

An Assessment of the Aid Effectiveness Literature and an Analysis of Aid Instrumentation

By

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-abstract-

This thesis describes the history of aid donations and its economic and political foundations. The main aim of this thesis is to describe the aid effectiveness literature and the problems it faces answering the question how aid is related to growth. Aid is thought to stimulate growth as part of capital input into a country's production function. Effectiveness of aid can be influenced by who donates aid and with what intention and how the results are measured. Also it can depend what type of aid is given and how well the recipient government policies are and how good the quality is of a country's institutions. Main problem is the endogenous characteristic of aid in most growth equations and how to solve for this in order to find the true effect of aid on growth. Several instrumentation methods are examined and one of Bruckner (2011) is reproduced by his own database and of this author. The reproduction of the instrument for aid was unsuccessful using own data but a positive effect of aid on growth was found.

Table of contents		page
Chapter 1	Introduction	4-8
Chapter 2.1.1	Development Aid History	8-9
Chapter 2.1.2	Policy Based Lending	9-10
Chapter 2.1.3	Importance of Agriculture	10-11
Chapter 2.2	Aid Trends	11-14
Chapter 3	Aid Effectiveness Literature	15
Chapter 3.1	Common Problems in the AEL	15
Chapter 3.1.1	Measuring Output	15
Chapter 3.1.2	Variables of Interest	16
Chapter 3.1.3	Control Variables	16
Chapter 3.1.4	Instrumental Variables	17
Chapter 3.1.5	Reverse Causality Problems	17-18
Chapter 3.1.6	Multicollinearity Problems	18-19
Chapter 3.1.7	Serial Correlation in the Error Terms	19
Chapter 3.1.8	Heterogeneity Problems	20
Chapter 3.1.9	Adding Too Many Variables	20
Chapter 3.1.10	Conclusion	20
Chapter 3.2	History of the AEL from 1950 till 2000	21-23
Chapter 3.3	The Burnside-Dollar Debate Between 2000 and 2005	23-27
Chapter 3.4	Rajan and Subramanian (2008) and Arndt et al (2010)	27-31
Chapter 3.5	How Aid Might Negatively Affect Growth	32-33
Chapter 3.6	Other Factors that Influence Aid Effectiveness, Aid Allocation and the AEL in General	33-36
Chapter 4	Reproduction of Bruckner	37
Chapter 4.1	The Bruckner Instrumentation	37-38
Chapter 4.2	Data Description	38
Chapter 4.2.1	Countries selection	39-40
Chapter 4.2.2	NBER data	40-41
Chapter 4.2.3	UNCTAD	41
Chapter 4.2.4	Precipitation Data	41-42
Chapter 4.2.5	World Bank Data	42
Chapter 4.3	Results	43
Chapter 4.3.1	Results of the Original Database	43-46
Chapter 4.3.2	Results of this Authors Database	46-49
Chapter 4.3.3	Summary of Difference between Bruckner's Article and this Thesis	49-51
Chapter 5	Conclusion	51

References		51-54
Bibliography		54-56
Appendix 1	Countries Selected	57-58

1 Introduction

Development aid is a heavily debated political subject and has questionable results at best. Most individuals in Western countries support development aid but have critiques on how it is supplied. Also results are debated heatedly because after more than half a century of aid donations poverty is still rampant in Africa. Politicians have their own views on how to allocate the aid and how to improve the effectiveness. Not only in the political arena are the results from aid donations heavily debated, the effectiveness of aid in creating economic growth in recipient countries has been a topic for academic research for several decades. However, even though the final word is not out on aid's effectiveness it is interesting to see how the argument has evolved and what lessons can be learned.

Both scientifically and politically the debate around development aid has centered on its effectiveness to reduce poverty or improve standards of living in underdeveloped countries. Both the popular and scientific view is that development aid has not been effective at achieving those goals or at least not as effective as it should have been. However, surveys have shown that around 90 percent of respondents in Germany, France and Britain, and 84 percent of respondents in the United States agree that rich countries have a moral obligation to help poor countries develop (Kharas 2007). However, it is also common belief that government institutions are not the best channel through which to disburse the funds but rather the public has more faith in NGO's.

Development aid disbursements have been increasing over the past decades, however, some worrying trends have come to the surface. For starters a significant fraction of the increase has gone to debt relief and most of the rest went to combatting the effects of natural disasters or other emergencies. Country programmable aid to sub-Saharan Africa, which is defined as aid that a recipient can invest in long term social and infrastructure development, has not increased over the past 20 years (Kharas 2007).

The Millennium Development Goals (MDGs) were set equally for every country regardless of whether it was feasible for a country or not. Even though the MDGs may not have been achieved for each individual country the actual progress made should not be discarded. Another problem with setting the MDGs is that they have never been properly costed, which means that no one really knows how much money it will take to accomplish ,for instance, an educational goal or who has to pay the price be it the local government (tax) or the international community (aid).

Recently Dutch development aid policy has seen some shocks due to a need for fiscal contraction but also due to pressures of politicians thriving on seemingly populist views. The Dutch government, which consisted of Christian Democrats (CDA), Liberals (VVD) and the right wing party of Wilders (PVV), faced two rounds of budget cuts in the last two years. During the first round the development aid supplied by the government was reduced to 0.7% of GNP as has been the agreement for OECD countries for decades. In the second round a more severe budget cut regarding development aid was in the making, however, parties could not reach complete agreement and the proposed budget cut was rejected in a last moment in a new coalition between CDA and VVD and three other parties Groenlinks, D66 and Christenunie. In general, development aid is not under a lot of discussion except for how it is spent. When studying the political parties' 2010 election programs all but one agree that development aid is a necessity but they all differ in their approach of how it needs to be spent. The one party not agreeing on development spending is the Wilders party PVV who wants to abolish development aid altogether and only send aid in case of acute crises. Due to electoral success of the PVV, the liberal party VVD and the Christian democrats CDA are now also contesting the 0.7 percent rule with a move to the right in an electoral battle with the Wilders party.

Even though most parties have a pro aid agenda, with the exception of Wilders party, political differences are still very visible. The liberals (VVD) want to promote entrepreneurship and free market thinking in underdeveloped countries rather than maintain health and education systems. The democrats (D66) take a broader stand on aid allocation and want to improve on the existing multilateral institutions that disburse aid and support underdeveloped countries in building their own institutions. Two Christian parties stress, besides a solidarity principal, development of the Third World could also reduce war and poverty and thereby reduce refugee flows to the West. The labour party wants to enhance trade agreements to contain a "social paragraph" so that trade and aid go hand in hand. According to party programs most political parties want to adhere to the 0.8% of GNP allocation rule (SP, Groenlinks, PVDA, Christen Unie and D66) while VVD and CDA are willing to reduce to 0.7% of GNP. The only dissonant note in the Dutch political spectre is the Wilders party (PVV) who wants to reduce aid to emergency aid only.

Internationally, the debate is also mostly on how to improve aid effectiveness. Most world leaders seem to favor development aid but do fail to commit to earlier agreements. President of the United States Barack Obama is a great proponent of increasing aid donations by the United States and increasing the efficiency of supplying aid to recipients. These ideas are substantiated by increased aid donations towards the Middle East and Northern Africa in order to aid political and economic reform in this turbulent region. President Obama underlines the importance of aid as not only being charitable but as a necessity for domestic economic growth and security. Obama's stance is to make development sustainable by providing aid to countries that want to build their own capacity for providing for their people and so create conditions where assistance is no longer needed. Germany's Chancellor Angela Merkel stated at a UN summit that the Millennium Development Goals will not be reached because Germany and other countries do not live up to their pledge of 0.7% of GNI. However, she added that ill will in recipient countries that do not spend the received aid properly is another big obstacle in achieving the MDGs. She was criticized in her own country for not living up to the pledge and for not punishing corrupt regimes in aid allocation as part of a "people pleasing" foreign policy. Additionally Merkel claims that aid contributions cannot go on forever but that Germany still aims to reach the pledged level of 0.7% of GNI in 2015. Cameron, the U.K.'s prime minister, underlines that recipient countries that do not adhere to human rights, including gay rights, must be punished. However, the BBC found out that 41 of the 54 countries of the Commonwealth ban homosexuality. Additionally Cameron also stresses the moral imperative for supplying aid and comments that we cannot use domestic problems as a reason not to give aid and that we should not let many people die of causes that can be easily solved. Cameron's focal point is increasing vaccination in the underdeveloped world in order to reduce child mortality towards Millennium Development Goals level. France is slightly closer to reaching the pledged rate with a 0.5% of GNI donation. Newly elected president Hollande declared during election that his position regarding aid was favorable but has not yet revealed his vision regarding France's future. During 2011 most countries decreased their aid donations in response to the crises except for Italy, Sweden and Germany. Most country decrease aid spending faster than their economies are shrinking.

There are several views on how to improve aid effectiveness. Former member of Parliament Arend-Jan Boekestein advocated that "bad regimes" need to be avoided in donating aid and that aid should flow more directly to people in need. Boekestein criticized the World Bank and EU policies of giving budget support to corrupt regimes that do not strive to develop their

countries but rather to enrich themselves and the ruling elite. Furthermore he notes that countries that do move towards a more democratic society should be stimulated to do so. This subject touches on research done in the academic world and that will be described in this thesis. For instance Cordella and Dell’Aricca studied the effect of budget support to good regimes compared to budget support to bad regimes and found the former to be more effective in achieving growth.

With all this attention for aid effectiveness in the news and bickering by politicians it is interesting what light the social sciences can shed on aid effectiveness. Has it been effective in the past? Are there conditions for it to work better or not at all? And how has it been spent and what is the best way to spend it?

Economists have tried to show the effectiveness of development aid by determining its effect on income measures such as GDP per capita. A lot of factors within an economy can cause growth and some are also related to growth. This makes it hard to discern between what part of growth is attributable to aid and what part is not. Many studies fail to find a positive effect on economic growth but often individual projects have been reported to be successful. This has been coined the micro-macro paradox, where the success of individual projects have not translated to macroeconomic growth.

To translate those results to countrywide economic growth seems more difficult. One example of successful development aid whose outcome on GDP was hard to measure was the “Green Revolution” in India. Here aid increased the development of the agricultural output in India and more or less made famines history in India. However, effects on GDP per capita were difficult to prove since there were more heads to divide the income over. Put differently the fact that more people survived has negatively influenced the most common output measure.

Many statistical techniques to measure the success of development aid are highly debated. Most important aspect of measuring aid effectiveness has been a simultaneity bias. This bias stems from the idea that not only aid can help a country to grow but at the same time countries that experience poor economic growth may receive additional development aid. This will negatively bias the effect of aid on growth. Different authors have found different techniques to reduce this bias from their research and the selection of this technique has a large influence on the outcome of the research.

This thesis will give a short description of the history of development aid and also the political or economic principles that were dominant among aid donating governments and institutions through time. In the third part the aid effectiveness literature (AEL) will be reviewed from the 1950s until the statistical debate of the last decade and will describe the most common problems that plague the AEL. The fourth part will reproduce the results of an article by Buckner (2011) using his own database as well as a database constructed by the author for this thesis. Part 5 will summarize conclusions drawn from the literature and the analysis of part 4.

2.1.1 Development Aid history

In early development aid, sectoral support was the most important according to Denizer et al (2011). In the 1950s development aid was solely spend on stimulating the development of the productive sectors while no interest was given to education or health spending. During the 1950s development agencies were more preoccupied whether the loans could be repaid and how the aid could directly benefit growth. In this early time development aid was based heavily on the Marshall plan. The Marshall plan worked very well in industrializing European countries, however, this did not directly translate into success for developing countries as well.

Denizer et al. (2011) continues to analyze the ideologies that affected aid donations and notices three shifts in three consecutive decades. During the 1970s economist started to doubt the trickling down effect of economic growth and were beginning to emphasize poverty alleviation in development aid. However, during the 1980s the neoliberal view, that growth was all that really mattered, gained momentum and it was believed that poverty and equality would sort themselves out. In the 1990s poverty was back on the agenda, however, the strategy towards alleviating poverty was new. This strategy entailed investments in social structures such as education and healthcare for the poor. During the 1980s the neoliberal view that only markets could foster growth and governments would only impede the growth process was dominant. In the 1990s the consensus was built that governments and markets were complements in the growth process. This view was in part stimulated by the World Bank paper on Assessing Aid by Burnside and Dollar (1998) which showed that aid is only effective in when it is accompanied by good government policies. Even though this paper is highly debated, as will be shown in the literature review, it had a large impact on the practice of aid donations (Lancaster 2004).

During the Cold War development aid was allocated on a geopolitical basis rather than on a poverty reduction basis. When the Cold War ended aid donations saw a decline in nominal terms during the 1990s according to White (2004). At the end of the 1990s allocation emphasis was placed on the countries with better policies since development aid should have a larger effect in countries where the governments implements good policies Hoeffler (2011).

One question that arises is how to alleviate poverty in countries with bad policies and how the World Bank could stimulate and aid countries in creating better institutions and policies. Nowadays the World Bank allocates aid based on a formula positively related government performance, which is the largest determinant of aid, and a small portion based negatively on GDP because of equity considerations (Denizer et al. 2011).

2.1.2 Policy Based Lending

After a period of growth in 1960s, in the early 1970s the growth came to a halt and this occurred together with heavy supply shocks such as oil crises and raising grain prices (White 2004). Furthermore worldwide inflation and volatile exchange rates caused a large problem (Lancaster (2004). Therefore aid became more and more conditional as a means to steer developing countries towards improved policies. High inflation for instance has a large effect on the poor.

During the Cold War development aid disbursements were not made on the condition that the domestic government would fight corruption because of foreign policy considerations. When the Cold War was over dictatorial and corrupt regimes did not needed to be supported any longer and this paved the way for having governance improvement conditions with aid. Good governance is endogenous to growth, it can either facilitate or hinder growth. Part of the cost of a corrupt government is that the private sector will try to allocate resources in order to affect government expenditures in their favor which leads the economy away from a socially efficient output optimum.

Economies can thrive under both liberal and statist regimes but all successful economies have a strong institutional setting in common. Strong institutions give limited possibilities for corruption and have good enforcement of property rights and sufficient provision of public goods (Denizer et al. 2011). Nowadays implementing good governance plays a huge role in development finance as shown in Gupta (2006) because many of the technical cooperation

expenditures are attributed to enhancing institutional qualities. Countries are required to develop a long-term plan to reduce poverty and reform their governments.

Since 1999 the World Bank implemented two new strategies to allocate aid. One is Sector-Wide Assistance Programs (SWAPs) where recipient countries have to write a plan on which sectors they will spend their budget support received (Lancaster 2004). The better the countries accomplish their long-term goals the more development aid they receive. Another instrument used by the World Bank to enhance the effectiveness of aid provided is by Poverty Reduction Strategy Papers (PRSP's) that the recipient government has to develop and implement. The PRSP's entail the government's economic, structural and social policies for enhancing growth and reducing poverty (Lancaster 2004). The countries are also stimulated to own their reform policies because when the reforms have the support of local government and population they have a much larger probability of succeeding (Dijkstra 2011). This change in disbursement policy has also moved donations away from single project aid towards multiannual, multi-donor aid and a larger emphasis to budget support for countries that successfully reform.

Collier (2011) adds to these new strategies donors should make sure that countries enforce their own laws on corruption before receiving ODA. So donor countries should not decide on what to spend the money but should ensure the recipient government acts in the interest of their own people. This exact element is what distinguishes his advice to a return to conditionally or as Collier (2011) puts it "Nowhere is the looting of the public purse an official policy". When a recipient has a trustworthy government there is no reason to bypass this government by disbursements through (costly) NGO's because budget support saves overhead costs. Donors should differentiate however, between government support and "life support". Some countries with poor governments would not survive without support. Collier states that even though donors should continue to give "life support" it should not be treated the same as budget support.

2.1.3 Importance of Agriculture

In the early years of development aid little focus was on the development in agriculture. The most common view was that resources needed to be transferred from agriculture to the industry sector in order to stimulate growth. However, recently focus is back on agriculture because of the important role it plays in the economy of developing nations. Agriculture is 25% of the average GDP of low-income countries and 9% for middle-income economies

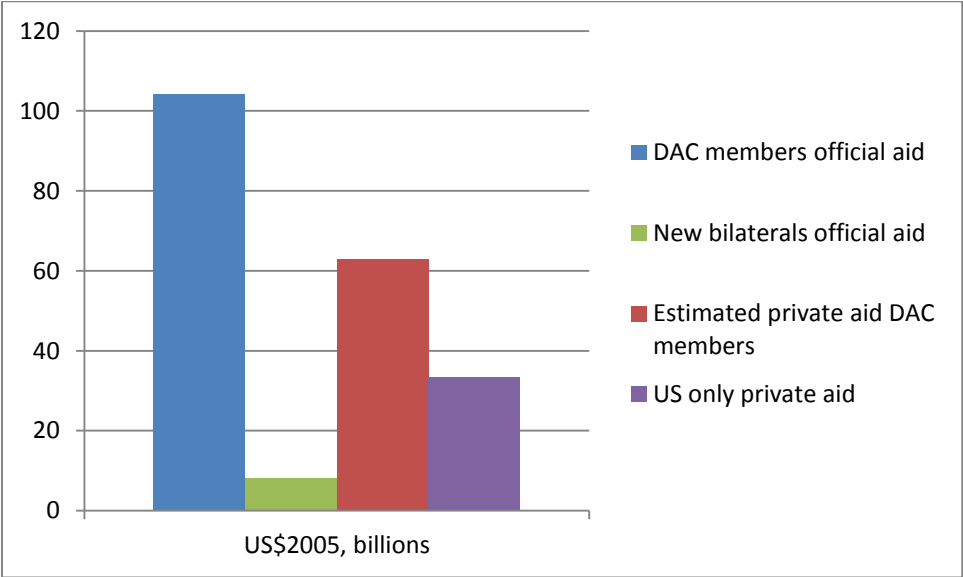
respectively. In comparison agriculture is only 1% of high-income countries GDP on average (Denizer et al. 2011). Furthermore 75% of poor people live in rural areas and are highly dependent on the agricultural sector for their livelihood. During the 1960s there was an increase in demand for the produce of agriculture due to fast growing countries, among which India. This demanded food to be produced more effectively and so, following private donors, the World Bank invested large amounts into agriculture productivity enhancement projects and this became known as the green revolution. However, due to power structures in rural developing areas the increased wealth did not trickle down to the poor. In order to improve this, the World Bank started the Integrated Rural Development program to boost productivity among the poor and improve health and sanitation in rural areas Lancaster (2004). However, in 1980s these approaches were largely abandoned in favor of neo liberal policies to improve the agricultural sector and reduce poverty. In 2008 the World Bank returned the emphasis to the agricultural sector because of its great importance to developing economies and the fact that 75% of the world's extreme poor live in rural areas (Denizer et al. 2011).

2.2 Aid trends

Different views on development aid spending have altered the sector spending over the past 50 years. Denizer et al. (2011) describe the following trends in aid donations. In the early years spending on agriculture was largely ignored because at the time economist thought it was a backward industry not important for growth. This perception changed in the 1980s as spending increased but the spending saw a decline in the early 1990s due to low world prices. Recently IDA disbursements towards agriculture have stabilized around 9%. Infrastructure was seen as the most important before the World Bank became interested at targeting poverty through investing in social infrastructure. In the 1960s around 40% of IDA grants and loans revolved around infrastructure at the beginning of the 1990s this percentage was around 20%. During the 1960s as little as 6% of IDA went to social services such as education, health, nutrition and social protection but by the 1990s disbursements had risen up to 20%. During the first 5 years of the 2000s it peaked at 30% of all disbursements and during the past 5 years has been 28%. Another remarkable change in IDA spending has been in the area of governance. This concerns spending towards public administration and law and did not exist in the 1980s, however, in the recent decade spending regarding governance rose from 0% till 25% of all IDA spending.

Kharas (2007) tries to distinguish between total aid transfers and country programmable aid. Country programmable aid (CPA) is aid that a country can invest in long-term development. So in order to get to this number he deducts emergency aid, debt cancelation and tries to estimate the value of donations to local standards, for instance when a European doctor performs in Uganda the worth is determined based on an Ugandan doctors salary. In researching the trends in development aid he finds that even though total aid to sub-Saharan Africa has increased CPA has remained around 12 billion in total between 1985 and 2005. Additionally aid given to the Middle East has increased substantially while the need for these funds is much greater in sub-Saharan Africa and according to Collier and Dollar (2002) reasoning this would be more effective in poverty reduction.

Apart from these developments private sector donations have increased to around 65 billion annually, according to Kharas (2007), half of which comes from the United States, supplied by around 18,000 NGO's. Furthermore non-DAC (Development Assistance Committee) members donations have increased as well, for instance from countries as Korea, Taiwan, India, China and Brazil. Estimates say these countries provide relatively more country programmable aid, one explanation could be that these countries have less loans outstanding to cancel. Total aid provided by non-DAC countries is estimated to be \$5.5 billion by Lancaster (2007) or at 1.5% of total ODA by White (2004).



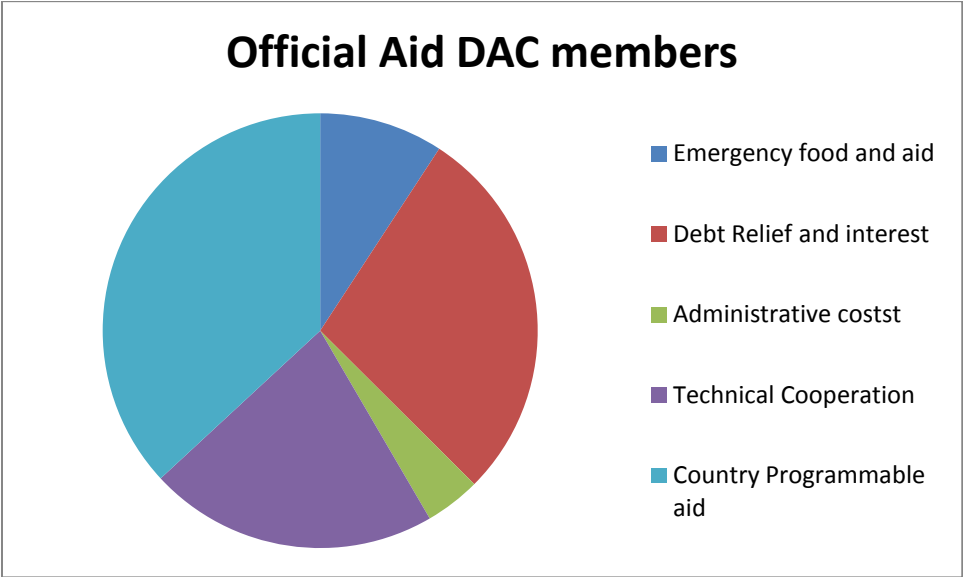
Based on calculations by Kharas (2007)

Kharas (2007) provides a great overview of how aid flows from rich individual to poor individuals and what happens to all the flows in between. A total of 105 billion is given

through taxation towards official aid channels and 63 billion through private organizations. Of the 105 billion through official channels around 22.5 billion flows back through services provided by western professionals. Gupta (2006) further analyses these services also estimates technical cooperation to be a bit under 25% of total ODA. These services provided are largely used to support the recipient government in institution building. Additionally the focus of technical cooperation has increasingly been the social infrastructure according to Gupta (2006) such as education and health care related investments.

Kharas (2006) overview shows that an additional 29 billion is used for debt relief, it is not to say these funds are wasted, however, they cannot be directly allocated for long-term development by the recipient government itself. Gupta et al. (2006) also sees an increase in debt forgiveness in sub-Saharan Africa in recent years.

Also Kharas (2006) analyses the distribution channels of ODA. From the total of 105 billion dollars 26 billion is given directly to poor governments as bilateral aid. Additionally 25 billion is given to multilateral institutions of which 20 billion reaches the poor governments. Furthermore 6 billion goes from the official channel to private aid organizations, who in return also give half a billion to multilateral institutions. So in the at the end of the official channel 10 billion reaches poor people through emergency and humanitarian aid and 38 billion reaches poor individuals through development aid, half of which is estimated to disappear through corruption and administration.



Based on calculations by Kharas (2007)

Regarding flows to poor individuals private organizations seem much more effective. Starting with only 69 billion in funds, they get 39 billion to poor individuals directly and 24.5 billion in emergency and humanitarian aid. This is a much greater result than through official channels. One myth that Kharas disproves is that private aid organizations pay too many wages and let funds flow too much toward fundraising instead of actually achieving their goal. In Kharas overview private aid organizations spend only 5 billion of their 69 billion funds in administration and fund raising purposes, which seems to be more cost effective than the official channels’.

Recently aid flows from OPEC countries as well as from China and India has increased, however, it still only accounts for 5% of all aid given. The other 95% comes from the Development Assistance Committee member countries and of this portion 77% came from five donors namely, the US, Japan, France, Germany and the UK. Both the US and Japan donate 24% of DAC- members aid, France and Germany each 12 % and the UK accounts for 5% as summarized by Kimura (2011).

Chinese aid has been estimated to be around 1.5 billion according to Lancaster (2007), however, estimation is troublesome because official figures are not available. One possibility is that the Chinese government does not know exactly how much aid it donates because aid is entangled in trade deals and other investments. Aid is mostly supplied by the Chinese Ministry of Commerce but other ministries might make some donations as well. Some advocates of Chinese aid claim Chinese aid might be very successful in achieving development (Michel and Beuret 2008). It is estimated that half of Chinese aid goes to Africa and that aid is given without conditions common for western aid such as human rights improvements and economic policy (Lancaster 2007). However, just as western aid, Chinese aid is thought to have a strong geopolitical component. Regarding poverty alleviation Chinese present itself as a country rapidly (but not completely) emerging from poverty and can relate to difficulties faced by underdeveloped countries. However, the political base for development aid is shaky where China still has a lot of poverty itself, however, this is a political problem western governments face as well.

3 Aid effectiveness literature

3.1 Common problems in the AEL

The AEL is plagued by problems common to all growth regression analysis since growth of GDP per capita is most commonly used in AEL to determine its effectiveness or at least a lot of development economists try to establish a causal relationship between aid and growth. What follows in this section is a small summary of problems that plague growth regressions and are the main reasons no consensus on the aid-growth relationship are found.

3.1.1 Measuring output

In the introduction it was already stated the difficulty to measure the success of development in general not only due to measurement error but also in how to define the measure of success properly. In the introduction the example was used of the Indian “Green Revolution” which reduced famines and thereby increased life expectancy but because more people stayed alive this had a negative effect on GDP per capita which is the most common measure of economic growth. GDP per capita is used because it is the most accurate variable describing economic prosperity, however, it cannot capture all development. Of course the increased life expectancy and health of the population increased labor productivity as well, however, it takes around twenty years for the labor productivity factor to outweigh the increased population factor in the GDP per capita variable (Acemoglu and Johnson 2007). So the true value of development achieved within an economy might not be perfectly measured by the economic output per capita.

Other indicators of development such as school enrollment rates and health indicators are easier to measure and have been positively correlated with aid. Furthermore these results can be more directly studied from individual projects. Result of an individual project can be measured by whether the school was build, whether students attended and whether literacy went up in surrounding villages. However, for these developments to have a positive effect on GDP per capita may take generations and this is another reason why a relationship between aid and growth is hard to find.

The World Bank Independent Evaluation Group (2006) found that 22.2% of their projects completed in Africa had unsatisfactory outcomes and another 20.1% were probably unsustainable so they did not influence development in the long term. Even though the evaluations of these projects are based on reports by World Bank staff, if they are an indicator

for average success rate of development aid it's an additional reason why the relationship between aid and growth is difficult to prove.

3.1.2 Variables of interest

In addition every author adds their own variables of interest. For instance an author interested in returns to human capital could add a variable of enrollment in secondary education. Another author interested in return to infrastructure could add variable for km of road per square kilometer or number of phone lines per capita. For these two examples the authors claim that these factors could be considered part of the production function. Where infrastructure is seen as capital that enhances the productivity of other capital and education and health levels increase the productivity of labor. In the AEL some form of aid is usually taken as variable of interest since the goal is to determine whether aid has an effect on growth. So in most studies aid is used, in some form, as capital inflow in the production function.

Another group of variables often included are proxies for good policy and good institutions. For instance Burnside and Dollar proxy for good policy by first regressing the impact of inflation, budget surplus and openness to GDP growth and then use the estimators for these variables to predict the level of growth based on the level of these three variables as a control in their regression equation. Other variables of interest could be the protection of property rights, the degree of market freedom within a country or other indicators for institutional quality in a country. For instance, Chang (2009) uses minimum wage levels for labor market flexibility. These are institutions that can foster or inhibit growth.

3.1.3 Control variables

"A key aim of empirical analysis is to falsify or discriminate between competing hypotheses"

-Arndt et al. (2010)

The need of controls partly arises because we are not only interested in a relationship between growth and aid but hope to find a causal relationship. The idea behind the use of controls is that when these variables are controlled for we could exclude them as spurious variables actually explaining the real relationship. However, this is only the case when no multi-collinearity exists between the independent variables. So even though the use of control variables is necessary to make valid inferences from OLS, adding more control variables has a downside as well. As for all statistical problems mentioned here multi-collinearity is a

problem in OLS in general. However, there is a vast list of controls possible in growth regressions and in the AEL there is much discussion on which controls need to be included.

3.1.4 Instrumental Variables

Instrumental variables are often used because they are related to the variable of interest but are believed to have statistical qualities that are superior to the variable of interest such as no correlation to the regression errors or show no multicollinearity but mostly it is used to try to control for endogeneity issues. One doubt that could be raised is that these instrumental variables could still be related to variables purposefully left out of the equation. This could bias the results since this violates the variables being independent or solely representing the variable they should but simultaneous show variation of other variables and therefore indirectly those other variables become part of the regression equation. Within the AEL solving for endogeneity is a major issue of discussion and various techniques for solving this problem have been applied and debated. Most influential authors arrive at different results based mostly on their approach to solve for endogeneity.

The problem of endogeneity is closely related to reverse causality. The assumption in ordinary least squares regressions is that the independent variables are generated outside the model, they are exogenous, and then the independent variables have a causal link with the dependent variable. However, the assumption that the independent variables are exogenous is not entirely valid. For instance, even though institutions, infrastructure and human capital can cause growth. There is also a relationship that countries with growth in income can afford better infrastructure, institutions and education. So part of the, assumed to be, exogenous variables are determined or caused by other variables within the model.

3.1.5 Reverse Causality Problems

Reverse causality is one problem that can imply endogeneity problems. For instance some authors, such as Roodman (2007), Rajan and Subramanian (2008) Arndt et al.(2010) and Bruckner (2011), state that instead of development aid causing growth, growth actually causes aid. For instance when a country starts growing after aid the aid proves to be successful and therefore more aid will flow to the country. However, when a country gets too successful aid flows will stop. In both cases the causal link goes from growth to aid. Of course the opposite can be true as well, that a country that performs badly will demand more aid, giving a negative relationship between growth and aid.

Roodman (2007) also stated a problem with the variable often used to test for aid, which is aid as a ratio of GDP. The argument was that when a country receives a fixed donation and during that time GDP would grow an OLS regression would pick up a negative relationship between aid and growth because Aid/GDP would decrease because Aid is constant while GDP grew. Therefore this author advised to use Aid per capita instead.

Arndt (2010) also preferred Aid/ Population because the donor might not target aid/GDP in their decision rules and so Aid/Population might better reflect this decision-making. Also inappropriate use of ratio variables may lead to misinterpretations in least square regressions for instance if the denominator of the dependent variable is correlated to the RHS independently of the numerator. Furthermore there could be a direct association between the GDP levels and population size or colonial experience. Therefore it is beneficial to remove GDP from the variable of interest and move towards Aid per capita as an explanatory variable.

Closely related to reverse causality is the simultaneity problem suggested by Arndt et al. (2010) that in a regular OLS regression the Aid/ GDP coefficient is negative because countries that have a period of slow growth generally receive more aid. The simultaneity assumption means that causality could go both ways, so aid might have a positive effect on GDP but economic growth simultaneously has an effect on development aid received. This gives a result of negative effect of aid on growth, however, Rajan and Subramanian among others say the simultaneity can work the other way too when aid is successful in a country then a donor might be willing to continue or increase development aid donations to a country. Bruckner (2011) attempts to correct for simultaneity bias in his instrumentation and his results will be reproduced using his own database in the empirical part of this thesis and with a database constructed by this author.

3.1.6 Multicollinearity problems

Another Endogeneity problem is that there might be a relationship between two or more independent variables. This could make the results unreliable since OLS assumes the two variables to be uncorrelated. Roodman (2007) gives an example when two independent variables are positively correlated but slightly differ in one observation this gives the estimates opposite signs even though this does not reflect their actual impact on the dependent variable. In the AEL and growth regressions literature a large number of explanatory variables

is used to explain growth differences between countries. There is a high likelihood that some of these variables are correlated.

The numerous variables brought in by different authors to explain growth brings the attention to exchangeability of variables of theories. Here the author states that even though one theory is valid does not imply that another theory is less valid (Brock and Durlauf 2001). However, this idea is closely related to jointness of variables. This idea states that some variables show a stronger relationship to the dependent variable when they are combined than when they are regressed on their own. Another example of jointness is that some variables effect gets weakened when they are combined in a regression (Doppelhofer 2009).

These considerations are important when applying a technique like Bayesian Model Averaging (BMA). This is a statistical technique, which tests on whether to add or deduct a variable. This technique is rather complex and is used in growth regression literature but not yet in development aid literature. It is possible within BMA to start with certain variables that must be included and then apply the technique to the left over model space. An example could be that three variable must be included in the model and so are fixed and that you leave a space for four more variables which are added in their likelihood. However it is also possible to take the outcome of these BMA exercises done by other authors and run an ordinary regression with the variables they find to be most significant.

3.1.7 Serial Correlation in the Error terms

Roodman (2007) says that most growth data in the literature are serially correlated but that this problem is masked mostly by a few countries that produce very volatile growth statistics such as Gabon and Nicaragua. However, Roodman argues there is a significant tendency for China to repeatedly grow faster than a model predicts and for Argentina to repeatedly grow faster. Roodman argues this for a specific article but the serial correlation issue might be problematic for AEL in general. It does not say that the analysis is invalid but there is some causation of growth by variables not included in the analysis. Sometimes growth is caused by variables that are not possible to measure or define and this make the inclusion of all relevant variables for growth difficult, not to mention the multicollinearity effects that might arise from adding too many variables.

3.1.8 Heterogeneity Problems

Heterogeneity problems can be the largest in cross sectional regressions. Here for instance openness variable is regressed to growth, however, it is unlikely that ten years of openness has the same impact for a fast growing Asian country as it has for a sub-Saharan African country. Within cross sectional regressions this can partly be resolved by regional dummies. For instance, different dummies can be created for fast growing Asian countries and for African countries. This could catch the regional heterogeneity that exists within the dataset. With panel data several authors claim that this problem can be fixed more easily by introducing country fixed effects.

3.1.9 Adding Too Many Variables

According to Arndt adding too much variables can hurt the analysis in at least two ways. First by adding redundant variables there may result a loss in efficiency. Here Arndt (2010) criticizes Rajan and Subramanian (2008) for adding variables such as budget surplus, money supply, budget surplus and ethnic fractionalization. These variables are insignificant in all periods of Rajan and Subramanian cross-section study. Another critical point regarding the adding of variables is exemplified by the inclusion of institutional quality. Here Arndt claims that aid may add through growth by having an effect on institutional quality. Therefore, including institutional quality as a control variable might "block potential channels through which aid may effect growth and thereby restrict the estimated coefficient on aid to a partial as opposed to a general effect".

3.1.10 Conclusion

This gave an overview of the many problems that exist in the AEL and OLS in general. Authors in the AEL come up with different strategies to solve these problems but all strategies have their downside. The usage of different estimation methods has given the AEL a variety of answers to its main question and no consensus has arisen from the voluminous literature on the subject. As can be seen in part 3, the AEL biggest problem is how to solve for endogeneity bias. And differences in results mainly stem from differences in approach to solve for this bias. What follows is a summary of some of the most influential articles in the AEL and how they deal with the problems common to this strand of literature.

3.2 History of the AEL from 1950 till 2000

Arndt et al (2010) summarizes the history of the aid effectiveness literature into three separate periods with each period its own theoretical background and statistical tools. Development aid started after the success of the Marshall Plan. After the Second World War the Marshall plan involved the provision of funds by the US to support the reconstruction of Europe. The Marshall plan was considered successful because during the first ten years of the plan Europe's economies industrialized rapidly and the success strengthened European- US relationships and thereby containing Soviet expansion (McGillivray et al. 2006). Developed countries thought that poor countries did not have enough savings to invest into the economy and this could be replaced by giving development aid. However, even though foreign aid levels desired were reached the growth levels that were expected were not.

The idea that aid could provide steady growth by filling a need for investment was based on gap models. First and most well known was the Harrod–Domar growth model. This model suggested that underdeveloped economies had excess labour but could not supply sufficient capital to ensure economic growth. In these countries saving rates were too low to supply capital. Supplying foreign aid to these countries could increase savings and thereby investment which would insure growth.

In the late 1960s studies began to investigate the impact of aid on savings with quite straightforward models. These studies assumed that one dollar of development aid would result in a one dollar increase in savings and in investment. A model of this sort commonly took the following form:

$$\left(\frac{S}{Y}\right)_i = \delta_0 + Y_i + \delta_1 \left(\frac{A}{Y}\right)_i + \mu_i$$

Here the dependent variable was saving as a part of output and the explanatory variables were a constant, Gross National Product, aid received as a part of output and finally an error term.

These models assumed that all aid was added to national savings and none of it was consumed. This was highly debated and some authors observed negative influences of aid inflows to the savings rate Rahman (1968) and Weiskopf (1972). Hansen and Tarp (2000) try to summarize the literature of this time into two tested null hypothesis and counted the negative, positive and insignificant outcomes. The first hypotheses is that the effect of aid on the savings rate is zero. Out of 24 articles reviewed by Hansen and Tarp 14 have a

significantly negative outcome and 10 an insignificant outcome. This suggests that indeed aid inflows have a negative outcome on domestic savings. Another null hypotheses often tested in this period is that the effect of aid inflows is -1. This reflects the criticism of this time that if a one percent increase in aid would reduce the savings rate by less than one percent the overall effect on investment would still be positive Papanek (1972) and Newlyn (1973). In Hansen and Tarp (2000) summary of the literature they find that 8 out of 22 papers find a coefficient smaller than -1 which would support the theory and 13 out of 22 cannot find a result significantly different from zero.

A second type of gap model was a foreign exchange gap as identified by Chenery and Bruno (1962). Their idea was that developing countries have insufficient export earnings to pay for the import of capital goods needed. This second gap could also be met by supplying funds in the form of foreign aid. Finally in the 1990s Bacha (1990) and Taylor (1990) developed a third type of gap where the tax revenues of local governments were not sufficient and therefore could not invest enough in infrastructure or education.

Papanek (1973) continues in regressing aid directly to growth with the explanatory variables differentiated to domestic savings, foreign capital flows, foreign aid flows among others. He found a positive effect of development aid on growth. This type of growth regressions often took the following form:

$$G_i = \alpha_0 + \alpha_1 S_i + \alpha_2 A_i + \alpha_3 P_i + \alpha_4 O_i + \mu_i$$

This growth model was often augmented with different explanatory variables, however, no consensus on the effect of aid on growth was ever established (McGillivray et al. 2006). These aid- growth regressions took many forms and Hansen and Tarp (2000) summarize this group by all articles of this time that had a similar form. They found only one article that reported a negative influence of aid on growth, 38 articles reported a positive influence of aid on growth and 25 found no significant result.

Mosley (1980) found ambiguous results for different groups of countries and different time intervals. Mosley's article was influential because he tried to correct for endogeneity and used time lags. For instance he found no statistical significant result using data for 83 developing countries but did find a significantly positive effect of aid on growth when he restricted the database to the poorest 30 countries. In 1987 Mosley et al. published a paper over a longer

period using various sub periods and country sample where he did not find a statistically significant relationship.

In the year 2000 Burnside and Dollar published one of the most influential papers on the aid and growth relationship. In this paper they made aid effectiveness conditional on good policy by receiving countries. According to their paper aid had a larger effect in countries with better fiscal and monetary policies. The neoclassical growth models of this period generally looked like this:

$$G_i = \beta_0 + \beta_1 A_i + \beta_2 A_i^2 + \beta_3 P_i + \beta_4 (A_i * P_i) + \beta_5 Z_i + \varepsilon_i$$

One innovation of this period is that they used panel data compared to the cross section analysis done in previous generations. Other important innovations were the relationship between the inclusion of government policy and institutional quality into the regression equation. Finally the aid squared variable was added to capture nonlinear effects of development aid. (Hansen and Tarp 2000).

Burnside and Dollar (2000) determined the policy variable based on Sachs and Warner (1997) policy indicator, which is determined by budget surplus to GDP ratio, inflation rate and a measure for degree for openness. Burnside and Dollar had a two stage least regression approach where first the impact of these three variables on growth was determined and by combining the coefficients acquired with the three policy observation for each country a variable of expected GDP as a result of policy was produced as an instrumental variable for policy. This instrumental variable for policy was implemented into a regression equation similar to the one above. However, Burnside and Dollar did not use the quadratic aid term. Their result is that aid is only effective when combined with proper policies and so aid effectiveness could be improved by reallocating growth to countries with sound policies and away from countries with poor policies. Collier and Dollar (2002) estimate that when reallocating development aid to countries with good policy environment poverty would be reduced by an extra 18 million people per year compared to the existing allocation of development aid.

3.3 The Burnside-Dollar Debate Between 2000 and 2005

These findings were criticized by Hansen and Tarp (2001) who applied another technique to find no relationship between aid*policy and growth but did for aid in general. Easterly et al. (2004) expanded the dataset to include an extra period and more countries and showed that

the results of Burnside and Dollar were fragile. Roodman (2004) points out that Burnside and Dollar's result crucially depends on the removal of 5 observations and his analysis shows that when another selection of observations is removed the opposite result comes out of the analysis. Furthermore numerous articles doubt the construction of the policy variable. First there are several ways to create a variable for openness, according to Pritchett (1996). Different openness variables measure different aspects of openness and correlation between these variables are low. Thus the selection of an openness variable has a large impact on the outcome. Additionally inflation does not have a linear effect on growth because little inflation is good for growth whereas a lot of inflation harms growth, so the relationship between growth and inflation is more likely to be quadratic. Also inflation might be for some part out of the control of the government and therefore a bad indicator of quality of government policy. Finally Burnside and Dollar leave out other policy measures that have been proven to influence growth performance such as privatization, educational policies and financial market liberalization. Burnside and Dollar do not provide a rationale for their selection of policy variables.

During the early 2000s there were other theories tested on how aid could affect growth. Bulir and Haman (2003) show that aid flows are highly volatile and those countries that have more volatile aid flows also have more volatile government revenues and are more dependent on aid. Lensink and Morrissey (2000) estimate the effect of aid and aid volatility on growth and find that aid contributes to growth but the effect is reduced when aid becomes more volatile. Other authors determine the relationship between aid effectiveness with climatic conditions or other external shocks. Guillaumont and Chauvet (2001) that aid is more effective in countries with negative external shocks as export instability and natural disasters. Dalgaard et al (2004) look for aid effectiveness dependent on geographical location by measuring the fraction of the country that is located in the tropics. They regress this geographical variable in a Burnside-Dollar fashion and interact it with aid. In this specification the policy interaction variable becomes insignificant, whereas the subtropical fraction of the country has a negative significant effect on aid effectiveness.

Furthermore several studies have been done in a Burnside-Dollar fashion with regards to political stability and institutional quality. Islam (2002) adds a political instability measure and its interaction with aid to a Burnside-Dollar type model over a 1968-1997 cross section regression and finds that aid is only effective in a stable country and finds the policy*aid interaction variable to be insignificant. In 2004 Burnside and Dollar reply to several critics by

reinvestigate their previous work but now with a variable for institutional quality instead of policy. They declare that most differences in countries income levels are determined by the countries institutional qualities. They find institutional quality to have a significant effect on growth and its interaction with aid, whereas the aid variable itself proves insignificant.

Roodman (2007) describes the debate on the effectiveness as between gainsayers and apologists where gainsayers say the effect of aid is generally positive and apologists have arguments that aid only works in certain circumstances. One of the apologists theory depends on how much of the country is located in the tropics. The theoretic background is that countries that are outside the tropics were more inviting for the Europeans to settle and therefore have inherited an improved institutional infrastructure. Dalgaard, Hansen and Tarp (2004) argue that aid works outside the tropics but not in them. However, Roodman (2007) argues that this result is highly dependent on the observations of Jordan, Syria, Egypt and Botswana. The first three are non-oil producing Middle Eastern countries that have received massive economic growth through spillover effects from their neighboring oil producing countries. Botswana has been involved in a customs union with South Africa, which not only increased trade that comes along with positive effects of its own, also it restricted officials from extracting rents from the exporting sector because of the free trade agreements. Another counter argument comes from Acemoglu et al. (2002), which states that Botswanas institutional framework was well developed before it was colonized by Europeans. This would break down the transmission of favorable conditions for Europeans to settle towards improved institutions but not necessarily the link between being located outside the tropics and improved institutions.

Cordella and Dell'Aracca (2003) try to determine the effectiveness of budget support and project aid separately. The assumption is that project aid is less fungible than budget support, which means that governments who receive budget support can more easily divert spending from development towards spending that is of no interest to the donor. Of course project aid might also divert some of the government spending away from development but the assumption is this effect is small relatively to budget support. Cordella and Dell'Aracca (2003) first make a microeconomic decision model in a principle-agent fashion to create a theoretical foundation for the donor to determine the amount of aid and the reaction of the recipient under conditionality and non-conditionality. In a second step they compare budget support with project aid. Their theory suggests that budget aid should be given to countries that are relatively richer and more oriented towards development and project aid should be

given to poorer countries that are less development orientated. The development orientated intuition is that when a country has a preference for spending aid towards development instead of non-development spending i.e. the recipients preferences are more in line with that of the donor budget support will be most effective. Poor countries are better off with project aid because the larger the project aid donations relatively to government revenues the smaller are the possibilities for a recipient to divert government spending.

Cordella and Dell'Aracca (2003) also try to prove their theory empirically in a Burnside-Dollar fashion but distinguish between project and budget aid. Budget aid is defined as funds "Non-sector allocable program assistance whose provision is explicitly linked to agreed policy packages and in particular those implementing recommendations made by the World Bank and IMF" and "all actions relating to debt forgiveness, swaps, buy-backs, rescheduling and refinancing". Sector aid is specified as all sector-specific aid. However the line between these types of development aid might be blurry because even though sector-specific aid might not be an allocation decision of the local government, the government will be involved in such projects as for instance laying a road or building a hospital. The outcome of their Burnside-Dollar type equation is that neither project aid or budget support has a positive effect on GDP on its own but both have a positive effect provided a good policy environment. However, the results also support their theory because the effect of the budget support*policy interaction term is significantly larger compared to project aid*policy interaction term. This result suggests that budget support is more sensitive to a good policy environment and also has a more positive effect on growth within this environment. Finally Cordella and Dell'Aracca test for robustness with GMM estimators and the results are confirmed even though they lose some of their significance.

In 2004 Clemens, Radelet and Bhavnani try to determine the short term impact of aid by separating impact that is likely to have short term impact, such as budget support, balance of payment support, investment in infrastructure and sector support, from aid with an impact that is more likely to have effect in the long term from aid, such as education and health spending, and from aid likely to be negatively correlated to growth such as emergency and humanitarian aid. Clemens et al (2004) suggest that their focus group accounts for around 45% of all aid flows. They relate this type of aid with growth figures four years later and find a large positive impact of this type of aid where 1\$ increase in this type of aid could raise output by 8\$.

In 2009 Baliaoune et al. in his paper on the relationship between social capital and aid effectiveness comments on the relationship suggested by Burnside and Dollar on policy and aid effectiveness. One important argument he brings forward is that policy is an endogenous variable, by which he means that countries with higher income causes policies to improve (Baliaoune 2009).

In the aid-social capital relationship, Baliaoune refers to both positive and negative effects of aid on social capital in the literature. On the one hand that money invested in conflict prevention, promoting democracy, equal citizenship and fighting corruption will build social capital and this in turn will promote development and growth. On the other hand high levels of aid might negatively influence quality of institutions because recipient governments will be less reliant on their popularity with their electorate. In their results they find that social capital and quality of institutions enhance the effectiveness of aid on growth and that once they account for social capital and quality of institutions the effect of policy quality disappears. They do not claim that policy is irrelevant for growth, however, it might not be a fair and optimal factor for aid allocation.

3.4 Rajan and Subramanian (2008) and Arndt et al.(2010)

Rajan and Subramanian (2008) derived an expectation regarding the aid growth relationship. They derived the expected increase in growth from a neoclassical model. With this model they calculated that when the development aid would be fully invested and had no effect on productivity the result of a 1% increase of aid to GDP ratio would result in a .16% increase in GDP growth. Given that at least some development aid is directed at non growth enhancing activities they argue that an aid donation of 10% of GDP would result in a 1% GDP growth. This is considerably smaller than expected by the Harrod Domar models from the 1970s. Surprisingly Rajan and Subramanian are one of the few authors that actually set prior expectations to the effect of aid on growth. It is an odd observation that this is not common practice since the setting of priors can give additional value to (unexpected) results.

Rajan and Subramanian (2008) perform an extensive study on the effect of aid on growth in a cross section study which controls for different variables and timing issues. Additionally they devise an instrumental variable for Aid/GDP to lose some of its endogenous properties, such as that ill performing countries might receive more aid negatively biasing results. Finally they also run tests on panel data using GMM estimation methods.

For the regression analysis Rajan and Subramanian use the following set of explanatory variables. They base their selection on papers by Burnside and Dollar (2000), Collier and Dollar (2002) Hansen and Tarp (2001) and Dalgaard et al (2004) but replace assassination by revolution because it appears more robustly significant.

Average annual growth of per capita GDP

$$\begin{aligned}
 &= B0 + B1 * \frac{Aid}{GDP} + B2 * Initial\ per\ cap.\ GDP + B3 * Initial\ level\ of\ policy + B4 \\
 &* Initial\ level\ of\ life\ expectancy + B5 * Geography + B6 * Institutional\ quality \\
 &+ B7 * Initial\ inflation + B8 * Initial\ \frac{M2}{GDP} + B9 * Initial\ \frac{budget\ balance}{GDP} + B10 \\
 &* Revolutions + B11 * Ethnic\ Fractionalization + e_i
 \end{aligned}$$

When using the Aid/GDP variable flat out in their regression they find a significant negative relationship between aid and growth, however, these results are deemed invalid because of endogeneity issues.

In their estimation strategy they take a new perspective. Rajan and Subramanian model the supply of aid to instrument for development aid and include factors that could influence the donation of aid except for income of the recipient. Two key aspects that influence aid donations that are the foundation for their instrumentation are influence and history. Influence is captured by a variable of relative size of the donor to the recipient. The bigger the donor relative to the recipient, the larger his possible influence will be. In order to proxy for historical relations they take variables as common language dummy, currently a colony dummy, a dummy for ever being a colony and specific colony relationship dummies for U.K, France, Spain and Portugal. Additionally they use interaction variables between specific colonial relationships and relative size. In their regression of these variables to Aid/GDP almost all estimates are significant at the 1% level.

After having constructed the instrument for aid/GDP Rajan and Subramanian run several regressions trying to encompass all existing theories. With their initial specification they find no significant result for the periods 1960-2000, 1970-2000, 1980-2000. For 1990-2000 they find a negative result significant at the 10% level, however, they claim their instrument does not work on such a short time frame. For robustness they regress with the inclusion of dummies for ever being a colony of the U.K., France or Spain but results are similar. Also they perform a regression with both their instrument and regular aid/GDP variable but also no significant relationship is found. They go on and test for different time horizons for growth and aid given testing all (37) possible timing combinations but find only 10 significant results

none of which are positive. Also no significant results are found with nonlinear and conditional effects such as Aid-squared, aid*policy and aid*geography.

Rajan and Subramanian (2008) continue to explore differences between “good” aid and “bad” aid. First they place some remarks on the possible effects of “good” and “bad” aid, for instance strategic aid is considered to be “bad” aid, however, this depends on the ability and willingness to convert the aid into growth. Also if some part of the donation is conditioned to be spent on goods manufactured by the donor this does not necessarily mean those goods are not useful. Additionally strategic aid has been given to various dictators but there are countries that used that strategic aid to flourish such as Pinochet in Chile and Suharto in Indonesia, while Nordic countries have given well-intentioned aid to a variety of African countries that have not grown strongly. Therefore the relationship between “good/bad” aid and growth has shaky foundations. Also in their analysis Rajan and Subramanian find no significant positive effect when differentiating aid between multilateral or bilateral, to top 5 donors or between social and economic aid.

Finally Rajan and Subramanian (2008) test several regressions in a GMM panel setting and again find no significant positive result.

Arndt (2010) do find a robust and significant result of aid's effect on growth. Using their improved instrument for Aid/GDP they find positive and significant results for all specifications and all different estimators. Using their specification instead of Rajan and Subramanian their results are significant at the 5% and 1% dependent on the estimator. Their tests were run on the 1970-2000 cross section data. When using a smaller time frame results became insignificant. However, they conclude that there is no empirical or theoretical basis to deny the long term impact of aid on growth. Important in arriving at the result is the difference in instrumentation strategy which will be described below. Arndt (2010) focus on the period of 1970-2000 because before 1970 many former colonies were not yet independent. Additionally there is the assumption that aid influence on growth has to be determined in the long term because of the time some social investments, such as health and education, need to translate in economic growth. The effect of spending aid on education might take years to take effect. When increasing the primary school enrollment it will take years before this increases the knowledge level of the work force. Additionally the effect of increased health on GDP growth may take even longer. Ashraf et Al. (2008) and Acemoglu and Johnson (2007)

find that increases in health actually decrease per capita growth for three decades due to increased population and dependency ratios.

Including a colony variable into regressions is not optimal because results of colonization are orthogonal (uncorrelated) to growth according to Arndt (2010). Even though colonization has an impact on economies today through for instance the legal system the impact of colonization may differ per colonized country and per colonizer. This supported by Acemoglu et al. (2002) where similar colonizers had different effects because of institutional qualities of colonized countries before colonization.

Regional dummies are widely applied in the AEL in order to account for heterogeneity. For instance, to have a South Asia or Sub Saharan Africa dummy in order to account for the differences in these regions such as climate, culture and history. However, Arndt (2010) et al. criticize this because of the ex post nature of these fixed effects. They claim that the decision that these two regions are "special" is made after the 40 years of ODA and that initially there was no reason to differentiate between these regions. They would rather expand the number of regional dummies to give a fairer picture of what the effect of each region is rather than controlling for unsuccessful regions ex post. Additionally Arndt. et al apply additional variables that reflect initial socioeconomic conditions such as education and health as well as additional geographic variables to represent trading distances. For their selection they refer to Sala-i-Martin (2004) to determine that distance to major port is the best for this objective. Furthermore they draw from Sala-i-Martin (2004) that a 1972 civil liberties variable is a good indicator of initial institutional qualities and the ability of the citizens to make the government account for its actions.

Arndt (2010) criticizes the choice of instrumental variables by Rajan and Subramanian (2008) referring to a study of Clemens and Bazzi (2009) that "different authors have used the same variables as instruments for a wide range of endogenous variables. This raises the possibility that these exogenous instruments are correlated with other omitted variables, thereby invalidating the exclusion restriction on which valid causal inference depends."

Arndt tests the validity of the instruments for Aid/GDP chosen by Rajan and Subramanian by regressing them to Aid/ GDP as a dependent variable. They find a high R-square and three highly significant relations being the population ratio, a dummy variable for historically having been a colony and a variable for ever being a UK variable. Arndt (2010) aggregates the data for even a better fit with a R-square of 99% versus 95% and even more significant

variables such as a population ratio and ever a colony interaction term, a common language dummy and a French colony dummy variable.

Additionally they test whether these instruments exclusion assumption by saving the residuals from growth regression to see whether the instruments are correlated to the unexplained variation. This test shows that the population ratio, the ever being a colony dummy and their interaction are not related to unexplained growth variation, however, common language only at a 10% significance level and formerly being a UK or French colony respectively at the 5% and 1% significance level. Finally they perform a test where the effect is shown per variable of leaving the variable out of the equation by a difference-in-Hansen C-statistic. These tests corroborate that the colony dummies are highly suspicious and reassure the use of population variables as valid instruments.

Average real growth rate

$$\begin{aligned}
 &= B0 + B1 * \frac{Aid}{GDP} + B2 * (Initial\ per\ cap.\ GDP) + B3 * (Initial\ level\ of\ policy) + B4 \\
 &* (Initial\ life\ expectancy) + B5 * (Geography) + B6 * (Coastal\ pop.\ density\ in\ 1965) + B7 \\
 &* (Primary\ schooling\ in\ 1960) + B8 * (Malaria\ risk\ in\ 1966) + B9 \\
 &* (Investment\ goods\ price\ 1960 - 64) + B10 (Civil\ liberties\ in\ 1972) + B11 \\
 &* \log (Air\ distance)
 \end{aligned}$$

The Arndt specification has a similar structure concerning initial per capita GDP variable, initial level of policy, life expectancy and geography, however, they drop the institutional quality and revolutions since the improvement of this might be one of the channels through which aid has an effect on growth. Furthermore it removes the separate initial policy variables and ethnic fractionalization since they are insignificant in Rajan and Subramanian (2008) results for all periods. To this they add variables that reflect initial socioeconomic conditions such as education and health variables and some geographic characteristics such as trading distances. They select these variables from Sala-i-Martin et al in 2004 who through Bayesian Model Averaging identify the most important control variables for growth regressions. Arndt et al. (2010) perform two tests with their IV estimation, one were they only test with the test variables that they have in common with Rajan and Subramanian (2008) and one where they add their additional control variables. They find a significantly positive effect for all tests and all specifications.

3.5 How Aid Might Negatively Affect Growth

Rajan and Subramanian published a paper in 2011 which studied some possible negative effects of aid on growth. The article supplied Dutch disease as a theoretical basis on how aid might actually damage growth. The inflow of capital might for instance be largely invested in the non-tradable sector, which increase wages here and attracts resources from the tradable sector and increase wage overall. This increase in wages might negatively affect the competitiveness of the export sector. Furthermore the increase of the non-tradable over the tradable appreciates the real exchange rate further damaging the competitiveness of the export sector. However, in the long run the increased productivity in the non-tradable sector, by improved infrastructure and educational levels could increase the competitiveness of the economy. So Dutch Disease could be a foundation for a two stage effect, where it has negative effect in the short run but a positive effect in the long run. Supportive evidence for a different effect of aid between short and long term was found by several studies in the early 2000s (McGillivray et al). In these studies the effect of aid becomes negative after a certain threshold, however, the actual threshold found varies from 5 till 45% of aid per GDP. One channel through which the decreased competitiveness of the tradable sector might affect growth is that through the tradable sector best practices from other countries are often imported. Therefore the Dutch disease effect of aid might block this channel of improved productivity, thus blocks a channel of possible growth.

Rajan and Subramanian (2009) try to determine the effect of aid on the growth of a particular industry with an interaction term and the exportability of that particular industry. The exportability variable has two different definitions, the first is whether the export to value added ratio is larger than the median of all industries and the second is a dummy variable that becomes equal to one for industries that historically have been most related to growth of development countries after they have moved out of agriculture. Both of these interaction terms between aid per GDP and exportability have a significantly negative effect on the growth of that industry. As a robustness check they also test the specification with their instrument for Aid/GDP as developed in Rajan and Subramanian in (2008).

From here on they continue to test two sub questions, first does aid cause the excess depreciation and second whether the excess appreciation is a reflection of policies rather than aid. First they make a simple regression where they relate aid/GDP to the dependent variable excess depreciation. This gives a highly significant and positive relationship. Then they test

several equations with an excess appreciation*exportability interaction variable proving that excess appreciation is the channel through which aid deteriorates the exporting industries. They test first the effect of the appreciation*exportability on its own which gives a significant negative result. And then they test whether this channel holds up when adding an aid/GDP*exportability variable and another test with the instrumented aid/gdp variable. In both cases the excess appreciation* exportability holds and the aid/gdp* exportability interaction loses some or all of its significance. From these series of tests Rajan and Subramanian conclude that aid influences excess depreciation which in turn slows down the growth of exporting industries.

Secondly it tests whether other channels are more significant than aid*exportability for growth of the industries such as trade reform variable as done by Sachs and Warner, tariffs, black market premium, the standard deviation of inflation and financial independence but none of these variables influenced the size or significance of the aid*exportability variable on growth of the industries.

3.6 Other factors that influence aid effectiveness, aid allocation and the AEL in General

Kimura (2007) tries to determine the effect of aid proliferation on the effectiveness of aid. This is one research in line with other articles that try to differentiate between types of aid such as Cordella en Dell'Arricca (2004) and Minoiu and Reddy (2010) among others because the assumption that aid is homogenous might not be realistic. As an example of aid proliferation Kimura quotes James D. Wolfensohn, who stated that Tanzania filed 2,400 reports to aid donors and hosts 1,000 aid missions each year (Roodman 2006). So the theoretically aid proliferation creates some type of transaction cost and that reduces the effectiveness of aid. Kimura develops a team production model to display a theoretical free rider model where when there is more than one donor the individual optimal donation level is below the social optimal except when a donor is fully altruistic. This means that aid proliferation is problematic when self-interest is the donor's motivation.

Kimura (2007) creates a Herfindahl Index for donor concentration as his variable for aid proliferation. Figures created by Kimura show an increasing trend of bilateral donors per recipient country and a decreasing trend of the Herfindahl Index between 1973 and 2001 both of which are indicators of increased aid proliferation. Kimura bases this estimate on the

OECD Credit Reporting System so between NGO's and non-DAC donors the real proliferation is assumed to be worse. Kimura tests his hypothesis with a Roodman specification extended with an aid*Herfindahl index and an aid*Herfindahl-squared variable in a system GMM estimation and finds that the Herfindahl index has a significantly positive sign and the squared interaction variable a significantly negative sign. From these results Kimura concludes that donor concentration has a positive influence on aid effectiveness and that the aid effectiveness with respect to the Herfindahl index has an inverted U-shape, which would mean there is an optimal point of aid proliferation/concentration. As a robustness check Kimura interacts the Herfindahl Index with control variables such as policy, institutional quality and regional dummies but this does not alter results.

Minoiu and Reddy (2010) contend the results of Rajan and Subramanian (2008) with regards to the different effects of “good” and “bad” aid. Minoiu and Reddy differentiate between developmental aid and non-developmental aid in three ways, aid given by top donors, aid from multilateral organizations and all other aid. Top donors have a record of giving aid with the aim of developing the recipient and multilateral aid has been shown to have a larger concern for development than bilateral aid. Some examples of “bad” donors are for instance the U.S. where only 15% of all aid is donated according to economic and poverty criteria (Brainard 2006). Furthermore the US pattern of aid is heavily influenced by its interest in the Middle East which is also established by the fact that one third of its donations are received by Israel and Egypt. Moreover France and UK seem to donate largely to their former colonies. Furthermore U.K., U.S., Germany and France donations are highly correlated by UN voting patterns of the recipients. On the other hand Nordic countries do seem to target countries based on income, institutional qualities and macroeconomic policies. The Netherlands gives only 17% of their aid to former colonies. In general small economies are more likely to donate based on income levels. So to proxy for development aid in their study they select aid from these good donor countries which are Denmark, Finland, the Netherlands, Norway and Sweden. They also run regressions with more expanded groups.

Minoiu and Reddy run their cross sectional regressions in a Rajan and Subramanian fashion and include the same controls. First they reproduce Rajan and Subramanian results using an unaltered Aid/GDP variable and get similar results, however, when they add deeper lags they significantly positive results. They also implement lags in their analysis with their proxy for development aid, where they regress development aid from 1960 till 1990 to growth between 1990 and 2000. Here they find highly significant positive results for all “good” donor groups

and no significant results for the non-development aid and multilateral aid variables. Average growth was found to be between 1.2 and 1.3 percent higher for each 1 percent of GDP of aid received by these “good” donor countries. These results seem robust in a GMM panel estimation.

Hoeffler and Outram (2011) investigate what determines the allocation of aid. Besides development motives geopolitical motives play a large role. The large donation of the US to Egypt and Israel was mentioned before and Hoeffler and Outram estimate this to be 40% of US aid even though their ranks with respect to GDP per capita are 98th and 23rd of the world respectively. Additionally they mention that Japanese aid goes mostly to Asian countries such as Vietnam and Indonesia. Furthermore in recent years Iraq and Afghanistan have entered to aid recipient top 10. These observations underline the relevance of the question of donor motives.

Hoeffler and Outram differentiate them from earlier work such as Alesina and Dollar (2000) through their estimation technique. Alesina and Dollar would try to estimate separate equations for each donor. However, since donors do not donate to the same group of countries the coefficients estimated are not entirely comparable. Hoeffler and Outram solve this problem by estimating one equation with a dummy for all but one donor and an interaction variable for each donor dummy and each explanatory variable. They estimate this first for the top 5 donors, being US, Japan, France, Germany and the UK and second for all the 22 donor countries. Explanatory variables are grouped in recipient need, recipient merit and donor self-interest. Recipient need is measured as GDP per capita and donations by other countries. Recipient merit tries to capture good policy by GDP per capita growth and democracy and human rights. Finally donor self-interest is measured by how UN voting patterns of the recipient align with that of the donor.

The results are that all donors take recipient need into account and the average donor gives 1% of aid less when income increases by 1%. Of the top 5 donors only the UK donates significantly more to poor countries than the average donor. Additionally the UK rewards countries with good policies but does not take human rights into account. France, Germany and Japan do take human rights abuses into account and the UK, US and Japan give more to democratic recipients. All top donors except Germany give more to donors that have similar voting patterns and without exception they give more to trading partners. However, when country fixed effects are included the voting pattern variables become insignificant. Evidence

on “small country bias” is mixed where UK donates relatively more aid to small countries and Germany and the US relatively more to big countries.

According to the meta study of Doucouliagos (2008) there are three families of AEL models. First family is where aid increases growth through savings and investment. Second family is where aid directly affects growth. Third family where there is a condition through which aid either positively or negatively affects growth. However, it could be argued that there is a fourth family that distinguishes between types of aid and their effect on growth as suggested by Clemens et al. (2004). In their meta study Doucouliagos solely concentrate on the direct estimates of aid-growth effects. They try to answer whether there is a positive effect of aid on growth and whether it matters how old the study is, where and by whom it is published and what variables are controlled for. They find that aid effectiveness studies results tends to find smaller positive effects through time, where an increase in the effectiveness is expected due to learning by doing effects of the aid industry.

In the Meta Regression Analysis they regress the effect of characteristics of an article on the outcome of the article. The characteristics are separated into 6 groups, where it was published, certain characteristic of the author such as where he or she works, data characteristics, conditionality applied, specification and control issues and estimation types. Some of the interesting findings are that outcomes are related to where the paper is published and also that articles tend to confirm results of other authors with whom they are associated. Regarding data issues a stronger relationship between aid and growth is found when more Asian countries are included in the sample. Asian countries seem to experience higher aid-growth effects. Concerning conditional effects the inclusion of aid*policy interaction or an aid-squared term has no robust effect on the aid effectiveness coefficient according to Doucouliagos (2008). Adding an aid*institutional quality interaction variable does negatively influence the aid effectiveness coefficient negatively so Doucouliagos concludes that institutional quality does have a positive effect on aid effectiveness. However, when policy variables are entered into the equation separately it does have a negative effect on the reported aid effectiveness coefficient. Thus, concludes Doucouliagos, aid effects growth through improved policy and the consequent aid effectiveness coefficient is the direct effect of aid, whereas when policy variables are excluded the coefficient entails the total effect of aid. In the end taking 68 aid-growth studies in their dataset with results of over 40 years of research Doucouliagos concludes aid does not have a significant positive effect on growth.

4 Reproduction of Bruckner

In 2011 Bruckner developed a correction for simultaneity bias. He developed a two stage least squares where first the impact of growth on aid was determined. The result was used to correct the aid received and then regress this to the effect of Aid on growth. The intuition behind this is that when countries start to grow they will receive less aid and so it will seem in a regression as if less aid is related to more growth. A similar case can be made for countries that seem to have an economic downturn and as a result will receive more aid. This can result in a negative coefficient for aid on growth. Therefore Bruckner developed a method to control for the effect of growth on aid in order to determine the real effect of aid on growth. The Bruckner method for simultaneity bias will be specified below.

4.1 The Bruckner Instrumentation

First Bruckner instruments economic growth by regressing the country specific commodity price index and annual rainfall data to annual growth data. This instrumentation is valid because as Bruckner puts it:

“a key characteristic of the LDC’s that makes the estimation strategy plausible is that these countries are highly dependent¹ on the agricultural and commodity exporting sector. Hence variation in rainfall and international commodity prices can induce substantial variation in real per capita GDP growth *vis-à-vis* changes in agricultural activity and terms of trade” (Bruckner 2011).

The first step for the instrumentation is to regress growth to change of natural logarithm of rain, rain-squared and the commodity price index.

$$\Delta \ln(y_{i,t}) = a_i + b_t + B(0) + B(1) * \Delta \ln(ComPI_{i,t}) + B(2) * \Delta \ln(Rain_{i,t}) + B(3) * \Delta [\ln(Rain_{i,t})^2] \quad (1)$$

The coefficients of both rain and the commodity price index are positive and the rain-square variable is negative which indicates that very high levels of rain might damage the economy. These coefficient are used to instrument for growth and this instrument can be used to

¹ Not all countries in this authors database are heavily dependent on agriculture or exports. However, robustness checks were done by excluding countries from the database that have less than 20% of either Agri/GDP or Export/GDP.

determine the effect of growth on aid received. The effect of growth on aid is estimated with the following formula:

$$\Delta \log(aid_{i,t}) = a_i + b_t + B(0) + B(1) * \Delta \log(y_{i,t}) + e_{i,t} \quad (2)$$

Where a_i are country-fixed effects and b_t time fixed effects. The result of Bruckner for the B(1) coefficient was around -4 at a 5% significance level. This means that a one percent increase in growth of an LDC result in a 4% decrease in Aid/GDP.

To get from the actual aid received to the Bruckner corrected aid Bruckner's deducts the correction for GDP from the actual aid to get to an aid level independent from growth $\Delta \log(aid_{i,t})^*$

$$\Delta \log(aid_{i,t})^* = \Delta \log(aid_{i,t}) - B(1) * \Delta \log(y_{i,t}) \quad (3)$$

Finally Bruckner (2011) regresses his corrected Aid as percentage of GDP variable to GDP to estimate the true effect of aid on growth. For robustness he controls for changes in political institutions and with a civil war dummy.

$$\Delta \ln(y_{i,t}) = a_i + b_t + B(1) * \Delta \log(aid_{i,t})^* + B(2) * \Delta(polity2) + B(3) * \Delta(civil\ war) \quad (4)$$

First step in this thesis is to replicate the results of Bruckner (2011) using his own database to ensure the methods applied in this thesis are correct. The second step will be to replicate the result with a more extensive database constructed by this author. The need for an extended database comes from comparison of the set of countries included in Bruckner's analysis and a leading article in the aid effectiveness literature by Rajan and Subramanian (2008).

4.2 Data Description

Table 1.1

Countries included and percentage of agriculture, export and aid to GDP (Data from world bank)

Country	Agri/GDP	Export/GDP	ODA/GDP	Country	Agri/GDP	Export/GDP	ODA/GDP
Algeria	10	26	0,7	Liberia	45	55	10,7
Argentina	8	8	0,1	Madagascar	31	16	8,5
Bangladesh	29	7	5,4	Malawi	41	25	18,2

Benin	35	16	9,7	Malaysia	20	64	0,5
Bolivia	19	23	6,2	Mali	50	16	16,4
Brazil	10	9	0,1	Mauritania	32	43	22,4
Burkina Faso	32	9	12,2	Mexico	9	16	0,1
Cameroon	27	23	4,3	Morocco	17	22	3,2
Chad	37	15	11,7	Mozambique	37	10	29,7
Chile	8	25	0,2	Nepal	55	13	7,7
China	27	12	0,4	Nicaragua	23	24	14,1
Colombia	19	16	0,5	Niger	45	18	12,8
Congo, Rep.	12	51	7,8	Nigeria	N/A	27	0,5
Costa Rica	13	33	2,0	Pakistan	29	13	3,1
Cote d'Ivoire	27	37	4,6	Papua New Guinea	34	44	13,1
Cyprus	8	48	2,4	Paraguay	28	26	1,8
Dominican Rep.	16	27	1,3	Peru	12	16	1,1
Ecuador	N/a	26	1,3	Philippines	24	28	1,5
Egypt, Arab Rep.	22	21	7,6	Samoa	19	33	21,5
Ethiopia	57	7	7,8	Senegal	21	28	10,1
Fiji	21	50	3,1	Sierra Leone	41	21	11,2
Gabon	8	55	2,7	Singapore	1	163	0,3
Gambia, The	33	46	20,4	South Africa	6	27	0,3
Ghana	50	18	6,5	Sri Lanka	26	30	6,1
Guinea	21	26	10,9	Syrian Arab Rep.	29	22	6,0
Guinea-Bissau	51	10	42,3	Tanzania	44	16	18,7
Guyana	29	74	14,6	Thailand	18	29	0,8
Honduras	24	34	6,9	Togo	33	41	10,5
Hungary	15	40	0,0	Trinidad and Tobago	2	44	0,3
India	33	7	0,8	Tunisia	17	36	3,1
Indonesia	25	26	1,7	Turkey	23	12	0,5
Israel	N/A	36	3,6	Uganda	56	12	8,3
Jamaica	8	43	3,4	Venezuela, RB	5	26	0,0
Jordan	7	44	16,4	Zambia	17	37	14,9
Kenya	33	28	6,8	Zimbabwe	17	26	3,2
Kiribati	27	29	29,3	Average	23	28	6,9
Korea, Rep.	15	30	0,6				

4.2.1 Countries selection

Countries were selected based on two different databases. First is the database originally used by Bruckner, which included fifty countries. The other set of countries was taken from Rajan and Subramanian (2008) which used a database of around 100 countries. These two sets countries combined gave a total list of potential countries included of 105 countries. The total list of countries and whether they were included in the Bruckner and/or in the Rajan and Subramanian can be found in the appendix 1.1. Additionally this table gives information

whether there was data available for these countries in the databases used in this thesis. These databases include NBER data on world trade, UNCTAD data on commodity prices, data on rainfall from the GHCN database and the World Bank database on growth and ODA (Official Development Aid) data. Table 1.1 shows the countries included in the reproduction of Bruckner's regression that correct for simultaneity bias. Additional information is given on the share of the agricultural sector, the export sector and ODA received as a part of GDP since these are the three main components of our analysis. When comparing the dataset used in this analysis and in the original dataset used by Bruckner two things stand out. First is that Bruckner uses relatively small countries. This can be rationalized is that in these countries variance in rain has a larger impact on agricultural production since in a large countries variance of rainfall tends to average out. Additionally smaller economies are more vulnerable to external price shocks since there are more a price taker on the world market compared to big players, such as China, India and Brazil, who affect world prices through their own output to a larger extent. However, the second aspect is that he left out countries that grew from relatively poor countries into economic powerhouses, such as indeed China, India, Brazil but also Mexico and Chile. This selection bias works both ways, first to Bruckner's analysis leaving out successful countries might positively influence his results but also including them into Rajan and Subramanian might have negatively biased their results since they do not control for simultaneity bias. In this thesis the two datasets were combined to give an as complete as possible estimate on the simultaneity bias of growth on aid

4.2.2 NBER data

In order to determine the average time invariant value of exports of commodities of interest for each country this thesis collected data from a dataset on World Import and Export Data constructed by Feenstra and Lipsey. It contains trade flows from 1962-2000 and it was constructed from United Nations trade data. This dataset contained information on exports of all goods which were coded by and SITC code and between all countries. Within the database exports were classified by code and the sum of all exports was given in the exports to world category. First it was necessary to calculate the total value of export for a country. Then the value of exports of a particular good was summed. This is because most goods had an SITC code that had different sublevels. For instance oil has SITC code 33, however, oil can be subdivided into many different groups. The value of these exports had to summed and then divided by the total value of export for that country in order to arrive at the time invariant value of a commodity export. In this thesis data on export was used for the year 2000. This

decision was based on the idea that shares of a commodity in export is largely stable and assumed to be time invariant in Bruckner’s article. The following table shows the commodities used and their respective SITC codes.

Commodity Name	SITC code	Commodity Name	SITC code
Aluminum	285 + 684	Oil	33
Beef	011	Rice	042
Coffee	071	Rubber	62
Cocoa	072	Sugar	06
Copper	283+682	Tobacco	12
Cotton	263	Wheat	041
Gold	97	Wood	24
Iron	281 + 67		

Source: <http://www.census.gov/foreign-trade/reference/codes/sitc/sitc.txt>

4.2.3 UNCTAD

The UCTAD (United Nations Conference on Trade and Development) database provided data on commodity prices. Several commodities have several prices stated per commodity if these prices were available for the whole time period they would be averaged over the number of prices stated. In the calculation of the price index the commodities tea and maize were excluded. Primarily this is done because of a lack of data concerning the commodity prices. This will have a minor impact on the outcome because these commodities were not a large export sector for any country. The commodity prices were used in combination with the previously calculated time invariant portion of exports that the commodity accounted for to calculate a commodity export price index for each country for each period. The change in this index would show the impact of worldwide commodity prices on the economy through the percentage of total exports that that specific commodity represented. In accordance to Bruckner (2011) method the natural logarithm of this index was taken and differenced with its value of the previous period.

4.2.4 Precipitation Data

Data on the rainfall of each country was downloaded from a database of the National Climatic Data Center of the U.S. Department of Commerce. Which is a part of the National Oceanic

and Atmospheric Administration's Satellite and Information service. This institution supplied the GHCN version 2 dataset on monthly precipitation around the world. GHCN stands for Global Historic Climatology Network. Since my research would span only the years from 1970 until 2000 only those observations were selected. This dataset contained multiple rainfall observation station per country. For some countries only 10 observation centers were available, however, Brazil had around 1000 observation stations for each year. These observation stations provided monthly precipitation data. The monthly precipitation was summed to an annual total. Then the annual totals were averaged over the number of observation stations. However, the treatment of this data had to be done with care because over the years the number of observation stations declined for almost all countries and so the data became less reliable. This was exacerbated by an increase of missing observations. This led to declaring observations for precipitation as non-available for a large part of the 1990s in many cases. The source of precipitation data is different from Bruckner who used observations from the Tyndall Centre of Climatic Research (TYN). The problem with this dataset is that it gives rainfall data according to a longitudinal and latitudinal grid instead of observations per country. Composing the dataset from these observations would be beyond the scope of this thesis. When the precipitation data was collected for each year it was not ready to be used in the analysis. Bruckner would take the natural logarithm of each observation and take the difference with the preceding year to arrive at the change in log rainfall. A second variable derived from the precipitation is the squared of the log of annual precipitation and its difference with the preceding year.

4.2.5 World Bank Data

From the World Bank's World Development Index databank data on GDP per capita and ODA as a percentage of GDP was used in the analysis. Other data acquired were ODA per capita, total population figures and export and agricultural value added as a percentage of GDP. The World Bank data base goes back until 1960 however, when reviewing the sample the validity of Arndt et al. (2010) argument stood out because most countries had not achieved independence before 1970 and so no growth data is available for years prior to 1970 for numerous of the countries selected. Additionally I removed some countries due to lack of growth data. Afghanistan for instance only has growth data since 2002 and for Somalia no growth data is available since 1991 till the present. Also I have removed Haiti, Poland and Yemen since there was no growth data available before 1990 of these countries.

4.3 Results

4.3.1 Results of Original 'Database

First series of regressions were run with the original database used by Bruckner which was downloaded from the Journal of Applied Econometrics website. In Bruckner's paper various regressions are run with different time frames and with some variation in countries included. The reproduction in this this is done over the full sample of countries supplied and over the time frame of 1970-2000 to ensure comparability with the reproduction with this author's database.

In the first column of the reproduction is the regression for the effect of the logarithmic change in rainfall, rainfall squared and in the export price index to GDP. In this regression the effect of the change in rainfall is positive and significant to the change in GDP per capita. The logic behind this is that rainfall in developing countries positively affects agricultural output which is a significant part of GDP. There is a difference, however, with Bruckner's results in his paper. In this reproduction the logarithmic change in rainfall is significant at a 5% level, whereas in Bruckner's results it is significant at a 1% level. Possibly this reduction of significance is due to deleting the part of the sample before 1970. The second coefficient of the change in the logarithmic rainfall squared is significant at the 10% level and has a negative sign. Both the sign and the size of the coefficient are correct, however, also here the significance is less than in Bruckner's paper. The meaning of this variable is that when the change in rainfall becomes too large it may have a detrimental effect on growth such as rainstorms destroying the crops or drought. One comment on the notation in the original paper is that Bruckner describes this variable as $[\Delta \ln (rain)]^2$ which implies that he squares the change in the logarithm. However, his dataset shows that actually he squares the natural logarithm of rain and then takes the difference. Finally the table shows the effect the change in the natural logarithm of the commodity price index on the change in GDP. Here the size of the coefficient and its sign are the same as in the original article and it is significant at a 10% level. The sign of the coefficient means that an increase in export commodity price has a positive effect on the economic growth. In conclusion all coefficients in the regression have the same direction and in most cases the same size as in the original paper, however, the results have a lower significance level.

The second column determines the impact of the same variables on the change of aid to GDP. Here, as expected the signs are reversed. Where the change in rainfall has a negative effect on

aid received as does the change in commodity prices. This is exactly the expected results since these two variable are positively related to GDP growth their relation to aid is negative. Similarly for the change in rainfall squared which has a negative effect on GDP but has a positive effect percentage of aid to GDP. The theory here is that improved rainfall and increased export prices has a positive effect on GDP and therefore a country receives less aid, for instance because a donor decides that other countries need it more, perhaps countries with negative growth. This is the point of the simultaneity effect of growth on aid Bruckner tries to prove. Similarly the change in rainfall squared represents large shocks to rainfall which the previous section determined have a negative effect on growth and proves to have a positive effect on aid per GDP received. In this column the significance levels of the reproduction align mostly with the same regressions in the article. Only the results for the commodity export price index significance level is less than the 5 % level stated in the article.

Table 2.1 Bruckner reproduction With Bruckner's Database

	GDP growth $\Delta \text{Ln}(\frac{GDP}{POP})$	Change in Aid $\Delta \text{Ln}(\frac{Aid}{GDP})$	Change in Aid $\Delta \text{Ln}(\frac{Aid}{GDP})$	Change in Aid $\Delta \text{Ln}(\frac{Aid}{GDP})$
Change in log rainfall	.150** (.075)	-.742* (.432)		
Change in log rainfall squared	-.01* (.006)	.058* (.033)		
Change in log commodity price index	.359 * (.205)	-2.233*(1.172)		
GDP growth $\Delta \text{Ln}(\frac{GDP}{POP})$			-.397*** (.117)	
Instrumental variable $\Delta \text{Ln}(\frac{GDP}{POP})$				-4.105 ** (1.977)
Country fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
R-squared	.098	.123	.120	.069

*10% significance ** 5% significance *** 1% significance

The third column regresses the effect of GDP growth directly on the change in aid to GDP. This shows the negative relationship between aid and growth, however, the result is influenced by all factors that also influence aid to growth regressions. Therefore the result of the first column is used to determine an instrumental variable for changes in GDP per capita. Because changes in the weather and world commodity prices are outside the influence of the country itself they are assumed to be exogenous shocks to GDP as opposed to measures as government policy, political institution and human capital improvements. The construction of the instrumental GDP consisted of multiplying the coefficients from the first column by the variable of interest for each country in each specific year. This gave a change in GDP you would expect based on these external shocks to the economy. Key in this analysis is that the shocks are external and not influenced by endogenous factors mentioned above.

In the fourth column the impact of the instrumental variable for GDP growth to changes in aid to GDP is shown. The results of this reproduction are the same as in the original paper where a 1 percent increase of GDP implies a reduction of 4 % in Aid to GDP. This result is significant at a 5 percent level as it is in the original paper.

There has to be one remark regarding the usage of an Aid to GDP variable which has been debated in the literature. The problem here is that aid to GDP as a variable already contains GDP and GDP influences the variable. Because if GDP goes down *ceteris paribus* aid to GDP goes up. This means that variables negatively correlated to GDP will automatically contain positive relations to Aid to GDP ratio. However, in the analysis that follows with own data regressions have been run with Aid to population instead but this did not give a different result.

The second step of the reproduction of the original paper is to correct aid to gdp for the effect of GDP growth and then to determine the real effect of development aid to GDP. In this part of regressions Bruckner tries to show that when you correct development aid for simultaneity bias development aid has a positive effect on growth. As a test for robustness Bruckner adds a control variable for changes within the country's political institutions and a dummy variable that indicates whether there is a civil war going on.

The corrected aid variable is constructed by taking the change in log aid and then corrects it by the change in GDP times the coefficient found in the previous group of equations.

$$\Delta \ln (Aid)^* = \Delta \ln(Aid) - c\Delta \ln (y) \quad (3)$$

Where C is the coefficient found in the last regression of table 2.1 which said that a 1 percent increase in GDP gives a 4 percent decrease in aid. Therefore to arrive at the corrected change in aid he adds back four times the change in GDP.

Regressing the corrected aid/GDP to GDP growth gives a positive result which is significant at the 1% level in both cases. The size, directions and significance are similar as in Bruckner's original analysis.

Table 2.2

	GDP growth $\Delta \ln\left(\frac{GDP}{POP}\right)$	GDP growth $\Delta \ln\left(\frac{GDP}{POP}\right)$
Corrected change in Aid/GDP	.118*** (.004)	.110*** (.005)
Within country changes in political institutions		.001 (.001)
Civil war indicator dummy		-.029*** (.008)
Country fixed effects	Yes	Yes
Time fixed effects	Yes	Yes
R-Squared	.488	.418

4.3.2 Results of this Authors Database

Table 2.3 presents the results regarding the reproduction of Bruckner's results with this author's own database constructed with additional countries as explained in the data section of this thesis. Looking at the first column the regressions with this database give no significant results. Even though the direction of the coefficients is correct they are not significantly different from zero. In the second column the effect of the same variables on aid is regressed and only the change in the commodity price index is significant at the 10% level. Furthermore the commodity price index coefficient is the only one that has the correct sign. The coefficient indicates that when there is a positive shock to the economy in the form of increased export commodity prices development aid is reduced. The third column displays a direct regression of the change in growth to the change in aid. Here the result similar to Bruckner's finding that an increase in GDP per capita reduces aid expressed as a percentage in GDP. This result is significant at the 1% level and is four times as large as in the original paper. Perhaps this is due to the inclusion of fast growing countries in the sample. In the fourth column the instrumental variable for GDP was regressed to growth and gives a highly insignificant result. However, this can largely be explained by the insignificance of the coefficients with which the instrument for GDP is constructed. Since the coefficients were not significantly different from zero the instrument based on these coefficient have no profound effect as well. In the

literature besides country fixed effects additional tests with regional dummies are often performed, however, inclusion of a sub-Saharan Africa dummy did not alter results.

Table 2.3

	GDP growth $\Delta \text{Ln}\left(\frac{\text{GDP}}{\text{POP}}\right)$	Change in Aid $\Delta \text{Ln}\left(\frac{\text{Aid}}{\text{GDP}}\right)$	Change in Aid $\Delta \text{Ln}\left(\frac{\text{Aid}}{\text{GDP}}\right)$	Change in Aid $\Delta \text{Ln}\left(\frac{\text{Aid}}{\text{GDP}}\right)$
Change in log rainfall	.067 (.042)	.139 (.336)		
Change in log rainfall squared	-.005 (.003)	-.018 (.026)		
Change in log commodity price index	.041 (.044)	-.668* (.353)		
GDP growth $\Delta \text{Ln}\left(\frac{\text{GDP}}{\text{POP}}\right)$			-1.260***(.207)	
Instrumental variable $\Delta \text{Ln}\left(\frac{\text{GDP}}{\text{POP}}\right)$				-1.069 (4.132)
Country fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
R-squared	.179	.094	.086	.112

Table 2.4 represents the same procedures as the previous table, however, with a more limited sample in order to test for robustness. Countries that had an initial GDP per capita of over 1500\$ were removed. Additionally the same test was done with countries that had an initial GDP per capita below 1000\$, however, this did not improve results. Results in the first column are similar to the previous table with the only distinction that the change in log rainfall is significant at the 10% level. This increased significance could be explained by the selection of lower income countries which might be more dependent on agricultural output. Therefore the effect of rainfall on GDP growth could be more pronounced. In the second column there are no significant differences with the previous table. The rainfall and rainfall squared signs are still wrong and still insignificant. Furthermore the sign and significance of the commodity price index are similar, however, the size of the coefficient are a bit smaller. The direct regression of GDP growth to changes in Aid per GDP is roughly the same size and

is still significant at the 1% level. The instrumental variable for GDP growth in the fourth column has the same size and sign as in the original article, however, it is not significant.

Table 2.4 - Robustness reproduction - Countries with initial GDP per capita over 1500\$ removed from sample

	GDP growth $\Delta \ln\left(\frac{GDP}{POP}\right)$	Change in Aid $\Delta \ln\left(\frac{Aid}{GDP}\right)$	Change in Aid $\Delta \ln\left(\frac{Aid}{GDP}\right)$	Change in Aid $\Delta \ln\left(\frac{Aid}{GDP}\right)$
Change in log rainfall	.074*(.045)	.072 (.305)		
Change in log rainfall squared	-.005 (.003)	-.010 (.023)		
Change in log commodity price index	.037 (.047)	-.574*(.316)		
GDP growth $\Delta \ln\left(\frac{GDP}{POP}\right)$			-1.155***(.199)	
Instrumental variable $\Delta \ln\left(\frac{GDP}{POP}\right)$				-4.184 (3.520)
Country fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
R-squared	.165	.111	.103	.111

As a final robustness check the sample was altered in two separate attempts. The first attempt was to remove all the countries from the sample that are not present in Bruckner's sample. It has to be noted that this does not give the exact same country selection since some of the countries used in the original sample were not present in all the databases used by this author. The first column produces roughly the same outcomes as in the two previous tables but none of the coefficients are significant. The second column is the only output of that type of specification was the change in the commodity price index is not significant.

The second sample used two rules to select countries. First all countries with a population of over 100 million people were removed because these economies might be less sensitive to a change in world commodity prices since they are so big they can no longer be considered price takers on the world market.. And secondly countries were excluded where either Export to GDP ratio and agriculture value added to GDP ratio were below 20%. Again this produced similar results relative to the other sample selections.

Table 2.5

	GDP growth $\Delta \text{Ln}\left(\frac{\text{GDP}}{\text{POP}}\right)$	Change in Aid $\Delta \text{Ln}\left(\frac{\text{Aid}}{\text{GDP}}\right)$	GDP growth $\Delta \text{Ln}\left(\frac{\text{GDP}}{\text{POP}}\right)$	Change in Aid $\Delta \text{Ln}\left(\frac{\text{Aid}}{\text{GDP}}\right)$
Change in log rainfall	.093 (.098)	.494 (.621)	.070 (.043)	.182 (.343)
Change in log rainfall squared	-.008	-.038 (.045)	-.005 (.003)	-.020 (.026)
Change in log commodity price index	.038	-.340 (.464)	.041 (.046)	-.717** (.026)
Country fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
R-squared	.171	.128	.178	.098

Finally a regression was run with the same correction for aid with this author's database. One assumption made was that the c coefficient in equation (3) is still -4. When then applying the aid correction to arrive at aid star and regressing this to growth a positive relationship was found with a 1% significance level albeit the coefficient was smaller than the original in the Bruckner article.

Table 2.6

	GDP growth $\Delta \text{Ln}\left(\frac{\text{GDP}}{\text{POP}}\right)$
Instrumental variable $\Delta \text{Ln}\left(\frac{\text{GDP}}{\text{POP}}\right)$.032***
Country fixed effects	Yes
Time fixed effects	Yes
R-squared	.233

4.3.3 Summary of differences between Bruckner's article and this thesis

The difference in outcomes between the original article and this thesis can only be explained by differences in data sources and in different country selection. The methodology was copied

as well as possible. This could be verified by the reproduction of Bruckner's results using his own database.

The most crucial difference is in the acquired rainfall data. Here Bruckner used data from a 0.5-degree by 0.5-degree latitude- longitude grid, whereas this authors database was constructed by using the average of observations supplied by the weather stations. This fact alone might decrease the reliability of the rainfall data, however, additionally the number of weather stations supplying observations decreased by time and parts of the database became unreliable during the 1990s, which left no choice in declaring observations not available.

The commodity price index was constructed using the same databases as the original article. The only unknown is how Bruckner constructs his invariant value of each commodity as a percentage of exports. In this thesis' database the percentages of 2000 were used since the assumption is that they are time invariant.

The data on development aid were downloaded from the World Bank as in the original article. However, in Bruckner's article growth data was taken from the Penn World Tables, whereas in this article they were taken from the World Bank as well. However, there is no reason to assume the World Bank GDP figures to be any less reliable.

Most results did not survive this alteration of data source and country selection. The rainfall and commodity price index did not seem a strong predictor of economic growth and as a result the instrumental variable for GDP based on those variables was not significant for predicting changes in development aid.

One conclusion from this could be that Bruckner's methods are not very robust. This leads to question his country selection. His selection was very small and did not include any large or fast growing countries, unlike other important articles in the literature such as Rajan and Subramanian (2008). Another important difference is that this thesis only uses data from 1970 until 2000. In Bruckner's original paper the results from this period were also among the least significant. However, the decision on this period was made on the fact that before 1970 a lot of countries with a colonial history were not yet independent and so no growth data was available for these countries. In order to reduce bias in the sample countries were chosen that could supply data for nearly the entire period on all variables. Another difference in the country selection is that Bruckner only selected the least developed countries, however, when

reducing the sample to contain only countries with an initial income of below 1000\$ per capita results did not improve.

5 Conclusion

A solid conclusion is hard to draw because the AEL provides so many different answers. Important factors are the government and institutional qualities of a country both for aid effectiveness and growth in general but the actual effect of growth is hard to distinguish. Also the type of aid supplied is an important factor combined with the time horizon in which growth is measured. Furthermore the allocation of aid plays a role, on and the basis on which it is allocated. The fact that aid is supplied to countries that struggle in their development biases results negatively and different approaches to solve for bias give different results on aids effectiveness. The most remarkable consequence of different approaches for this endogeneity bias are the differences in results between Rajan and Subramanian(2008) and Arndt (2010). Here Rajan and Subramanian find no significant effect of aid on growth in several different settings but Arndt (2010) improves the instrumentation for aid and does find a significant effect. Whether Arndt (2010) result will stand the test of time is yet to be seen. Bruckner (2011) developed a very interesting instrument for reducing simultaneity bias. When using this instrument for aid a positive relationship between aid and growth was found. When using different data sources and different country selection the instrument could not be constructed due to insignificant results in the first stage. However, when applying Bruckner's correction to the aid variable a positive relationship between aid and growth was found also in this sample. It seems that endogeneity and the instruments to solve the problem will remain imperative in the AEL and therefore a more extensive research into this instrumentation could be interesting for further research.

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Appendix 1. Countries selected

Country	R08	Bruckner	Country	RS08	Bruckner
Afghanistan	No	Yes	Laos*' **	No	Yes
Algeria	Yes	No	Liberia	No	Yes
Argentina	Yes	No	Madagascar	Yes	Yes
Bangladesh	Yes	No	Malawi	Yes	Yes
Benin	Yes	No	Malaysia	Yes	No
Bolivia	Yes	No	Maldives *	No	Yes
Botswana*	Yes	No	Mali	Yes	Yes
Brazil	Yes	No	Mauritania	Yes	Yes
Bulgaria **	Yes	No	Mauritius	Yes	No
Burkina Faso	Yes	Yes	Mexico	Yes	No
Burundi***	Yes	Yes	Morocco	Yes	No
Buthan*'***	No	Yes	Mozambique	No	Yes
Cambodia **	No	Yes	Namibia*	Yes	No
Cameroon	Yes	Yes	Nepal	No	Yes
Cape Verde*	No	Yes	Nicaragua	Yes	No
Chad	Yes	Yes	Niger	Yes	Yes
Chile	Yes	No	Nigeria	Yes	No
China	Yes	No	Pakistan	Yes	No
Colombia	Yes	No	Panama ***	Yes	No
Comoros *	No	Yes	Papua New Guinea	Yes	No
Congo Dem. Rep. **	Yes	No	Paraguay	Yes	No
Congo Rep.	Yes	Yes	Peru	Yes	No
Costa Rica	Yes	No	Philippines	Yes	No
Cote d'Ivoire	Yes	No	Poland	Yes	No
Cyprus	Yes	No	Romania **	Yes	No
Djibouti **	No	Yes	Russian Fed **. .	Yes	No
Dominican Republic	Yes	No	Rwanda ***	Yes	Yes
Ecuador	Yes	No	Samoa	No	Yes
Egypt	Yes	No	Sao Tome and Principe* ' **	No	Yes
El Salvador **	Yes	No	Senegal	Yes	Yes
Equatorial Guinea **	No	Yes	Sierra Leone	Yes	Yes
Eritrea *	No	Yes	Singapore	Yes	No
Fiji	Yes	No	Solomon Islands *	No	Yes
Gabon	Yes	No	Somalia	No	Yes
Gambia	Yes	Yes	South Africa	Yes	No
Ghana	Yes	No	Sri Lanka	Yes	No
Guatemala***	Yes	No	Sudan ***	No	Yes
Guinea	No	Yes	Syrian Arab Republic	Yes	No
Guinea-Bissau	Yes	No	Tanzania	No	Yes
Guyana	Yes	No	Thailand	Yes	No
Haiti	Yes	No	Togo	Yes	Yes
Honduras	Yes	No	Trinidad and Tobago	Yes	No
Hungary	Yes	No	Tunisia	Yes	No
India	Yes	No	Turkey	Yes	No

Indonesia	Yes	No	Uganda	Yes	Yes
Iran, Islamic Rep. ***	Yes	No	Uruguay	Yes	No
Israel	Yes	No	Vanuatu *	No	Yes
Jamaica	Yes	No	Venezuela	Yes	No
Jordan	Yes	No	Yemen, Rep.	Yes	Yes
Kenya	Yes	No	Zambia	Yes	Yes
Kiribati	No	Yes	Zimbabwe	Yes	Yes
Korea, Rep,	Yes	No			

*Not in NBER Dataset **Not in Sala-i-Martin *** not in NCDC database