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The Link between Sources of Public Spending and Growth in Sub-Saharan Africa

A dissertation submitted to the Department of Finance and Tax of the University of Cape Town in full fulfilment of the requirements for the award of a Masters Degree in Commerce (Finance)

By

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Plagiarism declaration

I declare that this thesis hereby submitted for the Masters of Commerce degree in Finance at the University of Cape Town is my own effort and has not been previously submitted anywhere else. I also acknowledge that plagiarism is an offence and therefore I have quoted all sources that I have used in this thesis.

MalimuMuseru

Abbreviations

2SLS	Two-stage least-squares
ADI	African Development Indicators publication.
CID	Center for International Development at Harvard University
CPIA	Country Policy and Institutional Assessment
CPIA	Country Policy and Institutional Assessment
DAC	Development Assistance Committee
EDA	Effective Development Assistance
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
HIPC	Heavily Indebted Poor Countries
IMF	International Monetary Fund
IV	Instrument variable(s)
LDC	Least Developed Countries
MDGs	Millennium Developments Goals
ODA	Official Development Assistance
OECD	The Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
OLS FE	Ordinary Least Squares with fixed country and time effects
PRS ICRG	Political Risk Services International Country Risk Guide
SSA	Sub-Saharan Africa

Abstract

This thesis assesses the impact of sources of public spending on GDP per capita growth using a panel data set of Sub-Saharan Africa (SSA) countries. The purpose of this investigation is twofold. First, I study the effect of the sources of public spending on its level. I argue that any impact on public spending from any of its sources (including foreign aid) should be carried over to GDP per capita growth. Of the three sources of public spending (namely central government revenue, foreign aid and external debt), this study finds central government revenue to have the most significant impact on public spending levels. On average, a unit increase in the ratio of central government revenue to GDP increases public spending levels by between 2-6 percentage points, ceteris paribus. Second, the study analyses the link between sources of public spending and growth. After correcting for the potential endogeneity of aid, there is strong evidence to suggest that Sub-Saharan African countries have benefited significantly from the decades of development assistance. The results show that on average a unit change in the ratio of aid to GDP accelerates GDP growth by 0.25-0.40 percentage points, ceteris paribus. However, the benefits of aid may have been countered by the volatility of public spending which has been detrimental to growth over the covered period.

Chapter 1: Introduction

One of the most debated issues in development economics is whether Official Development Assistance (ODA) promotes GDP per capita growth in aid recipient countries[1]. This debate has evolved in spite of differences among researchers, which have ranged from econometric modelling issues to fundamentally different approaches in the design and implementation of development policy. Following decades of foreign aid debate, researchers have shown a renewed interest in foreign aid. Of course there is a moral imperative to this renewed debate - achieving the United Nation's Millennium Developments Goals (MDGs) in Africa[2]. The principal MDG target—reducing poverty to half the 1990 level by 2015—on current trends will not be met in Sub-Saharan Africa (SSA) and, as a result, in the African continent as whole (Addison et al, 2005a). This new literature focuses on the effects of aid inflows on growth rates, as well as determining which socio-political, climatic, institutional, and economic factors undermine or enhance the effectiveness of foreign aid with respect to growth. Overall, there is no consensus on the matter of aid effectiveness. Disagreement remains in assessments of the necessary conditions for aid to have a positive impact on the GDP per capita growth of aid recipient countries.

This study begins by examining the effect of the sources of public spending on the public spending level. It is argued that any impact on public spending from any of its sources (including foreign aid) should be carried over to per capita GDP growth. Subsequently, the study analyses the link between sources of public spending and growth. After correcting for the potential endogeneity of aid, there is strong evidence to suggest that African countries have benefited significantly from the decades of development assistance. However, the benefits of aid may have been countered by the volatility of public spending which has been detrimental to public spending levels and growth over the covered period.

[1] ODA and foreign aid will be used interchangeably.
[2] MDGs are time bound, quantifiable targets aimed at addressing poverty in its many dimensions.

The plan of the study is as follows. Chapter 2 looks at the objectives of the study while chapter 3 provides a comprehensive literature review. Chapter 4 outlines the empirical models. Data overview and sources together with the study's solution to the problem of missing data is dealt with in chapter 5. This is followed by a discussion on the methodology employed and general issues regarding methodology in chapter 6. Subsequently, I present and discuss the results in chapter 7, before making brief concluding remarks in chapter 8.

It is worth noting that due to the importance of aid in meeting MDGs and the renewed debates on aid effectiveness, a significant portion of this study will be dedicated to the aid-growth debate.

Chapter 2: Objectives of study

What does this study contribute to the voluminous literature on the aid-growth nexus? This study fills two important gaps. First, unlike most papers in literature which have examined foreign aid effectiveness in isolation, the present study explicitly considers the effects of other sources of public spending on growth rates in SSA countries. The relevance of this exercise is to ascertain what are the potential impediments of growth in aid recipient countries using public spending as a transmission mechanism. Second, the study focuses exclusively on SSA countries, some of which are the largest recipients of foreign aid.[3,4] As far as the first objective is concerned, it is important to note that this study is dedicated to understanding the links between all sources of public spending (including foreign aid) and the public spending levels, and then studying the effect that these sources of public spending have on growth. However, given the relevance of foreign aid as a source of public spending, and the controversies around its effectiveness, special attention will be given to foreign aid.

How will these objectives be achieved? To achieve the objectives of the study, I will employ two separate models for the analyses, i.e. a public spending model and a growth model. The analysis will begin with the public spending model. Initially it is assumed that there are three sources of public spending namely central government revenue, external debt, and foreign aid. Each of the sources is hypothesised to have a positive impact on public spending levels as it represents an inflow to the public spending process[5]. However, since the three sources support public spending, and because the volatility of public spending (on aggregate) has been recently found to be detrimental to public spending levels (Ebeke &Ehrhart, 2011), I also hypothesise a negative relationship between the volatilities of central government revenue and foreign aid and the public spending levels. Subsequently, each hypothesis in the public spending model is extended to the growth model after incorporating a multitude of control variables borrowed

[3] There is a clear shortage of studies that have focused on SSA countries. Gommanee et al. (2005) is the only recent study to cover this region.
[4] In 2010, 3 of the top 10 ODA recipients by receipts (Ethiopia, Congo DRC, and Tanzania) were SSA countries. In addition, Africa as a whole has historically received the largest share of aid measured as a percentage of total ODA (OECD, 2012).
[5] Debt service payments which are a result of external debt stock are hypothesised to negatively impact public spending levels.

from growth-literature. The logic is intuitive. Public spending leads to GDP per capita growth, therefore the hypotheses regarding public spending can be carried over to the growth model.

Refer to the diagram below for a complete list of hypotheses for the two models.

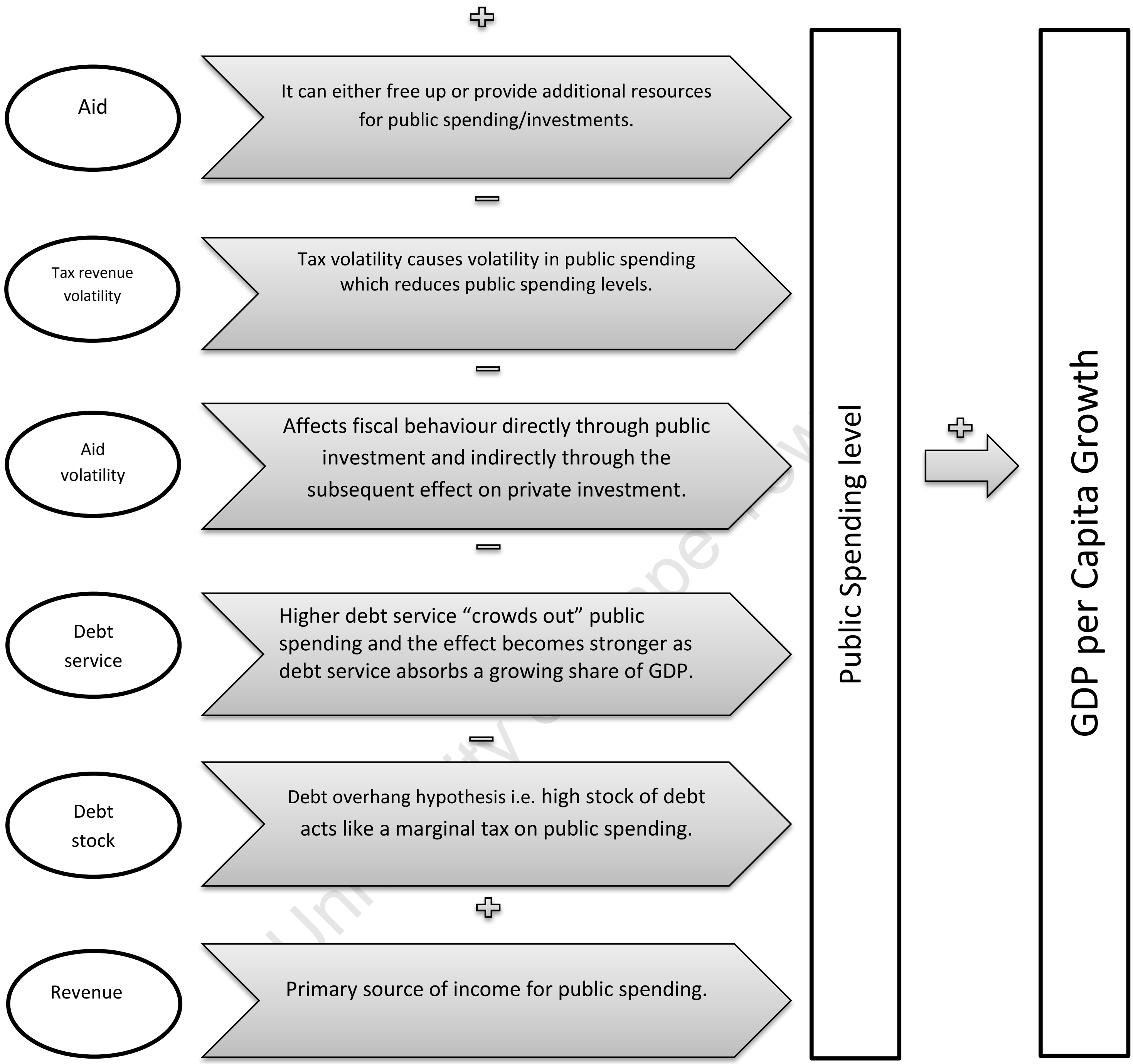

Figure 1: Main hypotheses

A note on the Hypotheses:

The left side of the diagram contains the main variables of interest (aid, debt service, revenue etc.). As previously explained (Chapter 2), this study first assesses the impact of the variables of interest on public spending levels. The expected relationships/hypotheses are described using arrows containing the expected direction of these relationships (above the arrow) and explanations for the expected relationships (within the arrow).

Secondly, the variables of interest are assessed with respect to GDP per capita growth. Because the level of public spending is assumed to positively impact GDP per capita growth, it follows that the expected relationship between the variables of interest and public spending levels will be carried over to GDP per capita growth.[6] For example, aid is hypothesized to have a positive impact on public spending levels because it can either free up or provide additional resources for public spending. Since public spending levels have a positive impact on GDP per capita growth, aid is hypothesized to also have a positive impact on GDP per capita growth. Alternatively, it is hypothesized that debt service will negatively affect public spending levels due to 'crowding out' public spending and hence will negatively affect per capita GDP growth.

[6] The argument of a positive relationship between public spending levels and growth is intuitive and will not be tested in this study but rather implied.

Chapter 3: Literature review

3.1. Aid-Growth literature

3.1.1. Gap-financing models and first generation literature

Traditionally, empirical analysis of the impact of aid on growth was based on the so called 'gap' models. At the core of the original gap model (the Harrod-Domar or HD model), the level of investment depends on private savings, public savings, and net foreign savings (net investment including aid)[7]. Consequently, if a government wishes to increase the growth rate, then it has to increase savings. In the case where national savings (private and public savings) are too low (constrained), aid permits increased investment and growth (Morrissey, 2001). Early literature made no effort to measure the aid-growth nexus directly. These studies instead tested the aid-savings link empirically by making savings the dependent variable and aid the independent variable in their regressions.[8] The HD model did not survive closer scrutiny and later, several aspects of it were modified. It is believed that these modifications greatly enhanced the model and its connection with reality (Papanek, 1972).

Chenery and Strout (1966) extended the HD model into a two-gap model by introducing import capacity (foreign exchange gap) as a separate potential constraint on growth. The authors contended that a country will transform its economy successfully via a simultaneous increase in skills, domestic saving, and export earnings. "In cases of acute shortages of imported goods, the economy will be unable to transform potential saving into investment because of insufficient supplies of investment goods (p. 682)."Despite this extension, the spirit of the two-gap model remained similar to the HD model i.e., investment spurs growth. Since national savings and imports are constrained in low-income countries, aid has the potential of filling these gaps and hence fuelling growth. However, the impact of additional foreign finance will vary depending on which gap is binding. The foreign finance gap, rather than the savings gap, is deemed to have a

[7] The HD model was developed by Roy Harrod and Evsey Domar in the 1940s.

[8] The typical equation in this analysis was $\boldsymbol{s_t = \alpha_0 + \alpha_1 a_t}$ where α_0 is the marginal savings rate and α_1 captures the impact of aid inflows (as a share of income) on the savings rate.

greater impact on investment when foreign exchange is the constraint.[9] This arises because the foreign exchange constraint implies that productive capacity is unutilized as opposed to it being fully utilized when savings alone is binding (Bacha, 1990).

There were other implications of the two-gap model. Hansen and Tarp (2000) stressed that while the aid-savings interaction is positive when savings are binding, a similar result will not hold when trade is binding. In addition, when the trade gap is binding there is a direct impact from aid on growth that bypasses the HD causal chain running from aid to growth via savings and investment (p. 378).

Finally, using a theoretical argument, Bacha (1990) introduced a third gap - the fiscal gap. This stemmed from the idea that growth prospects of highly indebted developing countries are severely hampered by the resulting fiscal constraints. As debt 'lingers' on, the primary source of growth problems is derived from budget limitations rather than foreign exchange or savings constraints (p.283). As the majority of aid is extended directly to governments, the fiscal constraint should be relaxed, provided that aid is used for productive investments.

In summary, the essence of the gap approach was that low-income countries face various financing constraints (gaps). If sufficient aid is granted to relax the constraints (fill the gaps), and provided that it is used for productive investment, the growth rate can be increased.
However, there was one major shortcoming in the gap models. It was generally assumed that foreign assistance represented an exogenous, one-for-one increment to capital stock. Put differently, aid was not treated as a component of national income (adding to both consumption and investment), and therefore the aid component that was consumed was bypassed in this type of macroeconomic aid-impact analysis (Hansen & Tarp, 2000). A

[9] This theoretical argument lends support to 'tied' aid. "If aid is given in the form of capital goods, the foreign exchange constraint is relaxed and investment can be increased. However, if the savings constraint is binding (i.e. productive capacity is fully utilized), then tied aid will be ineffective. Aid given as 'cash' can be effective if it is given (and then used) to relax the greater (binding) constraint" (Morrissey, 2001, p 40).

fundamental flaw in such an approach is that it assumed aid fungibility; i.e. the additional resources provided by aid are used as intended by the donor. Aid envisioned for investment may be diverted to finance consumption or 'non developmental' expenditure (Griffin, 1970).

This sparked the first round of debates in aid literature. Griffin took to the firing line by dismissing earlier literature.[10] He asserted that the benefits of foreign assistance in raising investment are outweighed by the decline in the capital-output ratio such that the growth rate falls. Griffin and Enos (1970) lent further support to this argument. They reported a low (negative) correlation between aid receipts and growth in 27 countries (Africa, Asia and Latin America). They maintained the pessimistic view by positing that even though the association between aid and growth is 'loose', it was clear that greater foreign capital led to lower growth (p. 318). In the remainder of their paper, focus shifted away to explaining why aid may hamper long term growth. It was suggested that aid may not only lead to lower savings, but it may also retard economic growth by altering the composition of investment to the dis-advantage of the recipient.[11]

Several authors came forward and sided with Griffin and Enos (1970). Chenery and Eckstein (1970) and later Weisskopf (1972) demonstrated a significant negative correlation between foreign capital flows and savings in their samples of developing countries.[12] While the focus was still on single country studies, their approach made use of Ordinary Least Squares (OLS) regressions.

[10] Studies in the 1960s were optimistic in their projections of aid. Take, for example, Chenery and Strout (1966) who estimated the range of capital requirements of $10-$17billion corresponding to a rate of growth of external capital of 3%-10% in 1970 from the 1962 levels.

[11] "A large proportion of publicly sponsored foreign assistance is channeled into activities which either are not directly productive or have long gestation periods (p. 323)."

[12] Chenery and Eckstein (1970) found this to be true for 12 out of 15 cases while Weisskopf (1972) confirmed this for 14 out of 17 developing countries studied.

In contrast, Papanek (1972) launched an attack on what he termed 'revisionist' literature.[13] Despite acknowledging that the contribution of these critics had been useful in challenging the 'naïve' optimism of foreign capital inflows, two interesting anti-revisionist arguments were put forward. First, the statistical basis for their conclusions was flawed. This is because the 'proxy' for foreign assistance, the current account deficit, was contaminated. Current account deficits are financed not only by aid, but also private investment, short term commercial borrowing and other sources (p. 935). Second, he alluded to the negative correlation between foreign capital and savings as not being a finding. Since savings were calculated as investments minus foreign capital inflows, such a correlation is 'expected' as long as the marginal effect of foreign resources on investment is less than 1. Papanek found a strongly significant positive correlation between aid and growth in 51 countries over the period 1950-1965.[14]

Newlyn (1973) elaborated on Papanek's main criticism and demonstrated the correct interpretation of negative values of regression parameters in the aid-savings context. Contrary to conventional wisdom, values between 0 and -1 meant 'no change' in the absolute amount of national resources.[15] Such values simply reflected the extent to which resources have been consumed. "Only if the negative parameter value exceeded unity, could it be concluded that aid led to an absolute reduction in the total amount of resources being used for investment". Newlyn argued that most writers had failed to make the above distinction and some have gone a step forward to rationalize such theoretically baseless results (p. 869). To this point, literature generally lacked a broad test of the aid-growth relationship.

The first round of debates in empirical work continued into the nineties. In a comprehensive survey, White (1992) provided a closing argument to this debate. First he contended that in early literature, there is no agreement as to the positive or negative relationship between aid

[13] He referred to Griffin and Enos (1970) as the most notable 'revisionists' who have gone to the opposite extreme from earlier studies by claiming that foreign assistance does not impact growth.

[14] This overall result was not statistically significant when he restricted the sample to the Americas.

[15] Conventional wisdom dictated that values between 0 and -1 meant a reduction in the dependent variable (national resources used for investment to promote growth).

and savings. Rather than explaining the absence of such a relationship, the literature has failed to conclude whether the relationship exists or not (p.223). In addition, he recommended further research into the channels through which aid impacts the macro-economy and a range of appropriate variables in studying the aid-growth link.

3.1.2. Second generation literature

The second era of literature ran from the early 1970s to the early 1990s. During this period there was a shift of focus from investigating the aid-savings link to attempting to directly investigate the aid- growth nexus. In the empirical work, some researchers estimated the link via investment and some directly (bypassing investment) in reduced form equations.[16] Regardless of the choice of growth models, there was a general consensus that investment was the main determinant of growth.

Papanek (1973) became the first to assess the impact of aid on growth after disaggregating investment into its principle components.[17] While employing a similar sample to his earlier article (Papanek, 1972), Papanek made several observations which were sensitive to regional differences. Overall, aid appeared to be the most significant regressor and the combination of foreign inflows and savings explains most of the growth.[18] On the other hand, aid and foreign private inflows were found to be uncorrelated and there lacked a significant relationship between growth and 'other' factors such as education, exports and per capita income. All things considered, these results pointed to what he acknowledged as the weaknesses of cross country analyses and the results were only meant to be suggestive and not conclusive (p. 129).

Mosley (1980) became the first to instrument for aid and thereby address the issue of causality. In his cross country analysis of 83 countries between 1970 and 1977, he found a negative but

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[16] A typical reduced form equation was $\mathbf{g}_{Yt} = \boldsymbol{\lambda}_0 + \boldsymbol{\lambda}_1 \boldsymbol{s}_t + \boldsymbol{\lambda}_2 \boldsymbol{a}_t + \boldsymbol{\lambda}_3 \boldsymbol{f}_{pt} + \boldsymbol{\lambda}_4 \boldsymbol{f}_{ot}$ where s_t is savings, a_t is foreign aid, f_{pt} and f_{ot} are private and other inflows respectively.

[17] These components are the independent variables in the behavioral equation above.

[18] Only results based on Asia and Mediterranean countries were unequivocal (p. 123).

insignificant effect of aid on growth. However, the results were not universal. For example, when Mosley split his sample into 30 'poorest' countries and 53 'middle income' countries, a different pattern emerged. In the 'poorest country' sample, aid was positively and significantly correlated with growth. In contrast, middle income countries exhibited a negative but insignificant correlation. The one conclusion that could be drawn from this article and others that followed in this spirit was that aid may be poorly instrumented. The literature generally provided insufficient information regarding the instruments used or their validity.

The remainder of this era of literature was dedicated to inconclusive debate. Studies with more pessimistic results gained disproportionate attention particularly because they were contrarian. After restricting his sample to low income countries of Sub Saharan Africa (with populations of over a million people) and extending the period of observation to 15 years, Levy (1988) claimed a positive and significant effect of aid on growth. In his article, he addressed concerns over both the harmful effects of averaging annual data and of lagged responses in such studies.[19]

Singh (1985) begged to differ. Singh found aid to have no effect on growth. He deviated from earlier literature in two main ways. First, he explicitly evaluated the impact of a nation's economic intervention policy on growth.[20] Second, and also due to 'claims' of better data availability, Singh compared the effect of aid in the periods 1960-1970 and 1970-1980. However, since the concept of aid employed (official development assistance) was only introduced in 1968, and there were no comparable measures prior to that, there are suspicions over the validity of the author's results. His results were confirmed by the widely cited article by Mosley et al. (1987). Perhaps the most important contribution of Mosley and associates was the use of a different definition of aid: gross Official Development Assistance (ODA), rather than net ODA, without controlling for repayments on aid. They argued that gross ODA was a more

[19] Levy (1998) used two samples, one with annual data (to avoid eliminating substantial random annual effects by averaging) and the other with averaged data (to mitigate the effects of lagged responses).

[20] The subjective measure comprises the state's role in industry (ranging from liberal to state planned economy) and nationalization policy.

'appropriate' proxy of aid on the presumption that it is relieving a savings constraint. In a sample of 81 countries classified by income levels and geography (allowed to vary according to data availability), Mosley et al. found a significant negative effect of aid on growth in the 1960s, a negative but insignificant effect in the 1970s, and an insignificantly positive effect in 1980-83. Once they instrumented for aid using a 3SLS approach, aid again had no effect on growth.[21] In this analysis and several others (e.g. Boone, 1996), it was concluded that aid has no demonstrable effect on growth in recipient countries. Such conclusions gave rise to the micro-macro paradox i.e. aid seemed to show optimistic results at the micro-level (e.g. in evaluating aid funded project performance) but rather pessimistic results (if not ambiguous) were observed at the macro-level.

Hansen and Tarp (2000) disqualified this paradox.[22] They found only one study in their survey which indicated a negative effect of aid on growth. On the other hand, among the remaining 71 analyses, 40 showed a positive impact of aid on growth, while 31 showed statistically insignificant results. Although the results appeared mixed at first sight, a closer inspection of the insignificant results revealed, however, that at least 12 of these were based on regressions, which did not satisfy the minimum requirements for drawing such conclusions. Furthermore, the savings coefficient was found to be insignificant in the large majority of regressions they observed in this period. Instead of maintaining that aid does not work at the macro-level, they put forward a different view that savings do not work. This result led them to express concerns over the appropriateness of the underlying structural model in the particular analyses (p. 385).

3.1.3. New growth theory and third generation literature

The third generation, believed to be inspired by Boone (1994), is more closely linked to the research described in this thesis.[23] It brought several innovations to existing literature. First, the

[21] They reported instrumented results only for the period 1970-1980.

[22] Their survey was based on 131 cross-country regressions from 29 articles, papers and books identified in the literature published from the late 1960s to 1998.

[23] The studies in focus here share a common theoretical background, and while the choices of econometric techniques differ, they have a lot in common from an analytical perspective.

data sets cover more developing countries and years, and are invariably panels. Second, in line with the new growth theory; studies include explanatory variables to control for the economic and institutional environment, which is a departure from earlier literature. These variables are incorporated directly in the reduced form growth regressions alongside 'traditional' macroeconomic variables. The potential endogeneity of aid is addressed through instrumenting and finally, the aid-growth relationship is explicitly seen as non-linear as it is argued that aid has diminishing returns (Hansen & Tarp, 2000).

Boone (1996) found aid to have no significant contribution to investments or human development; but a positive impact on government consumption.[24] As has often been the case in aid effectiveness studies, his results were sensitive to observations. For example, in small countries (or countries where the aid/GNP ratio exceeds 15% of GNP) aid was observed to lead to higher investment. He attributed this to the lack of 'fungibility' of aid flows in such countries. As a second step he examined whether the increased government consumption impacted basic indicators of human development. The premise was that indicators like infant mortality responded quickly to higher consumption and could be considered a 'flash' indicator of improvements in economic conditions of the poor. Yet again he found no significant impact of aid on improvements in infant mortality or any of the other human development indicators employed. This led him to positing that aid flows primarily benefited a 'wealthy political elite'. Ironically, Boone proceeded to conclude that aid programs have not 'engendered or correlated' with the basic ingredients that cause investment and 'growth'.[25]

The work of Boone inspired two distinct strands of literature. The first group agrees (to a certain extent) with the results of Boone that despite the average impact of aid being undetectable across all developing countries, aid may have a positive contribution in some countries in

[24] This is the published version of the widely cited Boone (1994) working paper. It covers over 90 countries between 1971 and 1990. Proxies for human development included infant mortality, primary school rates and life expectancy.

[25] This causal hypothesis would be easy to test by using growth as a dependent variable, but Boone does not make the effort.

various periods. Subsequently, proponents of this school of thought have attempted to identify 'conditions' that make aid effective in different subsets of countries in varying periods. Contrastingly, the second strand of literature argues instead that Boone is wrong. To the naysayers, although aid's impact is not universal, it does have on average a positive impact on growth which is unconditional.

Conditional impact of aid

The underlying goal of this literature has been to provide some insight into why aid is not effective in the typical recipient country (Burnside and Dollar 2000, p. 864). It has been argued by many authors that the 'conditional' strand of the literature has received wide attention and has been very influential in policy circles. Pioneering this strand of literature is the article by Burnside and Dollar (2000)[26]. Their research has supported moves by the World Bank, other bilateral and multilateral donors including governments to be more 'selective' by giving more aid to countries with stronger policies and institutions where aid was thought to have a larger impact on growth (Clemens et al, 2004).

Burnside and Dollar (2000) tested whether an interaction term of aid and a recipient country's economic policy were significantly associated with growth. Their panel dataset consisted of developing countries outside the former Eastern bloc, covering the six four-year periods between 1970 and 1993. The authors employed a new database on foreign aid developed by Chang et al. (1999), in which aid is termed effective development assistance. This new measure consisted of the summation of the grant equivalents of all financial inflows.[27] They drew from recent literature and also incorporated some control variables found to be significant in aid-growth literature. Their dependent variable was the annual real growth rate of gross domestic product (GDP) per capita. The explanatory variables in their growth regression were aid as a percentage of GDP, initial GDP to capture convergence; ethno-linguistic fractionalization

[26] Their findings were initially put forward in Burnside and Dollar (1997), a working paper of Burnside and Dollar (2000).

[27] Refer to chapter 4.2.1 for a discussion on Effective Development Assistance (EDA).

(Easterly & Levine, 1997); number of assassinations per capita (Banks, 2002); an interaction term of ethnicity and assassinations; the Knack and Keefer (1995) measure of institutional quality, based on the International Country Risk Guide Economic rating (ICRGE); the ratio M2/GDP to measure financial depth which was lagged one period to avoid endogeneity (King & Levine, 1993); dummy variables for Sub-Saharan Africa and fast-growing East Asia and a squared policy term. Their policy index comprised the budget surplus, the inflation rate, and the Sachs and Warner (1995) dummy measure of trade openness. Each of these variables was weighted with weights determined by running a regression for GDP growth including the three previously mentioned explanatory variables.

The main conclusion was driven by the statistical significance of the aid-policy interaction term (the main variable of interest). When Burnside and Dollar ran their regression including aid and aid-policy, aid -policy did not enter significantly. However, it became significant following either of two modifications. The first involved an extra interaction term (squared aid –policy), in which case both aid -policy and squared aid -policy gain significance, the former with a positive coefficient and the latter with a negative sign. Alternatively, their point could be made by excluding five outliers. Their results suggested that aid is only effective in promoting economic growth in a good policy environment, but not by itself (unconditionally). Their results provided a strong argument to policymakers who insisted on 'sound' economic policies in aid recipient countries as a condition when giving aid. Burnside and Dollar's famous conclusion sparked responses, some supportive, but most critical.

Hansen and Tarp (2001) were amongst the first to criticize. They made several modifications to the Burnside and Dollar two-stage least-squares (2SLS) regressions, most importantly by adding squared aid to directly capture diminishing returns. Aid -policy was not significant in their results, but aid and squared aid were, both with the expected signs. The implication was that aid is effective on average, but with diminishing returns—regardless of recipients' policies. Hansen and Tarp then criticized the Burnside and Dollar estimation methods for overlooking several standard concerns. They contended that the Burnside and Dollar regression results may be biased as a result of the joint effect of endogeneity of the aid flows, conditional convergence and unobserved country specific factors that correlate with both policies and growth. Failing to control for all such effects could give spurious explanatory power to policy and aid - policy. They suggested using the Arellano-Bond Generalized Methods of Moments (GMM) estimator, which accounts for country fixed effects by first-differencing in addition to incorporating lagged endogenous variables as instruments to deal with endogeneity.

On the other hand, Dalgaard and Tarp (2001) showed that a model with decreasing marginal effects of aid on growth (aid squared) is superior to a policy selectivity model (aid-policy interaction) if the decision is made on the grounds of statistical significance of parameters. By way of conclusion, they warned against evaluations that are based on weak theoretical grounds. Subsequent research also showed that the results of the BD study were sensitive to sample selection. Examples include the studies by Easterly (2003) and Easterly, Levine and Roodman (2004) which extended the BD sample to cover the period between 1970 and 1997, using four year averages and the same controls and methodology as Burnside and Dollar (2000). The authors found that the coefficient on the interaction term between aid and policy was insignificant in the expanded sample, casting doubt on the conclusion that aid works better in good policy environments only.

Collier and Dollar (2002) corroborated the BD results employing a different data set and specification. They addressed key concerns over the practical applications of Burnside and Dollar's results. First they argued that since Burnside and Dollar confined their policy measure to three variables only, it is implausible that those were the only policies that impacted growth. In addition, the authors dismissed any policy conclusion that were drawn from such a narrow sample as that used by Burnside and Dollar. Consequently, they performed OLS estimations only, include former Eastern bloc countries, and use net ODA rather than EDA. Furthermore, they study 1974–97 instead of 1970–93, using 349 growth–aid–policy episodes of four years each, compared to Burnside and Dollar's 275 observations. They dropped all Burnside and Dollar controls except log initial GDP per capita, ICRGE, and period dummy variables. As replacements, the authors added region dummy variables and they defined policy as the overall score from the World Bank's Country Policy and Institutional Assessment (CPIA), a composite rating of countries on some twenty aspects of policies and institutions. The most significant variable in their first regression was the aid-policy interaction, with a positive coefficient, significant at the 1 percent level. Hence, they asserted that the validity of the core Burnside–Dollar result was not due to its particular choice of policy variables and is robust to sample expansion. The CPIA measure of policy also entered directly with a positive coefficient, and marginal significance. However, the coefficient on aid itself was not significantly different from zero. In a second and more frugal specification, they add squared aid but then dropped the linear aid term from their preferred specification as it was found to be insignificant. With all the changes, aid -policy was again significant, as was the quadratic aid term, with the expected negative sign.

Guillaumont and Chauvet (2001) argued that the economic vulnerability of a country influences aid effectiveness and hypothesized that the more vulnerable a recipient country was, the greater the need for aid, and thus the more effective the aid would be. To avoid confusion, they called economic vulnerability 'environment' and economic policy (as per Burnside and Dollar) just 'policy'. In this story, aid acted as an insurance mechanism to countries that were particularly vulnerable to terms of trade difficulties, export instabilities, and climatic shocks. The 'environment' is a composite index of four external forces: volatility of agricultural value added (to proxy for natural disasters), volatility of export earnings (to proxy short term trade shocks), long term terms of trade trend, and log of population (to structure for structural exposure to terms of trade i.e. small countries are more vulnerable to external forces than larger countries). Their specification was distinctive in using twelve year periods, and in its controls, which included population growth, mean years of secondary school education among adults (Barro & Lee, 2000); the Barro-Lee measure of political instability (Barro & Lee, 1994), based on assassinations and revolutions; ethnic fractionalization; and financial depth. In their OLS and 2SLS regressions, the aid-environment interaction term appeared with the expected negative sign, indicating that aid works better in countries with worse environments. The term also outperformed the aid-policy term which was generally insignificant.

Collier and Hoeffler (2004) studied aid and policy reform in the post-conflict growth process. For the growth relationship, they drew upon the analysis and database used in the Collier–Dollar growth regression (Collier and Dollar, 2002). Notwithstanding the limited post-conflict observations (only 34 observations with complete data), the authors formulated three dummy variables to indicate how recent civil war ended. They considered three episodes, the one in which conflict ends and two successive periods. Peace onset was a dummy that assumed the value one in the period when a country goes from civil war to peace. Post-conflict 1 was one in the following period and post-conflict 2 was one in the period after that, assuming that civil war does not recur. The Aid -policy -post-conflict 1 interaction term was significant in their preferred (OLS) specification and this guided them into contending that aid works particularly well in a good policy environment a few years after civil conflict. However, in conclusion, they warned that the confidence in their results should be discounted due to data limitations (p. 1141)

Dalgaard, Hansen, and Tarp (2004) introduced geography into the aid literature and focused on the proportion of a country's area that is in the tropics as a determinant of both growth and the influence of aid on growth. The transmission mechanism as suggested by Easterly and Levine (20003) may include institutions and economic policies. Dalgaard, Hansen, and Tarp thus saw tropical area as an exogenous "deep determinant" of productivity (and ultimately growth) that may even compensate for a bad policy environment. In their regressions, aid and aid –fraction of tropics interaction terms were both significant, the first with a positive sign and the second with a negative sign. Thus, on average, aid seemed to work outside the tropics but not inside them. The result was robust to changes in estimation techniques and the underlying data. The authors concluded that their new interaction term outperformed both the policy interactive term and the quadratic aid term.

Rajan and Subramanian (2011) tell the Dutch-disease (or aid curse) story - aid leads to an overvaluation of the exchange rate which then leads to lower exports and consequently, lower growth. Particular attention was paid to the manufacturing sector where high labour intensity makes it most prone to an overvalued real exchange rate. They employed a sample of 32 countries for the 1980s and 15 countries for the 1990s using OLS in their core specification.[28] Their coefficient of interest was the interaction term between a country-specific aid variable and an industry's sensitivity to the exchange rate effects induced by foreign aid. They posited that countries that received more aid should see a more negative impact in industrial sectors that are more sensitive to the exchange rate effects. Results confirmed their hypothesis that aid inflows have adverse effects on a country's competitiveness, as reflected in the lower relative growth rate of exportable industries. One shortcoming of this article is the failure to provide a direct causal link to economic growth (as opposed to growth of exportable industries).

While many of the interaction effects suggested in this strand of literature are plausible, Roodman (2003) and Easterly, Levine and Roodman (2004) have expressed concern over the qualitative conclusions of a majority of these studies. They found that the significance of the interaction coefficient was frequently not robust to changes in specifications. Roodman's more recent work found that estimates of the interaction term in much of this literature were fragile to influential observations, corrections for autocorrelation, and above all, sample expansions (Roodman, 2007).

Sadly enough it appears that this strand of literature is more concerned about finding robust results on conditions that may hamper growth, than providing solutions to the plight. Burnside and Dollar (2000), for example, promoted aid for countries with good economic policies. While their argument is plausible, they overlooked several critical arguments. One such argument is how aid can in itself lead to better policy environments. Therefore a country with 'bad' polies may improve its policies through aid flows. Dalgaard and associates (2004) on the other hand reached a conclusion which is of no practical use- on average; aid seemed to work outside the tropics but not inside them. At a policy level, the main question then boils down to: should donors stop giving aid to tropical countries?

[28] To tackle endogeneity, they use an instrumentation strategy suggested by Rajan and Subramanian (2008).

Unconditional impact of aid

A majority of advocates of this school of thought argue that Boone's assumption of a linear impact of aid on growth is less realistic than a nonlinear relationship between the two, in which aid is subject to diminishing returns partly due to aid receiving countries having absorptive capacity (Clemens et al., 2004).

Hadjimichael et al. (1995) were the first to allow for a nonlinear effect of aid. The main scope of the study by Hadjimichael et al. (1995) was to investigate the impact of macroeconomic policies, exogenous factors, and structural reforms on growth, savings, and investment in sub-Saharan Africa. According to Hansen and Tarp (2000), there were four novelties compared with earlier-generation work. The regressions included an intercept for each year in the sample and addressed country-wise heteroskedasticity by estimating parameters using weighted least squares. In addition, the potential endogeneity of economic policy and aid was instrumented by lagging most of the explanatory variables, including foreign aid, by one year. Lastly, a squared aid term was included in the regression to capture possible non-linearities in the aid-growth relationship (p. 385). In their 31 country sample between 1986 and 1992, Hadjimichael and associates found a strongly positive impact of aid with diminishing returns.

Durbarry et al. (1998) corroborated the result in an expanded sample of 68 Less Developed countries across 1970-1993. They expressed concerns over aid assessment studies having ignored recent advances in growth theory which allowed for more sophisticated models. Their solution was to use an augmented Fischer-Easterly type model and estimate this using both cross-section and panel data techniques.[29]As well as the typical policy variables, the authors also included other forms of investment finance such as net private capital flows and 'other' inflows (both as ratios of GDP). The cross-sectional results showed that macroeconomic and policy control variables were statistically significant with the expected signs, supporting the findings of Fischer (1991, 1993) and Easterly (1993). The foreign aid coefficient was also positive and

[29] They actually augmented the Fischer-Easterly model (see Fischer, 1991, 1993; Easterly, 1993) and as a robustness test, they re-specified the model as an augmented Barro model (see Barro, 1991; Barro and Sala-i-Martin, 1995).

significant in its linear form but insignificant (with the expected sign) in its quadratic form suggesting that this sample of countries had not reached its aid absorptive capacity. In the panel data results, aid retained its expected sign and significance while the quadratic term now appeared significant. Most importantly, private capital flows appeared to be positive and significant suggesting possible misspecifications in earlier aid-effectiveness studies. The main conclusion was that there was robust evidence that greater foreign aid inflows have a beneficial impact on growth.

Dalgaard and Hansen (2000) and Hansen and Tarp (2000, 2001) also found a strong, unconditional, nonlinear impact of instrumented aid on growth that did not depend on influential observations. Hansen and Tarp (2000) became the first to employ a Generalized Method of Moments estimator in an aid-growth regression. Lensink and White (2001) confirmed the nonlinear impact in a greatly expanded sample of 111 countries for the period 1975-1992, with a 2SLS estimator. Dalgaard et al. (2004) also found an unconditional positive and nonlinear effect of aid in the absence of the aid-fraction of tropics interaction.
Several studies have been categorized under this school of thought because they found an impact of aid on growth not conditioned on some interaction with a recipient country's traits, despite their exclusion of the quadratic aid term.

Lensink and Morrissey (2000) included an indicator of uncertainty in aid inflows constructed by comparing aid commitments and disbursements, and covered a 25 year period. The authors made an interesting distinction between uncertainty (which incorporates information regarding the sensitivity of the economy to shocks) and instability of aid flows. They hypothesized that it is aid uncertainty (or the unanticipated instability of aid flows) rather than the overall instability that affected growth. Their OLS results showed a strongly significant, positive, linear relationship between aid and growth only after controlling for uncertainty. The overall instability measure remained insignificant in all cases.

Clemens et al (2004) demonstrated that not all aid is alike.[30] However, the novelty in the authors' approach was analyzing the impact of aid within appropriate time horizons with a specific interest on short-impact aid. They separated aid that might affect growth over a four year period ('short-impact' aid) from long term aid which only impacts growth in a longer period. In addition they created a third sub-category, aid for humanitarian purposes, which is considered to have the purpose of consumption smoothing and not intended to directly promote long-term growth (e.g. emergency food aid during calamities). The authors reported a positive relationship between short-impact aid and economic growth (with diminishing returns) over a four-year period. It is also worth noting that the impact was two-to-three times larger than that found in studies using the aggregate measure of aid. The results were highly statistically significant and robust over a wide variety of specifications, time periods, and estimation techniques. Interestingly, the basic result was independent of initial levels of income, institutional quality and quality of policies even though good institutions and policies only increase the significance of the variable of interest.

More recently, Rajan and Subramanian (2008) re-examined the cross-country evidence of the effects of aid on growth. Of particular interest was their instrumentation strategy which stood out from earlier literature. The key idea behind their instrumentation was to model the supply of aid based on donor-related rather than recipient-specific characteristics. In other words, they based their instruments on considerations that drove individual donors' allocation decisions rather than those related to a recipient country's level of income or growth. Nevertheless, the authors found a tenuous link between foreign aid inflows and subsequent economic growth. They tested the robustness of the aid-growth relationship using different lags of aid, different time frames, multi- and bilateral aid, types of aid, short- and long-term impact of aid, different samples, and cross-section and panel specifications. The evidence of aid effectiveness was described as weak, whether the aid variable is interacted with policy, institution or even geography variables. The authors expressed concern that cross-country growth regressions may be 'plagued' by noise in the data which causes such tenuous links which are far from conclusive.

[30] Disaggregating aid is not new to aid-growth literature. See Mavrotas (2002, 2003).

One way of ameliorating this problem as suggested by Rajan and Subramanian is by a paradigm shift away from traditional aid-effectiveness studies, towards pursuing direct evidence of the channels through which aid might help or hinders growth (p. 660)

Overall, the literature often succumbs to a cycle in which one paper finds a result, and is followed by another paper disqualifying the previous results and so on. The conclusion from this literature is that several aspects of the aid-growth relationship need to be further investigated to reach conclusive results. First, a better theoretical understanding of the determinants of aid allocation and its links to growth will help in improving methodological issues especially in determining which explanatory variables to include in regression analyses. Moreover, the transmission mechanisms through which aid affects growth need a closer examination.

3.2. Public spending

Once we control for political, social and cultural factors, how much governments can spend depends on their domestic revenues, ability to borrow from international and domestic sources, and external development assistance. In this section literature is explored to demonstrate how each of these sources of public spending affects public spending levels, which in turn impact growth.

3.2.1. Aid volatility and growth

The issue of aid volatility is relatively new to literature. Aid inflows are important determinants of investment decisions (for this study, public spending) that in turn influence growth. Likewise, as noted by Lensink and Morrissey (2000), aid is an important component of recipient government revenues and hence its volatility may negatively impact on fiscal behaviour, which in turn may hinder growth.

Several papers have underlined the problems induced by aid volatility. Perhaps the most cited results in this debate are from the study by Lensink and Morrissey (2000). The authors did not provide theoretical relevance of aid instability, but offered plausible explanations as to why it may be important. Their hypothesis was intuitive- foreign aid is much more effective when the inflow is expected because uncertainty affects investment behaviour. When confronted with uncertainty, investors will more likely postpone if not cancel their investments. Furthermore, they hypothesized that it is aid uncertainty (or the unanticipated instability of aid flows) rather than the overall instability of aid that affects growth. Since aid commitments are generally predetermined, and due to the expected continuity of donor-recipient relations, knowing past values of aid inflows enables recipients to anticipate some variability in aid. They constructed the uncertainty proxy by calculating, for each recipient country, the standard deviation of the residuals of aid forecasting equations. The merit of the uncertainty measure is that it captured unanticipated changes in aid, whether due to external shocks or actions by donors or recipients. In doing so, the proxy captured the volatility that is presumed to have a negative impact on investment, and as a result on growth. Their sample covered developing countries over a 25 year period. Their OLS results showed a significantly negative, linear relationship between public spending and the uncertainty.[31]

Other studies have noted that aid is often among the most volatile sources of foreign exchange income. For example, Bulír and Hamann (2003) used a sample of 72 countries over the period 1975-1997, to perform a comparative analysis of the volatility of aid flows and the volatility of domestic revenue in aid recipient countries. In line with earlier studies, they found that aid was substantially more volatile than fiscal revenue and that its volatility increased with the degree of aid dependency as measured by the aid-to-revenue ratio.[32] Furthermore, the authors confirmed the tendency of foreign aid to be procyclical- that is recipient countries received more aid during economic upturns. Lastly, and perhaps more importantly, they found that the information content of aid commitments was very small or statistically insignificant especially in countries with high aid dependency ratios.

[31] The overall instability measure remains insignificant in all cases.

[32] Earlier studies (e.g. Gemmell & McGillivray, 1998; Pallage and Robe, 2001) have reached a similar conclusion.

One key drawback of the literature up to this point was that it used a single aggregate measure of aid. However, it is plausible to hypothesize that different types of aid may have varying degrees of volatility. Fielding and Mavrotas (2005) addressed this problem by disaggregating aid into project aid and programme aid. They hypothesized that the volatility of project aid (sector-specific aid) is more detrimental to growth than that of programme aid (non-sector specific) since the former is intended for capital formation. In a sample of 66 countries spanning the period 1973-2002, they found that project aid and program aid were positively correlated, with programme aid being more volatile. The authors failed to assess their initial hypothesis on the impact of the volatility of sector and programme aid on economic growth in low-income countries.

Hudson and Mosley (2008) advanced the literature by assessing the impact of aid volatility on GDP shares of expenditure. Their sample covered 131 developing countries over the period 1977–2001. A major novelty in their study was the distinction between positive and negative aid volatility. They argued that positive volatility represents sudden surges of aid and has the potential of reducing aid effectiveness due to absorptive capacity constrains while negative aid volatility (sudden declines in aid) may result in projects being abandoned and can disrupt government budgetary planning, thus reducing aid effectiveness. In addition, Hudson and Mosley hypothesized that capacity constraints will be most related to investment and least to consumers' expenditure, whilst the disruption caused by negative volatility will affect the least flexible type of expenditure (p. 486). The authors regressed GDP expenditure shares on a vector of variables including aid volatility. Their results showed evidence of absorptive capacity. Positive volatility significantly reduced the shares of government expenditure, investment and consumers' expenditure at the 1% and 5% levels respectively while not affecting exports. Similarly, negative volatility significantly reduced the different GDP shares of expenditure the 1% and 5% levels respectively, but substantially increased the share of consumption.

3.2.2. External debt and growth

According to Hepp (2008), the theoretical literature on the relationship between external debt and growth has largely focused on the concept of debt-overhang. Krugman (1988) defined debt-overhang as a situation where the existing 'inherited' debt is sufficiently large that creditors have no expectations to be repaid (p. 254). In this situation, the high stock of debt acts like a marginal tax on investment. "It removes the incentives for investors and debtor governments from investing at home where any positive returns from investment projects are used for debt payments. Anticipating this, however, economically sensible investment projects will be forgone, thus harming the long-term economic growth rate of the debtor country (Hepp, 2008, p. 5)". While the original debt-overhang theory centered on the adverse effects of external debt on fixed capital formation, subsequent research showed that the theory of debt-overhang could be extended to cover other economic aspects.

For example, Clemens et al. (2003) cautioned that a high level of external debt could also dis-incentivize a debt-ridden government from undertaking austerity measures such as economic and structural reforms, since any progress with the reforms will likely 'intensify pressures to repay foreign creditors'. Such dis-incentives are unique to low-income nations and are a cause of concern to these countries, where an acceleration of structural reforms is needed to sustain higher growth to meet the Millenium Development Goals (p. 4).

While the debt-overhang hypothesis may seem attractive as an explanation for the observed poor economic growth and investment, the empirical evidence on the existence of a debt-overhang is not conclusive (Djikstra &Hermes, 2001). A thorough review of the empirical evidence reveals a scarcity in studies that have econometrically assessed impact of the debt stock on growth in low income countries. A majority of the studies employed reduced-form growth equations where external debt is presumed to affect growth both directly (by reducing the incentives to undertake structural and fiscal reforms), and indirectly through its effects on investments (Clemens et al., 2003)[33]. In his empirical study of 35 sub-Saharan African countries, Fosu (1999) found support for the debt-overhang hypothesis. The author's results were corroborated by Chowdhury (2001) who also found evidence of the existence of the debt-overhang theory. He used extreme bounds analysis for sensitivity tests and the mixed, fixed, and random coefficient approach that allowed for heterogeneity in the causal relationship between debt and growth on two separate country groups (HIPC and non-HIPC). The results were robust across the two country groups for all of the four debt variables employed in the study.

In contrast, Hansen (2001) found that the inclusion of three additional explanatory variables (the budget balance, inflation, and openness) in his sample of 54 developing countries led to a rejection of any significant relationship between external debt and growth. In similar vein, Savvides (1992) found that the ratio of debt to GNP had no statistically significant effect on growth.

Pattillo et al. (2002) started a new chapter in the literature by examining non-linearities in the debt-growth nexus. The authors advanced literature by isolating the channel through which debt effects growth. This was achieved by controlling for potential crowding out (using a debt service as a proxy); in addition to the debt-overhang effect which was proxied with a variable representing the burden of future debt service (i.e. debt stock). Using a panel data set comprised of 93 developing countries for the period 1969-1998, they suggested that at a debt stock level of 35-40 percent of GDP (160-170 percent of exports), the average effect of debt on per capita GDP growth became negative. The results were robust across different estimation methodologies and specifications.

[33] In addition, the authors argued that debt overhang affects growth (via investment) by increasing uncertainty. As the external debt stock grows, governments may resort to distortionary measures such as inflation tax to meet their debt obligations.

Clements et al. (2003) confirmed their results of a debt-overhang in a comprehensive study. Their study examined the channels through which external debt affected growth in low-income countries using a sample of 55 low-income countries that are classified as eligible for the International Monetary Fund's Poverty Reduction and Growth Facility. Moreover, they found that debt service crowded out public spending, hence retarding the GDP per capita growth rates of countries in their sample. The direct effects of the debt relief initiative would be to raise GDP growth rates in some HIPC countries by half a percentage point annually if the 'freed' resources could be redirected towards public spending. Moreover, reductions in debt service obligations could also provide an indirect boost to growth through their effects on public spending. "If half of all debt-service relief were channelled for such purposes (holding the budget deficit constant), then growth could accelerate in some HIPCs by an additional 0.5 percentage point per annum (p. 18)". Since access to international capital markets is an issue for many poor countries, the impact of external debt on growth can be different in such countries relative to emerging economies. Clements et al. (2003) proposed additional research to further explore the channels through which debt affects growth (both directly and indirectly) across these two country groups and assess the impact on growth.

3.2.3. Tax revenue volatility in SSA

The primary concern associated with tax revenues instability in Sub-Saharan Africa is that it may result in public spending instability which is a 'grave' concern for SSA countries since it is detrimental to growth (Ebeke &Ehrhart, 2011). Moreover, these countries are often without access to international financial markets which makes it difficult, if not impossible to stabilize their revenues.

Due to the uncertainty that revenue instability creates, it can be argued that the ability of governments to provide public goods is weakened by the volatility of their revenues (Ebeke &Ehrhart, 2011). However, as Barro (1979) suggested, public spending should be stabilised and based on permanent volatility rather than the temporary component of volatility. As a result, public spending should not be affected by tax revenue cycles. However, in a sample of 51 developing countries from 1970 to 2002, Akitoby et al. (2006) demonstrated that the public investment component is the most erratic category of public expenditure in developing countries. This can be explained by various reasons (Thornton, 2008; Ebeke & Ehrhart, 2011):

The first set of reasons relates to the political economy. Governments often encounter political pressures to increase their spending during economic upturns, and this is usually reversed during low-growth periods where high spending cannot be justified nor sustained. Alternatively, governments often lack the ability to ascertain whether the revenue cycles will be temporary or permanent. For the above reasons, one can expect a significant positive effect of tax instability on public spending instability. This instability of government expenditures in developing countries might contribute to reducing the mean level of public spending (Talvi, 2005; Thorthon, 2008).

On the contrary, a number of studies have identified a positive relationship between procyclical fiscal policy and the size of the government (e.g. Akitoby et al. 2006, p. 919). The expenditure category which is mostly affected by volatility is the current public expenditures, that is, government consumption (Ebeke &Ehrhart, 2011). The public spending category on the other hand is not as sensitive to volatility. Akitoby et al. (2006) contended that governments of developing countries are more prone to slashing capital spending relative to other spending categories during economic downturns. The authors concluded that elasticity of capital spending to GDP is relatively high; implying that governments expand public spending proportionally more during economic upturns, or reduce such outlays disproportionately during economic downturns (p. 919). According to Ebeke and Ehrhart (2011), this can be partly ascribed to the lower costs pertaining to reduction of public spending compared to a similar reduction in components of current spending like wages and salaries. The authors hence hypothesized a negative association between public spending instability and its level, which is detrimental for the long-term capital accumulation.

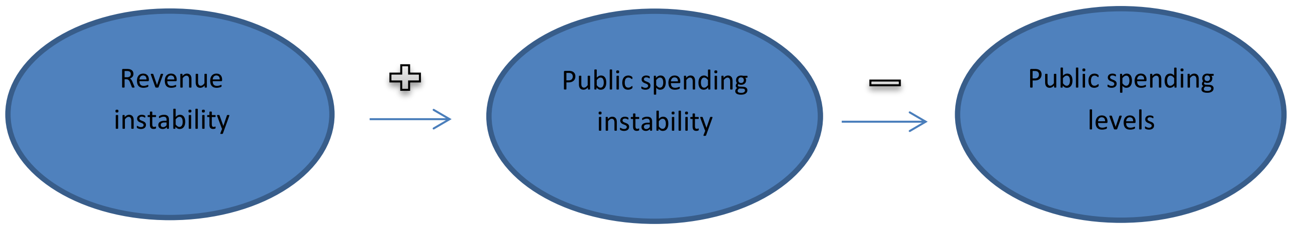

Figure 2: Transmission of revenue instability on public spending levels

Several studies in literature have tackled the problem of revenue volatility. Lim (1983) is believed to provide the first empirical test for the link between revenue instability and public spending instability. He concluded that tax revenues instability was the main cause of spending instability in 45 Least Developed Countries (LDCs) over the period 1965-1973. While he acknowledged that foreign reserves and other forms of external borrowing played a pivotal role in reducing some of the instability, he also suggested further research into the subject (p. 450).

Bleaney, Gemmel and Greenaway (1995) analysed the sources and the consequences of revenues temporal instability in developing and less developed countries. Tax revenue instability was found high in open LDCs especially where output variance and inflation were rampant. Moreover, the authors' results showed that countries with high tax revenue instability also had high total expenditure instability. Unlike Lim (1983), the authors found evidence of foreign borrowing being geared more towards financing expenditure increases rather than stabilising revenue cycles.

More recently, Ebeke and Ehrhart (2011) repeated the exercise with the aim of analysing tax revenue instability in a panel of SSA countries over the period 1980-2005, and its effect on public spending instability, government consumption instability and the public spending levels. Their study used a recent dataset on the composition of the tax revenues compiled by Keen and Mansour (2010). Employing different models and different specifications, the authors established that the instability of tax revenues in SSA led to public investment and government consumption instability in their sample over the covered period. Subsequently, the instability negatively impacted the public investment ratio and was detrimental to the long term economic growth. The authors went a step further by investigating the two means available to governments to deal with the tax revenue instability i.e. foreign aid and indirect domestic taxes. Foreign aid was found to reduce the elasticity of spending shocks to tax revenue shocks. While a full offsetting effect of the impact of tax revenue instability only occurs for levels of foreign aid per capita higher than the sample mean level, on average foreign aid enabled absorption of 84% of the destabilizing effect of the instability of tax revenue on public investment instability (compared to the extreme case of a zero aid situation) (p. 13).[34]

With regards to taxes, the most important result was that the high dependency on trade taxes was a significant and positive determinant of the instability of tax revenue in SSA and this appeared to be robust to the alternative specifications used. On the other hand, the dependency on domestic taxes had a stabilizing effect. Hence, the authors concluded that the departure from trade taxes toward indirect domestic taxes in developing countries is beneficial for limiting tax revenues instability.

[34] This result with regard to the destabilizing effect of foreign aid was only reported in the working paper of Ebeke and Ehrhart (2011).

Chapter 4: Empirical model overview

Before going into details about the setup of the regression analysis, a brief overview of the issues addressed in the empirical exercise is necessary. Two main questions are being addressed in this study. The first is whether sources of public spending influence public spending levels. Second, are growth rates of GDP per capita influenced by the sources of public spending? The former is investigated using the entire SSA sample of 30 countries. Due to data constraints, the latter is investigated using a sample of 24 countries. As seen in the previous chapter, there is a plethora of literature investigating the link between aid and growth rates. This study is – to the best of my knowledge – the first study of those reviewed that explicitly incorporates public spending into the aid effectiveness framework.

4.1. The Public spending model

Research on the determinants of public investment in developing countries is very limited (Clemens et al., 2003). Tanzi and Davoodi (1997) model the public investment ratio for a wide range of countries as a function of corruption, GDP per capita, and the government revenue. The authors' results suggested a positive relationship between corruption and public investment. They concluded by warning economists to refrain from supporting high public spending programmes in corrupt countries.

Sturm (2001) focused on developing countries and modelled public spending using a combination of structural, economic, and politico-institutional variables. The author found politico-institutional variables (such as political stability) insignificant in explaining public investment in developing economies, in contrast to structural and economic variables (Strum, 2001 in Clemens et al., 2003).

In the empirical analysis of public spending, the present study follows Clemens et al (2003) by excluding institutional variables whose significance in explaining public investment is questionable. Recent work has not found these variables to be of significance in explaining public investment in developing countries (Clemens et al, 2003). Moreover—and more importantly—is that given the lack of available data, inclusion of these variables would significantly reduce the number of observations in this study.

The following public spending equation is estimated:

$$pbinvest_{it} = \beta_0 + \beta_1 aid_{it} + \beta_2 rev_{it} + \beta_3 xdebt_{it} + \beta_4 dservx_{it} + \beta_5 aidvox_{it} + \beta_6 revvox_{it} + \beta_7 pbvox_{it} + \beta_8 aiduncert_{it} + \propto_i + \emptyset_t + \varepsilon_{it} \quad \textbf{(Equation 1)}$$

where

pbinvest = Public spending (% of GDP).

aid = Aid (% of GDP).

rev =Central government revenue (% of GDP).

xdebt = External debt stock (% of GDP). Expressed in natural logs.

dservx = Debt service (% of GDP).

aidvox = aid volatility. Expressed in natural logs.

revvox = Central government revenue volatility. Expressed in natural logs.

pbvox = Public spending volatility. Expressed in natural logs.

and aiduncert = aid uncertainty.

The wisdom behind the model is very intuitive. Public spending is financed by central government revenues, foreign aid and external debt - and should hence be a function of the 3 sources of financing. It is acknowledged that any reasonably complete model would need additional variables to explain public spending. However the primary focus of the study is the impact of sources of public spending on growth therefore a very partial analysis may be justified.

4.2. The Growth model

To empirically address aid effectiveness with respect to growth, a model that is relatively standard in the aid-growth literature is employed[35]. The aim is to account for a range of socio-political, institutional, and economic factors that can help to explain the growth performance of

[35] This specification has been used in almost all of the reviewed ‘third generation’ studies. Refer to chapter 3.1.3.

poor countries, to ensure that any inferences about the relationship between aid and growth are robust [Burnside & Dollar, (2000)]:

$$y_{it} = \propto_0 + X'_{it}\beta_x + Z'_{it}\gamma_z + \propto_i + \emptyset_t + \varepsilon_{it} \qquad \textbf{(Equation 2)}$$

Where y_{it} is the average growth rate of GDP per capita; X'_{it} and Z'_{it} are vectors of variables of interest and control variables respectively; $\propto_i$denotes country fixed effects; $\emptyset_t$ is a time dummy; and $\varepsilon_{it}$is an i.i.d. error term.

Dependent variable	**Variables of interest**	**Control variables**
GDP per capita growth	Aid	Per capita GDP $_{t-1}$
	Debt stock	Financial depth $_{t-1}$
	Debt service	Institutional quality
	Aid volatility	Freedom
	Aid uncertainty	Land area in tropics
	Revenue volatility	Aid squared
	Public spending volatility	

Figure 3: The Growth model: summary of variables

4.2.1. Defining Aid

It is imperative to have a precise measure of aid flows before assessing the potential effects the inflows have on development. The conventional measure of aid flows is the Net Official Development Assistance (Net ODA) statistic compiled by the Development Assistance Committee (DAC) of the Organization for Economic Cooperation and Development (OECD). It measures the net resource transfer from the donor's perspective, i.e. disbursements minus amortizations.[36] In spite of its popularity, the statistic is far from perfect in concept.

[36] Full definitions of variables are provided in appendix B.

One major shortcoming of ODA stems from the OECD 'all-or-nothing approach' employed in the inclusion of specific flows (Chang et al., 2002). For example, to be considered ODA, a concessional loan must have a grant element of at least 25 per cent. What is recorded however is not the grant equivalent of a loan (i.e. the product of the face value of the loan and grant element), as one might expect, but rather the full value of the loan in the year it is disbursed. Loans which don't meet this criterion are discarded. The former choice tends to overstate total aid, while the latter tends to understate it.

In a World Bank working paper, Chang et al. (1999) proposed a new approach that corrects the methodological shortcomings of conventional aid measures. The 'conceptually superior' Effective Development Assistance (EDA) is the sum of the grant equivalents of all development flows disbursed in a given period.[37] It is argued that in addition to addressing the 'all-or-nothing approach', this new measure also addresses another shortcoming of Net ODA which is the deduction of amortization payments.[38]

Despite its shortcomings, the aid variable used in this study is Net ODA. Net ODA is preferred for two main reasons - one because EDA is not a published aid figure and while it is acknowledge that it is a better measure of aid, its computation is beyond the scope of this study.[39] It is also worth noting that the EDA and ODA measures are highly correlated and that the choice between the two measures should make no significant difference in estimations (Dalgaard & Hansen 2001; Easterly 2003).

[37]"The grant equivalent of a financial flow is the amount that, at the time of its commitment, is not expected to be repaid, i.e., the amount subsidized through below-market terms at the time of commitment (Chang et al. 2002, p.202)."

[38] The reader may wish to consult Renard and Cassimon (2001) for a useful critique of aid measures with a broader scope than the present study.

[39] See Chang et al. (1999).

4.2.2. Variables of interest

The variables of interest include aid, debt variables, and volatility variables. The general model also includes squared terms for some of these regressors. Together with the variables of interest, these regressors form the response surface in a second-order polynomial regression (Hansen & Tarp, 2000). Apart from the public spending and revenue instability variables, other variables of interest included in the regression are not new in the aid-growth literature.

Foreign aid is assumed to be growth enhancing via public investment. It can either free up or provide additional resources for public investments that would otherwise be forgone due to a lack of resources (Hepp, 2008). Likewise, Arsanalap and Henry (2004) argue that aid promotes growth by supporting recipient countries in building the necessary institutions and infrastructure to eventually make them attractive investment destinations.

The set of variables of interest is complemented with the ratio of debt service to GDP and debt stock to GDP. The former is expected to have a negative coefficient, as high debt servicing could prevent a country from devoting resources to productive activities (crowding-out hypothesis). On the other hand, the ratio of debt stock to GDP is included to capture debt-overhang hypothesis, and determine whether the marginal impact of debt on growth becomes negative beyond a certain threshold level (non-linear relationship).

The standard growth equation is augmented with volatility variables. A negative relationship between growth and the volatility variables is hypothesised. In the spirit of Ebeke and Ehrhart (2011), a revenue instability variable is included[40]. Instability is measured as a rolling standard-deviation of the growth rates of the corresponding variables (in % of GDP) over 4-year overlapping sub-periods. Instability is stated in logarithmic terms.

From Lensink and Morrissey (2000), the present study borrows the aid uncertainty variable. Aid uncertainty is measured as the standard deviation of the error term in a second order auto

[40] Instability and volatility are used interchangeably.

regressive (AR) process.[41] It is further assumed to be time invariant. The merit of the uncertainty measure is that it captures unexpected changes in aid are presumed to have a negative effect on public spending, and therefore GDP per capita growth.

4.2.3. Control variables

Following the literature, a set of control variables (which are assumed to be exogenous with respect to growth) is included:

The first control variable is conditional convergence derived from the Solow (1956) model. The model predicts that economies have a tendency of converging towards a steady-state path, and that while the path is determined by technological progress; its level fluctuates because of variables such as the savings rate and population growth rate (McQuinn and Whelan, 2006). It is argued that growth rates in SSA countries will depend on the initial income levels of the countries. Conditional convergence effects are captured by including the initial (lagged) level of real GDP per capita.[42] The variable is expected to have a negative sign suggesting the convergence towards a steady-state path.

An aid squared term is included to control for non-linear effects of aid (diminishing returns to aid). A non-linear relation between aid and growth can be explained by various theories. Durbarry et al. (1998) attributed the non-linear effect to limited absorptive capacity and Dutch disease problems (aid curse), the latter being a view shared also by Rajan and Subramanian (2011).[43] On the other hand, Hepp (2008) ascribed diminishing returns to aid dependence i.e. governments relaxing their efforts for revenue collection due to substantial and sustained aid

[41] $Aid_t = b_0 + b_1 Aid_{t-1} + b_2 Aid_{t-2} + \varepsilon_t$

[42] This variable is measured as a natural logarithm of the initial GDP figure.

[43] "When resources are spent on the non-traded sector, rather than on imports, it could raise the country's real exchange rate in the short run and make it harder for the country to export. If aid does not increase the supply of non-traded goods, the country's real exchange rate could be permanently higher, leading to a long-run loss of competitiveness proportional to the aid received and spent (Rajan and Subramanian, 2005, p. 4)."

inflows. It seems reasonable to assume that SSA countries may suffer from diminishing returns to aid.

M2/GDP is used as a proxy for financial depth (King & Levine, 1993). Because of concerns over the endogeneity of the variable, it is lagged one period.

In studying the relationship between institutions and growth, researchers have used a number of different measures of institutional quality:

The measure for institutional quality follows from the work of Knack and Keefer (1995) and is a composite of three equally weighted measures - bureaucratic quality, law and order, and corruption. However, since the present study requires institutional quality measures that are available over a longer span of time, the study replicates the measure using similar variables from the Political Risk Services International Country Risk Guide (PRS ICRG).[44] The PRS ICRG has the advantage of having data available for many developing countries dating back to the 1980s. Unlike in some papers (such as Burnside & Dollar, 2000) were this measure is assumed to be time invariant (mainly due to lack of data); the present study argues the contrary. The lower the risk point total, the higher the risk, and vice versa.

The variable "restriction on freedom" or freedom is used as a proxy for the political system and the degree of a democratic process. It is measured as the combined average of political rights and civil liberties on a one-to-seven scale, with one representing the highest level of freedom and seven the lowest.

Moreover, recent cross country analyses of economic growth have incorporated physical geography in an attempt to explain whether geographical endowments influence

[44] The ICRG model allows users to make their own risk assessments based on the ICRG model or to customize the model to meet their unique specifications. If particular risk factors are of greater importance to the user, composite risk ratings can be recalculated by giving greater weight to the preferred factors.

development.[45] Following Dalgaard et al. (2004), land area in tropics (which measures the percentage of the land area in a tropical climate zone) is included. This variable is presumed to contain information regarding differences in productivity and in the evolution of institutions. Sub-Saharan Africa is the most tropical (highest proportions of land and population in the tropics) of the world's major regions, and tropical regions in general lag far behind temperate regions in economic development (Bloom & Sachs, 1998, p. 211).

[45] See Sachs (2001) or Easterly and Levine (2003) for more on the influence of geography on economic development.

Chapter 5: Data

5.1. Missing data

Missing data is a major obstacle in econometric studies involving African countries, having serious implications on the robustness of results. Several options are available to deal with the missing data problem. The practice of listwise deletion (available in most statistical packages) involves excluding entire cases with one or more missing observations from the data sample, has become standard in many studies. Such treatment of missing data can reduce the sample size and also introduce bias to the sample where remaining cases are not representative of the full sample. Mean imputation is an alternative technique which replaces missing data with the average for the observed values for that particular variable. This method reduces the variance of the variable in question as well as potentially impacting on its relationship with other variables in the analysis (Anderson et al, 1983).

The present study employs the multiple imputation technique of Honaker and King (2010) in order to adjust the data sample for missing data. The technique estimates or imputes missing data using a predictive model that incorporates both the available information and any prior knowledge of the data and the relationships between the variables. Multiple possible complete data sets are generated by the model and the expected value for any missing observation is the mean value of these multiple imputations. Each of these data sets can be analysed individually or the results combined using the approach of Rubin (1987). The use of multiple rather than single imputations for missing observations is deemed more appropriate in providing more robust standard error across the estimated values (Honaker and King, 2010).

5.2. Data overview and sources [46]

The public spending model sample contains 30 countries while the growth model sample covers 24 countries within the SSA region. Both models cover the time period 1990-2005. The time period will be further subdivided into four 4 year period averages i.e. period 1 (1990-1993),

[46] Refer to appendix B for a complete description of all variables and sources of data.

period 2 (1994-1997), period 3 (1998-2001), and period 4 (2002-2005). The averaging of data and subdivision is in line with the study's methodology discussed in the next chapter.

Data on per capita GDP, the growth rate of per capita GDP, exports (as a percentage of GDP) and population are taken from the World Bank publication, African Development Indicators (ADI) 2010. Data on the inflation rate and M2 are also available in ADI 2010 publication, but for the purposes of this study were taken from the International Monetary Fund's International Financial Statistics datasets. The aid variable used in this study is net official development assistance (net ODA) provided by the OECD. The budget balance and revenue data are compiled by World Bank country economists for the ADI 2010 publication. The two terms (as percentages of GDP) are computed by the author.

The measure for institutional quality is similar to that of Knack and Keefer (1995) and consists of the sum of three equally weighted measures - bureaucratic quality, law and order, and corruption – all taken from the Political Risk Services International Country Risk Guide (PRS ICRG) and recomputed by the author.

The restriction on freedom variable is the average of the measures for political rights and civil liberties from the Freedom House World Country Ratings 2011.

Finally, the variable describing the percentage of land area in the tropics is from the geography datasets of the Center for International Development (CID) at Harvard University.

Chapter 6: Methodology

6.1. Issues in growth theory methodology

In this sub-chapter, I will briefly outline the estimation problems, and then comment on the study's estimators of choice. The estimators offer a reasonably robust solution in light of the problems that will be discussed hereafter.[47]

Aid effectiveness literature has come a long way and has seen major methodological improvements over the last four decades. While earlier literature addressed a variety of issues, Hansen and Tarp (2000) argued that the 'third-generation' studies represent a distinct step forward in empirical cross-country work on aid effectiveness (p. 386).[48,49] Despite the progress made, it is a known fact that cross-sectional regressions have statistical limitations which can have a significant bearing on the results. Four key drawbacks exist in cross sectional regressions involving aid effectiveness.

The first drawback is the issue of business cycles. While previous literature generally averaged data using 3 to 6 year periods to get a more balanced panel, there are concerns regarding loss of information contained in the annual data when using such an averaging technique. Hepp (2008) emphasized that this likelihood increases when there are dramatic changes in the variables of interest over short time periods. In addition, Hepp expressed doubt over the practice of averaging data to deal with business cycles which may vary widely across countries as well as over time. Hansen and Tarp (2000) argued that the solution to this problem of

[47] The methodology used in aid effectiveness literature relies heavily on advanced econometrics. While the present study touches briefly on some of the issues, the reader may wish to consult Wooldridge (2002) for a broader and more useful econometric analysis of panel data.

[48] Third generation studies were inspired by Boone (1996) and Burnside and Dollar (1997) in a working paper of the popular Burnside and Dollar (2000) article.

[49] While there are more recent articles (See Tarp, 2006; Roodman, 2007; Doucouliagos & Paldam, 2009; Hauk & Wacziarg, 2009 and Rajan & Subramanian, 2011 to mention a few), there have not been major methodological improvements.

business cycles is one of the novelties of the 'third generation' studies. The panel data structure is used to remove the world business cycle by including time dummies/intercepts in each of the averaged periods. "These time-dummies capture the effect of shocks that are common to all of the countries in each of the years, but not captured by other included variables (p. 386)."

The second issue to account for is country-wise heteroskedasticity. The fact that the panel is unbalanced is one reason to expect country wise heteroskedasticity which affects regression inferences. To account for country-wise heteroskedasticity, Hadjimichael et al. (1995) estimated parameters using weighted least squares (WLS. The method involves first weighting the data by dividing the dependent and independent variables for each observation by the standard deviation of the dependent variable conditional on the independent variable i.e. $\sqrt{Var\ (Y_i|X_i)}$. Subsequently, the regression is applied to the weighted data. However, lately it has become more popular to estimate parameters by regression techniques even when heteroskedasticity is suspected or tested to be present. This is achieved by adjusting the standard errors and test statistics so that they are valid in the presence of arbitrary heteroskedasticity. Since these standard errors are valid whether or not the assumption on homoskedasticity holds, this method is much easier than a WLS procedure (Wooldridge, 2002). For this reason, Burnside and Dollar (2000) amongst others used heteroskedasticity-consistent standard errors. [50]

Furthermore, there is a problem of biased estimates when using OLS. This bias is attributed to the potential endogeneity of aid with respect to growth. One way of describing the potential endogeneity is by thinking of the aid allocation decision by donor countries. Simply put, donor countries may incentivize a recipient country with a high level of GDP growth by rewarding additional foreign aid. Simultaneously, donors may wish to assist slow-growing poor countries with additional aid (Hepp, 2008). The way Rajan and Subramanian (2008) see it is "if donors are

[50] Burnside and Dollar (2000) applied White's heteroskedasticity-consistent standard errors and Newey and West heteroskedasticity- and autocorrelation- consistent standard errors where they found evidence of serial correlation in the estimate residuals.

motivated by suffering in the recipient country, the lower the growth (and the more the suffering), the greater the desire to give aid to alleviate it. Thus there might be a negative correlation between aid and growth. Conversely, if donors are motivated to give to successful recipients, one might see a positive correlation between aid and growth (p.647). "Turning to the other regressors which include central government revenue and external debt, it can be argued that all of these components are potentially be correlated with the growth rate. As a matter of practice, one may apply standard regression techniques, but the estimates obtained from the regressions will be inconsistent due to the likely correlation between the independent (explanatory) variable and the stochastic disturbance (error) term. The simplest procedure, and one that has been used extensively in literature to correct for this, is to use lagged values, a procedure known as instrumentation. Instrumentation seeks to find a 'proxy' for the stochastic explanatory variable such that, although resembling the explanatory variable (by being highly correlated with the explanatory variable), it is uncorrelated with the stochastic disturbance term. Rajan and Subramanian (2008) suggest minimizing endogeneity associated with the regressors in panel studies by using values of the potentially endogenous regressors that are for the beginning of the relevant time period, while exogenous variables are averaged over the relevant time horizon. However, they warn that there is no 'perfect' instrumentation method due to inherent difficulties in the instrumentation variable procedure. Previous literature has recognized the problem of endogeneity. Most of the more recent aid effectiveness studies test for biases in the estimated parameters resulting from the potential endogeneity of aid. The studies test for endogeneity of aid using variations of the Durbin-Wu-Hausman test. According to Dalgaard et al. (2004), most studies accept the null hypothesis of valid inference from OLS regressions, with Dalgaard and Hansen (2001) as the exception. [51]On the other extreme, Hansen and Tarp (2001) contended that both estimators (OLS and IV) are not consistent suggesting that the test statistics are invalid tests for endogeneity of aid in the growth regressions. It is in their

[51] For example, in the Burnside and Dollar (2000) study, the test statistics revealed that OLS estimates were not significantly different from instrumental variable estimates in the growth regressions when the aid regressors are treated as endogenous variables. Subsequently, endogeneity of aid is accounted for using an IV procedure, while endogeneity of the policy variables was tested and found insignificant.

view that most of the explanatory variables included in the recent aid effectiveness studies are, likely endogenous.

Moreover, the problem of unobservable heterogeneity (or omitted variables) needs to be addressed. Admittedly, in cross-country regressions, it is impossible to control for every single aspect in which countries might differ. The parameters in IV estimations are estimated under the assumption that there is no correlation between exogenous variables and the error term in the model. Put differently, the only country specific effects (variations) allowed are the country specific effects in the regressors (i.e. what the model is controlling for). It is argued by Hansen and Tarp (2001) that the existence of unobserved effects invalidates the IV estimators because some unobserved country specific effects are correlated with regressors such as initial level of income. In addition, they claim that any correlation between policy variables and unobserved country specific effects would also result in inconsistent IV estimators because the policy variables are used as instruments. The solution to the problem of unobservable heterogeneity is found in panel estimations. Panel estimations address the problem of unobservable heterogeneity by incorporating country fixed effects (Rajan & Subramanian, 2008). For instance, fixed effects (FE) estimators are usually applied to panel data models where regressors are correlated with the country specific effects.[52] The problem with this approach is that, if some of the policy variables at time '*t*' are correlated with random shocks at some earlier time, then the FE estimator and IV estimators, derived from the fixed effects transformation, are inconsistent regardless of the presence of conditional convergence (Dalgaard et al., 2004).

An alternative approach and one that has been used for dynamic panel data models is the Generalized Method of Moments (GMM) technique. As well as correcting for endogeneity, the technique also takes deals with country-specific effects implicitly, an attribute that makes it comparable to OLS regressions with fixed effects (Hepp, 2008). In dealing with potential omitted variable bias (and country fixed effects), the GMM technique first-differences the original regression equations. The first-differenced endogenous variables are then instrumented with

[52] In a static model all explanatory variables are dated contemporaneously with the dependent variable.

lags of their own levels. Like the FE estimator, the GMM technique also presents some problems that require considerable attention. Hansen and Tarp (2001) outlined some of the issues to consider when using the GMM estimators as loss of information, serially correlated measurement errors and the timing of relationships. The authors proceed to caution on the importance of testing the validity of the instruments and serial correlation in the error terms.

Rajan and Subramanian (2005), on the other hand, contended that the problem with the GMM technique lies in the degrees of freedom. The GMM technique grants more freedom than simple OLS estimations: Such freedoms include the freedom to specify the variables whose lags will be used as instruments; the variables whose contemporaneous values will be used as instruments and how many lags to be used for instrumentation (p. 15). The inherent risk here is that results may be driven by the freedom, thus, claims of robustness must be thoroughly investigated.

In summary, most of the 'third genaration' studies with the exception of Hansen and Tarp (2001, 2002), Dalgaard, Hansen and Tarp (2004), Roodman (2007) and Rajan and Subramanian (2005a, 2008) employs either OLS or 2-stage least squares estimations (2SLS) procedures without fixed effects.

6.2. Choice of estimator and formulations

The two estimators that will be employed in this study are the OLS regression with country and time fixed effects[53], and the first difference GMM technique. These panel estimators take into account most of the key drawbacks that were previously discussed. The advantage of a fixed effects estimator is that it provides consistent estimates in the presence of country-specific effects that are correlated with the explanatory variables in the model. In a traditional fixed effects formulation, the estimates of the lagged income variable are often understated. To

[53] Henceforth OLS FE.

overcome this problem, this study follows Patillo and others (2002) and Clemens et al. (2003) and also provide estimates based on the first difference GMM methodology.

As previously mentioned, the complete data sets for the public spending and the growth models will be subdivided into 4 periods by averaging the annual data in each distinct period. Concerns over losing information contained in the annual data by averaging are mitigated by the use of time fixed effects or period dummies. For each model, the study offers several formulations/specifications. The number of formulations is dependent on the number of hypotheses to be tested as well as the functional forms of the hypothesised relationships.[54] In addition, the practice of testing several plausible formulations acts as a robustness check for the results obtained from the models.

[54] By functional form I mean whether the relationship between variables is linear or non-linear. For example, it is possible to think of the effect of debt service payments on growth in both functional forms. In its linear form debt service may or may not affect growth due to it consuming or not consuming a significant proportion of national income. However, it might be that debt service hinders growth as debt service payments absorb growing share of GDP (non-linear).

Chapter 7: Analysis of Results

The descriptive statistics are reported in tables 1a and 1b. Moreover, an analysis of the regression results is provided, starting with the public spending model and concluding with the growth model. The focus here is on the main questions of interest: How do the different sources of public spending affect the public spending levels? And what is the link between these sources of public spending and GDP per capita growth? The regression results are reported in table 2a to 5b.

7.1. Descriptive statistics

This study will first focus on the descriptive statistics reported in tables 1a and 1b. The data covers the time period 1990 to 2005. In line with the methodology, the time period will be further subdivided into four 4 year period averages i.e. period 1 (1990-1993), period 2 (1994-1997), period 3 (1998-2001), and period 4 (2002-2005). A casual comparison reveals signs of economic development in the sample over time.

Starting with gross domestic product, it is observed that in period 1, the sample countries had very low average income levels (average of 758 dollar per capita) compared to an average of 819 dollars per capita in period 4. The same is true for the average GDP per capita growth rates. Over the first two time periods, growth was much lower (-1.11% and 0.92% respectively) compared to the average growth of 1.49% experienced over period 4. Uganda experienced the highest growth in period 1 (averaging 2.34%), initially driven by post-war recovery and reconstruction which was followed by macroeconomic and structural reforms. On the other hand, Togo trailed the group with a growth rate of -7.29% over the same period owing to a protracted political crisis which culminated in economic sanctions by the international community. In contrast, period 4 was more favourable to the resource endowed Sierra Leone, which averaged a growth rate of 8.55% per year in the aftermath of a civil war. Zimbabwe was at the bottom of the list with an average growth of -5.92% over the period which was the beginning of its economic collapse that started with land reforms.

Moving on to aid, the average aid to GDP ratio for period 1 was 15.04%, with Mozambique receiving the highest levels of aid (an average of 53%). Between 2002 and 2005, Burundi was the largest aid recipient, receiving almost 44% of aid to GDP on average. Not surprisingly, Africa's largest economy (South Africa) received the smallest amount of aid as a percentage of GDP among the sample countries. South Africa and Botswana provide a good argument for those who believe that growth can be achieved in Africa by weaning African countries off foreign aid. Another noteworthy observation is how aid levels have declined over time. In contrast to period 1 (average aid to GDP ratio of 15.04%), the average aid to GDP ratio declined steadily in periods 2 and 3 to 14.20% and 9.36% respectively and showed slight recovery in period 4 where the ratio was 11.43%.. Earlier studies (e.g. Addison et al., 2005) have noted that the decline in aid volumes from aid donors (both bilateral and multilateral) to SSA in the first 3 periods was a result of a re-allocation away from Africa to Eastern Europe and East Asia.

Turning to fixed capital formation (composed of public and private investment); it is seen that public investment/spending has consistently trended downwards over the four periods. This provides some support to the argument that public spending is a major contributor of growth and if the amount spent by SSA government on infrastructure, healthcare and education among other things has been declining, it comes as no surprise that growth has been poor. The contribution of private investment has grown from an average of 11.76% in period 1 to 12.98% in period 4, thereby increasing overall fixed capital formation over time.

Sub-Saharan Africa's debt burden as measured by external debt stock to GDP appears to have increased between 1990 and 2001. The average debt stock to GDP for these countries was 0.68% in period 1 and increased to 0.93% in period 3. The countries on average experienced a reduction in their debt stock in period 4 likely resulting from the effects of debt relief under the Heavily Indebted Poor Countries (HIPC) initiative. At the forefront was Sierra Leone which had an average debt stock of 1.98% in period 1, while Burundi led the group with an average of 2.17% of GDP in period 4. Sierra Leone's debt stock subsequently fell to 0.29% in period 4. A point that has also been noted in earlier literature [(Krugman, 1988) and subsequent studies] is the detrimental effect of a country's debt stock to growth, a concept known as debt-overhang. In the presence of debt-overhang, the debt stock acts as a marginal tax on investment, disincentivising the indebted country from earning any returns on investments because such returns will ultimately be re-diverted to servicing the debt burden. A closely related proxy in measuring a country's debt burden is the debt service to GDP ratio which has trended downward over time.

One of the fundamental aspects of growth in any country is its ability to tax its citizens. The challenge to SSA countries in the sample (most of which are major recipients of aid) is that significant volumes of aid create dis-incentives in the collection and administration of tax revenue (Moss et al, 2006). Central government revenue as a ratio of GDP was on average 19.50% in period 1, 18.81% in period 2, 18.46% in period 3 and 19.48% in period 4. Holding all other variables constant, there appears to be a similar movement observed with the ratio of aid to GDP. This simple observation suggests that aid and central revenue may in fact be positively correlated. This is plausible if aid constitutes a significant component of the recipient country fiscal budgets.

A recent study by Ebeke and Ehrhart (2011) shows that tax revenue volatility causes pubic spending instability which reduces public spending levels and ultimately growth. Looking at the numbers, on average, revenue volatility in 2002-2005 was about a third of what is used to be between 1990 and 2003 among the sample SSA countries. Despite a clear difference in the reported volatility numbers, Ebeke and Ehrhart (2011) reached a similar conclusion. Aid volatility and public spending volatility have also decreased over time as is evident from the tables.

Table 1a **Descriptive statistics**

	Period 1 (1990-1993)				Period 2 (1994-1997)			
Variable	**Mean**	**Standard deviation**	**Minimum**	**Maximum**	**Mean**	**Standard deviation**	**Minimum**	**Maximum**
GDP per capita Growth	-1.11	2.49	-7.29	2.34	0.92	3.68	-11.14	8.26
GDP per capita	758	1 088	135	4 595	757	1 105	142	4 642
Aid[1]	15.04	11.35	0.21	53.03	14.20	11.36	0.26	48.55
Public Investment[1]	7.58	4.30	0.95	19.38	7.54	5.06	0.56	24.42
Private Investment[1]	11.76	8.41	0.85	44.68	11.57	8.08	0.37	43.83
Fixed Capital formation[1]	19.38	10.71	5.39	64.06	19.11	10.49	6.76	62.23
Debt service[1]	0.04	0.03	0.00	0.10	0.04	0.03	0.00	0.13
Debt stock [1]	0.68	0.45	0.00	1.98	0.89	0.57	0.03	2.37
Central Government revenue[1]	19.50	8.95	7.09	42.90	18.81	10.24	5.91	50.98
School Enrolment[2]	24.58	17.42	5.13	68.43	26.35	18.96	5.32	79.51
Aid volatility[3]	0.52	1.56	-6.16	2.80	0.93	1.40	-4.05	3.57
Public spending volatility[3]	-0.06	0.88	-1.78	2.22	0.04	0.91	-2.00	1.62
Revenue volatility[3]	0.67	0.93	-1.09	3.72	0.61	0.71	-0.66	2.88

Notes:

All variables are based on 116 observations.

[1] % of GDP.

[2] % of population.

[3] 4 year rolling standard deviation of the change in the variable. Volatility is in logarithmic terms.

Table 1b **Descriptive statistics**

	Period 3 (1998-2001)				Period 4 (2002-2005)			
Variable	**Mean**	**Standard deviation**	**Minimum**	**Maximum**	**Mean**	**Standard deviation**	**Minimum**	**Maximum**
GDP per capita Growth	0.61	2.84	-5.31	5.98	1.49	3.16	-5.92	8.55
GDP per capita	785	1 124	148	4 331	819	1 172	134	4 071
Aid[1]	9.36	7.41	0.38	24.80	11.43	10.44	0.33	41.53
Public Investment[1]	6.49	3.18	1.55	12.78	6.41	2.87	2.42	11.51
Private Investment[1]	11.79	6.64	1.04	35.26	12.98	5.26	1.98	28.17
Fixed Capital formation[1]	18.55	8.07	5.63	49.76	19.82	6.61	7.54	37.53
Debt service[1]	0.03	0.02	0.01	0.09	0.02	0.02	0.00	0.06
Debt stock [1]	0.93	0.57	0.04	2.30	0.76	0.52	0.05	2.17
Central Government revenue[1]	18.46	9.06	8.41	46.50	19.48	8.86	8.03	46.13
School Enrolment[2]	31.27	21.97	5.83	87.91	35.14	22.15	6.10	92.95
Aid volatility[3]	0.43	1.13	-3.20	2.01	0.40	1.16	-2.81	2.74
Public spending volatility[3]	0.01	0.91	-2.46	1.74	-0.14	0.92	-2.57	1.34
Revenue volatility[3]	0.33	0.73	-0.96	1.80	0.25	0.70	-1.15	1.97

Notes:

All variables are based on 116 observations.

[1] % of GDP.

[2] % of population.

[3] 4 year rolling standard deviation of the change in the variable. Volatility is in logarithmic terms.

7.2. The Public spending model

The regression results for the public spending model are presented in tables 2a to 4b below. The main question being answered here is: how do the different sources of public spending affect the public spending level, which in turn may lead to an impact on growth?

The results are presented using the OLS FE and the GMM methodologies. As far as model preference is concerned, the GMM methodology is preferred to the OLS FE as it accounts for the possible endogeneity of aid.

7.2.1. The impact of sources of public spending on the level of public spending in SSA (OLS FE)

Table 2a shows results of 9 regressions with public spending as the dependent variable in all specifications. Formulations are computed using the OLS FE technique, and reported standard errors are robust and panel corrected. The overall goodness of fit of the model is satisfactory, as evidenced by an R-squared of 79%.

With respect to individual coefficients, foreign aid is statistically significant and positive in all formulations of the model as expected. The impact of a unit increase in the foreign aid to GDP ratio on public spending is between 0.09% and 0.11% depending on the specification, ceteris paribus. These results are similar to those reported by Clements et al (2003), who found that in most specifications, aid had a positive impact on public spending. However, since their sample was not limited to SSA, the coefficients reported were lower in magnitude. This finding comes as no surprise especially since for decades, public spending has been thought of as the channel through which aid promotes growth.

Turning to central government revenue, a widely accepted notion is that a government's ability to move from aid dependency to economic freedom is reflected in its ability to collect domestic tax revenues. This hypothesis is addressed by examining the impact of revenue collection (proxied by the logarithm of central government revenue to GDP) on public spending. As was the case with foreign aid, it is evident that there is a strong relation between taxing and public spending. All 9 formulations yielded results that are significant at the 5% significance level and show that a 1% increase in the central government revenue increases public spending by 0.02%, holding all other variables constant. The results suggest that central government revenue is a significant component of public spending and as a country improves on its tax collection and administration (hence collecting more tax revenues); it has more to commit to health care, education and infrastructure.

With regards to debt stock (measured as a % of GDP), theory states that a large accumulated debt levels may lead to a debt-overhang where a country's growth is hindered due to the presence of the large debt levels, which require debt servicing and act as a tax on public spending.[55] Overall, the OLS FE results provide little support to this theory as evidenced by the lack of significance of the debt stock coefficients. Of the 9 formulations, only 1 (formulation 9) shows a significant debt stock coefficient (significant at the 5% level), which can possibly be regarded as a random occurrence and thus excluded from further analysis. Despite the lack of significance of the debt variable, what is more concerning is the direction of the coefficients of debt stock which appear positive instead of negative as one would expect in the presence of debt-overhang. Clemens et al (2003) found their debt stock variable to be insignificant in all specifications but maintaining a positive sign. The authors concluded that prospective debt servicing payments for the public sector (proxied by the NPV of debt) had no impact in the short run. Moreover, it is the current fiscal position of a country and availability of resources that influence public spending rather than longer term factors. In this case, the unexpected sign can mean either of two things. First, a positive sign on the coefficient could imply that the countries in our sample are below the debt-overhang threshold, suggesting that they could take on more debt which could be committed to public spending without necessarily having any consequences on the public spending level. This explanation is however not plausible considering that most of the SSA countries in our sample are part of the HIPC initiative, and have either received full benefits of debt relief or are in the process of completing requirements for debt relief. A second explanation for the positive sign lies in the model specification. It is important to distinguish the impact of the debt stock variable on public spending from its

[55] A detailed discussion is provided in chapter 3.2.2.

impact on growth (to be discussed later in chapter 7). Taking on more debt to be used in public spending should result in more public spending levels, holding all else constant. However, the decision to take on more debt may be harmful to growth through the effects of debt-overhang.

The last variable of interest from table 2a is debt service which is an extension of the debt stock variable in that it represents the current obligations towards the debt stock of these countries. A popular economic notion associated with debt service is that it leads to the 'crowding out' of public spending. Patillo et al (2002) examined this hypothesis in the context of a growth model and found evidence of the crowding out effect. Clemens et al (2003) repeated the exercise but went a step further to investigate the crowding out effect in the context of a public spending model. Most of their formulations provided support for the hypothesis that higher debt service crowded out public investment, and that this effect becomes stronger as debt service absorbs a growing share of GDP (non-linear relationship). This paper's results confirm the authors' findings (at least in direction).

The debt service coefficients in all cases have the expected negative sign and the coefficient is significant in 2 of the 3 formulations. There is also evidence to suggest that the effect becomes greater as debt service absorbs a growing share of GDP. This can be seen from the magnitude of the coefficient in formulations where the squared debt service term is included. Lastly, from our linear formulations (formulations 2 and 5) a much bigger effect of debt service is observed than what was reported in Clemens et al who found that for every one percentage point increase in debt service to GDP, public investment declines by 0.2%. My results indicate that a unit increase in debt service, leads to a 21% average decline in public spending, hence indicating that high debt burdens have had a very large effect on public investment in SSA countries. More importantly, this implies that, ceteris paribus, the benefits of debt relief on public spending could be astounding. The magnitude of the debt service coefficient further implies that there is either misspecification in the relatively parsimonious models or the definitions of debt service differ across these studies.

Table 2a **The impact of sources of public spending on the level of public spending in SSA, 1990-2005.**

	OLS								
	1	2	3	4	5	6	7	8	9
Aid	0.10***	0.114***	0.110479***	0.099***	0.114***	0.110***	0.114***	0.099***	0.094***
	(0.038)	(0.040)	(0.038)	(0.037)	(0.039)	(0.037)	(0.039)	(0.038)	(0.038)
Revenue	2.010**	2.319**	2.249**	2.12**	2.332**	2.264**	2.348**	2.064**	2.219**
	(0.914)	(1.021)	(0.950)	(0.924)	(1.037)	(0.964)	(1.088)	(0.913)	(0.958)
Debt stock				0.047	0.032	0.037	0.031		0.777**
				(0.253)	(0.255)	(0.250)	(0.255)		(0.359)
Debt stock squared								0.023	0.142**
								(0.044)	(0.055)
Debt service		-21.61***			-21.55***		-29.57		
		(8.798)			(8.599)		(30.403)		
Debt service squared			-158.87**			-158.44**	69.40		
			(78.802)			(77.958)	(247.073)		
R-Squared	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
P-Values:									
Fixed Effects test [1]	0.02	0.01	0.02	0.03	0.03	0.05	0.00	0.01	0.00
Wald test	0.91	0.94	0.72	0.92	0.94	1.00	0.91	0.92	0.92

Notes:

*** significant at 1%, ** significant at 5%, * significant at 10%.

The dependent variable in all regressions is public spending. Country and year fixed effects included in all estimations. Robust panel corrected standard errors are reported in parentheses.

[1] Both the Hausman test for correlated random effects and Redundant fixed effects test were computed. They invariably favoured fixed effects over random effects.

Table 2b **The impact of sources of public spending on the level of public spending in SSA, 1990-2005.**

	GMM								
	1	2	3	4	5	6	7	8	9
Aid	0.124***	0.136***	0.121***	0.108***	0.136***	0.119***	0.131***	0.125***	0.106***
	(0.016)	(0.023)	(0.017)	(0.015)	(0.014)	(0.013)	(0.023)	(0.014)	(0.007)
Revenue	3.78***	5.08***	4.98***	5.28***	6.67***	6.48***	6.29***	5.08***	6.55***
	(0.909)	(0.926)	(0.907)	(0.829)	(0.716)	(0.793)	(0.860)	(0.759)	(0.576)
Debt stock				0.424***	0.604***	0.571***	0.646***		1.448***
				(0.097)	(0.108)	(0.133)	(0.145)		(0.492)
Debt stock squared								-0.046*	0.180**
								(0.026)	(0.090)
Debt service		-22.23***			-19.78***		-99.06***		
		(4.714)			(6.975)		(21.786)		
Debt service squared			-67.375**			-55.4317	665.22***		
			(36.486)			(76.239)	(163.37)		
P-Values:									
Sargan statistic	0.58	0.34	0.59	0.34	0.40	0.52	0.29	0.52	0.35

Notes:

*** significant at 1%, ** significant at 5%, * significant at 10%.

The dependent variable in all regressions is public spending. Robust standard errors with White's correction for autocorrelation in parentheses.

Aid is instrumented with lags of its own level. Other instruments include lags of financial depth, institutional quality and freedom.

7.2.2. The impact of sources of public spending on the level of public spending in SSA (GMM)

As previously mentioned in chapter 6, the main shortcoming of the OLS FE approach is its failure to correct for bias brought about by the possible endogeneity of aid. Hence, the correction for this bias and the results of the process are reported in table 2b. All instruments employed pass the instrument validity test (Sargan test for validity of instruments).

Foreign aid is found to be significant in all formulations (similar to the OLS FE).The only difference is that now the aid coefficients are of greater magnitude suggesting that the OLS model yielded downward biased estimates. A unit increase in the aid to GDP ratio leads to GDP per capita growth of between 0.11% and 0.14%, ceteris paribus. Central government revenue behaves in a similar manner, yielding somewhat higher coefficients. On average, a percentage point increase in central government revenue leads to public spending increases of between 0.04% and 0.06%, ceteris paribus. In contrast to the OLS FE formulations, central government revenue is consistently significant at the 1% significance level in all GMM formulations.

Debt stock, which was found to be insignificant under the OLS FE formulations, is found to be significant at the 1% significance level in all of the GMM formulations. In addition, debt stock has a marginal impact on public spending. The effect of increasing the debt stock by 1% is to increase public spending by between 0.004% and 0.015% only, ceteris paribus. There are at least two plausible explanations for this observation. One is that a country's debt stock might have very little to do with current public spending (or short term public spending). This would hold true if the debt stock is fungible or misappropriated by debtor nations. On the other hand, these results could suggest that the SSA countries in the sample are deeply indebted and that the positive impact of adding on more debt to their current debt stocks is offset through the debt servicing that comes with the high debt levels. All other variables yield results similar to the OLS FE formulations.

7.2.3. The impact of public spending volatility on the level of public spending in SSA (OLS FE)

In table 2a and 2b, it was shown that sources of public spending (i.e. foreign aid, central government revenue, and external debt) have a positive impact of the level of public spending. However, it is also possible that volatility in these sources, especially revenue and foreign aid, can have an adverse effect on the levels of public spending and thus offset some, if not all, of the positive impact brought about by these inflows. To address this issue, several studies that have previously analysed these links will be referred to.

Table 3a highlights results from 8 formulations using OLS with country and year fixed effects. Again, the overall goodness of the fit for the formulations is satisfactory, as evidenced a minimum coefficient of determination (R-Squared) of 79%. The dependent variable in all formulations is public spending; with the last 4 columns reporting results using a log transformed public spending ratio. Volatility is measured as a 4-year rolling standard deviation of the change in the variable and is also expressed in logarithmic terms.

Results from the first 4 formulations are reported first. Once volatility is controlled for, foreign aid remains statistically significant in all formulations. Its impact on public spending ranges from 0.01% to 0.11% for a percentage point increase in aid. The results suggest that in the presence of volatility, aid has less of an impact on the public spending level.
Central government revenue is also significant in all formulations having a slightly lower impact than that reported in table 2a. The reduced impact of central government revenue is a result of controlling for volatility. Overall, the results obtained from the two variables (aid and central government revenue) with respect to the public spending level seem suggestive of a possible negative impact of volatility on public spending.

Aid is an important component of SSA countries' revenues and hence its volatility may negatively impact on fiscal behaviour, which in turn may hinder growth. Several papers have underlined the problems induced by aid volatility.[56] This study follows the approach by Lensink

[56] For example see Lensink and Morrissey (2000).

and Morrissey (2000) by constructing an aid uncertainty variable which is later discarded due to collinearity issues. As far as aid instability (or volatility) is concerned, this study's results are in line with those of Lensink and Morrissey as aid volatility appears to be insignificant in all formulations despite exhibiting the expected sign. These results suggest that the volatility of aid has no adverse impact on public spending likely due to aid recipient countries always anticipating some variability in aid inflows.

Turning to revenue volatility, the results are inconclusive. In spite of having insignificant results, the direction of the coefficients is unexpected. In both formulations 3 and 4, the impact of the variable is positive implying that revenue volatility increased public spending levels in the SSA country sample. This study offers no justification to this behaviour of the revenue volatility multiple.

Another unexpected sign is exhibited by public spending volatility (formulation 2) which also carries a positive sign and is significant at the 1% significance level. Past literature has confirmed that public spending volatility leads to reduced public spending levels [e.g. Ebeke & Ehrhart, (2011)]. Again, this is likely statistical noise.

Turning to results in columns 5 to 8. The dependent variable is still public spending, but expressed in logarithmic terms. This is an attempt to find a point of comparison with a recent study by Ebeke and Ehrhart (2011) which analysed the relationship between public spending levels and revenue and public spending instability. The authors hypothesized that the volatility of public spending reduces the level of public spending observed in the end of the period while when the public spending is relatively stable over time; it results in a higher level of spending. Their OLS results reveal that both public spending volatility and revenue volatility have a negative impact on the public spending level.

The present study reports mixed results upon repeating this exercise. First, there is a general tendency for the aid and central government revenue variables to reduce in magnitude. However, it is important to note that the scale of the dependent variable has changed states and therefore its interpretation changes. If all else is held constant, a unit increase in the aid to GDP ratio leads to an average 1.3% percentage point increase in public spending while a similar change in central government revenue leads to a 45% increase in public spending, ceteris paribus. On the other hand, the volatility variables produce controversial results. Aid volatility has no significant effect on public spending and is accompanied by an unexpected positive sign in all formulations.

Central government revenue volatility carries the expected negative sign indicating a negative relationship between revenue volatility and public spending levels. In both cases where revenue volatility is controlled for, the volatility coefficients are significant at the 1% significance level. Similar results have been reported by Ebeke and Ehrhart (2011), despite the authors' results exhibiting a greater magnitude of the impact revenue volatility has on public spending levels. Reasons for the difference in magnitude may range from differences in model specifications to variable inclusion.

Table 3a **The impact of public spending volatility on the level of public spending in SSA, 1990-2005.**

	OLS							
	1	2	3	4	5	6	7	8
Aid	0.108*	0.092**	0.099***	0.107**	0.013**	0.012**	0.0145***	0.014***
	(0.062)	(0.044)	(0.038)	(0.052)	(0.006)	(0.005)	(0.004)	(0.006)
Revenue	2.08**	2.21***	2.061**	2.051***	0.427	0.450	0.474**	0.474*
	(1.077)	(0.894)	(0.880)	(0.859)	(0.325)	(0.287)	(0.248)	(0.251)
Aid volatility [1]	-0.181			-0.174	0.011			0.002
	(0.441)			(0.356)	(0.060)			(0.064)
Revenue volatility [1]			0.112	0.099			-0.139***	-0.139***
			(0.371)	(0.360)			(0.044)	(0.046)
Public spending volatility [1]		0.801***				0.173***		
		(0.277)				(0.046)		
R-Squared	0.79	0.80	0.79	0.79	0.82	0.84	0.83	0.83
P-Values:								
Fixed Effects test [2]	0	0	0	0	0	0	0	0
Wald test	0.91	0.97	0.89	0.88	0.33	0.33	0.09	0.253

Notes:

*** significant at 1%, ** significant at 5%, * significant at 10%.

The dependent variable in all regressions is public spending. In regressions 5-8, public spending is expressed in logarithmic terms. Country and year fixed effects included in all estimations. Robust panel corrected standard errors are reported in parentheses.

[1] 4 year rolling standard deviation of the change in the variable. Volatility is in logarithmic terms.

[2] Both the Hausman test for correlated random effects and Redundant fixed effects test were computed. The tests consistently favoured fixed effects over random effects.

Table 3b **The impact of public spending volatility on the level of public spending in SSA, 1990-2005.**

	GMM							
	1	2	3	4	5	6	7	8
Aid	0.130***	0.139***	0.113***	0.141***	0.021***	0.006**	0.020***	0.021***
	(0.020)	(0.025)	(0.020)	(0.029)	(0.004)	(0.003)	(0.003)	(0.004)
Revenue	4.167***	5.368***	3.855***	3.781***	1.173***	1.229***	1.21***	1.171***
	(0.613)	(1.023)	(1.228)	(0.822)	(0.175)	(0.158)	(0.148)	(0.179)
Aid volatility [1]	-0.410*			-0.517	-0.016			-0.008
	(0.269)			(0.464)	(0.056)			(0.070)
Revenue volatility [1]			-0.058	-0.124			-0.004	-0.017
			(0.417)	(0.313)			(0.035)	(0.042)
Public spending volatility [1]		-0.87*				0.279***		
		(0.533)				(0.067)		
P-Values:								
Sargan statistic	0.52	0.60	0.74	0.68	0.39	0.36	0.33	0.33

Notes:

*** significant at 1%, ** significant at 5%, * significant at 10%.

The dependent variable in all regressions is public spending. In regressions 5-8, public spending is expressed in logarithmic terms. Robust standard errors with White's correction for autocorrelation in parentheses.

Aid is instrumented with lags of its own level. Other instruments include lags of financial depth, institutional quality and freedom.

[1] 4 year rolling standard deviation of the change in the variable. Volatility is in logarithmic terms.

7.2.4. The impact of public spending volatility on the level of public spending in SSA (GMM)

Table 3b is a repeat the formulations of table 3a using the GMM methodology. The dependent variable in all formulations is public spending; with the last 4 columns reporting results using a log transformed public spending ratio. Volatility is measured as a 4-year rolling standard deviation of the change in the variable and expressed in logarithmic terms.

Results from the first 4 formulations are reported first. With respect to the variables of interest, there is a repeated tendency for results to become more robust and exhibit coefficients of greater magnitude. Foreign aid and central government revenue are significant at the 1% significance level in all formulations. After controlling for volatility, the effect of increasing foreign aid by one percentage point is to increase public spending by between 0.11% and 0.14%, ceteris paribus. A similar increase in central government revenue would lead to public spending increasing by between 0.03% and 0.04%, ceteris paribus.

Once the GMM methodology is employed, all the volatility variables exhibit the expected negative sign. These results indicate that the coefficient signs observed in table 3a possibly arose from shortcomings inherent in the OLS FE estimator.

In formulation 1 aid volatility is significant at the 10% level suggesting that even though aid commitments are generally predetermined, and aid recipients can anticipate some variability in aid, the lack of access to financial markets acts as a constraint to their ability to make fiscal decisions. This finding is in favour of recent debates to rethink aid and encourage more innovative mechanisms for financing development.

Formulation 2 controls for overall public spending volatility which is found to be significant at the 10% level. Moreover, the size of the coefficient suggests that the volatility of public spending as a whole is more detrimental to the public spending level than that of aid volatility. Formulations 3 and 4 produce no significant results for the volatility variables.

Turning to the last 4 columns, foreign aid and central government revenue are significant in all formulations. The volatility variables also exhibit the expected sign (except for formulation 6) which we discard as a random occurrence.

7.3. The growth model

The regression results for the growth model are presented in tables 4a to 5b below. The principle question being investigated is: what is the impact of foreign aid on growth? To provide a more meaningful and complete analysis, debt variables (debt stock and debt relief) are added to the formulations[57]. This section has relied upon recent aid-growth literature of to develop a model which accounts for a multitude of social, political and economic factors that could affect the relationship between foreign aid and growth. [58]

Results are presented using the OLS FE and the GMM methodologies. As far as model preference is concerned, the GMM methodology is preferred over the OLS FE as it accounts for the possible endogeneity of aid. The time period considered is 1990 to 2005 and results reported are for 24 SSA countries.

7.3.1. The impact of aid on growth in SSA (OLS FE)

Table 4a highlights results from 10 formulations using OLS with country and year fixed effects. The minimum coefficient of determination (R-Squared) in all specifications is 49%. The dependent variable in all formulations is GDP per capita growth. The Hausman test for correlated random effects and the redundant fixed effect tests consistently favoured the current specification.

[57] Literature has often looked at the two issues separately with relatively fewer studies analysing the debt-growth nexus. The objective of the present paper is to provide a holistic analysis.

[58] The main challenge in attempting this exercise is the scarcity of studies that have focused exclusively on SSA countries.

The analysis begins by looking at the control variables which have gained popularity in the third generation of aid-growth literature.[59] The first control variable is conditional convergence derived from the Solow (1956) model. The model predicts that economies tend to converge towards a steady-state path. Conditional convergence effects are captured by including the initial (lagged) level of real GDP per capita. The variable is expected to have a significant negative influence on the growth rate. The results show a strong presence of conditional convergence within the sample with the coefficients in all 10 formulations confirming the significance of this control variable at the 1% and 5% significance level. While prior studies have widely reported the expected sign, only a few have documented a significant relationship [(e.g. Hepp, (2008), Rajan & Subramanian, (2009a) among others].

An aid squared term was initially included to control for non-linear effects of aid (diminishing returns to aid). There are many reasons for expecting a non-linear relation between aid and growth. One possibility is the limited absorptive capacity and Dutch disease problems (aid curse) (Durbarry *et al.*, 1998 and Rajan and Subramanian, 2011). On the other hand, diminishing returns to aid dependence can occur when governments relax their efforts for revenue collection in the presence of large sustained aid inflows (Hepp, 2008). This variable was found to exhibit a positive sign but is not significant and thus was discarded from further analysis.[60]

In studying the relationship between institutions and growth, researchers have used a number of different measures of institutional quality. The present paper follows Knack and Keefer (1995) by employing the sum of three equally weighted measures - bureaucratic quality, law and order, and corruption. In contrast, this paper departs from a number of previous studies, including Burnside & Dollar (2000) by allowing for the variable to be time variant. The results are easy to present.

[59] See section 3.1.3

[60] This suggests that the sample countries had not reached absorptive capacity. Such results are not new to literature. Take for example Hepp (2005) who found similar results in some of his formulations but refrained from commenting on the variable. Rajan and subramanian (2008) included a squared aid term in the regression and found no consistent pattern in their signs.

The variable coefficients exhibit the expected positive sign in all formulations suggesting that growth occurs faster in countries with developed institutions. Also noteworthy is the lack of significance of the institutional variable coefficients. This can be explained by several reasons. First, the insignificance of the results may imply that the most important factors determining institutional quality have been controlled for and hence, institutional quality may still be important. Alternatively, these results could imply that either institutional quality doesn't matter or there is misspecification in the model.

The variable restriction on freedom is used as a proxy for the political system and the degree of a democratic process. It is measured as the combined average of political rights and civil liberties on a one-to-seven scale, with one representing the highest degree of Freedom and seven the lowest. The negative coefficients on the variable confirm previously cited results in literature that less democratic countries (indicated by a higher index number of restrictions on freedom), grow at a slower pace compared to more democratic economies. Holding all else constant, a unit increase in restrictions of freedom would reduce economic growth by between 0.37% and 0.66%. Hepp (2008) reported a slightly higher coefficient when looking at HIPC countries but had less robust results than the present study.

Moreover, recent cross country analyses of economic growth have incorporated physical geography in an attempt to explain whether geographical endowments influence development.[61] Following Dalgaard et al. (2004), a control variable called land area in tropics, which measures the percentage of the land area in a tropical climate zone was incorporated. This variable is meant to capture differences in productivity and in the evolution of institutions. Unfortunately, the variable had to be discarded over concerns of collinearity.

M2/GDP is used as a proxy for financial depth in accordance with King and Levine (1993, p.531). It is hypothesized that better financial systems improve the probability of successful innovations

[61] See Sachs (2001) or Easterly and Levine (2003) for more on the influence of geography on economic development.

and hence accelerate economic growth. However, because of concerns over the endogeneity of the variable, it is common to lag it one period. The empirical analysis then finds that this variable is not significant and thus does not warrant further investigation.

Turning to the variables of interest, despite having the expected sign, aid is found to be insignificant in all 10 specifications. This finding supports the existing literature of Boone (1990), Dollar (2000), Lensink and Morrissey (2000), Collier and Dollar (2002), and Rajan and Subramanian (2008) who similarly report that aid had no impact on growth.

As far as the debt variables are concerned, there appears to be robust results in most of the specifications. In specifications 2, a significant coefficient on debt service is observed with the expected negative sign. This result is standard in literature and can be explained by the crowding-out hypothesis (Clements et al, 2003). High debt servicing prevents a country from directing resources to productive activities (i.e. public spending). However, the focus on this variable may be limited as it only measures long term debt obligations and thus excludes the effect of short term debt obligations.

Formulations 3 and 5 provide answers to the debt-overhang hypothesis- a situation where the existing 'inherited' debt is sufficiently large that creditors have no expectations to be repaid (Krugman, 1998, p. 254). Moreover, there are theoretical reasons to favour a non-linear relationship over a linear one. For example Patillo et al. (2002) contended that "the effect of debt could be positive at low levels of debt as the reduction of liquidity constraints in the economy might be associated with the growth-inducing effects of capital inflows. The effect of debt could however become negative when external indebtedness become excessive, as the debt-overhang might be growth-retarding (p. 13)". The results of the empirical analysis set out in Table 4a are in support of the debt-overhang hypothesis i.e. that external debt stock has a negative impact on growth in SSA countries. Hence, these results suggest that the debt stock levels present in the sample are already excessive and hence growth retarding, and that there exists a non-linear relationship between debt and growth.[62]

[62] Due to the difficulties in estimating the turning point in the debt-growth relationship, the present study did not attempt this exercise.

Table 4a **The impact of aid on growth in SSA, 1990-2005.**

	OLS									
	1	2	3	4	5	6	7	8	9	10
Aid	0.101	0.112	0.110	0.112	0.044	0.096	0.039	0.057	0.055	0.057
	(0.081)	(0.078)	(0.080)	(0.077)	(0.073)	(0.084)	(0.065)	(0.074)	(0.077)	(0.074)
Per capita GDP $_{t-1}$	-10.701**	-9.538**	-9.470**	-9.56**	-11.57***	-10.79**	-11.09***	-10.65***	-10.66***	-10.76***
	(4.597)	(4.144)	(4.250)	(4.165)	(3.806)	(4.575)	(3.525)	(3.468)	(3.57)	(3.524)
Financial depth $_{t-1}$	-0.029	-0.019	-0.015	-0.019	-0.036	-0.029	-0.048***	-0.029	-0.027	-0.031
	(0.089)	(0.080)	(0.084)	(0.086)	(0.078)	(0.089)	(0.074)	(0.076)	(0.080)	(0.082)
Institutional quality	0.791	0.939	0.923	0.939	0.630	0.770	0.791	0.751	0.734	0.749
	(0.728)	(0.839)	(0.833)	(0.841)	(0.703)	(0.746)	(0.606)	(0.806)	(0.808)	(0.815)
Freedom	-0.453**	-0.536**	-0.546**	-0.533**	-0.611***	-0.477***	-0.370**	-0.656***	-0.66***	-0.648***
	(0.195)	(0.201)	(0.222)	(0.216)	(0.185)	(0.182)	(0.191)	(0.182)	(0.197)	0.191488
Debt stock					-1.016***		-2.774***	-0.921***	-0.926***	-0.928***
					(0.200)		(0.325)	(0.206)	(0.212)	(0.219)
Debt stock squared						0.018	-0.37***			
						(0.015)	(0.055)			
Debt service		-29.636**		-33.016				-21.17*		-33.879
		(15.219)		(46.89)				(15.89)		(44.199)
Debt service squared			-219.89**	28.089					-148.405	106.17
			(117.85)	(381.62)					(130.77)	(385.15)
R-Squared	0.49	0.51	0.50	0.51	0.53	0.49	0.60	0.54	0.54	0.54
P-Values:										
Fixed Effects test [1]	0.00	0.02	0.01	0.02	0.00	0.05	0.00	0.02	0.00	0.05
Wald test	0.02	0.02	0.03	0.03	0.02	0.02	0.00	0.01	0.01	0.01

Notes:

*** significant at 1%, ** significant at 5%, * significant at 10%.

The dependent variable in all regressions is GDP per capita growth. Country and year fixed effects included in all estimations. Robust panel corrected standard errors are reported in parentheses.

[1] Both the Hausman test for correlated random effects and Redundant fixed effects test were computed. The tests consistently favoured fixed effects over random effects.

Table 4b **The impact of aid on growth in SSA, 1990-2005.**

	GMM									
	1	2	3	4	5	6	7	8	9	10
Aid	0.362***	0.382***	0.403***	0.401***	0.292***	0.326***	0.155*	0.263***	0.286***	0.263***
	(0.042)	(0.045)	(0.046)	(0.058)	(0.090)	(0.070)	(0.083)	(0.097)	(0.091)	(0.082)
Per capita GDP $_{t-1}$	-11.94***	-9.48***	-9.41***	-9.30***	-8.68***	-10.56***	-10.98***	-9.06***	-8.71***	-9.02***
	(1.537)	(1.913)	(1.882)	(2.243)	(2.386)	(2.594)	(2.336)	2.578	(2.288)	(2.508)
Financial depth $_{t-1}$	-0.137***	-0.122***	-0.116***	-0.115*	-0.047	-0.149***	0.001	-0.045	-0.039	-0.038
	(0.028)	(0.040)	(0.048)	(0.060)	(0.066)	(0.047)	(0.065)	(0.065)	(0.062)	(0.075)
Institutional quality	1.819***	2.027***	2.261***	2.211***	1.276***	2.001***	1.797**	1.247***	1.291***	1.207***
	(0.390)	(0.475)	(0.645)	(0.414)	(0.550)	(0.743)	(0.774)	(0.441)	(0.527)	(0.444)
Freedom	-0.575*	-0.405	-0.244	-0.266	-0.393	-0.738	-0.536	-0.236	-0.312	-0.261
	(0.340)	(0.561)	(0.666)	(0.484)	(0.667)	(0.607)	(0.477)	(0.497)	(0.594)	(0.436)
Debt stock					-2.282***		-4.96***	-2.343***	-2.227***	-2.463***
					(0.699)		(0.832)	(0.748)	(0.716)	(0.702)
Debt stock squared						-0.144	-1.553***			
						(0.472)	(0.435)			
Debt service		-40.012***		28.39				-7.079		44.216
		(13.457)		(87.837)				(16.219)		(60.433)
Debt service squared			***-278.37	-456.817					-99.215	-369.347
			(90.259)	(549.085)					(89.204)	(428.697)
P-Values:										
Sargan statistic	0.39	0.32	0.32	0.45	0.53	0.53	0.31	0.45	0.31	0.25

Notes:

*** significant at 1%, ** significant at 5%, * significant at 10%.

The dependent variable in all regressions is GDP per capita growth. Robust standard errors with White's correction for autocorrelation in parentheses.

Aid is instrumented with lags of its own level. Other instruments include lags of financial depth, institutional quality and freedom.

7.3.2. The impact of aid on growth in SSA (GMM)

Table 4b replicates previously reported formulations using the GMM methodology. The main advantage of this methodology is that it accounts for the possible endogeneity of aid. Moreover, Patillo *et al*. (2002) and Clemens *et al.* (2003) found that in traditional fixed effects formulations, the estimate of the lagged income variable may be understated. Comparing the results of the GMM and OLS FE (as set out in tables 4a & 4b) reveals that this effect is present in the empirical analysis conducted in this study as well. The coefficients of the lagged income control variable shows that there is evidence of convergence of the sample SSA economies since lagged income is significant at the 1% significance level in all formulations.

Financial depth proxied by the M2/GDP ratio shows that, unlike the OLS FE results which were not robust, the GMM results are moderately robust. However, the unexpected direction of the coefficient, which is still negative, has not changed. Unfortunately, there is no plausible explanation for this unusual behaviour of the variable.[63]

The Knack and Keefer (1995) inspired institutional quality variable tells a different story once the GMM method is employed. Recalling the OLS FE results, the variable coefficients exhibited the expected positive sign in all formulations as literature has suggested- however with insignificant results. These results led me to argue that perhaps the most important factors determining institutional quality have been controlled for or institutional quality did not matter. Again, results are easy to present- institutional quality is now statistically significant and there is sufficient robust evidence to suggest that development of institutions has led to growth in our sample over the covered period, ceteris paribus. Burnside and Dollar (2000) reported a coefficient ranging from 0.7-0.84 for lower income countries, while Hepp (2008) reported coefficients in the range of 0.8-1.5 for HIPC countries. However, the results reported based on

[63] This unexpected behaviour could explain the exclusion of this variable in widely cited studies like Lensink and Morrissey (2000).

the preferred GMM method are higher than those by Burnside and Dollar and accord more closely with Hepp's results for HIPC countries.

Democracy, which was proxied by degree of freedom, is found to be vital for growth in the SSA sample countries (using OLS with fixed effects). In addition, although the expected sign is still present, even after controlling for potential endogeneity of aid, there is a lack of robustness in the GMM results, which has possibly arisen from having controlled for this variable in the measure for institutional quality.

External debt stock maintains its negative impact on growth in SSA countries, which suggests that the debt stock levels present in the sample are already excessive and hence growth retarding, and that there exists a non-linear relationship between debt and growth (consistent with the OLS FE results). Holding all other variables constant the coefficients range from -2.34 to -4.96, indicating that a unit increase in the external debt to GDP ratio hinders growth by between 0.023 and 0.0496%, all significant at the 1% significance level. The non-linear specification (formulation 5) lends support to the non-linearities of the debt-growth links. There exists a turning point, after which the effect of debt on growth becomes negative (debt-overhang).[64] Several studies have assessed this relationship finding robust results which were mixed. For example, Patillo and associates (2002) found significant evidence of debt-overhang only in their OLS FE methodology (in a linear specification). Clemens et al (2003) found the debt stock coefficient to be between positive 3 and 6, indicating that countries in their low income country sample had debt levels below the debt-overhang threshold and could still benefit from additional debt stocks. More recently, Hepp (2008) reassessed the relationship through the introduction of debt relief into the model specification (an indirect form of aid). The author's results suggested a negative impact of debt stock on growth of around 0.03 and 0.09, holding all else constant. In contrast to past literature, the present study consistently reports robust results in all specifications using both the OLS FE and GMM methods.

[64] Following the significant results for the debt variable in its linear form, and the difficulties in estimating such a turning point, the present paper does not provide this estimate. In addition to difficulties in obtaining this estimate, results are often inconclusive due to the variability of the turning point e.g. Patillo et al, (2002).

Formulations 2 and 6 test the validity of the crowding out effect which was found present when employing the OLS FE technique. The direction of the coefficient is as expected. However, it is the magnitude which is noteworthy. Patillo et al (2002) and Clemens et al (2003) found no evidence of the crowding out effect. However, Clemens *et al*. concluded that perhaps the lack of robustness was due to the inclusion of investment in the model and hence, the effect of debt service are already realised through investment[65]. On the other hand, Hepp (2008) reported robust results ranging from -0.2 to -0.4 indicating that the marginal impact of increasing debt servicing, is reducing growth by between 0.2 and 0.4%. The results of the present study continue to trend significantly above Hepp's results. While the present study employs a debt service variable that only accounts for long term debt, is still appears unlikely that the differences are due to variable definitions.

Finally the focus shifts to the main variable of interest, foreign aid. Previously reported results from the OLS FE methodology suggested that aid is possibly not vital in achieving economic growth. As previously mentioned, such an argument has been echoed in previous studies [e.g. Burnside and Dollar (2000), Lensink and Morrissey (2000) and Collier and Dollar (2002), and Rajan and Subramanian (2008)] which all contended that the impact of aid on growth is conditional to some other variables like policy or geography, while alone, aid has no impact on growth. However, this argument can only be examined after controlling for the possible bias caused by the endogeneity of aid.

After correcting for the possible endogeneity of aid, the results of the analysis suggest that aid does contributed significantly to growth over the study's covered period. A unit increase in the ratio of aid to GDP accelerates growth by between 0.16% and 0.40%, ceteris paribus. In all specifications, this relationship is significant at the 1% significance level and hence throwing support to advocates of the unconditional impact of aid.

[65] Surprisingly, no further attempt was made by the authors to re-estimate the equations without the investment variable.

With regards to the variables of interest, the results from table 4a and 4b can be summarised up as follows. There is robust evidence in support of the debt-overhang theory in line with results reported by Hepp (2008). In contrast, the robustness of the crowding-out hypothesis results is contentious and will need further analysis. Foreign aid is observed to have an unconditional impact on growth once potential endogeneity of aid has been accounted for. Results from the main variable of interest (foreign aid) lead to conclude that Africa's poor growth record over the covered period was not attributed to aid ineffectiveness.

7.3.3. The impact of public spending volatility on growth in SSA (OLS FE)

Table 5a reports results of the impact of aid on growth, after controlling for volatility in public spending. Previously it was reported that volatility of sources of public spending can have detrimental effects on the public spending level. The main question being investigated here is to what extent does the volatility of sources of public spending impact growth? The dependent variable in all formulations is GDP per capita growth; with the last 3 columns reporting results with public spending as an additional explanatory variable. Volatility is measured as a 4-year rolling standard deviation of the change in the variable and expressed in logarithmic terms.

The control variables all exhibit their expected signs with the exception of financial depth. Notably, aid is insignificant in all specifications, possibly due to its endogeneity not being controlled for in the OLS FE methodology. The coefficient of initial GDP is significantly negative in all regressions, confirming the conditional convergence hypothesis, a standard result in the empirical growth literature. Freedom is highly significant, except in 2 formulations. Institutional quality is significant in 1 of 6 formulations. As argued earlier, this may be the result of having controlled for this variable through another variable.

Turning on to volatility variables, the first 3 formulations report results excluding the public spending variable. The aim is identify whether aid works through volumes of investment or through the efficiency of the investments. With regard to aid volatility, central government volatility and public spending volatility, it is found that they all act as hindrances to growth in

SSA. Even after controlling for volatility of public spending, there is no evidence to suggest that aid has a positive impact on growth.

Formulations 4 to 6 repeat the analysis with public spending as an explanatory variable. As expected, the size of the aid coefficients is reduced. Furthermore, public spending is significant, which suggests that the impact of aid on growth is through volumes of public spending rather than its efficiency and that aid has no impact on growth additional to the impact through public spending. Also notable is the size of the volatility coefficients. It is apparent that aid volatility has the least impact on growth while revenue volatility has had the most detrimental impact on growth in over the period.

7.3.4. The impact of public spending volatility on growth in SSA (GMM)

A repeat of the previous analysis using the GMM technique yields expected results. At this point it is clear that the OLS FE technique yields downwardly biased results.

Once again, the control variables all yield expected results with the exception of financial depth. The impact of the control variable on growth appears to be similar to results reported in table 4b.[66]

Once aid is instrumented, there is strong evidence of a positive impact of aid on growth. A unit increase in aid to GDP accelerates growth by between 0.27% and 0.40%, holding all else constant. Volatility variables all yield results with the expected negative sign. Again, such findings echo the importance of more reliable and predictable alternative sources of funding by SSA countries.

When public spending is excluded, the impact of aid is to raise growth in the range of 0.29% and 0.41%. Furthermore, only revenue volatility and public spending volatility appear to be significant in explaining growth as aid volatility loses significance. Interestingly, revenue

[66] For this reason a discussion is not provided.

volatility appears to be a bigger obstacle to growth than the overall public spending volatility. The central government revenue volatility coefficient is also more robust than the public spending volatility coefficient.

In order to assess whether aid has an additional impact on growth, other than through volumes of public spending, public spending is added as a regressor in formulations 4 to 6. The results show that there is a loss of significance (from 1% to 10% significance levels) and reduction in the coefficient size of the variable once public spending in included, ceteris paribus. Increasing the foreign to GDP level by a percentage point would accelerate growth by 0.25% and 0.27%. This suggests that there could be an additional impact of aid on growth that is through the efficiency of the investments rather than the volumes.

Tables 5a and 5b indicate that aid has been effective and has contributed to growth in SSA over the time period covered. However, despite its effectiveness, there is strong evidence to suggest that its effectiveness may have been eroded by volatility in public spending, and particularly revenue volatility. This would explain why African countries and particularly SSA countries have experienced very low growth rates over the covered period despite significant aid inflows.

Table 5a **The impact of aid on growth in SSA, 1990-2005.**

	OLS					
	1	2	3	4	5	6
Aid	0.112	0.077	0.119	0.039	0.009	0.032
	(0.081)	(0.077)	(0.087)	(0.076)	(0.073)	(0.085)
Public spending				0.442**	0.413**	0.483**
				(0.193)	(0.205)	(0.203)
Per capita GDP $_{t-1}$	-10.82***	-11.84***	-9.34**	-10.31***	-11.22***	-8.86***
	(4.459)	(4.392)	(4.312)	(3.207)	(3.154)	(3.010)
Financial depth $_{t-1}$	-0.032	-0.007	-0.049	-0.088	-0.058	-0.108
	(0.086)	(0.092)	(0.086)	(0.073)	(0.076)	(0.075)
Institutional quality	0.693	0.583	1.207***	0.541	0.506	1.123**
	(0.771)	(0.722)	(0.705)	(0.662)	(0.606)	(0.529)
Freedom	-0.47***	-0.509***	-0.163	-0.698**	-0.673**	-0.418
	(0.194)	(0.182)	(0.276)	(0.346)	(0.310)	(0.364)
Aid volatility [1]	-0.369**			-0.427**		
	(0.184)			(0.191)		
Revenue volatility [1]		-1.069**			-1.012	
		(0.518)			(0.381)	
Public spending volatility [1]			-0.852***			-1.036***
			(0.157)			(0.169)
R-Squared	0.49	0.51	0.51	0.55	0.56	0.57
P-Values:						
Fixed Effects test [2]	0.00	0.00	0.00	0.00	0.00	0.00
Wald test	0.01	0.01	0.05	0.01	0.00	0.02

Notes:

*** significant at 1%, ** significant at 5%, * significant at 10%.

The dependent variable in all regressions is GDP per capita growth. Country and year fixed effects included in all estimations. Panel corrected standard errors are reported in parentheses.

[1] 4 year rolling standard deviation of the change in the variable. Volatility is in logarithmic terms.

[2] Both the Hausman test for correlated random effects and Redundant fixed effects test were computed. The tests consistently favoured fixed effects over random effects.

Table 5b **The impact of aid on growth in SSA, 1990-2005.**

	GMM					
	1	2	3	4	5	6
Aid	0.391***	0.289***	0.408***	0.250*	0.161	0.265*
	(0.063)	(0.053)	(0.052)	(0.140)	(0.135)	(0.096)
Public spending				0.312	0.306	0.325**
				(0.235)	(0.248)	(0.159)
Per capita GDP $_{t-1}$	-10.645***	-11.12***	-10.752***	-11.924***	-10.835***	-9.896***
	(2.094)	(2.429)	(3.039)	(2.447)	(3.559)	(3.026)
Financial depth $_{t-1}$	-0.147***	-0.161***	-0.177***	-0.099	-0.117	*-0.133
	(0.051)	(0.039)	(0.055)	(0.089)	(0.093)	(0.075)
Institutional quality	1.912***	1.163***	2.156***	1.488***	1.103**	1.987***
	(0.479)	(0.395)	(0.475)	(0.524)	(0.554)	(0.492)
Freedom	-0.586	-0.911***	-0.197	-0.746	-1.314	-0.734
	(0.436)	(0.345)	(0.713)	(1.032)	(1.122)	(0.850)
Aid volatility [1]	-0.493			-0.565		
	(0.407)			(0.410)		
Revenue volatility [1]		-1.221***			-0.925**	
		(0.438)			(0.554)	
Public spending volatility [1]			-0.957**			-0.97**
			(0.482)			(0.508)
P-Values:						
Sargan statistic	0.53	0.38	0.61	0.37	0.37	0.30

Notes:

*** significant at 1%, ** significant at 5%, * significant at 10%.

The dependent variable in all regressions is GDP per capita growth. Robust standard errors with White's correction for autocorrelation in parentheses.

Aid is instrumented with lags of its own level. Other instruments include lags of financial depth, institutional quality and freedom.

1 4 year rolling standard deviation of the change in the variable. Volatility is in logarithmic terms.

Chapter 8: Conclusion

Foreign aid effectiveness has been a topic of debate in recent decades in academic discourse as well as the policy arena. Renewed interest in the subject emerged as a parallel debate following the proclamation of the Millennium Development Goals (MDGs). In this study, aid effectiveness has been investigated for a panel of 30 SSA countries over the period 1990–2005. The study's objectives were twofold: first, to determine whether the sources of public spending (including foreign aid) have an impact on the public spending levels; and second, to examine how these sources of public spending in turn affected GDP per capita growth rates in SSA. In achieving the objectives of the study, I employed a public spending model and a growth model respectively.

With regard to the impact of sources of public spending of its levels, the results of the study are similar to results reported by Patillo et al (2002) and Clemens et al (2003). The results reveal that foreign aid and central government revenue have the largest impact on public spending levels. On the other hand, the impact of a country's debt stock on the public spending level is marginal despite exhibiting the expected positive sign. Moreover, results on the debt service variables provided support for the hypothesis that higher debt service crowds out public spending, and that this effect becomes stronger as debt service absorbs a growing share of GDP (non-linear relationship). The robustness of the crowding-out hypothesis results is contentious and will need further analysis.

Turning to the growth model, several results of this study are noteworthy. First, the role of institutional quality and freedom (which is used as a proxy for the political system and the degree of a democratic process) among other control variables has been found to be significant in explaining GDP per capita growth rates.

Second, in line with results reported by Hepp (2008), there is robust evidence in support of the debt-overhang theory- a situation where a country's debt stock is sufficiently large that it acts like a marginal tax on investment. More specifically, these results suggest that the debt stock levels present in the sample are already excessive and hence growth retarding, and that there exists a non-linear relationship between debt and growth.

Third and most importantly are the results of the impact of foreign aid on growth. Contrary to numerous studies, the results reveal that foreign aid has an unconditional impact on growth once the potential endogeneity of aid has been accounted for. Results of the main variable of interest (foreign aid) show that Africa's sub-optimal growth rates over the covered period cannot be attributed to aid ineffectiveness.

In an attempt to explain the low per capita GDP growth rates of the sampled SSA countries over the covered period, the analysis was then extended to include detrimental effects of public spending volatility. The results find that there is strong evidence to suggest that aid effectiveness may have been eroded by volatility in public spending and particularly revenue volatility which is of great concern for SSA countries (Ebeke & Ehrhart, 2011). This may explain why African countries and particularly SSA countries have experienced very low growth rates over the covered period despite significant aid inflows and improved revenue collection and administration systems. Furthermore, such results are a cause of concern for SSA due to the general inability of SSA countries to access the international capital markets.[67]

Several solutions have been posited in literature to address the problem of volatility of public spending in SSA. For example, Ebeke and Erhart (2011) found that the dependency on domestic taxes had a stabilizing effect on public spending. Hence, the authors concluded that the departure from trade taxes toward indirect domestic taxes in developing countries is beneficial for limiting tax revenues instability. A recent paper by the World Bank also explores some of the more innovative and alternative ways of financing development in SSA. Among other solutions, the authors proposed the use of the International Financing Facilities for Immunization (IFFIs) which help to 'front-load' aid commitments, thereby increasing the predictability and reliability of aid flows on healthcare. Alternatively SSA countries may opt to raise bond financing backed by securitization of future-flows, such as remittances, tourism receipts and export receivables (Ratha, Mohapatra and Plaza, 2008). Future research should focus on a better theoretical understanding of the aid-growth link

[67] This finding needs to be investigated further. There is the possibility of the Olivera-Tanzi effect an economic situation involving a period of high inflation in a country which results in a decline in the volume of tax collection or the Patinkin effect where the real value of public spending (holding government spending constant) falls as a result of inflation.

including the transmission mechanisms. Furthermore, a considerable amount of attention needs to be redirected from fruitless debate over the validity of certain influential studies to studying the impediments of aid effectiveness (such as public spending volatility) and offering practical and feasible solutions to such problems.

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Appendix A: List of countries

Public spending model -30 countries (1990-2005)	Growth model -24 countries (1990-2005)
Angola	Angola
Botswana	Botswana
Burundi	Cameroon
Cameroon	Republic of the Congo
Cape Verde	Cote d'Ivoire
Central African Republic	Gabon
Chad	The Gambia
Republic of the Congo	Ghana
Cote d'Ivoire	Guinea
Gabon	Guinea-Bissau
The Gambia	Kenya
Ghana	Madagascar
Guinea	Malawi
Kenya	Mali
Lesotho	Mozambique
Madagascar	Nigeria
Malawi	Sierra Leone
Mali	South Africa
Mauritius	Sudan
Mozambique	Tanzania
Rwanda	Togo
Sierra Leone	Uganda
South Africa	Zambia
Sudan	Zimbabwe
Swaziland	
Tanzania	
Togo	
Uganda	
Zambia	
Zimbabwe	

Appendix B: Definitions and data sources

Variable	Definition	Source	
GDP per capita Growth	Growth of real per capita GDP.	World Bank.	
Per capita GDP	GDP per capita is gross domestic product divided by midyear population. Data are in constant U.S. dollars.	World Bank.	
Public spending	Comprises all additions to the stocks of fixed assets (purchases and own-account capital formation), less any sales of second-hand and scrapped fixed assets, by government units and non-financial public enterprises.	World Bank.	
Central government revenue	Central government revenues, excluding all grants.	World Bank.	
Aid	Official development assistance and net official aid record the actual international transfer by the donor of financial resources or of goods or services valued at the cost to the donor, less any repayments of loan principal during the same period. Data are in constant 2006 US dollars.	World Bank.	
Debt stock	Foreign debt consists of the outstanding stock or recognized, direct liabilities of the government to the rest of the world, generated in the past and scheduled to be extinguished by government operations in the future or to continue as perpetual debt.	ADI and computations done by author.	
Debt service	Long-term debt service payments (LTDS) are the sum of principal repayments and interest payments in the year specified. Long-term external debt is defined as debt that has an original or extended maturity of more than one year.	ADI and computations done by author.	
Financial depth	Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of	World Bank.	

	resident sectors other than the central government.	
Institutional quality	Sum of three equally weighted measures - bureaucratic quality, law and order, and corruption.	Political Risk Services International Country Risk Guide and recomputed by the author.
Freedom	Average of the measures for political rights and civil liberties.	Freedom House World Country Ratings 2011 and recomputed by the author.
Volatility	4 year rolling standard deviation of the change in the specific variable. Volatility is in logarithmic terms.	Author's computation.

Appendix C: Panel unit root tests: Summary (Public spending model)

	Levin, Lin & Chu t*		ADF - Fisher Chi-square		PP - Fisher Chi-square	
	Statistic	Probability	Statistic	Probability	Statistic	Probability
Aid	-12.7824	0.0000	93.5257	0.0022	137.740	0.0000
Dservx	-77.0797	0.0000	68.2858	0.1673	78.0416	0.0408
Fxdcap	-15.5112	0.0000	66.4440	0.2089	79.7569	0.0306
logaidvox	-19.3874	0.0000	133.548	0.0000	140.528	0.0000
Logdservx	-7.51599	0.0000	74.5881	0.0702	84.7775	0.0125
logpbvox	-16.9075	0.0000	116.799	0.0000	141.890	0.0000
logrevvox	-462.354	0.0000	59.0588	0.4366	69.0564	0.1518
Logxdebt	-20.0379	0.0000	84.6564	0.0128	119.133	0.0000
pbinvest	-76.1448	0.0000	114.288	0.0000	142.080	0.0000
pvtinvest	-12.0751	0.0000	63.5678	0.2868	74.8133	0.0678
revx	-32.5784	0.0000	111.806	0.0000	138.577	0.0000
xdebt	-71.5597	0.0000	86.6905	0.0087	113.075	0.0000

Panel unit root tests: Summary (Growth model)

	Levin, Lin & Chu t*		ADF - Fisher Chi-square		PP - Fisher Chi-square	
	Statistic	Probability	Statistic	Probability	Statistic	Probability
Aid	-8.92450	0.0000	64.2435	0.0389	93.8845	0.0000
Aidvox	-22.8817	0.0000	92.4131	0.0001	96.9218	0.0000
Dservx	-5.81771	0.0000	32.6021	0.9319	43.3839	0.5825
Freedom	-69.2993	0.0000	124.624	0.0000	146.113	0.0000
Fxdcap	-28.6979	0.0000	57.8875	0.0781	71.7815	0.0051
Geo	N/A	N/A	N/A	N/A	N/A	N/A
Growth	-7.72403	0.0000	54.7488	0.1766	71.9288	0.0086
Income	-0.85208	0.1971	48.8547	0.3591	57.6452	0.1165
Instx	-60.1603	0.0000	81.2174	0.0005	87.1856	0.0001
Lagincome	1.40842	0.9205	49.6729	0.3291	68.2026	0.0184
Lagm2	2.95238	0.9984	36.3542	0.8450	48.5119	0.3720
Logdservx	2.94411	0.9984	25.9136	0.9927	33.7977	0.9090
Logdservxsqr	4.94386	1.0000	24.6965	0.9957	31.6925	0.9464
Loglagincome	3.59116	0.9998	48.5487	0.3706	66.3917	0.0261
Logxdebt	-27.9595	0.0000	78.0880	0.0022	108.805	0.0000
Logxdebtsqr	-136.940	0.0000	88.6937	0.0002	107.152	0.0000
m2	-1.85733	0.0316	54.0656	0.1936	71.7860	0.0088
pbinvest	-72.2125	0.0000	93.8023	0.0000	116.749	0.0000
pbvox	-16.6249	0.0000	90.2251	0.0000	116.962	0.0000
pvtinvest	-25.0377	0.0000	57.0749	0.0893	73.0947	0.0038
revvox	-443.779	0.0000	56.1312	0.1455	62.7514	0.0507
revx	-14.5362	0.0000	75.7207	0.0038	100.301	0.0000
xdebt	-102.027	0.0000	68.7646	0.0164	89.4662	0.0001