional amendments which do not have significant impact on the political system are not counted.
8. *Major Government Crises*: The number of any rapidly developing situation that threatens to bring the downfall of the present regime - excluding situations of revolt aimed at such overthrow.
9. *Coup d'etat*: The number of extraconstitutional or forced changes in the top governmental elite and/or its effective control of the nation's power structure in a given year. The term "Coup" includes, but is not exhausted by, the term "Successful revolution". Unsuccessful coups are not counted.

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ACRONYMS

FGLS	Feasible Generalized Least Squares
GAO	U.S. General Accounting Office
GDP	Gross Domestic Product
HI	High Investment
HIPC	(*debt relief initiative for*) Highly Indebted Poor Countries
IMF	International Monetary Fund
IOCR	Incremental Output Capital Ratio
LI	Low Investment
PRSP	Poverty Reduction Strategy Paper
SSA	Sub Saharan Africa