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The effect of foreign aid on growth in sub-Saharan Africa
a panel data study on sectoral aid flows

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Abstract

Foreign aid and its success in generating economic growth is a heavily debated issue. Even though the primary goal of foreign aid might be to reduce poverty, generating economic growth is likely to be an important component in this matter. Widespread poverty in the sub-Saharan African region despite fifty years as recipients of foreign aid might indicate that aid has not been successful in promoting growth. The academic achievements points in various directions. There is no real consensus on neither methodological strategy to determine the aid and growth relationship nor on the impact of foreign aid on growth. The current policymaking debate on foreign aid does circulate around how measurable results could be ensured as an outcome of the Paris declaration (2005).

This study investigates whether different types of sectoral aid flows do affect growth differently in different time settings. The analysis is carried out on a data sample of the Sub-Saharan African countries for the years 1995-2011. By using a database of sectoral aid flows it is found that different aid flows do not only varies by impact on economic growth but also that the impact of the aid flows affects economic growth differently in different time spans. Therefore, it is of relevance to, when evaluating the growth effects from aid, to not only determine the type of aid flow and its potential impact on growth but also to adjust the aid flow to the time for which it could be expected to achieve an impact on economic growth.

Keywords: Foreign aid, sectoral aid, growth, macroeconomics, development cooperation

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Abbreviations

2SLS – Two Stage Least Squares

AU – African Union

CRS – Creditor Reporting System

DAC – Development Assistance Committee

EU – European Union

FE – Fixed Effects

GDP – Gross Domestic Product

GLS – Generalized Least Squares

IV – Instrumental Variables

JAES – Joint Africa-EU Strategy

LDCs – Least Developed Countries

MDG - Millennium Development Goals

NGOs - Non-governmental organizations

ODA – Official Development Assistance

OECD – Organization for Economic Cooperation and Development

OLS – Ordinary Least Squares

UN – United Nations

VAR – Vector Autoregressive (model)

WB – World Bank

WDI – World Development Indicators

1. Introduction

Foreign aid and its success in generating economic growth is heavily debated both on the academic arena and on the political stage. As a result of the Paris declaration (2005) the current donor debate circulates around how to ensure measurable results of foreign aid. Economic growth is an important component in this matter. My impression is that the time interval is often excluded from the debate and that the results therefore are unlikely to be detected in a large set of cases. Without adjusting the expected effects to its correct time interval could imply that a large set of successful aid allocations is marked as unsuccessful while it in fact is a matter of allowing for the effects to occur.

The literature illustrates two main fields of arguments; one stream argues that aid do generate economic growth while others argue that it doesn't. Some recent research such as Kaya et al (2012) and Clemens et al (2004) proposes the use of disaggregated aid terms when trying to determine the impact on economic growth. Other studies, such as Burnside and Dollar (2000), propose to take country heterogeneity into consideration. It is argued that countries with a stable political situation and relatively good institutions can absorb the aid better and thus expect a higher growth from the aid allocation. The main difficulty expressed in the research papers is the presence of endogeneity in the aid-growth relationship. In order to tackle the problem a wide range of different methods and regression techniques has been evaluated and submitted. Still, there is no real consensus on a robust methodology to use in order to determine the impact.

The underlying aim of this study is to investigate whether different types of foreign aid flows affect economic growth differently in different time spans. Two time dimensions of the aid term is used in this study; short and long. The short growth impact is measured as the average growth after 0-3 years while the long growth impact is measured as the average growth 6-9 years after the aid allocation. The aid term is measured as an aggregated measure as well as separated into social infrastructure, economic infrastructure, production sectors and multisectoral aid. To shed light on this issue an ordinary least squares (OLS) regression analysis has been made on a data sample covering 46 countries in Sub-Saharan Africa during the period of 1995-2011.

The main findings in this study are that different types of aid affect growth differently and that they also affect growth differently in different time spans. Short growth effects is found

to be significant on aid allocated into social infrastructure while long growth effects is found to be significant on aid allocated into economic infrastructure. As the results are conditional upon the inclusion of a measure of human capital in the regression, the result should be interpreted with caution. Likewise, the underlying challenge of endogeneity makes the coefficient estimates challenging to interpret and compare with previous studies. It might however be possible to conclude that; Different kinds of aid could be expected to not only affect growth differently but also differently in different time settings. It is therefore of relevance for policymakers to, when evaluating aid, consider *when* the aid is expected to affect growth as well as *whether* and *to what extent* the certain aid flow is expected to affect growth.

The structure of this study is as follows; the background of foreign aid and growth theory is presented in the second section. The background-section will be followed by a chapter covering the previous research of the aid and growth relationship. The fourth section presents the empirical model and methodology. The results are presented in the fifth section which is followed by a discussion of the results and its link to the policy debate. Lastly, the concluding remarks are found in the seventh section.

2. Background

This section presents a number of selected background theories and definitions of importance for the study. First, certain theories of economic growth are presented briefly. Thereafter, a clarification on the term foreign aid and the rationale behind it is presented. Lastly, an outline of the historical trends and the current policy debate is given.

2.1 Theories of economic growth

There are a number of theories suggesting why or why not economic growth occurs. The lack of classical theories touching on the aid and growth relationship has made previous studies on the issue to be founded upon the classical growth theories. A large set of the academic studies tend to collect control variables based upon some of the classical growth theories even though a large set of the current studies tend to divert from the classical theories.

Growth theories suggest a number of potential channels that are likely to promote economic growth. The Harrod-Domar model was the first one based on the rationale of increased savings in order to increase growth. The majority of the models are however founded upon the classical Solow-model which stresses the importance of how investments and capital promotes long-run economic growth. The Solow-model was followed by the Romer model which highlights the importance of human capital accumulation. Another model is the technology diffusion model which emphasizes the transfer of technology between countries. It is suggested that the higher the human capital, the easier it is to absorb the world technology. (Jones, 2002, chapter 2, 5-6)

2.2 Foreign aid: Definition

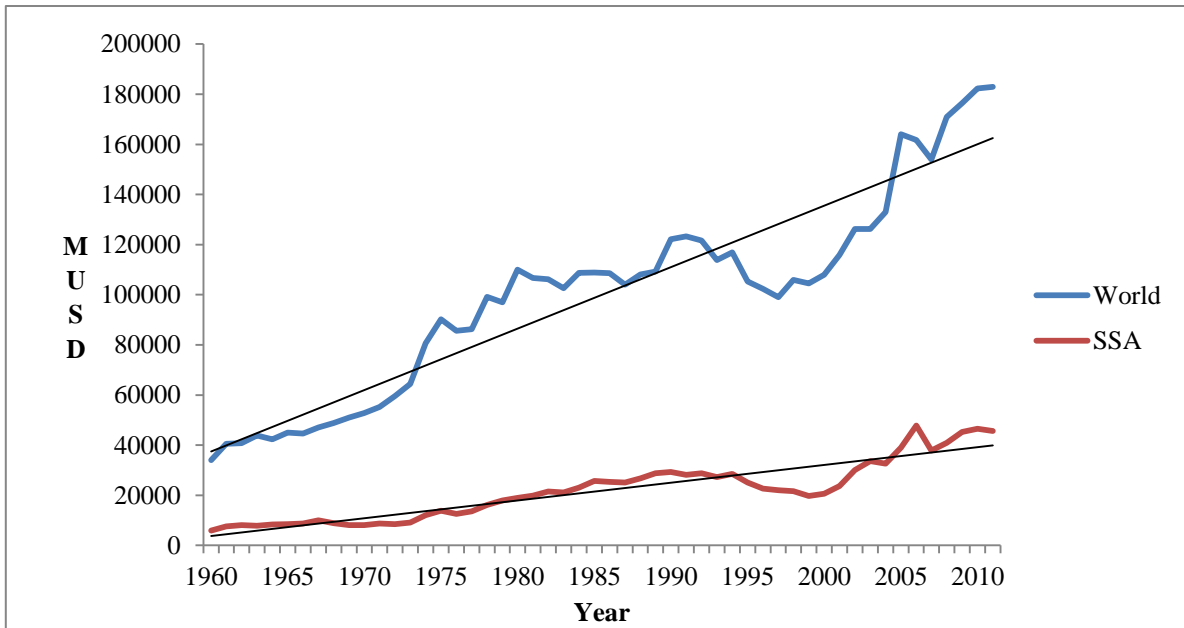
Economists have defined foreign aid as any flows of capital to least developed countries (LDCs) that meets two criteria (1) The donor objective should be non-commercial and (2) the interest rate and repayment period should be less strict than commercial loans. (Todaro and Smith, 2009, p. 729) The Development Assistance Committee (DAC) of Organization for Economic Cooperation and Development (OECD) defines aid activities as “Aid activities include projects and programmes, cash transfers, deliveries of goods, training courses, research projects, debt relief operations and contributions to non-governmental organisations.” (OECD 1)

Official development assistance (ODA) is furthermore the most commonly used measure of foreign aid. The term was introduced by the OECD and covers all official aid flows. Despite the official flows, aid can also consist of private assistance from non-governmental organizations (NGOs) and other potential sources which thus are excluded from the ODA-measure. Furthermore, the ODA is usually distributed in two separate ways: bilateral and multilateral. Bilateral aid is a direct funding of a programme in the recipient country. Multilateral aid on the other hand is canalized through agencies within the development sector such as the United Nations or any of the development banks. (OECD 1)

Most of the foreign aid is designed to meet a set of economic and development objectives. Those usually circulate around funding projects that strengthen infrastructure, productivity, educational structures, health systems, the political system, gender issues and emergency help during humanitarian crises. When judging aid's effectiveness, economic growth is the major component. It could be expected that more aid increases the economic growth rates.

2.3 Foreign aid: Background and policy development

The dilemma of foreign aid and growth seems to be the lack of a robust relationship between the two determinants. A combination of mixed empirical results and lack of theoretical foundation makes the relationship hard to determine. The mixed empirical evidence implies that some countries that have received large amounts of aid have experienced high growth records while other countries haven't. The latter group of countries have, despite large amounts of aid, been characterized by slow or even negative growth rates. (Radelet, 2006, p. 7) Therefore, the debate on the aid-growth relationship is characterized by disagreements. The figure below illustrates the development of ODA over time.



Source: OECD Data [DAC2a]

Figure 1. Development of Official Development Assistance (ODA) 1960-2011

The figure above illustrates the development of total net official development assistance (ODA) for the world and the sub-Saharan African continent. The ODA is calculated in constant 2011 million USD and illustrated over the years 1960-2011. One can see that there has been a steady increase over the time period, except for a dip in the early 1990s, of foreign aid donated. This trend is especially prominent in the world-ODA development. The aid donated to the sub-Saharan African region has also increased but with a weaker trend than the world development. Foreign aid has in other words been donated for approximately 50 years, with a quite steady increased trend. The very recent trends in the world-ODA, which is not shown in the figure, consist of two successive years of falling aggregated aid levels. The ODA fell by 2% in 2011 and 4% in 2012. Contributing factors to the fall were the financial crisis and the euro zone turmoil which have generated a budget tightening for the vast majority of the governments. (OECD 2) Still, according to the DAC survey on donor's forward spending plans, a recovery in aid levels is expected in 2013. The bilateral aid to the group of least developed countries (LDCs) fell by 12.8% in 2012. The bilateral aid to sub-Saharan Africa was 26.2 billion USD in 2012, which represents a fall of 7.9% to the region compared with the aid in 2011. (OECD 2)

The foreign aid policy climate experienced a paradigm shift during the year 2000 when the eight millennium development goals (MDG) were established. The goals of reducing world poverty and inequality by half are to be met in 2015. One of the targets of the eight MDGs is

that donors should set 0.7% of their gross domestic product (GDP) to ODA (UN 1). This can be one of the explanatory factors behind the steep increase since the 2000s in ODA.

In 2005, national donors and multilateral representatives agreed upon an action plan which resulted in the Paris declaration. The agenda suggests that the donors should place greater emphasis on monitoring and evaluate the effectiveness of the aid allocations. (Sida 1) The current debate on aid does still circulate around the effectiveness and on how measurable results of foreign aid can be ensured. In addition to the Paris declaration, a common aid-strategy for the African region was developed by the European Union (EU) and the African Union (AU) in 2007. The strategy was named the Joint Africa-EU strategy (JAES) and formulates a long-term relationship between Europe and Africa in aid donation and allocation.

The summit in Paris was followed by a meeting in Accra in 2008. It was decided that donors should coordinate and harmonize their aid flows to a larger extent. The background of this reform was the presence of a heavy administrative work and management of the aid flows for the recipient countries. A harmonization of the foreign aid flows was adopted in order to increase the ability for the recipients to fight poverty. (Sida 2)

In 2011, the finalizing meeting to follow up the Paris declaration was held in Busan. The summit resulted in a new approach with focus on how aid can work as a catalyst and how an interaction with other actors such as the private sector and emerging economies can be strengthened in order to achieve more sustainable development results. (Sida 4) The agreement in Busan marked the end of the process of a more efficient ODA that were initiated in Paris in 2005. (Sida 3)

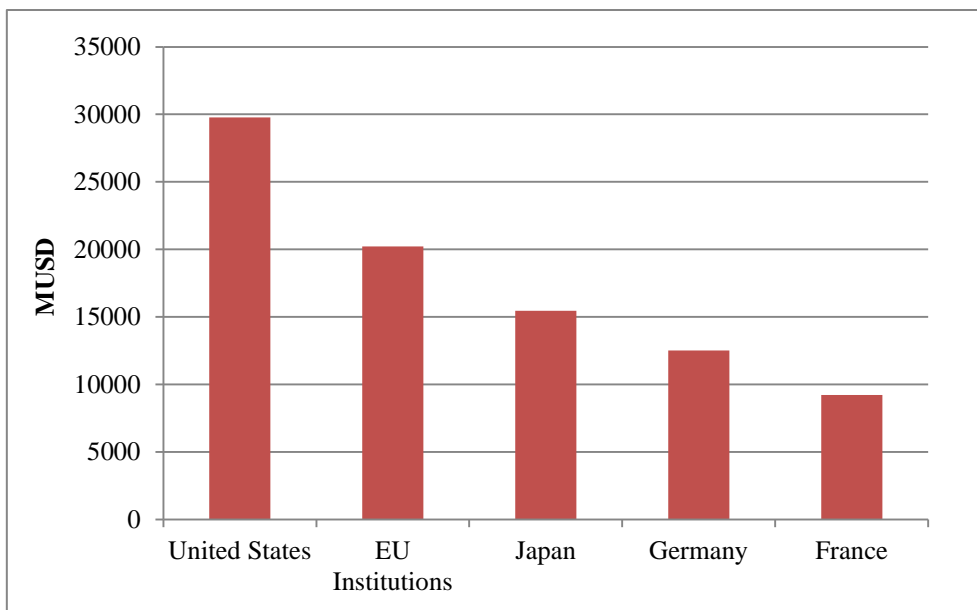
One recent trend on the development cooperation arena is the increased enrollment of the recipient's government and civil society in the policy implementation and allocation of aid. This is an effect of the weakening trend of donor domination in setting priorities, designing programs and implementing projects. (Radelet, 2006, p. 14-16) Another development is an increased allocation of resources into projects facing transnational global challenges. (Odén, 2011, p 180) Likewise, another tendency is that donors tend to earmark contributions for certain purposes or programs. This is likely due to the increased willingness to be able to demonstrate concrete results of the aid allocations. A future trend suggested is a higher selectiveness of recipient countries. This is based on the idea that different countries might face different abilities to absorb the aid and thus face dissimilar capacities to generate measurable results. (Odén, 2011, p 186-188)

2.4 Foreign aid: Who gives foreign aid to whom and why?

It could be questioned why donors seem to be motivated in providing aid and what dominates each specific donor's policy. There are a number of studies that determine the motivation for donor contributions. As the general view of aid is to fight global poverty, donors seem to provide most of their aid to the poorest countries. Still, several studies do argue that the pattern of donor allocation is characterized by strategic interests and historical relationships. In a prominent study by Alesina and Dollar (2000) the pattern of foreign aid is determined. The study uses a data set on bilateral donor contributions during the years 1970-1994. Bilateral aid flows are used as the dependent variable when controlling for a number of other factors¹. The regressions are made upon both aggregated donor basis as well as on differences among donors. The study suggests that a country receives relatively more aid if the recipient country is relatively open, democratic, has experienced a colonial past, votes in unison with Japan in the UN or is named Israel or Egypt. This indicates that the allocation of aid is dictated by political and strategic considerations rather than the economic needs and policy performance of the recipients. One outstanding finding is that the US targets about one-third of its assistance to Israel and Egypt. France on the other hand targets the majority of its aid to their former colonies while Japanese aid is highly correlated with the United Nations voting patterns such that countries voting in tandem with Japan receive more aid. It is argued that the pattern of aid allocations could explain why aid is not more effective in promoting growth and poverty reduction. Another study by Hoeffler and Outram (2011) suggests that 50% of the predicted value of aid is determined by "donor specific effects", 36% by "recipient needs", 16% by "donor self-interest" and 2% by "recipient merit".

More recently, new actors have been established and represent a more important role than previously on the aid assistance arena. China's assistance during the past decade has multiplied and works in a completely different way than the traditional donor strategies. With a strong focus on investment in infrastructure and less focus on political conditions in the recipient country, new views on the development arena are established. (Wohlgemuth, 2011, p. 163) At the same time as China's leading role on the global aid arena is increasing, the role of the US is reduced. (Odén, 2011, p. 180)

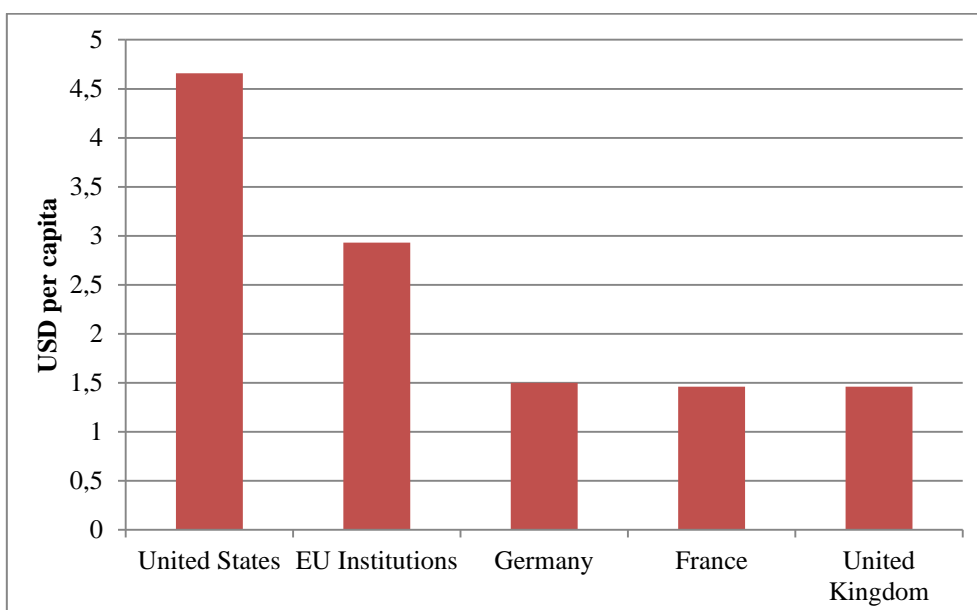
¹ Colonial past, UN friend, Egypt, Israel, initial income, population size, openness, democracy



Source: OECD

Figure 2. World Main Donors 2011, total ODA net

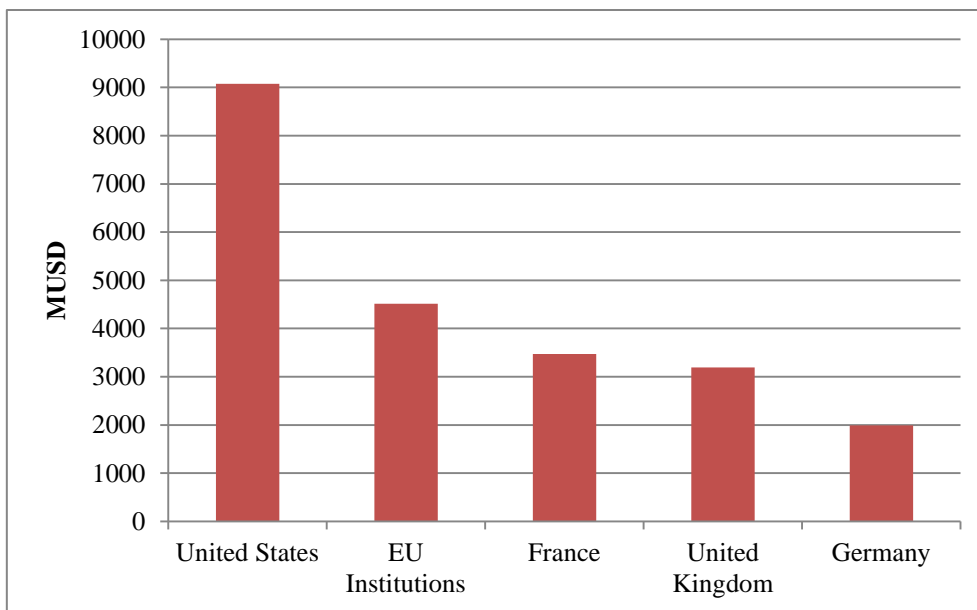
The figure above illustrates the top 5 of the world main donors measured on a total ODA-basis. The five main donors in 2011 were the United States, EU-institutions, Japan, Germany and France. The contributions are measured in constant 2011 million USD.



Source: OECD

Figure 3. World Main Donors 2011, per capita

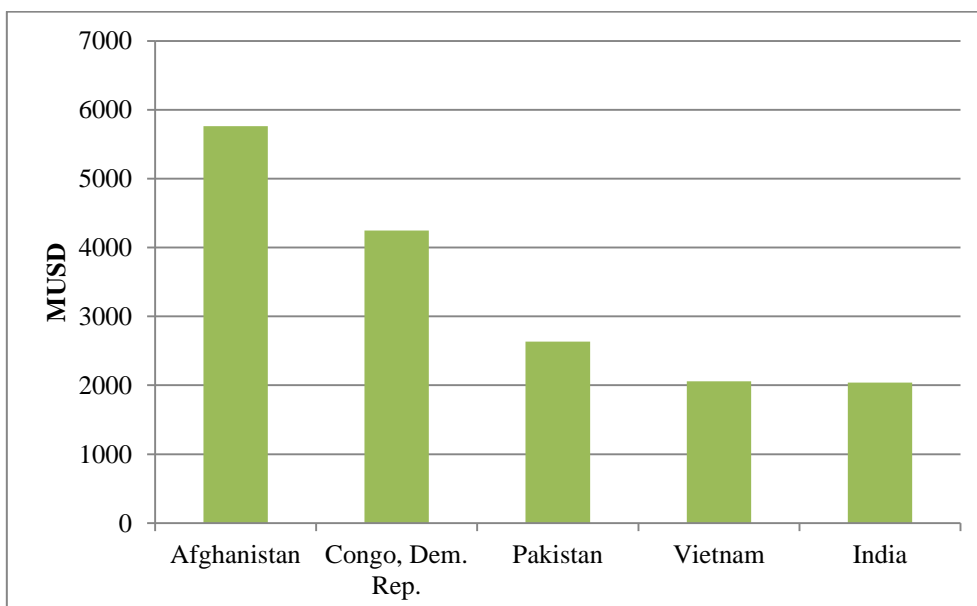
The figure above illustrates the top 5 of the world main donors measured on a per capita basis. One can see that the result do not differ dramatically from when measured on a gross basis. The five main donors in 2011 were the United States, EU-institutions, Germany, France and the United Kingdom. The per capita contributions are measured in current USD per capita.



Source: OECD

Figure 4. World Main Donors to Sub-Saharan Africa 2011, total ODA net

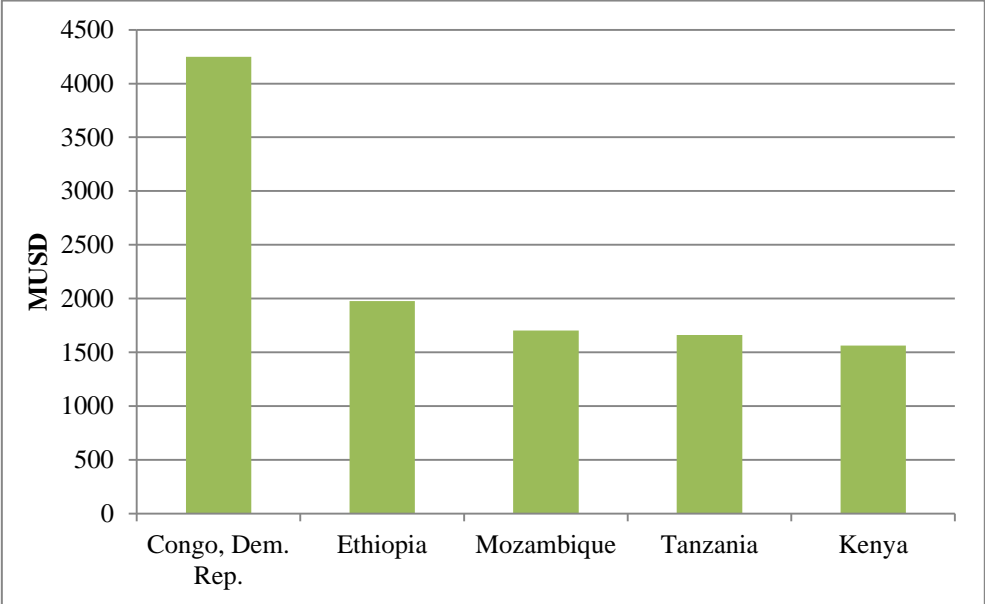
The figure above illustrates the top 5 of the world main donors measured on a total ODA-basis to Sub-Saharan Africa. The five main donors in 2011 were the United States, EU-institutions, France, United Kingdom and Germany. If compared with the world distributions one can see that both France and United Kingdom now has a higher ranking. This is most probably due to their colonial past in the Sub-Saharan region. The contributions are measured in constant 2011 million USD.



Source: OECD

Figure 5. World Main Recipients in 2011, total ODA net

The figure above illustrates the top 5 of the world main recipients measured on a total ODA-basis. The five main recipients in 2011 were Afghanistan, the Democratic republic of Congo, Pakistan, Vietnam and India. The gross contributions are measured in constant 2011 million USD.



Source: OECD

Figure 6. Sub-Saharan Africa Main Recipients in 2011, total ODA net

The figure above illustrates the top 5 of the Sub-Saharan African main recipients measured on a total ODA-basis. The five main recipients in 2011 were The Democratic republic of Congo, Ethiopia, Mozambique, Tanzania and Kenya. The contributions are measured in constant 2011 million USD.

The next chapter will give an outline of the recent research on the area of economic growth and foreign aid.

3. Previous research and methodological challenges

This section presents a selection of the relevant research within the field of aid and growth. Important empirical findings and methodological issues are presented.

The link of foreign aid and economic growth is heavily discussed in the academic literature as well as within multilateral and national institutions. Depending upon data transformation, assumptions and selection of econometric model diverse suggestions on the empiric relationship has been stated. Some studies conclude that aid does not promote growth, others suggest that it does. Some has found that aid supports growth when controlling for diminishing returns of aid and others have found a positive effect in countries with strong policies and institutions. Furthermore, some studies suggests that many aid-funded projects are able to report positive returns on a micro level but that the results are undetectable on the macro-level. Still, there is no strong consensus on what the relationship of aid and growth is, mainly because of the econometric problem of endogeneity.

3.1 Aid does not promote growth

Rajan and Subramanian (2005, 2008) finds that aid has no significant effect on growth. The initial version (2005) follows a broad cross-country growth setting while the latter (2008) is more in accordance with the academic aid and growth literature. The study (2008) applies ordinary least squares (OLS) as well as an instrumental variables (IV) estimation approach. The data is used over four time periods covering the years of 1960-2000. The findings of no effect from aid on growth are robust even when controlling for the donor, recipient, where the aid is allocated or the time frame. Boone (1994, 1996) also finds no significant impact from aid on growth. Boone (1994, 1996) uses a set of neo-classical growth models based on panel data regressions covering a time period of 20 years.

A large set of studies includes regional dummies, the sub-Saharan African dummy is often found to be characterized by a negative sign. Based on this, it has been argued that aid tend to have been ineffective in sub-Saharan Africa. The negative impact of aid on growth has also been explained by the fact that the African region is especially vulnerable to shocks, environmental disasters and political conflicts which might result in a negative estimate despite the large amounts of aid received.

3.2 Diminishing returns

Some studies include a squared aid term and conclude that aid seems to generate growth only through diminishing returns. Hansen and Tarp (2000; 2001), Dalgaard et al (2004) and Clemens et al (2004) find that there are diminishing returns to aid. Still, Hansen and Tarp (2000) find that the effect is sensitive to the choice of estimator and set of control variables which indicates that the result might not be very robust.

3.3 Country heterogeneity

A wide range of studies underline the importance of including country specific effects in the models. One way of doing this is to include interaction variables in the regressions in order to capture the country heterogeneity of the recipients. What might be the most quoted and discussed study in this matter is the one performed by Burnside and Dollar (2000). The study uses a panel data set of 56 countries over 1970-1993. The data is averaged over six four-year time periods. An OLS as well as a two stage least squares (2SLS) estimation procedure is applied in order to determine the relationship. A policy index² is developed and interacted with the aid term in the model in order to capture the differences in policy climates across the recipients. The authors find that the effect of foreign aid is conditional upon the recipients' policy environment. The findings have heavily affected the discussion on policy recommendations, whether aid therefore should be directed to countries characterized by good policy environments. Still, the result has also been questioned and criticized.

Contradicting the result found by Burnside and Dollar (2000), Hansen and Tarp (2000) finds that aid increases the growth rate, unconditional of the policy environment. A panel data set over 1974-1993 is used and regressed through an OLS as well as a GMM estimation technique in order to determine the relationship. Morrissey (2001) on the other hand argues that accounting for the policy environment is of importance but states that it is unclear whether aid only works in good policy environments. The latter study uses a cross-country panel data set of the recipient countries over 1973-1990. The data is averaged over five year periods and estimated through OLS, fixed effects (FE) and generalized least squares (GLS). Dalgaard and Hansen (2001) use the same data set as Burnside and Dollar (2000) with a modified model setting. They suggest that the finding by Burnside and Dollar (2000) is not robust and that they, by identifying outliers, can obtain a positive effect of aid on growth in

² The budget surplus, inflation rates and an openness dummy is used in order to create the policy index. The weight given to each parameter is calculated in the study. The policy index = $1.28 + 6.85 * \text{Budget surplus} - 1.4 * \text{inflation} + 2.16 * \text{openness}$.

any policy environment. Easterly et al (2004) updates the data used in the study by Burnside and Dollar (2000). The time period is extended and missing data is filled in. It is found that the study by Burnside and Dollar (2000) is not robust when making use of the additional data.

Clemens et al (2004) also argue against that the growth effects are dependent upon country specific effects, that growth can be generated even without a good policy or institutional climate. Dalgaard et al (2004) set up a regression which includes the fraction of land in the tropics and its interaction with aid. A similar model and estimation technique is used as the one proposed in Burnside and Dollar (2000). It is found that aid has a stronger positive impact on growth in countries outside the tropical region, while the impact is smaller in the tropics. Collier and Hoeffler (2004) use a database on countries recovering from civil wars. The data is averaged over 4-year periods and available from 1966 to 1998. An OLS-estimator is used and combined with robust standard errors. Interaction terms are included in the analysis and it is found that aid is more efficient in promoting growth in post-conflict countries.

3.4 Aid heterogeneity

More recent studies are concentrated on the effect of sector specific aid rather than aggregated aid in order to determine the growth impact. The rationale behind the usage of different types of aid is simply that all aid is not intended for growth purposes. Aid can also be provided to support humanitarian emergency needs, support to build up political systems or support democratic development where growth might be a distant objective. This stresses the importance of a division of aid into different sub-categories. Instead of focusing on the heterogeneity of the recipients, the importance of heterogeneity of the aid flows is stressed.

Kaya et al (2012) classifies aid into four categories; agricultural aid, social infrastructure aid, investment aid and non-investment aid. A panel data set based on all recipient economies is used over the years 1975-2004. The panel data is used on 4-year averages following the same model setting as Burnside and Dollar (2000). A generalized method of moments (GMM) estimation technique is applied. The main focus in the study is related to aid allocated into the agricultural sectors and its potential success in promoting economic growth. It is found that aid directed towards the agricultural sector is more effective in raising per capita income than aid directed to the other sectors. In more specific terms, it is found that an increase by US\$10 million of agricultural aid would generate an annual growth increase by 0.2 percentage points.

A frequently cited paper is a study by Clemens et al (2004) which classifies aid into three categories; emergency and humanitarian aid, long-impact aid and short-impact aid. A panel

data set of all recipient countries are used over four-year averages during 1973-2001. A two-stage least squares (2SLS) as well as a GMM estimation technique is applied. The authors determine the short-term component of aid on growth. It is found that the short-impact aid component has a strong, positive and significant effect on growth over a four-year period. The study suggests that an increase by US\$1 in short-impact aid increase the output and income by US\$8. The result is robust across various specifications and is not dependent upon the recipient's level of institutional quality and policies even though it is evident that the impact on growth is greater in countries with stronger institutions or longer life expectancies.

Minoiu and Reddy (2009) classifies aid into two categories; (1) aid that is predicted to promote development and (2) aid given for other purposes. Data is used over 5-year periods from 1960-2000. Both an OLS estimation as well as GMM estimation is performed. It is found that development aid with the objective to generate growth is significant and positively related to growth in contrast with other types of aid. Selaya and Thiele (2010) separate aid allocated into the tradable and non-tradable sectors. A panel data set is used consisting of 65 developing economies over the years 1962-2001. A GMM estimator is used in order to determine the impact of aid on growth. It is found that the growth effects do not differ between aid allocated into the tradable and non-tradable sector. The authors therefore conclude that aid does not seem to reduce a recipient's competitiveness.

3.5 Time horizon of the growth effects

Another argument discussed in a few papers is to adjust the growth effects to the time horizon assumed needed for the aid to generate an effect. As mentioned before, Clemens et al (2004) finds that the aid component which is assumed to affect growth within 4 years' time is significant upon growth. Minoiu and Reddy (2009) take the long-run time horizon into consideration and finds that development aid promotes long-run³ growth. Karras (2006) also investigates the long-run effect on data from 1960-1997. The variables are averaged over the entire period in order to determine the impact and a fixed effects (FE) estimator is used. It is found that the effect of foreign aid on economic growth is positive and significant. The result indicates that a rise in foreign aid by \$20 per capita would result in an increase in the growth of 0.16 percent.

³ Long run defined as 25 years after the aid allocation

However, many studies do not take the time horizon properly into consideration and there is definitely a gap in the present literature. The idea that different aid allocations might affect growth differently due to the time needed for the effects to be generated is often left out.

3.6 Studies on sub-Saharan Africa

The majority of the studies cover all recipient countries with inclusions of regional dummies in the regressions. As was mentioned before, the sub-Saharan regional dummy is often found to be negative in those cases. Therefore, the results found on an aggregated recipient level are likely to be upward biased if one desires to determine the effects solely for the sub-Saharan African region.

Justelius et al (2013) investigates the long-run impact of foreign aid in sub-Saharan Africa. Data from the mid-1960s to 2007 is used in a vector autoregressive (VAR) model. It is found that aid has had a positive long-run impact on GDP and investment levels in general. Hadjimichael et al (1995) and Durbarry et al (1998) found a similar result. The latter study uses both cross-section and panel data techniques and finds that foreign aid has contributed positively to growth in sub-Saharan Africa. Still, the result is conditional upon a stable macroeconomic policy environment.

3.7 Endogeneity and methodological challenges

The main challenge in determining the relationship of aid and growth is the presence of severe endogeneity. The endogeneity appears due to two reasons (1) a need-based allocation of aid such that countries with poor growth performances receive more aid (reverse causation) and (2) the presence of omitted variables that affect both aid and growth (simultaneous causation). The fact that donors to a large extent allocate more resources to countries with poor growth performances or other strategic interests result in that aid is not exogenously given upon growth. This is likely to result in a bias which, dependent upon the strength of the effects, might result in an either upward or downward bias. The omitted variable bias is captured in the error term which can contribute to a variety of econometric challenges. One such problem could be a correlation of the error term and the aid and/or the growth variable.

The most common estimation technique applied is the instrumental variables (IV) estimator which is seen as an efficient method when one wants to solve the simultaneity bias. It is argued that a use of an IV-estimator allows for a separation of the true and endogenous growth effects from aid. It is believed that the negative feedback of poor growth performance to compensatory aid is excluded when including the instruments and that the OLS estimator is

likely to generate biased estimates. The partial adjustment process⁴ of economic growth is often used as an argument contrary the use of a fixed effect (FE) or a random effect (RE) estimator. As recent studies tend to make use of both longer time series and more accurate data, the recent studies tend to be combined with more advanced econometric techniques.

Dalgaard and Hansen (2001) find a significant difference in their estimates when using and IV-estimator rather than an OLS-estimator. Brückner (2013) finds that a positive effect is found only when it is adjusted for the reverse causality by including instruments. Other studies⁵ account for the simultaneity bias of foreign aid by a two-step method. The two-step method first estimates the response of foreign aid on growth, and secondly estimates the residual variation in aid that is not driven by growth. The latter is used as an instrument.

There are arguments against using an IV-approach which suggests that there are no valid instruments that could be used or that the instruments applied are weak⁶. A valid instrument is supposed to highly correlate with the endogenous regressor, in this case aid, without correlate with the dependent variable, growth. In studies by Burnside and Dollar (2000), Clemens et al (2004), Hansen and Tarp (2000) and Boone (1996) lagged values of a number of social and political indicators were used as instruments. More specifically, lagged arms imports; mortality rates; secondary school enrollment; life expectancy; dummy for former French colonies and the natural log of the population were employed as instruments. Lagged values of aid have also been employed as instruments in some cases. It could be questioned whether these variables are really uncorrelated with economic growth.

Even though a large set of studies uses the instrumental variables technique Deaton (2010) argue that IV-techniques are unlikely to sort out effect of foreign aid. It is argued that there are two typical sources of confusion; misunderstanding of exogeneity and the handling of heterogeneity. It argued that the instruments used in the growth-aid research are external but not exogenous on growth which has caused confusion in the literature. As known, an exogenous instrument requires absence of simultaneity and Deaton exemplifies this with the use of historical variables. They are clearly external such that the mortality of the colonial settlers is not influenced by today's institutional arrangements. Whether this instrument is exogenous depends on the specification of the equation, and this is according to Deaton not guaranteed by its externality. Given this, the result is biased due to the choice of weak and

⁴ That current growth to a large extent depends upon past growth performances

⁵ See Boone (1994, 1996), Hadjumi et al. (1995) and Burnside and Dollar (2000)

⁶ Low correlation between the instrument and the endogenous regressor. (Verbeek, M., 2012, p. 151-152)

inconsistent instruments. Deaton instead suggest randomized evaluations of projects in order to determine the growth effects of foreign aid.

Even though the aid-growth literature contains a wide range of stories of how foreign aid affects economic growth there is no real consensus on what the actual effects are. Neither is there any consensus on what model or regression technique to use when determining the effects on a cross-country basis.

The next chapter presents the model and estimation procedure applied in this study.

4. Empirical model and estimator

This section presents the data and the modeling setup that will be applied in order to sort out the effects of aid on growth. In order to reduce the impact of country heterogeneity, this study is based on solely the sub-Saharan African continent.

4.1 Data

The panel data set consist of 46 countries in sub-Saharan Africa. The dependent variable is economic growth, while the explanatory variable of interest is foreign aid. A number of control variables are included in the regressions in order to reduce the impact of omitted variables and make a try to detect the sources of endogeneity. The control variables are based upon previous studies. Data has been collected from four different sources; World Development Indicators (2011) distributed by the World Bank, United Nations population division, The Barro Lee Dataset and OECD-DAC's Creditor Reporting System (CRS). The latter database is an aid activity database that contains detailed aid data on sectoral and geographical breakdowns. The summary statistics is presented in appendix B and the data is presented in table 1.

Description	Variable name	Units	Year	Source	Obs
Economic growth	growth	%, 4 year averages	2001-2011	WDI	414
Initial GDP per capita	gdp	log, USD	2001	WDI	46
Inflation, CPI	inflation	%	2002-2010	WDI	403
Population growth	popg	%	2002-2010	UN-Data	414
Life expectancy at birth	lex	years	2002-2010	WDI	414
External debt stocks	debt	% of GNI	2002-2010	WDI	414
Export	export	log, index 1-10	2002-2010	WDI	414
Budgetary and financial management	budg	average, index rating 1-6	2001-2009	WDI	334
Average years of schooling	school	years, 5 year averages	2005-2010	Barro Lee	288
French colony	french	dummy; 1 if former french colony, 0 otherwise		NE.se	414
Experience of a civil war during 2001-2011	cwar	dummy; 1 if experienced a civil war, 0 otherwise	2001-2011	WDI	414
Aid allocated into all sectors (coded "1000")	aidtot_long	% of GDP	1995-2003	OECD-CRS	414
Social infrastructure and services, total (coded "100")	socinf_long	% of GDP	1995-2003	OECD-CRS	414
Economic infrastructure and Services, total (coded "200")	ecinf_long	% of GDP	1995-2003	OECD-CRS	414
Production sectors, total (coded "300")	prod_long	% of GDP	1995-2003	OECD-CRS	414
Multi-Sector/Cross-Cutting, total (coded "400")	multisect_long	% of GDP	1995-2003	OECD-CRS	414
Rest of the aid (code "1000"- "450")	rest_long	% of GDP	1995-2003	OECD-CRS	414
Aid allocated into all sectors (coded "1000")	aidtot_short	% of GDP	2001-2009	OECD-CRS	414
Social infrastructure and services, total (coded "100")	socinf_short	% of GDP	2001-2009	OECD-CRS	414
Economic infrastructure and Services, total (coded "200")	ecinf_short	% of GDP	2001-2009	OECD-CRS	414
Production sectors, total (coded "300")	prod_short	% of GDP	2001-2009	OECD-CRS	414
Multi-Sector/Cross-Cutting, total (coded "400")	multisect_short	% of GDP	2001-2009	OECD-CRS	414
Rest of the aid (code "1000"- "450")	rest_short	% of GDP	2001-2009	OECD-CRS	414

Table 1. Illustration of collected data and its sources

Table 1 presents the data used in the study and its sources. Growth is calculated as 4-year averages in order to reduce the impact of minor shocks and cycles. Both the initial GDP per capita and the export index are used in log form in order to reduce the impact of influential outliers. The reason behind the use of log forms is due to large differences across countries where the use of logged indicators is more appropriate.

The log of the initial GDP per capita has been included in almost all studies since the 1990s and is expected to be negative on growth due to the convergence effects. The inflation levels are included as a proxy for the monetary stability in the country. Population growth and life

expectancy are included as social indicators. The level of external debt is included in order to capture the country's financial state. Exports are included as a measure of openness towards the rest of the world. An index of budgetary and financial management is included in order to reflect the capacity to carry out policies⁷ in the recipient country. The average years of schooling are included as a measure of human capital⁸. Finally, a dummy for former French colonies are included in order to control for historical differences.

As some of the control variables used by previous studies were unavailable for the chosen group of countries and time period alternative measures had to be included. The limited access to data also excluded the possibility of using an already existing model. Two variables that were unavailable are assassinations and ethno-linguistic fractionalization. Instead of these two measures a dummy for civil war is included to capture a somewhat similar effect.

The aid data is collected from the OECD's Creditor Reporting System (CRS) database. The aid terms are both on an aggregate level and a disaggregated level. The disaggregated aid terms collected are measures of social infrastructure, economic infrastructure, production sectors and multi-sector. A further explanation of the aid terms is included in section 4.2.3. As in many other studies, aid is calculated as a fraction of GDP when included in the analysis.

It is possible that some of the data that has been collected might be misleading or unreliable due to the challenge of collecting data in developing countries. Still, I assume that the vast majority of the data collected is reliable and hence possible to include in the regression analysis. See section 5.4 for a further discussion on robustness.

4.2 Time frame

Even though there are no strong consensus of the effect of aid on growth many studies have been made on direct growth effects and short-term growth effects. It is likely that the effects from sectoral aid on growth do differ when it comes to (1) the magnitude of the effect and (2) when the effect is likely to occur. Previous studies stress the complications to separate the effects of aid on growth when the time frame is prolonged due to more uncontrolled noise. However, many projects funded by foreign aid might need a longer period of time in order for the effect to mature. I do not believe that this is solely due to country heterogeneity but rather a result of aid heterogeneity. This point on the necessity of extending the time frame used and

⁷ A policy index following Burnside and Dollar (2000) were not possible to reconstruct due to lack of data for the chosen time period.

⁸ Various measures of human capital and school enrollment has been tested for, average years of schooling seemed to be the most efficient measure.

allow different aid allocations to differ in terms of time needed in order to generate an effect on growth. As have been mentioned before, the idea that different aid allocations might need shorter or longer time for the effects to be generated is often left out.

In order to assess whether different growth impacts could be expected from different types of aid flows in different time settings two measures of foreign aid are used. The short aid term is used in order to assess the direct effects on growth. Additionally, in order to see whether there in fact are different effects, the long aid term is separated from the economic growth term and used on a lagged $t-7$ basis. Due to lack of data the time frame could not be prolonged further. An alternative method considered was to keep the aid terms constant and prolong the growth and control variables used instead. According to my estimations, the most stable estimation method was to keep all indicators constant and hence change the aid term in order to assess the effect on growth when the time frame is prolonged.

Lastly, it is likely that the two different measures of aid might have different endogenous relationships with the growth term. It could be expected that a longer time interval between the aid and growth might diminish the effect that more aid is allocated to countries with poor growth performances.

4.3 Model and estimator

The literature suggests a number of different methods and specifications in order to determine the impact of aid on growth. The relationship of aid and growth also lacks a theoretically specified relationship which the regression could rely upon. This leaves the researcher with more flexibility when choosing a methodological strategy to apply.

A frequently used model and data set is the one created by Burnside and Dollar (2000). However, applying the model on this study was not possible due to lack of data for the sub-Saharan countries and the desired time period for which sectoral aid data is available. The model used in this study is inspired by the model used by Clemens et al (2004) and Burnside and Dollar (2000) and thus characterized by the same rationale as in the previous academic studies.

Returning to my question of interest, I would like to see (1) whether the growth effects from aid might differ when allowing for the effects to occur and (2) whether a division upon sectoral aid flows affects the findings in (1). Estimations based on the following model have been made.

$$growth_{it} = \alpha + \beta_1 aid_{ist-x} + \sum \beta_n c_{it} + \varepsilon_{it}$$

Growth in country i at time t is assumed to be explained by the allocation of aid in country i in sector s at time t and a vector of n control variables c in country i at time t . The index x represents the x years backwards that the aid is allocated.

The series of regressions start with a simple ordinary least squares (OLS) regression. The control variables are added one by one in order to determine whether they are of relevance for the specific regression. As each control variable is added, the impact on the aid coefficient is observed in order to see whether the variable might affect the endogenous relationship of growth and aid. For further information on this, see section 5.4.

Initially, the aid term is used on an aggregated basis and in time $t=0$. The later regressions make use of the aid term in $t=-7$ and on a sectoral basis. A more detailed stepwise explanation is included in 4.2.1; 4.2.2 and 4.2.3. Throughout the regressions, robust standard errors are applied.

An OLS-estimation technique is employed in this study due to the choice of following Deaton (2010) who argues that there are simply no valid instruments for aid that is exogenous on growth. I am aware of that the OLS-estimates will be biased from the endogenous relationship characterizing the aid and growth variables. Still, I suggest that it should be questioned whether the IV-method really illustrates a more accurate picture of the aid and growth relationship. A more efficient way in determining the relationship could be to focus more on the potential true relationship between aid and growth rather than the tendency of using more and more advanced econometric techniques.

4.3.1 Simple model

The first base regression (1) is a simple regression which follows the reasoning of the majority of the research. Growth is estimated upon aggregated aid when controlling for the log of the initial GDP per capita.

$$growth_{it} = \alpha + \beta_1 aid_{it} + \beta_2 gdp_{it=0} + \varepsilon_{it} \tag{1}$$

4.3.2 Country heterogeneity and extended time period

A large set of studies propose that the effect from aid on growth is conditional upon the recipient's characteristics. A set of control variables is added to the model in order to capture some effects from other factors influencing growth during the period.

Based on regression (1) a set of control variables are included in (2), (3) and (4). As in regression (1) the aggregated measure of the short-term aid is used. In (2) inflation, debt and exports are added in order to control for the macroeconomic environment. In addition to this, a dummy for experiencing a civil war and a dummy for being a former French colony is included in order to control for political instability and for colonial past. In (3) a budgetary and financial management index is included as a measure of institutional quality. Furthermore, life expectancy and population growth are included as measures of the social environment. In (4) the average years of schooling⁹ is included in order to control for the level of human capital. In regression (5) and (6) the time period¹⁰ is extended such that the aid term is measured in $t-7$. An extension of the time between the aid allocation and the economic growth term enables a comparison of whether the effect of aid on growth is identical if the effect from the aid is allowed to mature.

$$\begin{aligned} growth_{it} = & \\ & \alpha + \beta_1 aid_{it} + \beta_2 gdp_{it=0} + \beta_3 inflation_{it} + \beta_4 debt_{it} + \beta_5 export_{it} + d_1 cwar_i + d_2 french_i + \\ & \varepsilon_{it} \end{aligned} \tag{2}$$

$$\begin{aligned} growth_{it} = & \\ & \alpha + \beta_1 aid_{it} + \beta_2 gdp_{it=0} + \beta_3 inflation_{it} + \beta_4 debt_{it} + \beta_5 export_{it} + d_1 cwar_i + d_2 french_i + \\ & \beta_6 budg_{it} + \beta_7 lex_{it} + \beta_8 popg_{it} + \varepsilon_{it} \end{aligned} \tag{3}$$

$$\begin{aligned} growth_{it} = & \alpha + \beta_1 aid_{it} + \beta_2 gdp_{it=0} + \beta_3 inflation_{it} + \beta_4 debt_{it} + \beta_5 export_{it} \\ & + d_1 cwar_i + d_2 french_i + \beta_6 budg_{it} + \beta_7 lex_{it} + \beta_8 popg_{it} + \beta_9 school_{it} + \varepsilon_{it} \end{aligned} \tag{4}$$

⁹ A number of different measures of schooling have been tested for. Neither school enrollment measured as net nor gross enrollment contributed to the analysis. Even though average years of schooling reduce the number of observations dramatically it is likely that it contributes to the analysis.

$$\begin{aligned}
growth_{it} = & \alpha + \beta_1 aid_{it-7} + \beta_2 gdp_{it=0} + \beta_3 inflation_{it} + \beta_4 debt_{it} + \beta_5 export_{it} + \\
& d_1 cwar_i + d_2 french_i + \beta_6 budg_{it} + \beta_7 lex_{it} + \beta_8 popg_{it} + \varepsilon_{it}
\end{aligned}
\tag{5}$$

$$\begin{aligned}
growth_{it} = & \alpha + \beta_1 aid_{it-7} + \beta_2 gdp_{it=0} + \beta_3 inflation_{it} + \beta_4 debt_{it} + \beta_5 export_{it} \\
& + d_1 cwar_i + d_2 french_i + \beta_6 budg_{it} + \beta_7 lex_{it} + \beta_8 popg_{it} + \beta_9 school_{it} + \varepsilon_{it}
\end{aligned}
\tag{6}$$

4.3.3 Aid heterogeneity

In line with the suggestions and important findings by Clemens et al (2004) the aid term is divided into several terms in order to sort out whether different kinds of aid affects growth differently. Likewise the aid term is adjusted to fit the two different time horizons in order to test whether the different sectoral aid flows do affect the economic growth differently in different time horizons. The division of the aggregated aid term is presented in the table below.

1000: Total All Sectors
450: Total Sector Allocable
100: I. Social Infrastructure and Services, Total
110: I.1. Education, Total
120: I.2. Health, Total
130: I.3. Population Pol./Progr. and Reproductive Health, Total
140: I.4. Water Supply and Sanitation, Total
150: I.5. Government and Civil Society, Total
160: I.6. Other Social Infrastructure and Services, Total
200: II. Economic Infrastructure and Services, Total
210: II.1. Transport and Storage, Total
220: II.2. Communications, Total
230: II.3. Energy, Total
240: II.4. Banking and Financial Services, Total
250: II.5. Business and Other Services, Total
300: III. Production Sectors, Total
310: III.1. Agriculture, Forestry, Fishing, Total
320: III.2. Industry, Mining, Construction, Total
331: III.3.a. Trade Policies and Regulations, Total
332: III.3.b. Tourism, Total
400: IV. Multi-Sector / Cross-Cutting, Total
410: IV.1. General Environment Protection, Total
430: IV.2. Other Multisector, Total
500: VI. Commodity Aid / General Prog. Ass., Total
510: VI.1. General Budget Support, Total
520: VI.2. Dev. Food Aid/Food Security Ass., Total
530: VI.3. Other Commodity Ass., Total
600: VII. Action Relating to Debt, Total
700: VIII. Humanitarian Aid, Total
910: IX. Administrative Costs of Donors, Total
930: XI. Refugees in Donor Countries, Total
998: XII. Unallocated / Unspecified, Total

Table 2. Description of the division of the aid term into sectors

Table 2 presents the division of aid into the sectoral grouping applied by the CRS-database. The aid term used on an aggregated basis in this study is the one coded as “1000”. When applying the division of the aid flows into several sectors the following sectors are used as independent terms (1) 100: I. Social Infrastructure and Services, Total; (2) 200: II. Economic Infrastructure and Services, Total; (3) 300: III. Production Sectors, Total; (4) 400: IV. Multi-Sector/Cross-Cutting, Total. As is displayed in the table, the aid term “social infrastructure” covers aid projects related to education and health related services. The aid term “economic infrastructure” covers aid projects related to communications, transports and financial services. “Productivity” covers aid projects related to agriculture, industry, trade and tourism while multi-sector covers projects related to environmental protection and others. When referring to “rest” in the equations it is simply to the aid not captured in the four disaggregated terms (“1000”-“450”).

The equations in (7)-(10) are based on equations (3)-(6) where the aid-term is substituted for the sectoral aid term.

$$\begin{aligned}
growth_{it} = & \alpha + \beta_1 socinf_{it} + \beta_2 ecinf_{it} + \beta_3 prod_{it} + \beta_4 multisect_{it} + \beta_5 rest_{it} \\
& + \beta_6 gdp_{it=0} + \beta_7 inflation_{it} + \beta_8 debt_{it} + \beta_9 export_{it} \\
& + d_1 cwar_i + d_2 french_i + \beta_{10} budg_{it} + \beta_{11} lex_{it} + \beta_{12} popg_{it} + \varepsilon_{it}
\end{aligned} \tag{7}$$

$$\begin{aligned}
growth_{it} = & \alpha + \beta_1 socinf_{it} + \beta_2 ecinf_{it} + \beta_3 prod_{it} + \beta_4 multisect_{it} + \beta_5 rest_{it} \\
& + \beta_6 gdp_{it=0} + \beta_7 inflation_{it} + \beta_8 debt_{it} + \beta_9 export_{it} \\
& + d_1 cwar_i + d_2 french_i + \beta_{10} budg_{it} + \beta_{11} lex_{it} + \beta_{12} popg_{it} \\
& + \beta_{13} school_{it} + \varepsilon_{it}
\end{aligned} \tag{8}$$

$$\begin{aligned}
growth_{it} = & \alpha + \beta_1 socinf_{it-7} + \beta_2 ecinf_{it-7} + \beta_3 prod_{it-7} + \beta_4 multisect_{it-7} \\
& + \beta_5 rest_{it-7} + \beta_6 gdp_{it=0} + \beta_7 inflation_{it} + \beta_8 debt_{it} + \beta_9 export_{it} \\
& + d_1 cwar_i + d_2 french_i + \beta_{10} budg_{it} + \beta_{11} lex_{it} + \beta_{12} popg_{it} + \varepsilon_{it}
\end{aligned} \tag{9}$$

$$\begin{aligned}
growth_{it} = & \alpha + \beta_1 socinf_{it-7} + \beta_2 ecinf_{it-7} + \beta_3 prod_{it-7} + \beta_4 multisect_{it-7} \\
& + \beta_5 rest_{it-7} + \beta_6 gdp_{it=0} + \beta_7 inflation_{it} + \beta_8 debt_{it} + \beta_9 export_{it} \\
& + d_1 cwar_i + d_2 french_i + \beta_{10} budg_{it} + \beta_{11} lex_{it} + \beta_{12} popg_{it} + \varepsilon_{it} \\
& + \beta_{13} school_{it} + \varepsilon_{it}
\end{aligned} \tag{10}$$

The results are presented in the next section.

5. Results

This section presents the results from the regressions stated in section 4.3.1; 4.3.2 and 4.3.3. Despite a presentation of the results, a discussion on the robustness of the results is discussed in section 5.4.

5.1 Simple regression

Variables	(1)
aid_short	0.043*** (0.009)
gdp	0.015*** (0.004)
_cons	-0.025** (0.012)
Obs	414
R ²	0.046

*, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. The standard errors are provided in the parentheses.

Table 3. Simple regression

The simple model illustrates the relationship between aid and growth when controlling for the initial GDP. As can be seen in the table, the coefficient estimate of aid is significant with a coefficient value of 4.3%. Due to the endogenous effects aid was expected to be negatively related to growth at the initial stage, my estimate suggest otherwise. Secondly, the initial GDP is significant and positive on growth. This suggests otherwise from what could be expected, simply that countries characterized by higher initial GDP usually experiences higher growth rates. The reason for the contradictory estimates could be due to the limited period for which the data were collected and that an extended time period of data could yield other estimates.

5.2 Country heterogeneity and extended time period

The table below illustrates regression (2)-(6) which adds the dimension of controlling for country specific effects. The time horizon is extended in (5) and (6).

Variable	(2)	(3)	(4)	(5)	(6)
aid_short	0.042*** (0.009)	0.019** (0.008)	0.025*** (0.008)		
aid_long				0.027* (0.016)	0.015 (0.016)
gdp	0.010*** (0.003)	0.014* (0.007)	0.005 (0.006)	0.013* (0.008)	0.001 (0.006)
inflation	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
debt	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
export	0.008*** (0.002)	0.006*** (0.002)	0.006*** (0.002)	0.005** (0.002)	0.006** (0.002)
cwar	0.013*** (0.003)	0.015*** (0.003)	0.006** (0.003)	0.016*** (0.003)	0.008*** (0.003)
french	-0.015*** (0.003)	-0.022*** (0.003)	-0.019*** (0.003)	-0.023*** (0.003)	-0.021*** (0.003)
budg		0.006** (0.003)	0.004 (0.003)	0.005* (0.003)	0.001 (0.003)
lex		0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
popg		0.011*** (0.003)	0.010*** (0.003)	0.012*** (0.003)	0.013*** (0.003)
school			-0.000 (0.001)		0.001 (0.001)
_cons	-0.049*** (0.018)	-0.134*** (0.025)	-0.123*** (0.027)	-0.131 (0.024)	-0.106*** (0.027)
N	385	323	232	323	232
r2	0.231	0.414	0.504	0.413	0.489

*, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. The standard errors are provided in the parentheses.

Table 4. Regressions including control variables

When comparing regression (1) and (2) one can see that the macroeconomic variables contributes to the explanatory power of the model. As expected, inflation affects growth negatively and exports affect growth positively. The debt levels are however not significant. Furthermore, a French colonial past contributes negatively to growth, as is in accordance with other studies. The French dummy also adds a large amount of explanatory power. The dummy for civil war is positively correlated with growth which at first seems unexpected. However, it could simply be the case that the growth effects after the civil war, when the economy starts to recover, is higher than the direct negative impact on the growth rates. In (3) the index of budgetary and fiscal management¹¹ is included and yields a positive and significant result on

¹¹ The index used were compared with an index of property rights, the effects were similar and the indexes were highly correlated so the property rights index were excluded. The financial management index had a lower p-value and is more in accordance with the Burnside and Dollar index.

growth. Furthermore, life expectancy and population growth was added to the model which increased the explanatory power and reduced the coefficient value of the aid variable. As expected, higher life expectancy contributes positively to growth. However, population growth is unexpectedly positive on growth. It is hard to motivate why the population growth should be positive on growth except for the effect on that more people might be able to work and hence produce more output. In (4) the average years of schooling is added to the model. It contributes to an increase of the R^2 but at the same time reduces the number of observations dramatically. It is hard to motivate whether the increase in R^2 is due to the inclusion of the schooling or because of the reduction in the number of observations. As more control variables are added to the equation, the coefficient estimate of aid on growth is reduced indicating that other factors might explain growth to a larger extent than the aid term.

In (5) the time horizon is extended. Comparing (3) and (5) one can see that the coefficients of the control variables haven't altered much which indicates a robustness of the endogenous effects. The significance of the aid term have decreased but the coefficient estimate is however larger. This indicates that the impact from aid on growth, on an aggregated level, does increase when the time period is prolonged. Such that aid might need a couple of years before the growth effects are achieved. The reduced significance could however indicate that there is more uncontrolled noise which therefore reduces the possibility to determine the impact of aid on growth. Comparing (4) and (6) on the other hand makes the aid term insignificant when prolonging the time period. This insignificance is conditional upon the inclusion of a measure of human capital in the regression.

A number of previous studies argue that whether or not aid generates growth is conditional upon the policy environment. Therefore aid and its interaction with the budgetary and fiscal management were ought to be added to the model. The coefficient on aid changed greatly in magnitude and significance upon the inclusion of the interaction term. This suggests that there should be a difference in the way that aid affects growth in different countries dependent upon the policy environment¹². However, due to problems with multicollinearity the interaction term had to be excluded, the same problem occurs with the interaction of aid and life expectancy respectively inflation. The interaction term of aid and former French colonies did not suffer from multicollinearity but did however not contribute to the model and was therefore also excluded.

¹² proxied by the budgetary management index

Some of the previous studies also suggest that the relationship between aid and growth, and its interaction variables are nonlinear. Squared terms were included in order to control for this, no evidence were found that these effects are present for the sample used in this study.

5.3 Aid heterogeneity

Finally, the aggregated aid term is substituted by the five disaggregated aid terms; with the two different time horizons; with and without the inclusion of schooling. The results (7)-(10) and comparable previous estimates (3)-(6) are presented in the table below.

Variable	(3)	(7)	(4)	(8)	(5)	(9)	(6)	(10)
aid_short	0.019** (0.008)		0.025*** (0.008)					
socinf_short		0.041 (0.025)		0.052** (0.025)				
ecinf_short		0.017 (0.051)		0.016 (0.064)				
prod_short		-0.009 (0.168)		0.141 (0.176)				
multisect_short		-0.009 (0.109)		-0.110 (0.140)				
rest_short		0.011 (0.010)		0.017* (0.009)				
aid_long					0.027* (0.016)		0.015 (0.016)	
socinf_long						-0.037 (0.050)		-0.081 (0.064)
ecinf_long						0.090 (0.066)		0.159* (0.082)
prod_long						0.148 (0.163)		-0.019 (0.133)
multisect_long						0.059 (0.127)		-0.073 (0.107)
rest_long						0.029 (0.022)		0.068** (0.029)
gdp	0.014* (0.007)	0.014* (0.007)	0.005 (0.006)	0.005 (0.006)	0.013* (0.008)	0.013* (0.007)	0.001 (0.006)	-0.000 (0.007)
inflation	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000** (0.000)	-0.000*** (0.000)	-0.000** (0.000)
debt	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
export	0.006*** (0.002)	0.006*** (0.002)	0.006*** (0.002)	0.006*** (0.002)	0.005** (0.002)	0.006** (0.002)	0.006** (0.002)	0.006*** (0.002)
cwar	0.015*** (0.003)	0.015*** (0.003)	0.006** (0.003)	0.007** (0.003)	0.016*** (0.003)	0.016*** (0.003)	0.008*** (0.003)	0.008*** (0.003)
french	-0.022*** (0.003)	-0.022*** (0.003)	-0.019*** (0.003)	-0.019*** (0.003)	-0.023*** (0.003)	-0.024*** (0.003)	-0.021*** (0.003)	-0.021*** (0.003)
budg	0.006** (0.003)	0.006** (0.003)	0.004 (0.003)	0.004 (0.003)	0.005* (0.003)	0.004 (0.003)	0.001 (0.003)	0.001 (0.003)
lex	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
popg	0.011*** (0.003)	0.011*** (0.003)	0.010*** (0.003)	0.009*** (0.003)	0.012*** (0.003)	0.013*** (0.003)	0.013*** (0.003)	0.014*** (0.003)
school			-0.000 (0.001)	-0.000 (0.001)			0.001 (0.001)	0.001 (0.001)
_cons	-0.134*** (0.025)	-0.134*** (0.025)	-0.123*** (0.027)	-0.124*** (0.027)	-0.131*** (0.024)	-0.133*** (0.025)	-0.106*** (0.027)	-0.106*** (0.027)
N	323	323	232	232	323	323	232	232
r2	0.414	0.416	0.504	0.509	0.413	0.419	0.489	0.506

*, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. The standard errors are provided in the parentheses.

Table 5. Disaggregated aid flows and different time horizons

The first four columns illustrate the short time horizon while the last four columns illustrate the prolonged time frame.

One general finding is that, independent of the time horizon, when schooling is excluded from the model there is simply no significant effect from aid on growth. When schooling is included in the model, some of the aid terms become significant. This could either be a result of a biased regression due to the decrease in the number of observations or simply because of the inclusion of the schooling measure improves the model.

Comparing the aid terms in the short run model in regression (4) and (8) makes it possible to see that the social infrastructure aid seems to affect growth to a higher extent than the aggregated measure. The coefficient indicates that if aid allocated into social infrastructure is increased by 1%, this will increase the economic per capita growth by 5,2% in the short run. The rest_short is lower than the aggregate measure but still positive on growth.

Comparing the aid terms in the prolonged time horizon (7 years) in (6) and (10) one can see that the initial aggregated aid term is insignificant. When disaggregating the term, one can see that both economic infrastructure and the rest_long become significant on growth. The coefficient of 0.159 indicates that an increase by 1% in aid allocated into economic infrastructure increases the per capita growth by 15.9% in the long time setting. Still, allocating aid in economic infrastructure cannot be expected to contribute to economic growth in the very short run.

The other aid terms are simply not significant in the regression but it is likely that those variables could be significant if used in a different time horizon setting.

5.4 Robustness

It is quite hard to justify the robustness of the model and determine whether the result is trustworthy. Econometric tests are often performed in order to test the robustness of the model setting and results. However, the aim of this study is not to create a robust model which could determine the relationship of aid and growth but rather to as efficient as possible investigate whether different kinds of aid contribute differently to growth in different time horizons. I am well aware of the models weaknesses of endogeneity, omitted variables and other potential issues. Still, I am not convinced that econometric tests would improve the model setting or estimates in this matter. Neither am I convinced that an IV-approach would improve the efficiency and thus the ability to estimate the “true” relationship of the two variables.

A more efficient method might therefore be to diminish the obstacles on forehand. In order to avoid problems with heteroscedastic error terms and influential outliers, robust standard errors

have been used throughout the estimation process. This is one robustness action performed. The obvious problem of endogeneity in the OLS-regression has been reduced partly by using a prolonged time horizon of economic growth and a quite complete set of control variables which might reduce the endogenous effects. The stepwise inclusion of control variables to the regression was combined with observing the impact on the aid coefficient. It was apparent that both the index of budgetary and financial management as well as the measure of schooling both affected the aid coefficient greatly. This indicates that an inclusion of these two variables might reduce the endogenous effects aid and growth. Additionally, the significance levels of the control variables are quite high and robust across the different regressions. Still, it is likely that the model specification suffers from omitted variables and endogeneity which might bias the result.

Overall, the R^2 -value is quite high and robust for all of the final regressions. The value is increasing when disaggregating the aid term which additionally points in the direction that a model with disaggregated aid data can explain the growth effects to a larger extent than when the aid term is aggregated. The R^2 -values are around 40-50% for all regressions. This indicates that the included variables can explain around 40-50% of the differences in growth experiences across countries. It does on the same time indicate that 50-60% of the growth experiences are explained by other factors which stress the omitted variables issue.

Furthermore, since my data set consists of a rather large cross-sectional data set with a limited set of time series data I do not suspect that I will detect any presence of unit root. Autocorrelation might also be excluded from the analysis due to the usage of panel data combined with a measure of average economic growth. For a further description on these econometric issues I refer to Verbeek (2012).

Other studies have suggested that influential outliers do bias the result. Plotting growth and aid received indicates that there might be outliers present in the regression, see appendix D. An exclusion of the outlying observations does however not influence the result. It is furthermore suggested that excluding observations should be done with caution, see Verbeek (2012) for a further discussion on this issue. Therefore, no observations was excluded from the initial analysis.

6 Discussion

This section presents a summary and discussion of the results presented in chapter 5. The robustness of the results as well as its link to the policy debate is discussed. Lastly, a policy recommendation based on the results is outlined briefly.

The findings in chapter 5 do support the hypothesis that different kinds of aid do not only affect growth differently but also differently in different time settings. The result is somewhat similar to the findings in Clemens et al (2004) even though the findings in this study make use of a more specific decomposition of the aid term. What is contradictory to the findings in Clemens et al (2004) is that I find a short-term impact from aid allocated into social infrastructure. This decomposition is excluded from the short aid measure in Clemens et al (2004). The short run estimates suggest that an increase by 1% of aid allocated into social infrastructure would increase the per capita growth by 5.2%. The long aid setting (7 years) does however suggest that an increase by 1% in economic infrastructure aid increases the per capita growth by 15.9%. The social infrastructure aid is not significant on growth in the long aid setting while the economic infrastructure is insignificant on growth in the short run time setting. Neither multisectoral aid nor production sector aid is significant on growth in any of the two time dimensions. The estimates on a sectoral level are higher than the aggregated estimates and conditional upon the inclusion of the measure of human capital. The latter indicates that the parameter estimates might not be very robust. Still, it could be expected that the overall findings points on an issue of importance which is in line with the hypothesis stated in this study.

The result is not conditional upon the policy environment as have been suggested by previous studies. This study does therefore not support the policy recommendation that aid should be restricted to countries with a better policy environment in order for the aid to generate positive returns. Even though the coefficients and the results are hard to interpret due to the underlying challenge with endogeneity it might be possible to conclude that different aid allocations needs longer or shorter time periods in order for the effect on growth to occur.

The spread in the literature implies a variety of estimated magnitudes of the effect of aid on growth. The aggregated aid estimates in this study is quite similar to the ones achieved by the previous studies¹³. The aggregated aid term does however seems to be somewhat higher in this study. This could either implicate an upward bias in the result of this study, or a

¹³ Compared with the studies mentioned in chapter 3.

downward bias in the estimates achieved by the previous studies. As the majority of the previous studies are based on all aid recipients another interpretation could be that the sub-Saharan African countries on average are more efficient in generating economic growth during the time period estimated. Additionally, it is likely that the use of two different time measures might affect the endogenous relationship of aid and growth and thus the parameter estimates. It could be expected that a longer time interval between the aid and growth might reduce the effect that more aid is allocated to countries with poor growth performances. Such that the long growth effects will generate less bias than the short growth impact measure. It is however hard to determine the exact impact of the endogeneity in the two different contexts.

There is definitely need for more research on the area of different types of aid and their effects on growth in different time settings. As there is no consistent or reliable method to evaluate aid on a cross-country basis it might not be of recommendation for policymakers to base their recommendations on these types of studies. I suggest that further research on the area must take the time dimension into consideration in a more robust way as well as find a reliable way to account for the endogeneity effects from aid on growth. An instrumental variables approach might not be the ideal model setting due to the problem with weak instruments. The use of instruments in previous studies which for example consist of lagged aid values indicates, according to my result, that the instrument is correlated with growth. Likewise, a dummy for former French colonies or lagged civil war is indeed also highly correlated with growth. Therefore, another approach must be found in order to determine the effects of aid on growth.

As was suggested by Deaton (2010), the most efficient way of evaluating aid might be to perform randomized control trials. In that matter, randomized evaluations of specific aid projects on the micro level in certain countries should be evaluated. These randomized micro evaluations could later on statue as successful or unsuccessful examples of certain cases where growth has been generated or not. Even though the randomized evaluations might be hard to carry out by the academic literature it could be a useful strategy for the institutions dealing with foreign aid allocations. The randomized control trials could especially be a useful strategy in order to receive results on the projects and in that way get an indication of where to allocate the funds in order to get a relatively high payoff. It should still, when evaluating projects, be taken into consideration that different types of aid flows do affect growth not only differently but also differently in different time settings. It might also be of

recommendation to give more weight to the aspect of country heterogeneity in these randomized micro evaluations than what has been stressed in this study.

As have been stated before, the Paris agenda initiated in 2005, does still pervade the global aid climate. The agenda pushes for the importance of determining results and efficiency of foreign aid. I suggest that when the effects of foreign aid is determined it has to be taken into consideration that some of the projects into where aid is allocated might take several years to mature and thus generate an effect on growth. This is something that is often left out in the current aid agenda which in many cases have been criticized for being short-term focused. If a project which receives aid for improving a country's financial system is evaluated after three years it might, according to my estimations, be proven to be inefficient on growth while it in fact is efficient but that the adjustment to the time horizon for which the result has matured is left out.

7 Concluding remarks

The underlying aim of this study was to determine whether aid allocated into different sectors do affect growth differently in different time spans. The aid terms were used in two separate measures named short (0 years) and long (7 years). The aid term was furthermore measured on an aggregated basis as well as divided into social infrastructure, economic infrastructure, production sectors and multisectoral aid. In order to determine the effects, a regression analysis was carried out on a data sample covering the countries in Sub-Saharan Africa during the period of 1995-2011.

The presence of endogeneity, lack of robust evaluation strategies and lack of data has been mentioned as the primary challenges for the robustness of the study. The results do however indicates that different growth effects could be expected from different types of aid flows within different time spans. Direct growth effects can be achieved from allocating aid into the area of social infrastructure¹⁴. On the other hand, aid allocated into projects which are enrolled into economic infrastructure¹⁵ might not generate growth directly after the allocation while it does, according to my findings, increase growth around 7 years after the aid allocation.

The findings in the study point on two recommendations of importance. First, it seems to be of importance to use a sectoral decomposition of the aid term when determining the effect from aid on growth. Secondly, it seems to be of importance to adjust the aid allocation to a time horizon for which the effect could be generated. It is necessary for both policymakers and practitioners to take these two recommendations into their evaluation strategies when determining the effect of aid on growth. A more robust model setting to determine the growth effects from growth is highly demanded where the time span could be extended further in order to determine a more continuous long-term impact of aid on growth. I would therefore finally encourage researchers to, when better and more data is available, reproduce a similar study in order to determine a more consistent and long-term growth study.

¹⁴ Health, education, water, sanitation etc.

¹⁵ Improving financial systems, transports, energy, communications etc.

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Appendix A: List of countries included in the sample

Angola*	Liberia
Benin	Madagascar*
Botswana	Malawi
Burkina Faso*	Mali
Burundi	Mauritania
Cameroon	Mauritius
Cape Verde*	Mozambique
Central African Republic	Namibia
Chad*	Niger
Comoros*	Nigeria*
Congo. Dem. Rep.	Rwanda
Congo. Rep.	Sao Tome and Principe*
Cote d'Ivoire	Senegal
Equatorial Guinea*	Seychelles*
Eritrea*	Sierra Leone
Ethiopia*	South Africa
Gabon	Sudan
Gambia	Swaziland
Ghana	Tanzania
Guinea*	Togo
Guinea-Bissau*	Uganda
Kenya	Zambia
Lesotho	Zimbabwe

Table A.1 Countries included in analysis

Countries marked with an asterisk (*) are excluded when the measure of human capital is included.

Appendix B: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
growth	414	.0246272	.0342364	-.0934047	.2957632
aid_short	414	.131131	.1532178	.0009799	1.734219
socinf_short	414	.0503852	.0577625	.0006374	.7824242
ecinf_short	414	.0159091	.0254176	0	.2271021
prod_short	414	.0089108	.010109	2.59e-06	.061067
multisect_short	414	.0067385	.010672	.0000631	.1394825
rest_short	414	.0491873	.0959466	0	1.377095
aid_long	414	.1094421	.1123472	.0003954	1.056198
socinf_long	414	.0370284	.038584	.0002444	.2618927
ecinf_long	414	.014033	.021188	0	.2271021
prod_long	414	.0101321	.0132174	0	.0959404
multisect_long	414	.0068345	.0118225	0	.1394825
rest_long	414	.0414141	.0715716	0	.929877
gdp	414	2.84127	.4985744	1.963861	4.444336
inflation	403	76.52569	1217.06	-8.97474	24411.03
debt	396	83.02813	134.0543	3.438335	1380.766
export	414	5.319546	.7451032	3.451578	7.870105
cwar	414	.4130435	.4929762	0	1
french	414	.5	.500605	0	1
budg	334	3.059239	.6028887	1.785714	4.214286
lex	414	53.9872	7.185694	41.48944	73.77405
popg	414	2.311821	.9292631	-1.081092	5.081578
school	288	5.100486	1.997096	1.24	9.56

Table A.2 Summary statistics

Appendix C: Correlation matrixes

SHORT	socinf	ecinf	prod	multisec	restb	gdpc_log	infl	debt	logexp	cwar	french	budg	lex	popg	schyrs
socinf	1.0000														
ecinf	0.5678	1.0000													
prod	0.3970	0.5233	1.0000												
multisec	0.5907	0.3837	0.3797	1.0000											
restb	0.4004	0.2513	0.1635	0.2298	1.0000										
gdpc_log	-0.4149	-0.2261	-0.2905	-0.3039	-0.3451	1.0000									
infl	-0.0180	-0.0545	-0.0658	-0.0404	-0.0309	-0.0002	1.0000								
debt	0.2221	-0.0233	-0.0962	0.0657	0.2980	-0.3435	0.0053	1.0000							
logexp	-0.0583	0.0598	0.0492	-0.1733	-0.1478	0.3117	-0.0525	-0.4534	1.0000						
cwar	0.1361	0.0530	-0.0261	0.1772	0.1390	-0.1235	-0.0741	0.1766	-0.1631	1.0000					
french	-0.3289	-0.1300	-0.0626	-0.0546	-0.1417	0.2702	-0.0698	-0.1220	-0.1778	0.1464	1.0000				
budg	0.1029	0.1425	0.2636	0.0144	-0.0914	-0.0690	-0.1348	-0.2758	0.3683	-0.1778	-0.2538	1.0000			
lex	-0.1375	-0.0318	-0.0396	-0.0034	-0.0994	0.4297	-0.0917	-0.0850	0.0194	-0.0650	0.1957	0.0189	1.0000		
popg	0.3886	0.3420	0.3772	0.2900	0.3008	-0.2482	-0.2527	0.0472	0.1207	0.0676	0.0901	0.4121	0.2542	1.0000	
schyrs	-0.1476	-0.1678	-0.3094	-0.2220	-0.1178	0.4510	0.1452	-0.0431	-0.0815	-0.3020	-0.2446	0.1124	0.1128	-0.4593	1.0000

Table A.3 Correlation matrix, short-run growth and aid

MID	socinf	ecinf	prod	multisec	restb	gdpc_log	infl	debt	logexp	cwar	french	budg	lex	popg	schyrs
socinf	1.0000														
ecinf	0.2348	1.0000													
prod	0.4227	0.3424	1.0000												
multisec	0.3613	0.1882	0.3543	1.0000											
restb	0.5507	0.0900	0.1687	0.1269	1.0000										
gdpc_log	-0.2173	-0.0464	0.0089	-0.0734	-0.2225	1.0000									
infl	-0.0459	-0.0591	-0.0464	-0.0441	-0.0584	-0.0002	1.0000								
debt	-0.1025	-0.1646	-0.1359	-0.1308	0.2356	-0.3435	0.0053	1.0000							
logexp	0.3540	0.1501	0.1784	0.0449	0.2038	0.3117	-0.0525	-0.4534	1.0000						
cwar	-0.0999	-0.2124	-0.1912	-0.0987	-0.0371	-0.1235	-0.0741	0.1766	-0.1631	1.0000					
french	-0.3261	-0.1214	0.0402	0.0356	-0.3279	0.2702	-0.0698	-0.1220	-0.1778	0.1464	1.0000				
budg	0.4146	0.3020	0.2525	0.2131	0.2241	-0.0690	-0.1348	-0.2758	0.3683	-0.1778	-0.2538	1.0000			
lex	-0.1725	-0.1257	0.0031	-0.0121	-0.1697	0.4297	-0.0917	-0.0850	0.0194	-0.0650	0.1957	0.0189	1.0000		
popg	0.2223	-0.0515	0.1080	0.0964	0.1496	-0.2482	-0.2527	0.0472	0.1207	0.0676	0.0901	0.4121	0.2542	1.0000	
schyrs	-0.2236	-0.0310	-0.1414	-0.1986	-0.2312	0.4510	0.1452	-0.0431	-0.0815	-0.3020	-0.2446	0.1124	0.1128	-0.4593	1.0000

Table A. 4 Correlation matrix, long-run growth and aid

Appendix D: Plot of growth and aid received

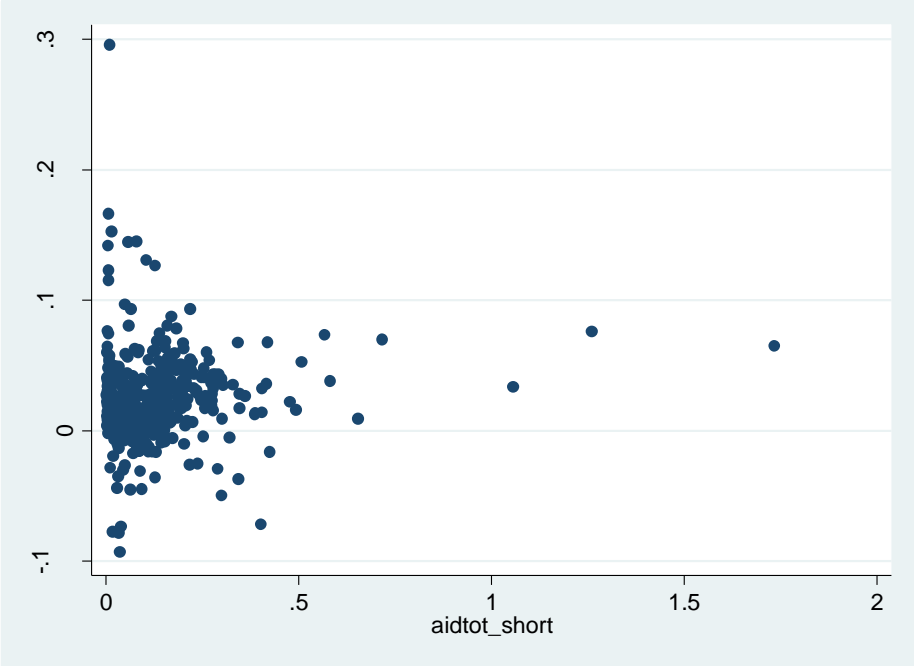


Table A.5 Plot of growth against short-term aggregated aid

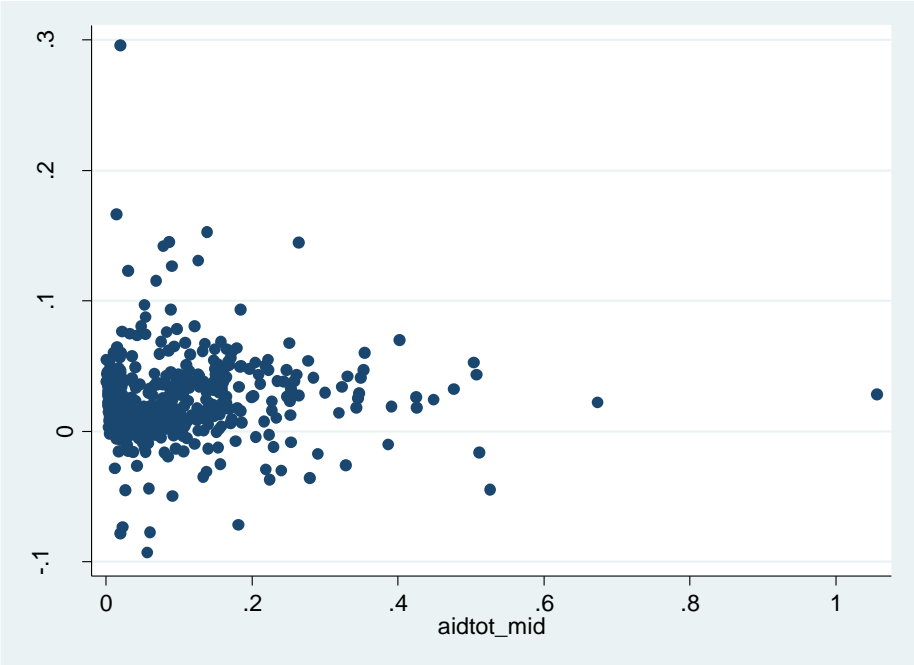


Table A.6 Plot of growth against long-term aggregated aid

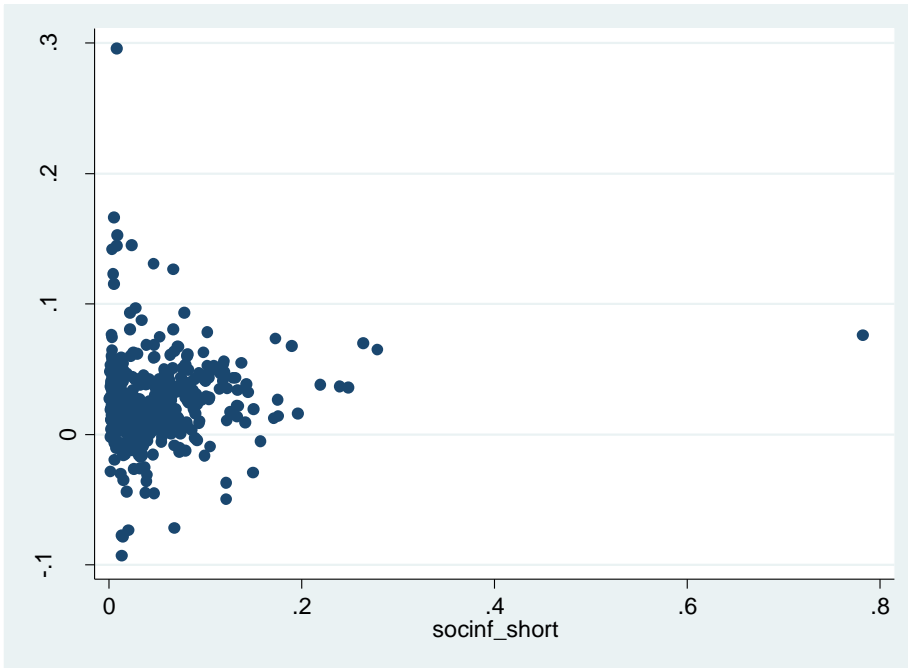


Table A.7 Plot of growth against short-term social infrastructure aid

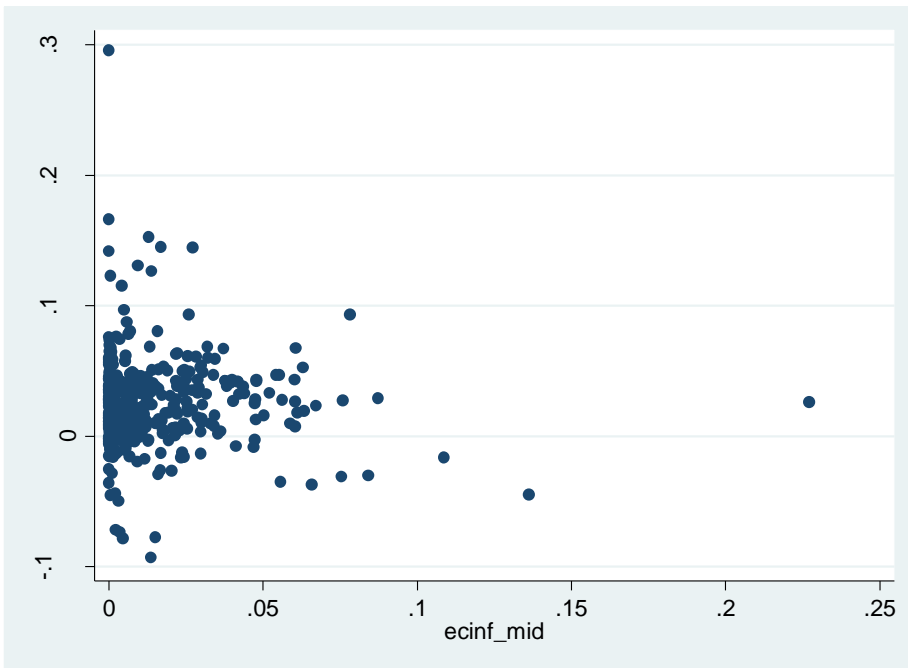


Table A.8 Plot of growth against long-term economic infrastructure aid