Is aid contributing to poverty reduction?

An analysis of the poverty-efficiency of Norwegian aid

by

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Master thesis

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Preface

The long and winding road has come to an end, and this master thesis is finally ready for submission. Looking back, I have learned a lot throughout this process. I have also had many good helpers. Firstly, thanks to my supervisor Rune Jansen Hagen for suggesting the topic, commenting on my drafts and most of all for asking the question that helped solve the mystery of the model in the end. Also thanks to Bjørn Sandvik, Sjur Didrik Flåm and Kjetil Gramstad in the Department of Economics at UiB for input on the maximization problem. Thanks to Craig Burnside for taking the time to talk to me during his visit at NHH in October 2012 and to Howard White for quick responses to my e-mails and for helpful advice.

To everyone at the Chr. Michelsen Institute: thank you for giving me the opportunity to be part of an inspiring research - and social - environment, and for providing me with a great work space. Thanks to the Aid research cluster for constructive feedback in the early stages of my writing, and a special thanks to my contact person, Elling Tjønneland, for reading my drafts and suggesting improvements. I also need to thank my good Stata helper, Vincent Somville, for guiding me through my many Stata frustrations. To Ingrid Hoem Sjursen: thank you for proofreading and commenting on my drafts and for continuously cheering me on. Also a special thanks to the CMI Quiz Cluster for giving me something to look forward to every day, JFK, 1500. I'm going to miss you guys!

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Arnhild Margrethe Linstad

Arnhild Margrethe Linstad, Bergen February 1st 2013

Abstract

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This master thesis aims at assessing the poverty-efficiency of the current Norwegian aid allocation. Is Norwegian aid allocated in a way that has the maximum impact on poverty reduction? I use panel regression and a model developed by Collier & Dollar (2002) to construct a poverty-efficient allocation of aid across countries. This is how aid would be allocated if the sole purpose of donors was to maximize poverty reduction. I thereafter compare the optimal allocation to the current allocation of aid, and in particular to the Norwegian allocation, and I find large discrepancies between them. This can partly be ascribed to a large number of recipient countries. In the poverty-efficient allocation only 32 countries are found to be eligible for aid receipts. Concentrating aid to fewer recipients would increase the poverty-efficiency of the current allocation. I also find that the current Norwegian allocation of aid is considerably less in line with the poverty-efficient allocation than that of the average donor, the rank correlations between them are 0.42 and 0.63, respectively. I believe that the recent integration of environmental and foreign policy with aid is partly responsible for the results. Brazil is today the largest recipient of Norwegian aid, and the share of the aid budget pertaining to least developed countries is declining. There appears to be a trade-off between allocating aid for poverty reduction and playing a leading role in the areas of forest preservation and conflict prevention, which are increasingly prioritized sectors in the Norwegian aid budget. Had considerations of future poverty reduction been taken into account in the model, Norwegian aid might have been evaluated as more poverty-efficient than is the case in this analysis. Estimations and calculations are made using StataSE 11 and the poverty-efficient allocation is constructed in Excel 2007.

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1 Introduction

In this master thesis I examine Norway's allocation of foreign aid the past decades and make an assessment of its current potential impact on poverty reduction. The World Bank report *Assessing Aid* from 1998 and the subsequent journal articles by Burnside & Dollar (2000) and Collier & Dollar (2001a, 2002) have been hugely influential in the policy arena regarding this topic. They single out two important criteria for poverty-efficient aid allocation, and argue that in order for countries to be eligible for aid receipts they should possess at least one and preferably both of the following characteristics: a large share of the population living in poverty, and sound economic policies.

Norway has a reputation for emphasizing recipient needs and for allocating a large share of its aid budget to low income countries, in addition to rewarding good governance. In the latest Development Assistance Committee (DAC) Peer Review[1] from 2008, Norway is considered a frontrunner when it comes to generosity, aid allocation decisions and aid effectiveness (Patrick and Taylor 2009). However, the past couple of years the country has also been criticized for its aid allocations. According to Easterly & Williamson (2011) Norway to a large degree ignores corruption and undemocratic practices and fails at targeting the poorest countries when allocating aid. Is there a basis for this criticism?

In 2001, Paul Collier and David Dollar from the World Bank made an assessment of Norwegian aid and its efficiency in reducing poverty, using a so-called poverty-efficient allocation of aid as their benchmark and comparing it to Norway's allocation. Norwegian aid was in fact found to be more efficient in reducing poverty than aid from the average ODA donor. However there was also identified a scope for improvement (Collier & Dollar, 2001b). In this thesis I make a similar econometric analysis as Collier & Dollar (2002), using more recent data to find out to what extent the current Norwegian aid is allocated in a poverty-efficient way. This includes running panel regressions to establish the marginal effect of aid on economic growth and constructing a poverty-efficient allocation of aid based on this. This allocation will then be compared to the current allocation of aid, and in particular to the Norwegian allocation.

[1]" Each DAC member country is peer reviewed roughly every four years with two main aims: to help the country understand where it could improve its development strategy and structures so that it can increase the effectiveness of its investment; and to identify and share good practice in development policy and strategy." http://www.oecd.org/dac/peerreviewsofdacmembers/

1.1 Background

The background for my choice of topic is that I find aid allocation decisions compelling, and would like to look into Norway's policy in this area. The recent criticism by several authors makes it even more interesting to take a closer look at these issues. Major changes in thematic and geographic priorities have occurred in the Norwegian aid portfolio the last decade. There has also been an increasing overlap between foreign policy and development policy. How efficient is Norwegian aid in contributing to its main aim; poverty reduction? Is this still the main aim when allocating aid, or have other considerations overtaken the development agenda in Norway?

1.2 Research questions

I will be looking at the following questions:

- i) To what extent is Norwegian aid allocated in line with the poverty-efficient allocation?
- ii) What has happened to the poverty-efficiency of Norwegian aid in the past decade, and what are the reasons for this development?
- iii) Has the increased integration of foreign policy and development aid weakened the poverty-efficiency of Norwegian aid?

My hypothesis is that Norwegian aid has in fact become less efficient in reducing poverty during the last decade, and I believe that this is directly related to question iii). I assume that foreign policy to a large degree has had influence on Norwegian aid allocation since 2001. One consequence of this is that a large portion of the country's aid budget is now allocated to rainforest preservation projects around the world, and in particular Brazil, a large middle income country. In addition to this, Norway takes on the role as a peace nation, accompanied by quite large aid disbursements being devoted to conflict resolution and prevention. These are noble causes, however may not be very effective at reducing poverty in the short run and within the framework of the model used.

1.3 Structure of thesis

The rest of the thesis is organized in the following way. In chapter 2 I define some of the key terms that will be recurrent in the rest of the thesis. Chapter 3 gives a brief overview of the history of Norway's foreign aid policy and how the focus on poverty reduction has changed throughout the past four decades. Here I also take a look at recent developments in Norwegian aid disbursements across sectors and country income groupings. The model used for constructing the poverty-efficient allocation of aid is presented in chapter 4, followed by a literature review in chapter 5, which in particular discusses empirical findings related to the underlying assumptions of the model. Chapter 6 gives a presentation of my data, and estimation method and regression results follow in chapter 7 and 8. The poverty-efficient allocation of aid is constructed in chapter 9, where I comment on the changes that have occurred in the Norwegian aid portfolio and its poverty-efficiency since Collier & Dollar's evaluation in 2001. Chapter 10 concludes and wraps up the findings.

2 Definitions of key terms

In this chapter I define and explain the key terms that will be recurrent throughout the thesis. These are *official development assistance (ODA)*, *poverty*, *poverty reduction* and *poverty-efficient allocation of aid*.

2.1 Official Development Assistance (ODA)

In the OECD-DAC Glossary of Key Terms and Concepts, *Official Development Assistance* (ODA) is defined as

> ”*Grants or loans to countries and territories on the DAC List of ODA Recipients (developing countries) and to multilateral agencies which are: (a) undertaken by the official sector; (b) with promotion of economic development and welfare as the main objective; (c) at concessional financial terms (if a loan, having a grant element of at least 25 per cent). In addition to financial flows, technical co-operation is included in aid. Grants, loans and credits for military purposes are excluded.*” (OECD, 2012a)

ODA thereby includes official bilateral and multilateral transfers that are grants or concessional loans provided for developmental purposes. Lending by export credit agencies, with the sole purpose of promoting their own exports, is excluded (International Monetary Fund, 2003). There is nothing wrong with export promotion lending per se, but it is not included in aid statistics because of its lack of a grant element and the fact that it is done with the purpose of benefiting the lending country, not the developing one. Tied aid[2] is included, and this kind of practice is still common among several donors.

One important implication of this definition is that financial assistance, although with grant elements, given to some Eastern European countries (so-called part II countries) is not defined as ODA. This assistance is defined as Official Aid, and was recorded until 2004. As a consequence of this some of the countries in Collier & Dollar’s analysis are not included in mine.

[2] The OECD defines tied aid as “official grants or loans where procurement of the goods or services involved is limited to the donor country or to a group of countries which does not include substantially all aid recipient countries” (OECD, 2012a). http://www.oecd.org/dac/aidstatistics/43544160.pdf

ODA flows can be measured at the time that they are firmly agreed (commitments) or at the time of the actual international transfer of money to the recipient country (disbursements). Disbursements can further be measured gross or net. Gross includes the full amount of transfers to the recipient in a given period, while the net amount is deducted of repayment of loans in the same period (OECD, 2008). The standard measure of donor effort is net disbursements, and this is also the data I use in my analysis. In the rest of the thesis I will be using the terms ODA and aid interchangeably.

2.2 Poverty

Poverty is a concept with many possible definitions. The definition that will be applied throughout this thesis is that of *absolute poverty*. This refers to people living without access to a defined minimum of resources necessary for covering basic needs like food and shelter. The measures of absolute poverty are related to the $1.25 or $2 a day poverty lines.

The $1.25 *poverty headcount ratio* is defined as “the percentage of the population living on less than $1.25 a day at 2005 international prices” (The World Bank Group, 2012). The $2 poverty line has a corresponding definition. The measures are adjusted for purchasing power parity, which means that they account for all people living on less than the equivalent of $1.25 or $2 a day in the United States.

The *poverty gap index* is a more comprehensive measure, which also takes into account the depth of poverty, not just its incidence. This is defined as “the mean shortfall from the poverty line (counting the non-poor as having zero shortfall) as a percentage of the poverty line” (The World Bank Group, 2012).

The *squared poverty gap* also takes into account inequality among the poor, and assigns more weight to individuals that fall far below the poverty line than those close to it. This means that inequality is punished in terms of a higher squared poverty gap. The measure is calculated by squaring all distances from the poverty line before calculating the mean shortfall.

These definitions of poverty are highly simplified, but nonetheless useful, as they make poverty and poverty reduction something that can be monitored and evaluated. These are the poverty measures reported in the World Development Indicators (with the exception of the squared poverty gap) and used in a lot of empirical work. It is however recognized that poverty is multidimensional. Most of the world’s poor are not just economically poor; they are also poor in health, poor in political participation, poor in education, poor in social inclusion, poor in security and so many other aspects of life (OECD, 2001). For the further work and estimations I will be doing the simple definitions of absolute poverty are sufficient.

2.3 Poverty reduction

With application of the absolute poverty definitions, *poverty reduction* can be simply defined as *reduction in a given poverty measure*, e.g. the poverty headcount ratio or poverty gap indexes.

In relation to the headcount ratio poverty reduction is quite easy to obtain by simply lifting the people closest to the poverty line from directly below it to directly above it. This will not have much impact in terms of giving people a better life, but will look good in poverty statistics. This reasoning tells us that the headcount measures could be quite easily manipulated, and poverty reduction should be evaluated against one of the other measures as well.

Barder (2009) also highlights the need to distinguish between different types of poverty reduction and understand the possible trade-offs between current and future poverty reduction, broad and deep poverty reduction and temporary and sustainable poverty reduction. Many do not see these different facets of poverty reduction, but simply see it as something that can be achieved through economic growth and increases in GDP per capita, which according to Barder (2009) is overly simplified. The simplified approach is the one applied in the model I will be using, and these considerations of tradeoffs can be useful to have in mind when looking at the resulting allocation, and what kind of poverty reduction is being prioritized.

2.4 Poverty-efficient aid allocation

The poverty-efficient aid allocation is the allocation of aid that would lift the most people possible out of poverty, given that the total amount of aid is unchanged but can be redistributed among recipient countries. In line with economic theory this occurs when the marginal impact of an additional million dollars in aid is equalized across recipient countries (Collier & Dollar, 2002). In effect this means that it does not matter to which country the last dollar is allocated, because it would have the same impact on poverty reduction everywhere.

The poverty-efficient allocation of aid is used by Collier & Dollar (2001a, 2001b, 2002) as a benchmark allocation, against which the actual allocations are assessed. Their poverty-efficient allocation is made on the basis of growth regressions supporting the assumptions that aid is most effective at reducing poverty when allocated to:

i) Countries with high levels of poverty (different measures of poverty yield similar results)

ii) Among these; countries with good economic policies

These assumptions are laid out in the report *Assessing Aid*, published by the World Bank in 1998, and have been hugely contested throughout the past decade, as I will return to in the chapter on empirical literature. My poverty-efficient allocation turns out to be independent of policy.

3 Norwegian aid at a glance

Norway has a long and proud history as a donor of foreign aid, and is by many regarded a role model for other donors. The country is known to be generous, as one out of a few donors for which aid now consists more than one percent of its gross national income (GNI). Norway is also perceived to be selfless and concerned with recipient needs and aid effectiveness in the allocation of aid money (Patrick and Taylor 2009). Does this give a correct description of Norway as an aid donor? In this chapter I will give a brief overview of what have been the main priorities for Norway's foreign aid throughout the last five decades. Norway has traditionally given a large share of its aid to low income countries, and more so than the average bilateral DAC donor (OECD, 2012). Significant changes have taken place in Norwegian aid policy, especially the last few years during Erik Solheim's time as Minister of Development and the Environment. First and foremost the rainforest preservation initiative has been a new priority, accounting for a considerable share of the aid budget. This affects the allocation of aid in general and also the share pertaining to low income countries. This change of priority is therefore likely also to affect the poverty-efficiency of Norwegian aid based on the criteria in the model I will be using.

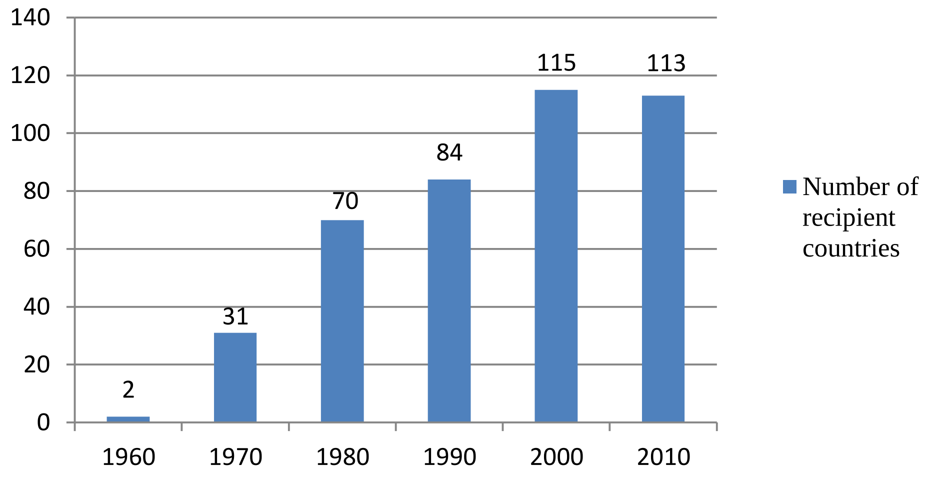
3.1 Historical recap of Norway's aid policy

Since the outset of Norwegian foreign aid with the fishery project in Kerala, India, in the 1950s, poverty reduction has been stated as one of its main priorities. This is evident in the choice of recipient countries and also in the strategy documents and White Papers published by the Norwegian government. In the 1960s and 1970s Norway had a few main partner countries that received large shares of the aid budget. These were all located in South Asia or in Sub-Saharan Africa and were among the poorest countries in the world at the time. In 1977 Norway's main partner countries were India, Bangladesh, Pakistan, Sri Lanka, Kenya, Tanzania, Zambia, Mozambique and Botswana (Ruud & Kjerland, 2003, p. 229). Being a main partner country entailed certain privileges. Norwegian representatives were present in the country with knowledge and competency, and there was also a long term commitment for aid disbursements. In the beginning Norwegian aid was highly committed to health, education and economic development projects, concerned with economic growth and poverty reduction.

3.1.1 The concentration principle

The so-called concentration principle was recurrent in White Papers and political debates throughout the 1970s and ‘80s. This was one of the most important principles for the aid policy of the Norwegian government. It entailed not spreading the aid money too much, but rather concentrate the disbursements to a few, preferably poor, main partner countries. In 1974 the seven main partner countries received about two thirds of all Norwegian bilateral aid, and 55 other countries were also receiving support. In 1989 the share pertaining to the main partner countries, now also including Mozambique and Sri Lanka, was reduced to about fifty percent of the aid budget. Another 77 countries were on the list of recipients, now covering large parts of the developing world, although disbursements in many cases were quite small (Ruud & Kjerland, 2003, p. 230). Figure 3.1 shows that the number of recipient countries increased rapidly in the 1970s and again in the 1990s, but has remained quite stable or even declined a little since 2000. The main reason for the large number of recipient countries is the presence of Norwegian NGOs in developing countries. The number of countries receiving state to state funding is considerably smaller.

Figure 3.1: Number of countries receiving Norwegian aid 1960-2010



Source: OECD.Stat 2012

3.1.2 Trade, not Aid

In the 1970s the "Trade, not Aid" initiative was launched as part of the movement towards a New International Economic Order (NIEO)[3] and also became embedded in the Norwegian development policy. Trade and market access were seen as possibly much more important than aid money for the developing countries themselves. Norway was an outspoken proponent of trade liberalization and granting of market access to developing countries. In practice the country had import restrictions on quite a few important export commodities from developing countries, creating an inconsistency between rhetoric and reality (Ruud & Kjerland, 2003). The new focus on trade was a contributing factor in challenging the Norwegian concentration principle. Norway's main partner countries were of little or no commercial interest to the business and industry sector, and this resulted in a large expansion of countries in the development cooperation portfolio (Ruud & Kjerland, 2003, p. 45). This also meant that some of the new beneficiaries were lower middle income countries.

3.1.3 Politics and development

In 1983 Norway got its first Minister of Development, and with this came a stronger political direction of development issues. Whereas Norad previously had the main responsibility for projects and funds, it now became subordinated to the new ministry. A White Paper was published in the mid 1980s stating once again that the foundation of Norwegian aid was poverty reduction and covering the basic needs of the poor. The long term objective was to help the poor to help themselves by providing infrastructure, small scale industry and loans and through this create opportunities for increased productivity and trade in the long run (Ruud & Kjerland, 2003, pp. 154-155). The focus of the Norwegian policy in this period partly switched from *poor countries* to *poor people*, and this approach somewhat collided with the principles behind the NIEO, which worked on a macro level trying to improve the economic situation of Third World countries. The Norwegian government was also criticized for providing "short term social care" and to some extent ignoring the long term goal of increased economic growth as basis for development (Ruud & Kjerland, 2003, p. 156).

[3] The New International Economic Order (NIEO) was a movement that started in the 1970s, working for leveling the playing field for developing countries, granting them market access and fair prices for their commodities.

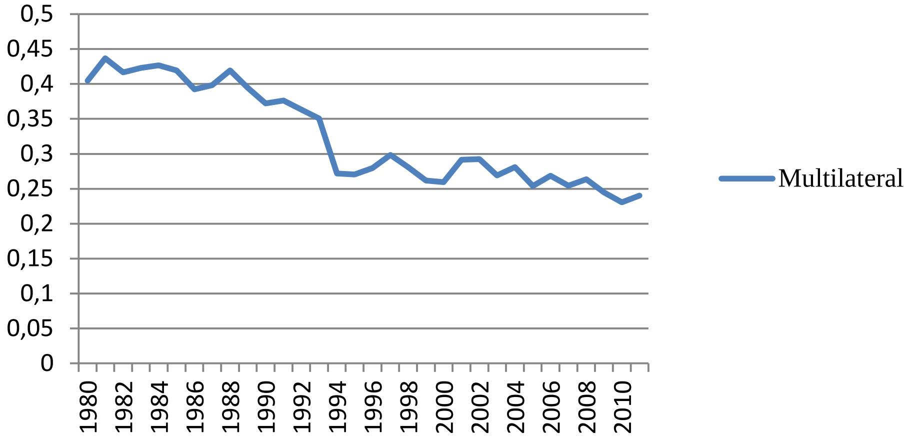
3.1.4 Debt crisis and Structural Adjustment Programs

The 1980s was also the decade of debt crisis and economic stagnation in many developing countries. During the 1970s the countries had been borrowing heavily from commercial Western banks, the World Bank and the IMF, and were encouraged to do so in order to create a foundation for future economic growth. The main investments were made in the agricultural sector, where African and South American countries were thought to have a comparative advantage over developed countries.

In 1982 Mexico was the first country to default repayment, soon followed by other Latin American countries. In the next stage also African countries, whose debt often amounted to three times their GDP, defaulted. Most of these countries were subjected to structural adjustment programs (SAPs) by the IMF and the World Bank, which proved costly for their economies. Several countries experienced negative economic growth for many consecutive years; some during the full decade and a long way into the 1990s, and at the end of the period were even poorer than at the outset. The programs largely entailed "getting prices right" which meant devaluation of local currencies to help exports, however making imports from abroad all the more costly. Trade liberalization and large cuts in the public sector were also required, and this led to reduced social welfare programs and salaries in the countries involved (Ruud & Kjerland, 2003, p. 163).

In the beginning Norway was quite uncritical to the approach of the IMF and the World Bank, which in many cases acted as the government of countries, pretty much commanding how to manage national finances. The role of the multilateral institutions was not discussed much in the Norwegian national assembly; however some critics did voice their opinions. There were also confrontations within the Norwegian aid community and the Ministry of Foreign Affairs about how to handle the situation. It was seen as important to continue support to the multilateral organizations, but it was also realized that this in effect put the World Bank in charge of Norway's foreign aid policy. At the same time Norway continued funding the sectors that were negatively affected by the SAPs in recipient countries. As can be seen from Figure 3.2 below, the multilateral share of Norwegian aid budget declined quite sharply in the late 1980s and early 1990s, and fell from almost 45 percent in 1982 to about 27 percent in 1994. It is not unlikely that this was partly due to skepticism towards the IMF and the World Bank.

Figure 3.2: The share of multilateral disbursements in the Norwegian aid budget



Source: Norad

3.1.5 The right to development

In the 1990s, after the end of the cold war, the focus of development shifted towards governance, institution building, democracy and human rights. This was also the case for the Norwegian aid policy and has been an important focus ever since. The right to development is deeply founded in the notion of every human being's inherent value and dignity. The Universal Declaration on Human Rights (1948) states that everyone has the right to a reasonable standard of living, including food, clothing, housing, medical treatment and essential social services. In this sense, the fact that more than one billion people in the world today are living in extreme poverty is a severe violation of human rights. Mary Robinson, former UN High Commissioner for Human Rights once said:

"I am often asked what is the most serious form of human rights violation in the world today, and my reply is consistent: extreme poverty."

Mary Robinson,
UN High Commissioner for Human Rights (1997-2002)

As we reached year 2000 the Millennium Development Goals (MDGs) were enacted, and there was a renewed focus on basic development issues like eradication of extreme poverty and hunger, universal primary education, and child and maternal health. The 2003 White Paper "*Fighting Poverty Together*" bore witness of the Norwegian government's continued commitment to the World's poor with a renewed focus on poverty reduction and aid effectiveness, as well as stating the moral obligation of rich countries to help those less fortunate. This White Paper also specifically addressed the need to make aid more efficient, and the responsibility and ownership of recipient countries for their own development (Norwegian Ministry of Foreign Affairs, 2003-2004).

3.2 Recent developments in Norwegian aid disbursements

The past ten years Norwegian aid disbursements have been more than trebled in terms of US dollars, from about $1310 million in 2000 to $4757 million in 2010 (OECD, 2013). This places Norway tenth in size among the DAC donors, and renders it a medium size donor in absolute terms. Norway is however a generous donor. It was one of the first DAC countries to reach the UN goal of contributing 0.7 percent of its GNI to aid in 1976 and has stayed above this target for more than 30 consecutive years (Patrick & Taylor, 2009). As from 2009 it is also one of a small handful donors that have reached the one percent target.[4]

3.2.1 Major recipient countries

The composition of the largest recipients of Norwegian aid has changed radically the past twenty years. In the 2000s the distinction between partner countries and other recipients has also gradually faded away. Table 3.1 below displays the top 15 recipients of Norwegian aid for the three periods 1990-91, 2000-2001 and 2010-11. From these lists it is evident that

i) Low income countries do not seem to have the same priority in the allocation today as twenty years ago.
ii) The top recipients are allocated a declining share of the total aid budget, which implies less concentration of disbursements.
iii) New priorities of preventing climate change as well as conflict resolution seem to a large degree to influence which countries receive the most aid money.

[4] In 2011 it was only accompanied by Sweden, which contributed 1.1 percent of its GNI in aid. Luxembourg was above the 1 percent target in 2009 and 2010, but fell down to 0.99 percent in 2011.

Table 3.1: Top recipients of Norwegian aid (percent of total)

1990-91		2000-01		2010-11	
Tanzania	7.90	Serbia	4.09	Brazil	5.22
Mozambique	5.07	Mozambique	2.70	Afghanistan	2.72
Zambia	4.47	Tanzania	2.68	Tanzania	2.50
Bangladesh	3.60	West Bank & Gaza Strip	2.50	West Bank & Gaza Strip	2.33
Nicaragua	2.59	Afghanistan	2.00	Sudan	1.72
Ethiopia	2.15	Bosnia-Herzegovina	1.82	Mozambique	1.66
Botswana	2.04	Zambia	1.74	Uganda	1.60
India	1.96	Uganda	1.55	Zambia	1.40
Zimbabwe	1.92	Ethiopia	1.52	Malawi	1.38
Sri Lanka	1.50	Bangladesh	1.49	Pakistan	1.22
Kenya	1.16	Angola	1.30	Somalia	1.22
Pakistan	1.12	Somalia	1.24	Nepal	1.02
Namibia	0.98	South Africa	1.21	Haiti	0.96
Mali	0.84	Sri Lanka	1.14	Guyana	0.72
Sudan	0.82	Nicaragua	1.06	Vietnam	0.67
Total	**38.12**		**28.04**		**26.34**

Source: OECD.Stat

Whereas the top recipients in 1990-91 were solely least developed countries (LDCs) and other low income countries (OLICs), the 2000-01 and 2010-11 allocations are characterized by large disbursements to lower or upper middle income countries (LMICs/UMICs).[5] Serbia, West Bank & Gaza Strip, Bosnia-Herzegovina, Brazil and Guyana are all on the list because of new priorities in aid allocation in the two latter periods.

A second feature that stands out is that the share of the aid budget allocated to the top recipients is steadily declining. In 1990-91, 38 percent of the budget was devoted to the fifteen largest recipients, with the top six accounting for almost 26 percent. In 2010-11 the share of the top 15 recipients was 26 percent. It also seems like this process has been going on for a while when looking at the numbers for 2000-2001. These are more similar to today’s figures than to the ones from twenty years back.

Noteworthy for the 2010-11 allocation is the presence of Brazil on top of the list, receiving 5.22 percent of the Norwegian aid budget. The aid disbursements to this country and to Guyana, also among the top 15 recipients, are almost exclusively devoted to forest preservation. Many of the top recipients are also post-conflict countries. Peace building and

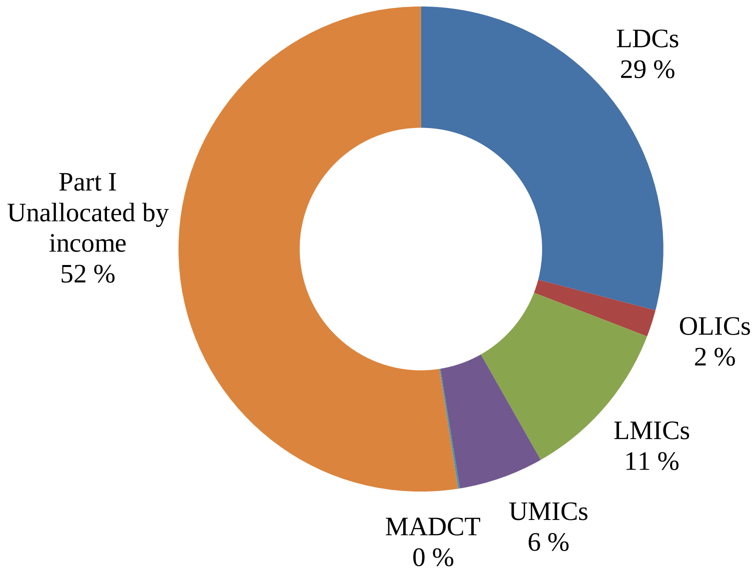
[5] A complete list of DAC recipients of official development assistance (ODA), grouped by income, can be found in Appendix A.

climate change are among the core areas of the Norwegian government's aid policy and have been stated as areas that will gain priority as the aid budget is increasing (Norwegian Ministry of Foreign Affairs, 2008-2009). Quite a few of the top countries in today's allocation are still low income countries, although the allocation seems to be less targeted to this group.

3.2.2 Allocation across income groupings

Figure 3.3 shows the allocation of Norwegian aid across income groupings. The allocation of Norwegian aid has the past twenty years become less targeted to low income countries, and an increasing share is now "unallocated by income". This is mainly due to parts of bilateral funds being disbursed through multilateral organizations like different UN agencies or civil society organizations. An increasing share of the Norwegian aid budget is also devoted to so-called global allocations, which are disbursed to thematic areas rather than to specific countries. These disbursements are administered by the Ministry of Foreign Affairs and in this sense subject to stronger political direction. Within these allocations we find the funds for rainforest preservation, conflict resolution, global health initiatives and money spent on refugees in Norway.

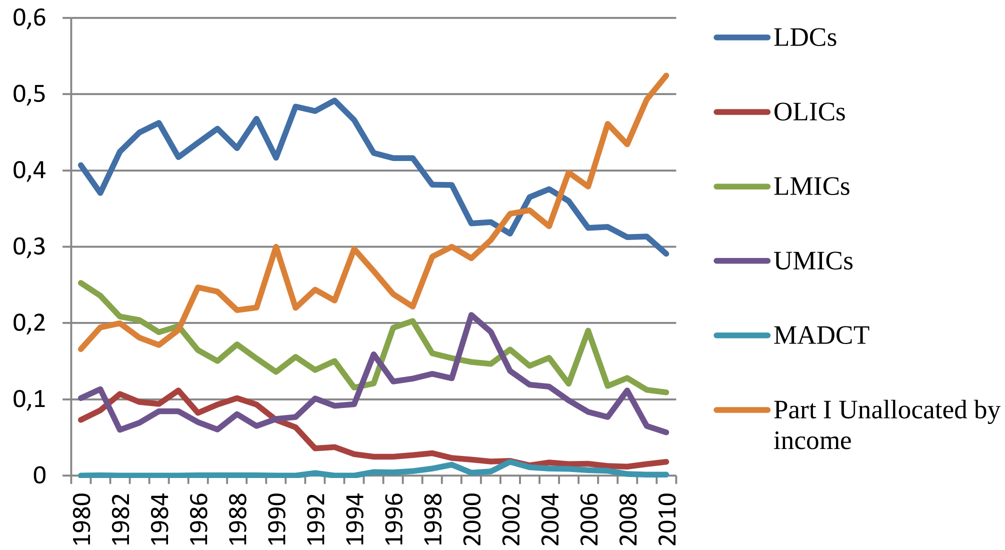
Figure 3.3: Norwegian aid allocation across income groupings in 2010



Source: OECD.Stat

From Figure 3.4 below we can see that the share of the aid budget pertaining to least developed countries (LDCs) was close to 50 percent in the early 1990s, and has since then had a steady decline towards today's level of 29,1 percent. This coincides with an increasing share that is unallocated by income. Disbursements to more advanced developing countries and territories (MADCT) are almost non-existent in the current Norwegian budget, and the share of other low income countries is also very small. The DAC average has traditionally been a lower share to low income countries, at between 20 and 30 percent of the budget, and more to the lower middle income countries.

Figure 3.4: Development of disbursements across income groupings

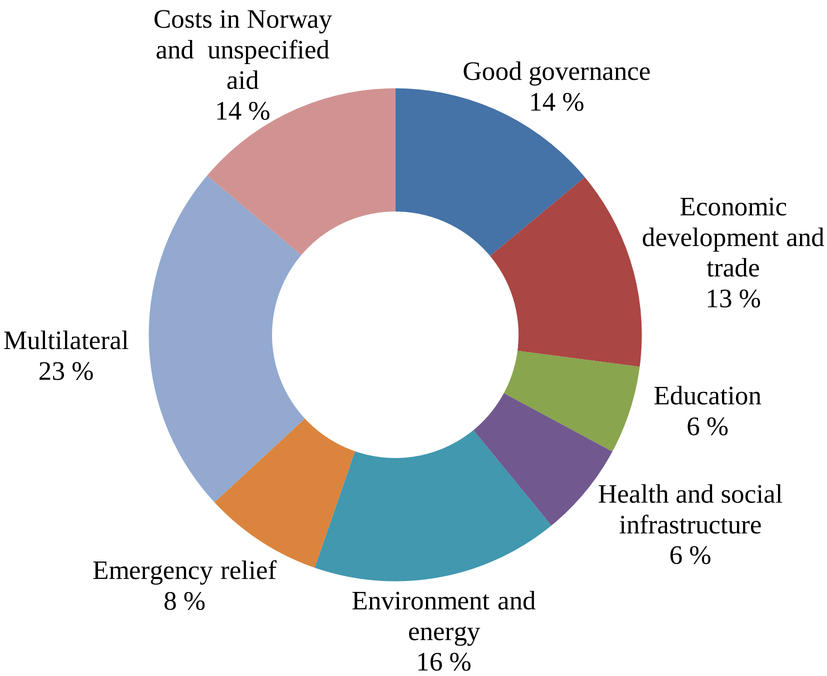


Source: OECD.Stat

3.2.3 Allocation across sectors

One of the most pronounced changes in the Norwegian aid budget the last decade is its composition across sectors. There has been a large increase in disbursements to environment and energy, and in 2010 this sector accounted for about 16 percent of the total budget, as opposed to 7 percent in 2000 (Norad, 2011). Since 2006 the disbursements made to environment and energy – mainly forest preservation – have been quadrupled in dollar terms and more than doubled as a share of total aid. In 2010 this sector received more than the traditionally very important sector economic development and trade, and more than the share devoted to good governance which was on an upsurge in the 1990s and is still of importance. Figure 3.5 gives a graphical representation of Norwegian aid allocation by sector in 2010.

Figure 3.5: Norwegian aid allocations by sector in 2010



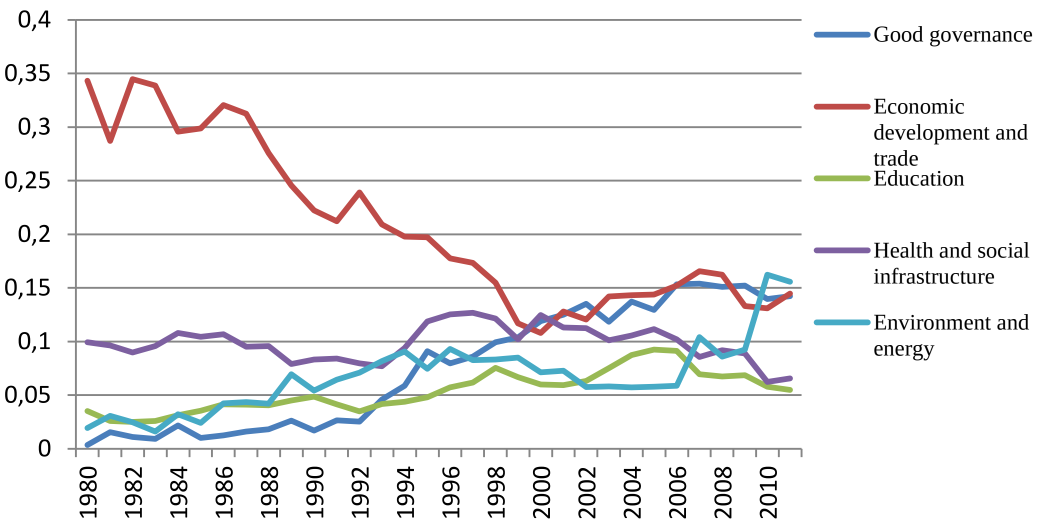
Source: Norad

It also appears that economic development and trade has gained importance again the past decade, after having a declining share of the aid budget ever since 1980. Disbursements to both of these sectors are still increasing in absolute terms, but they have gained little importance relative to other sectors the latest years. It can be noted that all budget support from Norway to the governments of developing countries are found in the economic development and trade sector.

Health and education are sectors where disbursements seem to have stagnated the past decade, and whose shares of the total aid budget have declined, as can be seen in Figure 3.6. This is quite remarkable, as they used to be the very core of Norwegian development assistance. These are also possibly very important sectors for future poverty reduction, in laying the ground for democracy, human rights and economic growth. The health related MDGs, and especially infant and maternal health, are still listed among the main priorities in the Norwegian government's latest White Papers on development. Considerable funds are also earmarked for primary education in order to support the MDGs, especially in conflict areas.

One possible reason that these sectors seem to have lost importance could be the new strategy of focusing bilateral aid on areas where Norway has special competency, and channeling funds to traditional sectors like health and education through multilateral donors (Norwegian Ministry of Foreign Affairs, 2008-2009).

Figure 3.6: Development of sectorial disbursements as share of total aid 1980-2010



Source: Norad

Average figures have the disadvantage of camouflaging individual differences across countries. Many of the poorest recipient countries still have the bulk part of their aid disbursed to the apparently declining sectors of economic development and trade, education and health. These include Afghanistan, Bangladesh, Burundi, West Bank & Gaza, Malawi, Mozambique, Tanzania, Uganda, Zambia, Timor-Leste, Zimbabwe, Eritrea, India, Nigeria, Vietnam and Madagascar (Norad, 2010). This contributes to turn the picture around a bit, compared to the overall impression that these sectors get less funding. Even though their shares of the total budget decline, disbursements in absolute terms are increasing.

Good governance is the main sector receiving aid in countries like Kenya, Angola, Bosnia Herzegovina, DR Congo, Kosovo, Nicaragua, Serbia, Somalia, Sri Lanka and Sudan, most of which are post-conflict societies. From 1999 onwards this sector is devoted to conflict resolution and prevention as well as support to government and civil society (Norad, 2011; Norad, 2010).

Countries receiving almost all of their aid as support to the environment and energy sector are Brazil, Guyana and Indonesia, where forest preservation is most pronounced. This means that there are really just a few countries to which these kinds of funds are provided. Still it is an enormous amount of money, which accounts for about ten percent of the total aid budget. More than fifty percent of disbursements to China and Liberia were also devoted to this sector in 2010 (Norad, 2010).

3.2.4 New priorities

The Stoltenberg II government that came into power in 2005 has attempted to integrate environmental and developmental policy. This approach became even more pronounced when Erik Solheim in 2007 became Minister of the Environment in addition to his post as Minister of Development. In its latest White Paper on development from 2011 the government advocates for the importance of climate and sustainable development for poverty reduction. Its claims are based on the assumption that much of the growth in developing countries today is grounded in depletion of natural resources, and will therefore not be sustainable in the long run. "This is the greatest paradox of international environmental and development policy: if the fight against poverty is based on economic growth that exacerbates climate change, it will in itself create more poverty" (Norwegian Ministry of Foreign Affairs, 2011, p. 10). In this sense perhaps forest preservation could be one way of preventing future increases in poverty, and thereby be of importance. This is one of the tradeoffs mentioned in the definition of poverty reduction, as I will get back to in the final remarks. In the model I outline this will not be considered, and Brazil as a middle income country will most likely be found not to be eligible for aid receipts.

The most recent White Papers also emphasize the role of conflict as an impediment to poverty reduction and the desire for Norway to be an important player in this field. This priority is reflected in the list of top recipients of Norwegian aid the past decade, where quite a few of the countries are post-conflict societies.

3.2.5 Challenges for the future

In the latest DAC Peer Review of Norway from 2008, concern is posed about the increasing scattering of recipient countries and focus areas of Norwegian aid. It is argued that Norway's aid is at risk of becoming fragmented and the effect of it diluted. The main reason for this claim is that Norway on top of its six core areas of development cooperation[6] also tries to maintain support for 11 other traditionally important areas. DAC underlines the possible conflict of interest between an ever expanding aid portfolio and maintaining or improving aid effectiveness, where Norway is "rightly seen as a leading player" (Patrick & Taylor, 2009, p. 52). The Peer Review committee recommends trying to limit the areas of attention to those where Norway has special competency and also concentrate efforts geographically. This would contribute to lowering administrative costs, and improving the overall efficiency of aid.

[6] These six core areas are i) climate change, the environment and sustainable development; ii) peace building, human rights and humanitarian assistance; iii) women and gender equality; iv) oil and clean energy; v) good governance and the fight against corruption; and vi) supporting the health related MDGs (Patrick & Taylor, 2009, p. 52).

4 Modeling

In this chapter I outline a model for poverty-efficient aid allocation, first developed by Collier & Dollar (2001a, 2002). This model explicitly states how much aid should be allocated to each recipient country to lift the most people possible out of poverty, under certain assumptions. The model assumes that poverty reduction occurs as a result of economic growth, and it is constructed in two stages. First the marginal effect of aid on economic growth is estimated using a panel regression model. The resulting expression is then inserted into an algorithm for poverty-efficient aid allocation. This algorithm is derived from the first order conditions of a maximization problem, where the purpose of giving aid is to maximize overall poverty reduction.

The estimated poverty-efficient allocation in Collier & Dollar (2002) is radically different from the actual aid allocations that year, and according to the authors the same aid volume could have the potential to double poverty reduction just by reallocations among recipient countries. As we shall also see however, the model rests on a few crucial assumptions that have been subject to debate in the aid research community. I will get back to these in chapter 5 on empirical literature.

4.1 A model for poverty-efficient aid allocation

Collier & Dollar (2002) formalize the idea of a poverty-efficient aid allocation by considering a world in which aid is given with the sole purpose of maximizing poverty reduction. Although there are many other reasons for giving aid, some of them purely in the interest of the donor country, this is a normative framework based on the moral rationale for aid. The World Bank, African and American Development Banks and many bilateral donors do state poverty reduction as the main goal of their development assistance (Barder, 2009, pp. 3-4). In the model poverty reduction is assumed to occur as a result of economic growth. This assumption will be discussed further in the literature chapter.

Since the only way that aid can affect poverty reduction in this model is through economic growth, the objective of maximizing poverty reduction can be seen as an attempt to maximize a weighted average of growth rates across countries, the weights being population size times a poverty measure. The policies and income distributions of recipient countries are seen as exogenous to aid donors; in other words one cannot expect to be able to affect these by allocation of aid.[7] Poverty is reduced through growth in average income. The objective function of donors can then be written as:

Max poverty reduction $$\sum_i G^i \alpha^i h^i N^i \qquad (4.1)$$

Subject to $$\sum_i A^i y^i N^i = \overline{A}, \qquad A^i \geq 0 \qquad (4.2)$$

In these equations *G* symbolizes growth, which is assumed by the authors to be a function of a country's policies and the amount of aid it receives,[8] α is the elasticity of poverty reduction with respect to income growth (for simplicity set to be the same for every country), *h* is a poverty measure (this could be a headcount index or a different measure), *N* is population, *A* denotes aid allocated to each country as a share of its GDP, *y* is per capita income (GDP) and $\overline{A}$ is the total amount of aid. The superscript *i* is used to index each individual country. The budget constraint says that the sum of the dollar amount of aid to every country should be equal to the total aid budget. As written in (4.2) this implies that A^i represents aid receipts as a share of the recipient country's GDP. However, this interpretation is not intuitive with the aid variable used by Collier & Dollar (2002).[9]

When solving this maximizing problem the first order condition is given by[10]

$$G_a^i \alpha^i h^i = \lambda y^i \qquad (4.3)$$

Here G_a^i represents the marginal effect of aid on growth in per capita GNI and λ is the so-called shadow value of aid, which is determined endogenously in the model. The other parameters and variables are the same as in equation (4.1). λ can also be interpreted as the marginal efficiency of aid, and using the headcount index as poverty measure this parameter would give us the number of people lifted from poverty by an additional (million) dollar(s) in

[7] In reality a lot of aid is given in an attempt to change a country's policies or at least to reward good governance or democratic reform. Many aid programs can also be directly targeted to the poorest people of a society. Redistribution is one of the focus areas of Norwegian aid in the latest budget from the Ministry of Foreign Affairs. Nevertheless, changing the income distribution of a country is hard.
[8] In my regressions this is not the case, as I do not get a significant interaction term between aid and policy. Thus the amount of aid a country receives and the degree to which the effect of it is diminishing are the only determinants of the growth effect of aid in my model.
[9] The aid variable used by Collier & Dollar (2002) is net ODA divided by GDP per capita, in which case this budget constraint will not give the dollar amount of aid.
[10] For a detailed exposition of the problem and the first order conditions, see Appendix B.

aid (Collier & Dollar, 2001a). Dividing (4.3) by y^i gives the following expression for the shadow value:

$$\lambda = \frac{G_a^i \alpha^i h^i}{y^i},$$

It increases with the marginal effect of aid on growth, $G_a{}^i$, the elasticity of poverty reduction with respect to income growth and the poverty rate and decreases with per capita income, which makes intuitive sense.

Equation (4.3) is the basis for the algorithm that is constructed for poverty-efficient aid allocation, as we shall soon see.

4.1.1 The marginal effect of aid on economic growth

To be able to construct the poverty-efficient allocation of aid, I need to estimate a growth equation to get an expression for the marginal effect of aid on economic growth, G_a^i in (4.3). These kinds of growth regressions have been done by many, and have included various independent variables. I will try as far as possible to specify the equation in a similar way as Collier & Dollar (2002). They mainly want to test two hypotheses that are the main results from Burnside and Dollar's (2000) analysis:

i) The effect of aid on economic growth is contingent upon policy
ii) The effect of aid on economic growth is subject to diminishing marginal returns

These results have been subject to close scrutiny by critics. Many studies agree on hypothesis ii) and conclude that aid does show signs of diminishing returns with respect to its effect on economic growth (Dalgaard, et al., 2004; Hansen & Tarp, 2001; Hudson & Mosley, 2001; Lensink & White, 2001; Lu & Ram, 2001). This assumption is crucial to be able to construct the allocation rule for poverty-efficient aid, as we need the aid variable to appear in the derivative of the growth equation with respect to aid, G_a^i. It is also intuitively reasonable that the growth effect of aid will decline when the aid volume increases, as we would expect countries to have a limited absorption capacity for aid. One study that does not find evidence of this diminishing effect is Rajan and Subramanian (2008).

As for the conclusion that the effect of aid on growth is contingent upon policy, that result has been highly contested. Very few other studies find this particular relationship in their data.[11] I will get back to empirical literature and discuss this assumption in the next chapter, but first I present the growth equation and outline the rest of the model.

Collier and Dollar include several explanatory variables in their regression, but the following specification is most interesting for testing their two hypotheses:

$$G = c + \beta_1 X + \beta_2 P + \beta_3 A + \beta_4 A^2 + \beta_5 AP \qquad (4.4)$$

In this equation the main determinants of growth are aid (*A*) and policy (*P*), as well as some other exogenous factors (*X*). The coefficient of the quadratic term, β_4, will capture the possibility of diminishing returns to aid. That is, its growth-enhancing effect is decreasing with the volume of aid. I have just argued that this is also empirically found to be a common conclusion. The coefficient of the interaction term, β_5, takes into account the hypothesis that the effect of aid on growth is contingent upon policy, or is more efficient at promoting economic growth in a good policy environment. In this equation the marginal effect of aid on growth the partial derivative of (4.4) with respect to *A* equals

$$G_a = \beta_3 + 2\beta_4 A + \beta_5 P \qquad (4.5)$$

4.1.2 The allocation rule

When inserting for G_a in the first order condition from the maximization problem, (4.3), we get the following expression:

$$(\beta_3 + 2\beta_4 A + \beta_5 P)\alpha^i h^i = \lambda y^i$$

Solving for A we can now derive a rule for the efficient amount of aid allocated to each individual country, as a share of the country's GDP:

[11] The exceptions being Burnside & Dollar (2000); World Bank (1998); Collier & Dollar (2001a, 2002); Collier & Dehn (2001).

$$A^i = \frac{\lambda y^i}{2\beta_4 \alpha^i h^i} - \frac{\beta_3}{2\beta_4} - \frac{\beta_5 P}{2\beta_4} \tag{4.6}$$

The main property of this equation is the relationship between aid, policy and poverty. If one of these variables is held constant, the relationship between the other two can be illustrated in two dimensions, as Collier & Dollar (2002) do in their article. The poorer a country, the lower is the quality of policy required to justify a certain level of aid. When the regressions have been made we can easily insert values for the coefficients β_3, β_4, β_5 and the variables and get an explicit figure for aid allocated to each country in the sample.

As will become clear in chapter 8, the results of my regressions do not give a significant interaction term between aid and policy, and the last part of equation (4.6) will therefore be eliminated. This means that my allocation rule is somewhat simpler, and the optimal level of aid is determined by the income level and poverty rate of a country.

5 Empirical literature

There exists a vast literature on foreign aid, the effect of aid on the economies of the recipient countries, donor behaviour and aid allocation decisions. In this chapter I will focus on the literature that is the most relevant for my thesis, mainly looking at the assumptions made by Collier & Dollar (2002) and what others have found in similar kinds of studies and analysis.

5.1 Underlying assumptions

Two important assumptions made by Collier and Dollar in order to argue for the poverty-efficiency of their aid allocation are subject to debate among researchers in the aid community:

i) Aid has an effect on economic growth, and this effect is contingent on policy
ii) Economic growth leads to, and is the driving force of, poverty reduction

The first of these claims does not have a firm foundation in the empirical literature. It is perfectly possible to produce empirical findings to confirm and dismiss it, and this has been done repeatedly throughout the past decades. The second hypothesis is less disputed, but the extent to which growth is a sufficient condition for poverty reduction is still discussed.

5.2 The effect of aid on economic growth

The literature most central to my thesis are the journal articles by Burnside & Dollar (2000) and Collier & Dollar (2001a, 2002), which have been hugely influential and center of debate in the aid research community ever since they were published in the early 2000s. All three of them find a postive effect of aid on growth in the presence of good fiscal, monetary and trade policies. Aid is seen to have little or no effect on growth where economic policies are poor. The findings of Burnside & Dollar (2000) together with the World Bank Report "*Assessing Aid*" from 1998 had large policy implications, and also had consequences for the actual aid allocation practices of donors. Their results would justify selectivity of aid disbursements, granting money to good policy countries and withholding funds where the policy environment was not as conducive to growth.

Collier & Dollar (2001a, 2002) took the findings of Burnside & Dollar (2000) one step further and constructed their poverty-efficient allocation of aid, using the model outlined in the previous chapter, based on the assumption that aid works better in a conducive policy environment. If this is not the case, their allocation rule might be wrongly discriminating countries that should have been awarded more aid on the basis of their poverty rates and per capita income.

Lensink & White (2000) make an analysis similar to the one by Collier & Dollar (2002). They find a positive and diminishing effect of aid on growth, but the interaction term between aid and policy is not statistically significant in their growth regressions. Their poverty-efficient allocation is therefore made without the policy term in the allocation rule. This results in an allocation of aid that is even more targeted to poor countries, as poverty rates and GDP per capita gain importance in the allocation rule. The diminishing effect is also found to be considerably lower than Collier & Dollar's estimate, with the result that fewer countries are found eligible for aid receipts and each country receives a larger amount of aid.

Others criticizing the conclusion that the effect of aid on growth is contingent upon policy are Easterly et al. (2004). They find weaknesses in Burnside and Dollar's (2000) growth estimates and claim that they are not robust even to small changes in time periods or countries included in the regressions. They expand the dataset with more years and fill in missing observations in the original data either by econometric prediction or by actual data from different sources. Their main criticism is addressed to the relationship between aid and growth, and in particular the interaction term of aid with the policy variable. This is in fact found not to be significantly different from zero when expanding the dataset, and it turns out to be highly sensitive to the inclusion or exclusion of a few outliers also in the original regressions made by Burnside & Dollar (Easterly, et al., 2004).

All of the studies mentioned until now conclude that aid does have a positive effect on growth, but this relationship is far from settled in the literature. Some actually find that aid has little or no impact on economic growth at all (Mosley, 1980; Boone, 1996; Rajan & Subramanian, 2008). The latter run a wide range of regressions with different specifications, time horizons and aid measures. They also account for the possible endogeneity of the aid variable by using different lagged variables as instruments in GMM estimation. None of their regressions produce significant evidence for an effect of aid on economic growth.

Others again find that aid has a positive impact on growth irrespective of the policy environment (Hansen & Tarp, 2001; Hudson & Mosley, 2001; Lensink & White, 2001; Lu & Ram, 2001). Similar studies also find the effect of aid on growth to be independent of policy, but claim that climatic conditions are important to explain the growth performance (Dalgaard, et al., 2004; Guillaumont & Chauvet, 2001). In these studies aid is seen to have less effect on growth in tropical areas. Others advocate for the importance of institutions (Burnside & Dollar, 2004), or political stability (Islam, 2005; Chauvet & Guillaumont, 2004) rather than policy as determinants of aid effectiveness. Most of these studies also conclude that the effect of aid on economic growth is subject to diminishing returns.

McGillivray et al. (2006, p. 1045) wrap up the findings of many studies in the field. They argue that despite the controversies about the impact of aid on the economies of developing countries, one thing can be said to have been agreed upon: aid does appear to have a positive effect on economic growth. From this they also conclude that poverty would be more widespread in today's world in the absence of aid. As mentioned, Rajan and Subramanian (2008) once again draw this conclusion into question.

5.3 The link between growth and poverty reduction

The assumption that economic growth leads to poverty reduction and is the most important driver behind it is also disputed in the research community. Most researchers will agree that economic growth is a *necessary* condition for poverty reduction. Most will however also agree that growth in itself is *not sufficient* for poverty reduction. When is growth pro-poor? What is pro-poor growth? Could economic growth have adverse effects on poverty rates and actually deteriorate the conditions of the poor or increase poverty? These questions are closely related to the relationship between growth, inequality and income distribution.

5.3.1 The Kuznets curve

One well-known example of how this process could unfold is the Kuznets curve, which plots the relationship between per capita income and inequality. The curve takes the shape of an inverted U, which suggests that in the process of growth inequality will first rise and then, after the economy reaches a certain level of per capita income, once again decline (Todaro & Smith, 2006, p. 212). This corresponds to the empirically observed low levels of inequality in countries with low or high per capita income and higher levels of inequality in middle income countries. This could also suggest that the number of poor people would actually increase in the beginning of a growth process in a country with a low per capita income, before it could eventually start declining.

One important reason to treat Kuznets' hypothesis with caution is that it was constructed on the basis of a cross-section of countries – not time series for individual countries during the process of growth – which means that there could be other reasons for this pattern to appear. One valid point of criticism is that most of the middle income countries with high inequality are Latin American, and perhaps inhibit other traits that could be associated with high inequality.

5.3.2 Pro-poor growth

What does it take for growth to be pro-poor? One view holds that growth is pro-poor if the accompanying change in income distribution by itself reduces poverty (Kakwani, 2000). This is a quite restrictive definition. According to Kraay (2006) its application would imply that the rapid growth of China the past decades was not pro-poor because the poor gained relatively less than the non-poor in the process, i.e. there was a rise in inequality. Knowing that millions of Chinese people were lifted out of poverty in the same period, this does appear rather strict. A broader and more intuitive definition is that growth is pro-poor if the poverty measure of interest falls (Kraay, 2006, p. 199). This is the one most frequently applied in empirical research.

Kraay (2006) further looks into three possible sources of pro-poor growth; i) a high growth rate of average incomes; ii) a high sensitivity of poverty to growth in average incomes and iii) a poverty-reducing pattern of growth in relative incomes. The results are quite interesting, as it turns out that in his data 70 percent of poverty reduction in the short run and 97 percent in the long run can be ascribed to growth in average incomes. This suggests that growth is actually a very strong determinant of poverty reduction.

Several studies conclude that it does look like the lowest quintile of the income distribution receives its proportionate share of the benefits from economic growth; that is, growth in average GDP per capita translates into proportional growth in the income of the poor (Dollar & Kraay, 2001; Ravallion, 2001; Roemer & Gugerty, 1997). If the income distribution stays the same during the process of growth, the absolute number of people living below the poverty line will decline even if inequality between the rich and poor will increase in absolute terms.

5.3.3 The elasticity of poverty reduction with respect to income growth

The effect of growth on poverty reduction will also depend on the elasticity of poverty reduction with respect to income growth, that is, the percentage reduction in poverty rates associated with a one percent change in mean per capita income. This in turn varies with – among other things – inequality. Empirical findings suggest that inequality in itself is negative for economic growth (Barro, 2000). It also appears that growth is less successful at reducing poverty in high inequality societies. This makes intuitive sense, as with high inequality a smaller portion of the benefits of growth accrue to the poor, and poverty is reduced in a smaller manner than would be the case with a more equal income distribution.

Studies from the 1990s and early 2000s find poverty elasticities in the range between 1.5 and 5, with an average of around 3. One recent journal article however suggests that the poverty elasticity of growth has declined the past decades, and that the poverty-reducing impact of growth was larger in the 1980s and 1990s than today. Particularly the elasticities of India and South Asia as a region are found to be very low and considerably lower than the average for LDCs as a group (Lenagala & Ram, 2010). The average estimated elasticity in the period 1999-2005 is 1.42 for the $1.25 a day poverty line, whereas the estimate for India is a mere 0.26. These findings could indicate that growth no longer has the same effect on poverty reduction as it did a few decades back. The lower elasticity is however associated with higher average growth rates, as the percentage decline in poverty is higher today than ten or twenty years ago.

5.4 Other channels for aid to reduce poverty

Collier and Dollar (2002) assume that aid has an impact on economic growth mainly through the policy environment, and in their model this growth is the only way in which aid enables poverty reduction. Lensink & White (2000)[12] are critical to this praise of economic growth as the solution to the world's poverty problems. They do recognize that growth is important, but stress that other measures, e.g. redistributive policies, should be in place to secure the path

[12] Their comments are directed to the authors' World Bank Working Paper 'Aid Allocation and Poverty Reduction' from 1999. This is however quite similar to the published version from 2002.

from growth to poverty reduction. They also emphasize that aid can help human development and poverty reduction through other channels than growth, for instance by supporting health and education programmes that improve the general living conditions of the poor. Growth without these additional measures will not be sustainable in the long run.

6 The Data

In this chapter I present the data used in my analysis, explain the variables and how they are measured, their availability and their sources. A full description of variables, source and descriptive statistics is posted in Appendix D.

6.1 My dataset

I have compiled my dataset collecting variables from several online databases and datasets, the most important being The World Bank's World Development Indicators (WDI) and PovcalNet, OECD's online database OECD.Stat, Penn World Table (PWT) 7.1 and the QoG Standard dataset from the Quality of Government Institute at the University of Gothenburg.

My regressions include data on 80 countries for 36 years from 1974 through 2009, averaged over nine four-year periods. This is adding another 21 countries and three time periods to dataset of Collier & Dollar (2002) whose data ranges from 1974 through 1997. In most of the growth regressions, only seven time periods (years 1982-2009) are included because of the lack of complete observations for all variables in all time periods. The main reason for the shortening of the panel is the inclusion of the institutional variable, ICRG, which is not available until the early 1980s. Where one variable is missing it will result in excluding the observation from the regression (this is done automatically by Stata). Quite a few countries have incomplete data for important variables like GNI growth, policy or institutional quality and therefore fall out of the analysis for certain time periods. The mean number of observations for each country is 5.4, ranging from 1 to 7. This leaves me with an unbalanced panel, the implications of which I will get back to in section 7.5 on econometric pitfalls. The table in Appendix F displays all countries and the number of periods they are included in the regressions.

The poverty-efficient allocation for 2010 includes 111 countries for which complete data on poverty and income are available. The income data are from 2010 and the poverty data from the latest available survey in PovcalNet. Most countries have poverty data from 2008 or from the mid 2000s. A few countries have quite old data, some from the mid 1990s.[13] The poverty rates are likely to have changed significantly since then. All of the countries with old data are

[13] These are Trinidad and Tobago, Botswana, Algeria, Turkmenistan, Papua New Guinea and St. Lucia.

allocated 0 in the optimal allocation, so this will not have implication for the results. For this reason I have decided to keep all countries with available poverty data in the sample.

6.2 Variables in the growth regression

Several of the variables used by Collier & Dollar (2002) are not available to me, and I have needed to substitute for these in the regressions. This results in different variables for policy and institutions, and I also use a different aid variable in order to check the robustness of their results.

6.2.1 The dependent variable

Growth rate of per capita gross national income (GNI)

GNI is defined as the "sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad" (The World Bank Group, 2012). The dependent variable in the regressions is the growth rate of per capita GNI, which is defined as annual percentage change in the gross national income divided by midyear population. This is the same dependent variable as Collier & Dollar (2002) use.[14] The growth rates are averaged over periods of four years in order to follow Collier and Dollar's analysis and the general approach in much of the aid-growth literature. The reason for using such averages is to be able to account for the world's business cycle (Collier & Dollar, 2002). Data on this variable is collected from the WDI.

6.2.2 Explanatory variables

Initial per capita GNI

This variable is GNI per capita for the first year of each time period, measured in constant US dollars. As an example this means that if period 3 consists of the years 1982-85, this measure will be GNI per capita for 1982. Data is collected from WDI.

[14] GNI was formerly called GNP, but these two measures are identical (The World Bank Group, 2012).

This variable is included in the growth regression to capture the hypothesis of conditional convergence between countries, which is the assumption that countries starting from a lower per capita income will grow faster than countries with a high per capita income, in line with the neoclassical growth model. The coefficient of this variable is expected to take a negative value in the regressions.

Policy

Collier and Dollar (2002) use the World Bank's Country Policy and Institutional Assessment (CPIA) as their policy variable. This measure includes 20 equally weighted indicators from four sub-categories: macroeconomic management, structural policies, policies for social inclusion and public sector management (Collier & Dollar, 2002, p. 1498). Data on CPIA is however not publicly available in the World Bank database prior to 2005.[15]

In search of a suitable policy variable I have decided to follow the approach of Burnside & Dollar (2000) and construct the variable as a weighted average of a few macroeconomic indicators. I also considered entering the variables separately in the growth equation, which Hansen & Tarp (2001) and Rajan & Subramanian (2008) suggest might be a better solution. This will however not enable me to have a single interaction term between aid and policy, which is one of the main properties of Collier & Dollar's growth equation.

Burnside & Dollar (2000) use inflation, government budget surplus and openness to trade measured by the Sachs Warner Index[16] in their policy variable. They construct the variable using as weights the coefficients from a growth regression that does not include the aid variable. This approach might be questionable since the constructed variable is later included in new regressions with more independent variables. This could have possibly changed the coefficients used as weights in the construction. An alternative way of constructing the policy

[15] I've been in contact with the Data Advisory Service and the Research Department at The World Bank inquiring about access to the original datasets or a longer time series of CPIA data. They were however not able to provide me with this. I have also corresponded with David Dollar via e-mail, but he no longer has access to the data as he has left the World Bank. Espen Villanger at CMI, who recently worked for the World Bank, also tried to get me the data without success.

[16] The Sachs-Warner openness index is a dummy variable that takes the value 0 or 1. An economy is considered closed (the index is 0) if one of the following occurs: average tariffs on machinery and materials are above 40 percent, the black-market premium is above 20 percent, or there is pervasive government control of key tradables (Burnside & Dollar, 2000).

variable is by principal component analysis (PCA).[17] Dunteman (1989, p.10) describes it like this: "Principal component analysis searches for a few uncorrelated linear combinations of the original variables that capture most of the information in the original variables". For details on the construction of this variable, see Appendix C.

The real challenge here is to find indicators that can truly be said to be policy indicators and not outcome variables. In many cases there will be an overlap between the two. Collier and Dollar (2002) include three independent macroeconomic indicators as control variables in their regressions, and these are the three I will use in my principal component analysis: openness to trade, inflation and government consumption. As mentioned Burnside & Dollar (2000) include budget surplus as a fraction of GDP in their policy variable instead of government consumption. This indicator might have been preferable to include in the PCA, but doing so reduced the number of observations in my regressions by almost two thirds, and I therefore decided not to include it.

Openness to trade is a matter that to a certain degree can be decided by the government of a country. Empirical evidence suggests that openness is positively related to economic growth (Dollar & Kraay, 2004). The Sachs Warner Index has not been updated since the early 2000s when Wacziarg & Welch made some adjustments to the openness measure (Wacziarg & Welch, 2008). For most countries the status is likely to be the same today as ten years ago, as from 1995 to 2003 only ten to twenty countries changed status from closed to open or the reverse. I still prefer to use a different measure of openness as these data are a bit old. The most widely used in the literature besides Sachs-Warner is the rate of exports plus imports to GDP. I here apply a dummy variable which takes the value 0 if the share of trade to GDP is lower than 40 percent and 1 otherwise. One possible drawback with using this measure is that large countries will tend to have a lower "natural" level of openness, whereas small countries would be deemed more open simply as a result of their dependence on trade. This is not necessarily related to the countries' policies toward openness. For many developing countries the trade policies of others will be just as important for their trade volumes as their own policies. This measure is however the most easily available, and also widely used in the literature.

[17] I was fortunate to talk to Craig Burnside during his visit to the Norwegian School of Economics (NHH) in Bergen in October 2012, and I asked his advice regarding the choice of a policy variable. He suggested doing something similar to their approach, but using principal component analysis to derive the weights of the variables included.

The second indicator included in the principal component is *inflation*. In most European economies and in the US the monetary (and fiscal) policy is closely related to an inflation target. Inflation can in this way be interpreted as a policy variable that the government can, or at least tries to, control. Many developing countries do not have this kind of target for their monetary policy, but it is becoming more widespread. Whatever the monetary regime, it is evident that sound macroeconomic management is needed to keep inflation low and stable. Giving a lot of aid to a country with a very high inflation rate is not likely to be fruitful in spurring economic growth. For these reasons inflation is included in my policy variable. Bruno & Easterly (1998) argue that inflation is not a serious problem for economic growth until it reaches a critical threshold of 40 percent. This presumed non-linearity of inflation could be a rationale to include it as a dummy variable in the principle component, which is what I have done. The variable takes the value 1 when inflation is below 40 percent and 0 when it is higher.

The last indicator included is *government consumption as percentage of GDP*. This measure can indicate how involved the government of a country is in economic management and will give an approximation of the size of the public sector. A large public sector is often associated with inefficiency and waste of resources that could have otherwise been used for growth-enhancing investments. When included directly as an explanatory variable in the growth regression, government consumption enters with a significant, negative coefficient. This could indicate the presumed association with growth, and is an argument for its inclusion in the policy variable. This indicator is also included as a dummy, taking the value of 1 if the rate of government consumption is between 10 and 40 percent of GDP and 0 if it is lower than 10 or higher than 40 percent. This approximation is made on the assumption that some public spending is needed in order to foster economic growth, but if the level becomes too high, inefficiency will arise. The size of this measure for developed economies mainly ranges from about 15 to 35 percent, so this is the reasoning behind the interval set (World Bank, 2012).

The policy variable can take eight different values based on the combination of the three indicators included. The value of the variable is higher whenever the dummy variables take the value of 1, which by the way they are constructed is presumed to be “good” for growth. The combination 0-0-0 gives the lowest value of the policy variable, and 1-1-1 the highest. Data on the variables included are collected from the WDI.

Policy is included in the regressions as a separate term and interacted with the aid variable. This is done in order to take into account one of the main results of Collier & Dollar (2002), namely the possibility that the quality of policy has implication for the effect of aid on growth. I expect policy to enter the growth regression with a positive coefficient.

ODA- Official Development Assistance

I estimate the growth regression using two different aid variables. The first is net ODA disbursements divided by real PPP GDP per capita.[18] This is the aid variable used by Collier & Dollar (2002). For simplicity I henceforth refer to this variable as *CDaid*. ODA disbursements are measured in constant 2010-dollars whereas real PPP GDP per capita from PWT 7.1 is in constant 2005 international dollars. I therefore convert the ODA figures into 2005-dollars by using the inflation conversion factors from Sahr (2012) before dividing it by the GDP measure.

The second aid variable is ODA as percentage of recipient country GDP. This variable is constructed using net ODA disbursements in current dollars from OECD.Stat and GDP in current dollars from the WDI. For the estimations this variable will be called *ODA/GDP percent*.

In the regressions the aid variable is included separately as a linear term and a squared term. I expect the coefficient of the quadratic term to be negative because of the assumption of diminishing returns to aid. The aid variable is also included in interaction terms with policy and with institutional quality.

Institutional quality

Collier and Dollar (2002) use International Country Risk Guide's ICRGE as a variable for institutional quality. This data is restricted to subscription, and I do not have access to the dataset. I therefore use the ICRG 'Quality of Government' indicator from the QoG Standard dataset as a measure of institutional quality. The score ranges from 0 to 1 and is given as the mean value of three other ICRG indicators; *corruption*, *law and order* and *bureaucracy*

[18] "PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as the U.S. dollar has in the United States. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products" (The World Bank Group, 2012).

quality. This variable is also included in an interaction term with aid as a sensitivity check to the aid/policy interaction term. Data on this variable is available for the years 1984-2008, which shortens my panel by two periods. Institutional quality is assumed to be important for economic growth, and I expect this variable to enter with a positive coefficient.

Other variables

Collier and Dollar (2002) include *openness to trade* measured as the ratio of import + export to GDP, *inflation rate* and *government consumption relative to GDP* as control variables in their regression. These can be taken as indicators of the government's ability for sound economic management, and in this respect can also be proxies for the quality of policies. As I use these three to construct my policy variable, they are not included separately in the regressions.

Regional dummy variables are included in the regressions to capture possible region-specific time-invariant factors that affect growth. The variable is from the QoG Standard dataset, and is "a tenfold politico-geographic classification of world regions, based on a mixture of two considerations: geographical proximity and demarcation by area specialists having contributed to a regional understanding of democratization" (Teorell, et al., 2012, p. 143). Appendix D displays the countries in my dataset included in each regional group.

Time dummies are included for each four-year time period to account for the world business cycle (Collier & Dollar, 2002). These variables capture occurrences that are common across countries but specific to one time period. The list of these dummy variables can be found in Appendix D.

6.3 Variables in the algorithm for poverty-efficient allocation

For the poverty-efficient allocation rule I also need data on per capita GDP and poverty rates.

The income measure used in the poverty-efficient allocation is *GDP per capita* measured in current US dollars.

> "GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources" (The World Bank Group, 2012).

The poverty measures I apply are the *poverty headcount indexes* at the 1.25$ a day and 2$ a day poverty lines and the corresponding *poverty gaps* and *squared poverty gaps.* These variables were defined in chapter 2.1.2. All data on poverty are collected from PovcalNet, an online poverty analysis tool developed by the World Bank's research department, the Development Research Group. This database is the source of the poverty data in the World Development Indicators.

7 Estimation method

In this chapter I go into the choice of data structure and estimation method. I give a brief introduction to the properties of panel data and describe the different models I have considered for estimations, their strengths and weaknesses. These are the Ordinary Least Squares (OLS) model, the fixed effects (FE) model and the random effects (RE) model. In section 7.5 I highlight possible econometric problems one can run into when doing estimations. Some of them also turn out to be relevant for my data.

7.1 The choice of data and estimation models

When performing econometric analysis the first thing to consider is what type of data to use and what model to estimate. For this kind of analysis the choice is initially between cross-section and panel regression. In the earlier growth literature both have been applied, each with their benefits and limitations. Collier & Dollar (2002) use panel data and so do many other prominent studies in the field (Tarp, et al., 1999; Burnside & Dollar, 2000; Dollar & Kraay, 2004; Rajan & Subramanian, 2008). This will be my approach as well, and in section 7.2 I get back to the advantages of panel data estimation.

Several different econometric models could be estimated, and it is important to make the right decision to get unbiased and efficient results. OLS is the *Best Linear Unbiased Estimator* (*BLUE*) under the Gauss-Markov assumptions.[19] This means that among all linear unbiased estimators OLS is the one with the smallest variance (Wooldridge, 2009, p. 835). OLS panel regression has been applied by many, including Collier & Dollar (2002). There are however several reasons to be cautious about OLS-estimation with panel data, for instance the possibility of unobserved individual heterogeneity or the risk of endogeneity of the explanatory variables. Several models are specifically adapted to estimation with panel data. Two of them are the random effects (RE) and fixed effects (FE) estimators. These are the ones I will be using for my estimations, in addition to running OLS regressions for the sake of comparison. The choice of estimation model will be treated in greater detail in sections 7.3 and 7.4.

[19] I list these assumptions in Appendix E, as they appear in Wooldridge (2009, pp. 158-159).

7.2 The properties of panel data

A data set constructed from repeated cross sections over time is a panel or longitudinal data set (Wooldridge, 2009, p. 843). The units of observation can be individuals, households, firms or as in this case, countries. Panel data is favorable in terms of giving a fuller description of the aid-growth relationship than a simple cross-section. General concerns in the application of empirical data are endogeneity, outliers, model uncertainty and measurement error, in addition to drawbacks like unobservable heterogeneity in the dataset or omitted variables (Rajan & Subramanian, 2008). Some of these problems can be addressed using panel data. Baltagi (2008, pp. 6-10) lists a number of benefits from using panel data, some of which are the following:

i) Panel data can give "*more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency*." (Baltagi, 2008, p. 7). The cross-sectional dimension of the data adds a lot of variability, and this can partly solve the problem of multicollinearity, which is the occurrence of high correlation between the independent variables in a multiple regression model, and very common in time series studies (Wooldridge, 2009, p. 842). The fact that there are two dimensions in the data also lets us produce more efficient parameter estimates.

ii) Panel data are better suited for studying the *dynamics of adjustment*, for example the process of moving out of poverty for a household or a country. Panel data opens the opportunity of following an individual or a country throughout a time period. These kinds of estimations are however more common at the micro level, for instance related to the labor market.

iii) The possibility of *controlling for individual heterogeneity* is perhaps the most useful feature of panel data. Countries are heterogeneous. Time series or cross-sectional studies that do not control for this heterogeneity are at risk of obtaining biased results (Baltagi, 2008, p. 6). All the variables in our growth regression vary with time and across countries, and this is not the cause of the problem, rather a strength of the data. It is however also possible that some characteristics vary across countries but stay the same within a country for the time period selected. If these characteristics are also affecting the growth of a country and are not included in the regression, the result is that we get an omitted variable bias in our coefficient estimates. It is possible to create dummy variables for countries we know inhabit such traits, but this will result in excluding them from the sample if estimated as a time series or cross-section. With panel data it is possible to keep countries in the sample and at the same time control for any country-specific characteristics, observable or not. This is the virtue of the fixed effects model, which will be presented in section 7.4.1.

Several methodological concerns are still present for panel data, and I will get back to these in section 7.5 on econometric pitfalls.

7.3 OLS estimation

The most common method of econometric estimation is the ordinary least square (OLS) model. This model fits the linear relationship between variables by minimizing the sum of squared residuals (Wooldridge, 2009, p. 843). For my growth equation OLS will estimate the following:

$$G_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 P_{it} + \beta_3 A_{it} + \beta_4 A_{it}^{\ 2} + \beta_5 A_{it} P_{it} + u_{it} ,$$

Here β_0 is the overall intercept, and u is an error term that captures all factors not included in the regression that still have an impact on the dependent variable. Each variable is indexed by country (i) and time period (t). The error term is assumed to be uncorrelated with the explanatory variables. This is the most important of the Gauss-Markov assumptions under which the OLS estimator is the *Best Linear Unbiased Estimator* (*BLUE*). An unbiased estimator is an estimator whose expected value is equal to the true population value of the parameter (Wooldridge, 2009, p. 847)

The assumption of zero correlation between the explanatory variables and the error term is unfortunately likely often to be violated when dealing with panel data. This would be a violation of assumption OLS.4, and will cause OLS estimates to be biased. For this reason it is not advisable to use regular OLS regression to analyze panel data. Because the data are clustered, we would also expect unobserved heterogeneity between countries to lead to within-country correlations in the error terms (Rabe-Hesketh & Skrondal, 2008, p. 185). Clustering of data means that the observations in the panel naturally belong to different groups, in my case countries. This serial correlation arises if there are omitted variables at the subject level, which would then be present in the error term for the country in consecutive periods.

Another important assumption for OLS estimation is homoskedasticity, which means that the variance of the error terms is constant conditional on the explanatory variables (Wooldridge, 2009, p. 839). If this assumption is violated, OLS will no longer be the efficient estimator. It is possible to test for the application of OLS by performing a Breusch and Pagan Lagrangian multiplier test for random effects. If this comes back with a significant test statistic, the null hypothesis of zero variance in the error terms is rejected, and OLS should not be applied. I ran this test on my data, and the test statistic was highly significant. This implies that OLS is not suitable for estimating this model. The result of the test can be found in Appendix G.

7.4 Panel estimation models

Most panel data models are estimated under the assumptions for fixed and random effects. These are posted in Appendix E, and are directly cited from Wooldridge (2009, pp. 503-505). I will get back to the most important assumptions when presenting the panel estimation models in the next sections. In the following I will be directly using some of the equations from Verbeek (2012, pp. 376-386).

7.4.1 The fixed effects model

The fixed effects model is a linear regression model in which the intercept terms vary over the individual units, *i*:

$$y_{it} = \alpha_i + x'_{it}\beta + u_{it}, \qquad u_{it} \sim IID\left(0, \sigma_u^2\right)$$

Here y_{it} is the dependent variable, α_i ($i = 1,\ldots, N$) are treated as fixed unknown constants that are estimated along with β, x'_{it} is a vector of explanatory variables and u_{it} is the error term, which is assumed to be uncorrelated to the explanatory variables. The overall intercept term β_0 is omitted, as it is subsumed by all the individual intercepts, α_i. When applying this to my growth regression the fixed effects model can be expressed as the following version of equation (4.4):

$$G_{it} = \alpha_i + \beta_1 X_{it} + \beta_2 P_{it} + \beta_3 A_{it} + \beta_4 A_{it}^{\ 2} + \beta_5 A_{it} P_{it} + u_{it}$$

For the further elaboration of the model it is more expedient to continue with the general form of the equation in order to find the expression for the estimated coefficients. The x' then represents all independent variables in the regression.

This model could be fitted by including dummy variables for each unit *i* in the model, which would result in a regression with a very large number of independent variables. In my case this would mean having 80 dummy variables for the individual countries. A simpler approach that will give the same results is to calculate the estimator for β by performing the regression on deviations from individual means. This implies eliminating the individual effects α_i by transforming the data. We have the following equation:

$$\bar{y}_i = \alpha_i + \bar{x}'_i \beta + \bar{u}_i ,$$

where $\bar{y}_i = \frac{1}{T}\sum_t y_{it}$ and $\bar{x}_i$ and $\bar{u}_i$ have corresponding definitions. These measures represent the means for each country's variables over time. We can now write:

$$y_{it} - \bar{y}_i = (x_{it} - \bar{x}_i)'\beta + (u_{it} - \bar{u}_i)$$

The β obtained from this transformed model is called the within estimator or fixed effects estimator, and is defined by Verbeek (2012, p. 377) as:

$$\hat{\beta}_{FE} = \frac{\sum_{i=1}^{N} \sum_{t=1}^{T} (x_{it} - \bar{x}_i)(y_{it} - \bar{y}_i)}{\sum_{i=1}^{N} \sum_{t=1}^{T} (x_{it} - \bar{x}_i)(x_{it} - \bar{x}_i)'}$$

Under the assumption that all x_{it} are independent of all u_{it}, it can be shown that $\hat{\beta}_{FE}$ is an unbiased estimator for β. The virtue of the fixed effects estimator is that it allows for spurious correlation between the independent variables and the country-specific intercepts, α_i which capture all observable and unobservable individual differences. This estimator has the great advantage of not being susceptible to bias due to omitted subject-level variables.

One important drawback with this model is that the effect of variables that are constant over time cannot be calculated. These are omitted from the regression in Stata, which in my case entails losing the regional dummies. Another feature is that we in reality lose the cross-sectional dimension of the data, since the coefficients will refer to the effects of the independent variables on the explained variable within each unit of observation. The result of this is that the estimates will be less precise than those of an estimator utilizing both dimensions of the data. This is a drawback that needs to be weighed against the possible biasedness of other estimators.

7.4.2 The random effects model

In regression analysis it is commonly assumed that all variables that are not included in the regression but still have an impact on the explained variable will be summarized in a random error term. For the random effects model this implies that the individual intercepts are treated as random factors independently and identically distributed (IID) over individuals (Verbeek, 2012, p. 381). The random effects model can therefore be written as:

$$y_{it} = \beta_0 + x'_{it}\beta + \alpha_i + u_{it}, \quad u_{it} \sim IID(0, \sigma_u^2); \quad \alpha_i \sim IID(0, \sigma_\alpha^2)$$

Or in the notation of my growth regression:

$$G_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 P_{it} + \beta_3 A_{it} + \beta_4 A_{it}^{\ 2} + \beta_5 A_{it} P_{it} + \alpha_i + u_{it}$$

In this model the individual intercepts are part of the error term $\alpha_i + u_{it}$. The individual effect α_i does not vary over time, and the second component is assumed to be uncorrelated over time. This means that all correlation in the error terms over time is ascribed to the individual effects. Because of this autocorrelation regular OLS will yield incorrect standard errors. This can be corrected by estimation by generalized least squares (GLS) which gives a more efficient estimator. The GLS estimator for random effects is given by:

$$\hat{\beta}_{GLS} = \frac{\sum_{i=1}^{N}\sum_{t=1}^{T}(x_{it}-\bar{x}_i)(y_{it}-\bar{y}_i)+\psi T\sum_{i=1}^{N}(x_i-\bar{x})(\bar{y}_i-\bar{y})}{\sum_{i=1}^{N}\sum_{t=1}^{T}(x_{it}-\bar{x}_i)(x_{it}-\bar{x}_i)'+\psi T\sum_{i=1}^{N}(x_i-\bar{x})(\bar{x}_i-\bar{x})'}$$

where T is the number of time periods and $\psi = \frac{\sigma_u^2}{\sigma_u^2 + T\sigma_\alpha^2}$.

The parameters σ_u^2 and σ_α^2 are the variances of the different components of the error term. It is easy to see that the GLS estimator collapses into the fixed effects estimator when T increases towards infinity, because this will imply $\psi \approx 0$ and the second part of the expression will be eliminated. In samples with a long time horizon the two estimation techniques will thus give the same result. The second part of the equation,

$$\hat{\beta}_B = \frac{\sum_{i=1}^{N}(x_i-\bar{x})(\bar{y}_i-\bar{y})}{\sum_{i=1}^{N}(x_i-\bar{x})(\bar{x}_i-\bar{x})'}$$

is called the between estimator and can be calculated by a regression of individual means that does not take into account the time series dimension of the data. The random effects (GLS) estimator is the optimal combination of the within and between estimators, and therefore more efficient than any of the other two under given circumstances. The most important of these conditions is that there is no correlation between the independent variables and the error terms. This is also the assumption that is most likely to be violated, in which case the random effects estimator, like the OLS estimator, will be biased.

7.4.3 Fixed effects versus random effects

The choice between fixed and random effects estimation is not an obvious one. This issue has generated hot debates in the biometrics and statistics literature, which has spilled over into panel data econometrics literature, and both approaches have strong proponents (Baltagi, 2008, p. 21). Particularly when T is small there can be quite substantial differences in the coefficient estimates. This is also evident in my regressions.

The fixed effects approach is contingent on the values of the individual intercepts, α_i. This estimator considers the distribution of the dependent variable y_{it} given α_i, where the α_i s can be estimated (Verbeek, 2012). Intuitively this approach makes sense if the individuals in the sample are 'one of a kind' and cannot be thought to be a random draw from some population. This would be an appropriate interpretation for our panel, where the units are countries.

The random effects estimator can be expressed mathematically as:

$$E\{y_{it}|x_{it}\} = \beta_0 + x'_{it}\beta ,$$

compared to the fixed effects estimator given by:

$$E\{y_{it}|x_{it}, \alpha_i\} = x'_{it}\beta + \alpha_i$$

This gives some rationale to prefer the fixed effects model if one is interested in some individual effect, since these are ignored in the random effects model (α_i is part of the error term, whose expected value is zero). Even in cases where one is interested in larger overall effects and the random effects approach may be considered superior, fixed effects might still be preferable. This is because of the possible correlation between the explanatory variables, x_{it}, and the individual part of the error terms, α_i. As mentioned, in the presence of such a correlation estimation by random effects will give biased estimators. This problem can be solved by incorporation of fixed effects (Verbeek, 2012, p. 385).

Generally FE will be the more robust estimator, producing unbiased estimates, but will have greater variance in the estimates because it can only exploit one dimension of the data. The RE estimator will be biased if the correlation between the error term and explanatory variables is not zero, which will often be the case. This estimator is however more efficient than the FE estimator, producing coefficients with smaller standard errors. Sometimes a biased estimator with small variance could be preferable to an unbiased estimator with large variance and thus large standard errors. The true value of the estimator could then in theory lie closer to the biased RE estimator than to the unbiased FE estimator (Clark & Linzer, 2012).

It is possible to test for the suitability of random effects estimation by performing a Hausman test on the data. This entails running both fixed effects and random effects models and testing for difference of the estimates. What is really tested is whether there is a correlation present between the independent variables and the error terms. Under the null hypothesis both estimators can be applied, and the random effects estimator is the more efficient one. A rejection of H_0 implies that RE gives biased estimates. Performing this test on my data, I do reject H_0. Due to this I will be using the coefficients from the fixed effects model for my further analysis. The result of the test is posted in Appendix G.

7.5 Econometric Pitfalls

In dealing with econometric analysis there are many pitfalls that should be avoided in order to get correct estimates for the coefficients. These include problems of missing observations, the possibility of endogenous explanatory variables, autocorrelation, heteroskedasticity and omitted variables.

7.5.1 Missing observations

Missing observations are always a challenge with large datasets. OECD-DAC has a vast database on aid disbursements and access to aid data is quite good. Missing data on policy or institutions is more prevalent, and this is the case for many observations in my data. Stata excludes every observation for which all variables are not available from the regressions. The mean number of periods for each country in the regressions is 5.4. About half of the countries have observations for all 7 periods, a few countries for just one or two and the rest somewhere in between. This is unfortunate because it leaves me with an unbalanced panel, which might have consequences for the further analysis. It is perfectly possible to perform the analysis even with an unbalanced panel, and in most cases statistical packages like Stata will make adjustments to account for this.

A more serious concern with using an unbalanced panel is the danger of selection bias. If observations are missing at random this will not be a problem, but if there is some endogenous reason that makes observations drop out of the sample, the use of an unbalanced panel may lead to biased estimators and misleading tests (Verbeek, 2012, p. 425). Even though rendering the panel unbalanced, it could be argued that the inclusion of single observations for some countries will give strength to the data by making them more informative and adding variation. The complete list of countries and time periods included in my regressions is posted in Appendix F.

7.5.2 Possible endogeneity of the aid variable

Several authors highlight the possibility of an endogenous aid variable in the growth equation due to simultaneity[20] (Dalgaard, et al., 2004; Hansen & Tarp, 2001; Rajan & Subramanian, 2008). It is not implausible that aid could be given partly as a response to either good or bad growth performances, which would complicate the settling of causality in the regressions. Estimation with OLS in the presence of endogenous explanatory variables will give rise to biased estimates because the variable will be correlated to the error term (Wooldridge, 2009, p. 846). Whenever there is uncertainty about the possible endogeneity of explanatory variables, alternative approaches need to be considered.

Two Stage Least Square (2SLS) or the more advanced Generalized Method of Moments (GMM) estimation have been used by several authors the last decade to take into account the possible endogeneity of the aid variable (Hansen & Tarp, 2001; Rajan & Subramanian, 2008). Burnside & Dollar (2000) estimate their growth equations with OLS and 2SLS instrumenting for aid, and find little difference between the estimates. Collier & Dollar (2002) take this as evidence that there is not an endogeneity problem and settle for the general OLS panel estimation. Instrumentation strategies also have their challenges, especially when it comes to choosing good instruments.[21] Applying weak instruments is just as bad as estimation with a biased estimator, and will lead to misguiding estimates and tests. Deaton (2009) argues that many of the instruments used in recent studies are in fact not exogenous and thus would not yield the correct results in 2SLS or GMM analysis. In my dataset there are no variables that I find suitable for instrumentation. Some frequently used instruments of aid are the relative sizes of donor and recipient, the geographical distance between them, or previous colonial links. All of these measures would require data on each pair of donor and recipient. This rules out using this instrumentation strategy as my data are on aggregate aid. Due to this I have decided not to run any regressions with instrument variables. The usefulness of making such estimations is also reduced as the results are likely not to be reliable.

[20] Simultaneity means that at least one of the explanatory variables in a multiple linear regression is determined jointly with the dependent variable (Wooldridge, 2009, p. 846).

[21] An instrument is a variable that does not appear in the regression, is uncorrelated with the error in the equation, and is (partially) correlated with the endogenous explanatory variable (Wooldridge, 2009, p. 840).

7.5.3 Autocorrelation

If the error terms in the model are correlated in different time periods, the errors suffer from autocorrelation. This is always a concern with time series data, and can also generate problems in panel datasets. The fixed effects and the random effects models both assume that the idiosyncratic errors, u_{it}, are uncorrelated over individuals and time because the α_i is believed to capture all correlation between the unobservable factors not included in the regression. Provided that the assumption of strict exogeneity[22] of the x_{it} holds, the presence of autocorrelation in u_{it} does not lead to biased estimators (Verbeek, 2012, p. 389).

In testing my data for autocorrelation the test statistic is marginally significant at the 5 percent level, so the null hypothesis of zero autocorrelation is rejected. The result of this test is posted in Appendix G. In the previous literature on aid and growth, perhaps somewhat surprising, autocorrelation is very rarely mentioned as a potential problem. Autocorrelation can however cause the standard errors and test statistics to be invalid, and complicate the ability to draw conclusions from the regressions because the estimators will no longer be efficient.

7.5.4 Heteroskedasticity

Heteroskedasticity is the phenomenon that the variance of the error term, given the explanatory variables, is not constant (Wooldridge, 2009, p. 839). It is rarely the case that errors are homoskedastic in the first place, but this is not a major concern. Heteroskedasticity can be easily corrected for by incorporating robust standard errors in the regressions. If the standard errors are similar in the two different estimations, nothing is lost using the robust ones. If there is a significant difference between them, the robust errors should be used. This is the reason why all my coefficients are calculated using robust standard errors.

7.5.5 Omitted variables

The risk of omitting relevant variables is definitely present in these kinds of growth regressions. Empirical studies find that about twenty different variables can be said to have an effect on economic growth (Sala-i-Martin, 1997). Omitted variables will lead to biased estimators. This is a smaller concern using the fixed effects model because this model allows

[22] The assumption that the explanatory variables x_{it} are uncorrelated with the idiosyncratic errors in every time period (Wooldridge, 2009, p. 846). Formally this is written: $E(x_{it}, u_{it}) = 0$.

for variables omitted at the subject-level to be correlated to independent variables in the growth equation.

8 Results

This chapter presents the results of my growth regressions. I estimate the growth equation using two different aid variables. I also run the regression with and without different independent variables and with and without outliers and a set of countries not included in Collier & Dollar's poverty-efficient aid allocation. The different specifications have large consequences for the results, which turn out to be sensitive to small changes, especially in relation to outliers.

8.1 Estimating the growth regression

I have decided to follow Collier & Dollar (2002) as closely as possible in specifying the growth regression. This leads me to estimating the following equation, where the main explanatory variables for economic growth are aid and policy, and the two interacted:

$$G_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 P_{it} + \beta_3 A_{it} + \beta_4 A_{it}^{\ 2} + \beta_5 A_{it} P_{it} + \alpha_i + u_{it} \qquad (8.1\ )$$

In this equation the X represents all other explanatory variables in the regression. In my case these include initial per capita GNI, the institutional variable and an interaction term of this with aid, as well as regional dummies and time dummies. The data included in most of the regression are from period three through period nine. This means that time dummies for period four through nine should be applied in the equation.[23]

8.1.1 Value of comparison with baseline

To be able to fruitfully compare my results to Collier & Dollar (2002) it would be ideal to start out with a dataset similar to theirs and subsequently expand the number of countries and time periods included. I have organized my data into four-year averages like they do, but the first two time periods, 1974-77 and 1978-81, fall out of the regressions once the institutional variable ICRG is included, as this is only available from the beginning of the 1980s onwards. Another issue is the policy variable, where I use an entirely different measure than they do.

[23] If all dummy variables are included, we have perfect collinearity between them, and the estimates become meaningless. This is the so-called dummy variable trap. Wooldridge (2006:837) defines the dummy variable trap like this: "The mistake of including too many dummy variables among the independent variables; it occurs when an overall intercept is in the model and a dummy variable is included for each group." Normally Stata will make sure this is implemented automatically by excluding one of the dummies if all are included.

There are also large discrepancies between the two datasets in terms of the countries included. Collier & Dollar (2002) have 59 countries in their regressions, whereof 39 are also in my dataset. Out of the twenty countries lacking in my dataset nine are Eastern European countries that have been reclassified in the DAC system and are no longer recipients of ODA.[24] Another five lack data for the institutional variable,[25] two lack data for the policy variable[26] and the four remaining do not have data on initial GNI or GNI per capita growth.[27]

All of this reduces the purpose of running regressions with an "original" set of countries and periods to try to replicate the results of Collier & Dollar (2002). In addition to the 39 countries that are common to their dataset and mine, my data includes 41 more countries.

8.2 Regression results

I have been running regressions with different specifications of the growth equation and different aid variables and observations included. The intention of this has been to test the robustness of the results, which turn out to vary considerably.

I run four different specifications of the growth equation, starting by including only initial GNI and the regional and time dummies in addition to the aid variables. This is the specification referred to as number 1 in the tables, with the prefix FE (fixed effects), RE (random effects) or OLS (ordinary least square). Specification 2 includes the policy variable and the variable for institutional quality, both of which are expected to have positive effects on growth. Specification 3 also includes an interaction term of the aid variable with policy to account for the possibility that the effect of aid on growth is contingent upon the level of policy, which is the main result of Burnside & Dollar (2000) and Collier & Dollar (2002). The latter include an interaction term of aid with institutional quality as a sensitivity check to the estimates of their policy–aid interaction term. This is done in specification 4. I run all models with three different estimators: OLS, FE and RE. Here I post the results from the fixed effects estimations, as these are the ones I will use for further calculations. Table 8.1 shows specifications 1 to 4 for fixed effects, and in table 8.2 I post the three different estimators for specification 4 so that the results can be easily compared. The rest of the results for OLS and

[24] Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Poland, Romania, Russia and Slovakia.
[25] Lesotho, Rwanda, Kyrgyz Republic, Mauritania and Nepal.
[26] Chile and Turkmenistan.
[27] Niger, Guinea-Bissau, Nigeria, Jamaica.

random effects will be briefly mentioned in the following, and the tables can be found in Appendix H.

In the first group of regressions I use the aid variable that I assume comes closest to the one used by Collier & Dollar (2002). This is net ODA disbursements divided by real PPP GDP per capita. In the following this variable is referred to as CDaid. I find this aid measure to be a bit arbitrary, as it is difficult to get a grasp of what it is actually measuring. Therefore the results I use for further calculations are from regressions using a different aid variable: ODA as a percentage of GDP, henceforth ODA/GDP percent. One reason for preferring this measure is that it is easily understandable. Lensink & White (2000) use a variation of this aid variable,[28] and other important studies apply the share of ODA to GDP (Hansen & Tarp, 2001; Rajan & Subramanian, 2008). Thus it seems like a reasonable alternative.

There are large differences between the two aid variables, and the correlation between them is a mere 0.26. I therefore expect that using the different variables has consequences for the results. I also run tests to identify potential outliers, and excluding these from the regressions has large implications for the statistical significance of the estimates. All results related to the CDaid variable and the regressions excluding outliers and observations at the country level are posted in Appendix H.

8.2.1 Different aid variables – different outcomes

In fixed effects estimations with the CDaid variable, aid appears not to have any impact on growth in per capita GNI, as none of the two aid terms are statistically significant. They even enter the regression with the “wrong” signs; negative for the linear term and positive for the quadratic one. The interaction term between aid and policy is however statistically significant at the ten percent level, and with a positive coefficient. This is in line with the results of Burnside & Dollar (2000) and Collier & Dollar (2002), who claim that the effect of aid on growth is contingent upon the policy environment. Initial GNI, policy and institutional quality are all statistically significant and with the expected signs in the specifications where they are included. Regarding RE and OLS, neither of these estimators give statistically significant coefficients for the aid terms related to this aid variable. Institutional quality is significant and positive for all three estimators. Using RE estimation, initial GNI and policy are also

[28] Lensink & White (2000) apply ODA as percentage of GNI as the aid variable in their growth regressions.

significant and with the expected signs. As these are not the results I use for my further calculations, they are posted in Appendix H.

When estimating the same specifications using the second aid variable, ODA/GDP percent, the results are very different. The FE results are posted in Table 8.1 below, and the ones comparing FE4 to OLS4 and RE4 are found in Table 8.2. In the tables asterisks indicate the statistical significance of the estimated coefficients, with three asterisks for the one percent level, two for the five percent level and one asterisk for significance at the ten percent level. Standard errors are shown in parenthesis below the coefficient estimates.

Table 8.1: Fixed effects regression results, calculated with robust standard errors. Dependent variable: Growth in per capita GNI. Aid variable: ODA/GDP percent.

	FE1	FE2	FE3	FE4
Log Initial GNI	-1.681	-3.300***	-3.285***	-3.169***
	(1.053)	(1.010)	(0.998)	(1.101)
ODA/GDP percent	0.307***	0.194**	0.182**	0.312**
	(0.103)	(0.095)	(0.089)	(0.136)
(ODA/GDP percent)^2	-0.003***	-0.004***	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
Period 4	-1.146**	1.306*	1.289*	1.274*
	(0.536)	(0.665)	(0.674)	(0.673)
Period 5	-1.713**	1.556*	1.536*	1.483*
	(0.697)	(0.791)	(0.803)	(0.803)
Period 6	0.206	2.573***	2.534***	2.443***
	(0.588)	(0.698)	(0.725)	(0.765)
Period 7	-0.145	1.657***	1.615**	1.470**
	(0.322)	(0.621)	(0.642)	(0.714)
Period 8	1.491***	3.695***	3.639***	3.476***
	(0.386)	(0.715)	(0.740)	(0.810)
Period 9	1.820***	4.015***	3.963***	3.801***
	(0.512)	(0.796)	(0.821)	(0.916)
Policy		0.506**	0.587**	0.597**
		(0.238)	(0.277)	(0.276)
Institutional quality (ICRG)		4.161**	4.162**	5.685***
		(1.631)	(1.651)	(2.035)
Policy x ODA/GDP percent			-0.018	-0.024
			(0.023)	(0.023)
ICRG x ODA/GDP percent				-0.347
				(0.243)
R^2	0.132	0.301	0.302	0.309
Observations	783	431	431	431

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

FE estimation gives statistically significant coefficients both for ODA/GDP percent and ODA/GDP percent squared, with the expected signs; positive for the linear term and negative for the squared. This suggests that aid (measured in this way) does have a positive impact on economic growth, with diminishing returns. The squared aid term is significant at the one percent level, and the estimates remain almost the same (-0.003 or -0.004) through all specifications. The estimates for the linear aid term vary more. We can especially note that it makes a jump from 0.182 to 0.312 once its interaction term with institutional quality is included. The interaction term is however not statistically significant. This result may be due to collinearity between the aid variable and the interaction term. The correlation between them is 0.88, which is high. Stata normally excludes variables from the regressions if collinearity is considered to be a problem.

The policy interaction term with aid is insignificant in both specifications. These results are thereby in line with Hansen & Tarp (2004), Lensink & White (2001) and others who find that aid has a significant, positive effect on growth, regardless of the policy environment. OLS and RE estimations still give insignificant coefficients for all aid variables included, as well as for the interaction terms. Institutional quality has a large, positive and highly significant coefficient for all estimators, and for OLS many of the regional dummies are also significant. Notably Eastern Europe and East Asia enter with positive coefficients and the Sub-Saharan Africa, Caribbean and Pacific regional dummies all have significant negative coefficients.

Table 8.2: Regression results, different models, calculated with robust standard errors. Dependent variable: Growth in per capita GNI. Aid variable: ODA/GDP percent.

	OLS4	RE4	FE4
Log Initial GNI	-0.384	-0.682**	-3.169***
	(0.302)	(0.301)	(1.101)
Policy	0.113	0.254	0.597**
	(0.201)	(0.218)	(0.276)
ODA/GDP percent	0.326	0.404	0.312**
	(0.276)	(0.284)	(0.136)
(ODA/GDP percent)^2	-0.001	-0.002	-0.004***
	(0.001)	(0.002)	(0.001)
Policy x ODA/GDP percent	0.006	0.007	-0.024
	(0.027)	(0.023)	(0.023)
Institutional quality (ICRG)	6.568***	6.337***	5.685***
	(1.952)	(2.029)	(2.035)
ICRG x ODA/GDP percent	-0.543	-0.639	-0.347

	(0.475)	(0.407)	(0.243)
Eastern Europe	2.638**	1.984	.
	(1.151)	(2.375)	.
Latin America	-0.662	-0.935	.
	(0.533)	(2.211)	.
North Africa and Middle East	-0.685	-1.057	.
	(0.499)	(2.215)	.
Sub-Saharan Africa	-2.417***	-2.938	.
	(0.833)	(2.261)	.
East Asia	4.945***	4.543*	.
	(0.677)	(2.395)	.
South-East Asia	0.695	0.246	.
	(0.750)	(2.261)	.
South Asia	0.455	-0.281	.
	(0.860)	(2.281)	.
Pacific	-3.249***	-4.145	.
	(0.618)	(3.137)	.
Caribbean	-1.281**	-1.514	.
	(0.544)	(3.071)	.
Period 4	1.282**	1.303**	1.274*
	(0.609)	(0.603)	(0.673)
Period 5	1.191*	1.276**	1.483*
	(0.680)	(0.639)	(0.803)
Period 6	2.211***	2.304***	2.443***
	(0.661)	(0.547)	(0.765)
Period 7	1.155**	1.206**	1.470**
	(0.526)	(0.540)	(0.714)
Period 8	3.447***	3.336***	3.476***
	(0.685)	(0.623)	(0.810)
Period 9	3.212***	3.197***	3.801***
	(0.601)	(0.568)	(0.916)
R^2	0.327		0.309
Observations	431	431	431

8.2.2 Sensitivity of the results

Since growth regressions of this kind are known not to be very robust to changes in specification and outliers, I run some regressions excluding observations at the country level and some excluding outliers. This turns out to have large consequences for the statistical significance of the estimates.

Excluding observations at the country level

In the regressions with different numbers of countries in the sample I start out with a sample of 66 countries (group 1), based on excluding 14 countries that are in my dataset but not present in the poverty-efficient allocation of Collier & Dollar (2002). I group the excluded countries into groups of one, two or three based on geography and other characteristics that make them similar, and expand the sample by including increasingly more groups of countries in the regressions. The groups of countries are listed in Table 8.3 below.

Table 8.3: Groups of countries subsequently added to regressions

Group	Country
2	Albania, Croatia, Serbia
3	Oman, Saudi Arabia
4	Cyprus, Malta
5	Iran, Lebanon, Syria
6	Liberia, Sudan
7	Singapore
8	Bahamas

For the CDaid variable the coefficient of the interaction term between aid and policy is positive and significant all the way up to 80 countries. None of the other aid terms are found to be significantly different from zero in any sample of countries.

Doing the same using the second aid variable, ODA/GDP percent, the effect of the aid variables remains significant all the way up to 80 countries, with only minor changes in the coefficients. The coefficient of ODA/GDP percent ranges from 0.255 with 78 countries in the sample to 0.312 with all 80 countries included. The coefficient of the quadratic term remains quite constant at -0.003 and -0,004. Both aid coefficients are statistically significant for all subsamples of countries. One peculiar observation is that in the smaller samples, the interaction term between aid and institutional quality is statistically significant and negative for the ODA/GDP percent variable. This is an unexpected occurrence because of the strong positive relation between growth and institutional quality, both in the literature and in my regressions. The seemingly negative relation could possibly be explained by interpreting the growth equation in a different way. Simplifying the growth equation to include only terms with aid and institutions,

$$G = c + \beta_1 X + \beta_2 I + \beta_3 A + \beta_4 A^2 + \beta_5 AI$$

This could be rewritten as $$G = c + \beta_1 X + (\beta_2 + \beta_5 A)I + \beta_3 A + \beta_4 A^2 \quad (8.2)$$

Equation (8.2) shows that the interaction term can be interpreted in two different ways: the effect of aid on growth is dependent on the quality of institutions – or the effect of institutions on growth is dependent on the level of aid a country receives.

In the latter case the negative interaction between aid and the institutional variable could represent the effect of institutions on growth in the presence of (more) aid, and conclude that aid has a negative impact on the ability of institutions to foster growth. For instance one could imagine that the government of a country, in order to please donors, "improves" institutions in a way that is neither lasting nor deep, and thus would not have the desired effect on growth.

Outliers

To check the robustness of the regression results it is also useful to identify potential outliers for the aid variables and for economic growth that could be driving the results in a certain direction. For this I apply the so-called Hadi method which has its own Stata command.

For ODA/GDP percent the Hadi method identifies five outliers where aid receipts amount to between 38.96 and 85.84 percent of the recipient country's GDP. These are listed in table 8.4 below and include Gambia, Liberia, Mozambique and the Democratic Republic of Congo.

Table 8.4: Hadi outliers for the ODA/GDP percent variable

Country	**Period**	
Gambia	1986-1989	
Liberia	2006-2009	
Mozambique	1990-1993	1994-1997
Congo, Dem. Rep.	2002-2005	

Once excluding these five observations, all of the aid terms in the FE regressions are rendered insignificant. This is a sign that the coefficients are highly sensitive to small changes, and likely to be driven by a few observations. I choose to proceed using the results I got in table 8.1, bearing in mind that they cannot be taken as a solid basis for the further calculations or for policy recommendations. Growth regressions of this kind are known not to be very robust to changes in specification. This result should therefore not come as a surprise, although it is unfortunate.

Table 8.5: Hadi outliers for CDaid

Country	Period					
Bangladesh	1986-1989	1990-1993	1994-1997			
China	1986-1989	1990-1993				
Egypt	1990-1993					
Ethiopia	1990-1993	1994-1997	1998-2001	2002-2005	2006-2009	
India	1982-1985	1986-1989	1990-1993			
Mozambique	1986-1989	1990-1993	1994-1997	1998-2001	2002-2005	2006-2009
Tanzania	1990-1993	1998-2001	2002-2005	2006-2009		
Congo, Dem. Rep.	2002-2005	2006-2009				

This list of CDaid outliers in table 8.5 looks quite different than the one associated with the ODA/GDP percent variable, and includes as much as 26 observations. Several more countries are included here, but two of the outliers for the other aid variable are not among them. Excluding these outliers from the FE4 model does not change the significance of the aid terms, but it does make the interaction term between aid and policy insignificant. It thereby turns out that every positive effect of aid on growth detected in regressions for either aid variable is rendered insignificant when excluding the outliers that receive a large amount of aid relative to their GDP.

There are also some outliers for the GNI per capita growth variable. More precisely, the Hadi method identifies two such observations at the ten percent level. These are Liberia for the period 2002-2005 and Azerbaijan for the period 2006-2009, with growth rates of 35.7 and 19.7 percent respectively.

Table 8.6: Growth outliers

Country	Period	GNI per capita growth
Azerbaijan	2006-2009	19.74
Liberia	2002-2005	35.72

For ODA/GDP percent the coefficients of the aid variables become insignificant once excluding these two observations. The positive coefficient for the CDaid interaction term with policy is robust to the exclusion of the growth outliers, now even significant at the five percent level. The results from the last round of regressions show that the coefficients are much more sensitive to single extreme observations than to changes of the sample at the country level, which is in line with the results of Burnside & Dollar (2000). The tables showing the results of these exercises are posted in Appendix H.

In addition to confirming the sensitivity of the results to small changes my regressions also highlight the significance of the aid variable used, as the two variables give very different results.

9 The poverty-efficient allocation of aid

I now have sufficient data to construct the poverty-efficient allocation of aid for 2010. In this chapter I make an assumption about the elasticity of poverty reduction with respect to income growth. This, together with the regression results and data on per capita income and poverty rates, enables me to calculate the optimal aid receipts of each country in the allocation. Different versions of the poverty-efficient allocation are constructed, showing the impact of using different poverty measures and elasticities. The benchmark allocation is then compared to actual aid disbursements for the same year, with a special emphasis on Norway.

9.1 The elasticity of poverty reduction with respect to income growth

As an estimate of the poverty-elasticity of growth Collier & Dollar (2002) use the median value of the elasticities in Ravallion & Chen (1997). They investigate the relationship between headcount poverty and mean income in a large sample of countries and conclude with an estimate of 2.[29] Lensink & White (2000) choose the same approach. I have used the value of 2 for constructing the poverty-efficient allocation related to the headcount measures, and also experimented with a lower value in order to account for recent developments in estimates from the literature (Lenagala & Ram, 2010). As long as the elasticity is the same for every country, this exercise results in the exact same allocation. This makes sense, as the relative relationship among countries is not affected by the change of elasticity.

In reality these elasticities will vary significantly across countries, especially depending on their income distributions. Country-specific elasticities are however not available in large samples. Collier & Dollar (2002, p. 1493) estimate some country-specific elasticities related to the poverty gap, *pg*, and squared poverty gap, *spg*. These are calculated on the basis of the relationship between the different poverty measures. The elasticity associated with the poverty gap is given by:

$$\alpha_{pg} = \frac{pg - h}{pg},$$

where h is the headcount ratio. For an elasticity that can be applied with the squared poverty gap they use the following equation:

[29] This is the absolute value of the elasticity. In reality this elasticity will be negative, since an increase in mean income reduces the poverty rate.

$$\alpha_{spg} = \frac{spg - pg}{spg}$$

By applying these elasticities and their corresponding poverty measures, their significance for the outcome of the poverty-efficient allocation can be detected. Collier & Dollar (2002) find small differences between the allocations calculated with individual elasticities and the one calculated using the constant elasticity of 2 for every country. The poverty headcount ratio and poverty gaps that will be used for calculating the allocations are posted in Table 9.1 below together with their accompanying elasticity measures.[30]

Table 9.1: Headcount ratio, poverty gap and elasticities for $2 and $1.25 poverty lines, latest available poverty data

Country	Poverty rates, $2		Elasticities, $2		Poverty rates, $1.25		Elasticities, $1.25	
	hc %	pov.gap%	hc	pov.gap	hc %	pov.gap%	hc	pov.gap
Congo, Dem. Rep.	94.46	65.75	2	0.44	86.15	50.47	2	0.71
Burundi	93.16	55.37	2	0.68	80.58	35.56	2	1.27
Liberia	94.65	58.98	2	0.60	83.06	40.14	2	1.07
Malawi	87.47	46.9	2	0.87	67.34	27.29	2	1.47
Niger	75.23	30.83	2	1.44	43.62	12.42	2	2.51
Sierra Leone	69.33	31.51	2	1.20	44.74	15.38	2	1.91
Madagascar	89.35	51.5	2	0.73	71.62	33.07	2	1.17
Mozambique	81.77	42.86	2	0.91	59.58	25.13	2	1.37
Central African Republic	80.09	46.78	2	0.71	62.83	31.26	2	1.01
Tanzania	87.33	46.75	2	0.87	66.76	27.34	2	1.44
Rwanda	84.75	48.3	2	0.75	67.66	30.62	2	1.21
Ethiopia	53.61	15.17	2	2.53	15.98	2.88	2	4.55
Guinea	68.66	30.32	2	1.26	42.29	14.44	2	1.93
Guinea-Bissau	77.28	34.27	2	1.26	47.97	16.1	2	1.98
Uganda	70.57	31.67	2	1.23	44.41	15.3	2	1.90
Burkina Faso	73.06	32.04	2	1.28	45.06	14.83	2	2.04
Togo	69.17	27.82	2	1.49	38.52	11.3	2	2.41
Mali	77.84	35.85	2	1.17	50.96	17.58	2	1.90
Nepal	64.96	24.62	2	1.64	33.9	8.95	2	2.79
Haiti	78.88	48.39	2	0.63	63.58	33.94	2	0.87
Bangladesh	78.43	32.22	2	1.43	46.62	12.53	2	2.72
Benin	73.34	31.82	2	1.30	44.79	14.48	2	2.09
Chad	70.99	32.15	2	1.21	44.86	15.85	2	1.83
Timor-Leste	70.61	25.37	2	1.78	34.7	7.9	2	3.39

[30] I also made allocations based on the squared poverty gap and its accompanying elasticity. Due to spatial considerations I do not post these results here. It could be noted that the allocation came closer to the allocation using the headcount poverty measure than the one using the poverty gap.

Comoros	66.44	35.39	2	0.88	47.72	21.83	2	1.19
Gambia, The	54.26	23.3	2	1.33	32.12	10.95	2	1.93
Kenya	64.55	29.77	2	1.17	40.58	15.44	2	1.63
Nigeria	84.03	48.84	2	0.72	66.46	32.17	2	1.07
Cambodia	53.27	17.41	2	2.06	22.75	4.87	2	3.67
Zambia	80.97	49.88	2	0.62	66.27	35.04	2	0.89
Pakistan	60.19	17.94	2	2.36	21.04	3.49	2	5.03
Lao PDR	66	24.83	2	1.66	33.88	8.95	2	2.79
Lesotho	55.98	28.66	2	0.95	37.64	17.43	2	1.16
India	72.42	27.07	2	1.68	37.37	9.02	2	3.14
Senegal	50.23	18.86	2	1.66	25.19	7.3	2	2.45
Papua New Guinea	63.81	30.27	2	1.11	42.47	15.95	2	1.66
Mauritania	47.69	17.66	2	1.70	23.43	6.79	2	2.45
Cote d'Ivoire	46.34	17.79	2	1.60	23.75	7.5	2	2.17
Tajikistan	32.2	9.55	2	2.37	10.73	2.65	2	3.05
Sao Tome and Principe	43.74	14.98	2	1.92	19.88	4.66	2	3.27
Yemen, Rep.	46.02	14.5	2	2.17	17.13	4.08	2	3.20
Vietnam	43.36	13.53	2	2.20	16.85	3.75	2	3.49
Ghana	46.66	18.52	2	1.52	24.64	8.2	2	2.00
Sudan	44.99	15.77	2	1.85	20.37	5.66	2	2.60
Cameroon	30.01	8.07	2	2.72	9.31	1.14	2	7.17
Congo, Rep.	73.82	38.27	2	0.93	53.37	22.33	2	1.39
Kyrgyz Republic	20.74	5.92	2	2.50	6.39	1.51	2	3.23
Nicaragua	25.83	7.06	2	2.66	8.11	1.37	2	4.92
Philippines	42.21	14.35	2	1.94	19.4	4.14	2	3.69
Swaziland	66.59	34.08	2	0.95	47.1	19.83	2	1.38
Indonesia	54.4	17.67	2	2.08	22.64	4.73	2	3.79
Micronesia, Fed. Sts.	45.8	25.25	2	0.81	32.05	16.84	2	0.90
Angola	71.64	43.62	2	0.64	55.9	31.06	2	0.80
Honduras	32.61	17.47	2	0.87	21.36	11.75	2	0.82
Bhutan	28.38	7.96	2	2.57	9.34	1.59	2	4.87
Bolivia	24.89	13.05	2	0.91	15.61	8.64	2	0.81
Georgia	32.21	11.73	2	1.75	15.27	4.57	2	2.34
Sri Lanka	26.43	6.38	2	3.14	5.55	0.72	2	6.71
Guatemala	25.86	10.22	2	1.53	13.17	4.58	2	1.88
Namibia	42.9	15.99	2	1.68	23.05	5.26	2	3.38
Cape Verde	26.3	7.88	2	2.34	10.55	2.21	2	3.77
Iraq	18.69	3.68	2	4.08	2.15	0.32	2	5.72
China	29.79	10.06	2	1.96	13.06	3.24	2	3.03
Belize	23.98	10.68	2	1.25	13.3	5.95	2	1.24
Egypt, Arab Rep.	15.43	2.84	2	4.43	1.69	0.38	2	3.45
Fiji	20.97	5.32	2	2.94	5.01	0.96	2	4.22
Guyana	16.64	6.11	2	1.72	7.94	2.45	2	2.24
Paraguay	13.56	4.8	2	1.83	5.59	2.12	2	1.64
St. Lucia	32.53	11.71	2	1.78	15.79	5.16	2	2.06
Morocco	12.18	2.68	2	3.54	2.06	0.45	2	3.58

South Africa	31.12	10.04	2	2.10	13.56	2.24	2	5.05
Moldova	6.91	1.44	2	3.80	1.05	0.26	2	3.04
Armenia	12.43	2.27	2	4.48	1.28	0.25	2	4.12
El Salvador	14.03	4.78	2	1.94	5.44	1.85	2	1.94
Botswana	26.22	8.99	2	1.92	11.92	2.81	2	3.24
Colombia	20.89	9.64	2	1.17	11.32	5.77	2	0.96
Ecuador	13.02	5.48	2	1.38	6.45	3.06	2	1.11
Algeria	13.91	3.25	2	3.28	2.73	0.52	2	4.25
Peru	14.81	5	2	1.96	6.2	1.76	2	2.52
Syrian Arab Republic	6.75	0.96	2	6.03	0.26	0.04	2	5.50
Suriname	19.32	7.72	2	1.50	10.2	3.47	2	1.94
Dominican Republic	11.08	3.07	2	2.61	3.3	0.82	2	3.02
Panama	15.79	6.01	2	1.63	7.45	2.69	2	1.77
Gabon	13.53	3.09	2	3.38	2.49	0.45	2	4.53
Tunisia	5.56	1.15	2	3.83	0.83	0.18	2	3.61
Albania	4.25	0.85	2	4.00	0.62	0.19	2	2.26
Thailand	4.98	0.81	2	5.15	0.37	0.04	2	8.25
Brazil	11.32	5.3	2	1.14	6.01	3.43	2	0.75
Maldives	6.74	1.06	2	5.36	0.22	0.02	2	10.00
Macedonia, FYR	4.26	0.7	2	5.09	0.29	0.04	2	6.25
Jamaica	4.41	0.63	2	6.00	0.13	0.01	2	12.00
Venezuela, RB	9.32	4.72	2	0.97	5.14	3.27	2	0.57
Costa Rica	4.99	2.3	2	1.17	2.42	1.47	2	0.65
Mexico	5.19	1.29	2	3.02	1.15	0.34	2	2.38
Jordan	2.11	0.25	2	7.44	0.07	0.01	2	6.00
Azerbaijan	2.81	0.57	2	3.93	0.43	0.14	2	2.07
Turkey	4.16	0.74	2	4.62	-	-	2	-
Argentina	3.66	1.65	2	1.22	1.94	1.02	2	0.90
Turkmenistan	1.49	0.22	2	5.77	0.11	0.02	2	4.50
Malaysia	1.92	0.11	2	16.45	-	-	2	-
Seychelles	2.5	0.46	2	4.43	0.32	0.09	2	2.56
Chile	2.68	1.07	2	1.50	1.24	0.6	2	1.07
Uruguay	1.91	0.37	2	4.16	0.26	0.05	2	4.20
Serbia	0.65	0.16	2	3.06	0.14	0.06	2	1.33
Kazakhstan	0.89	0.16	2	4.56	0.1	0.03	2	2.33
Trinidad and Tobago	1.46	0.4	2	2.65	0.38	0.15	2	1.53
Montenegro	0.3	0.12	2	1.50	0.12	0.08	2	0.50
Ukraine	0.13	0.04	2	2.25	0.04	0.02	2	1.00
Bosnia and Herzegovina	0.15	0.04	2	2.75	0.04	0.02	2	1.00
Belarus	0.19	0.12	2	0.58	0.1	0.1	2	0.00
Croatia	0.09	0.09	2	0.00	0.06	0.06	2	0.00

9.2 The marginal effect of aid on economic growth

The purpose of running the regressions is to find the marginal effect of aid on growth, which is needed for the next step of the analysis. As already mentioned, my regressions give different results, especially depending on the aid variable used. The most important thing for the construction of the poverty-efficient allocation is that A^i is present in the marginal effect of aid on growth. This means that the coefficient of the quadratic term in the regression must be statistically significant. If this is not the case it is not possible to solve for each country's aid receipts. This implies using the results connected to the ODA/GDP percent variable. This also implies not having a significant coefficient for the interaction term between aid and policy, which is one of the main results in Collier & Dollar (2002).

The main results of the growth regression I will be using for my further calculations (FE4) are the following:

i) I find a positive, significant effect of aid on economic growth.

ii) This effect is subject to diminishing returns, as the coefficient of the quadratic aid term is negative.

iii) The coefficient of the interaction term between policy and aid is not statistically significant. This implies that the effect of aid on economic growth is independent of policy.

It is perfectly possible to construct a poverty-efficient aid allocation without the policy term present in the allocation rule. The quadratic aid term is the one of crucial importance here. Lensink & White (2000) do so, and their allocation differs from Collier & Dollar's in two important ways:

i) It is more sharply targeted to poor countries, since policy is not included in the allocation rule. Poverty is thereby assigned more weight in determining aid receipts.

ii) More aid is allocated to each country that is fortunate to receive some, and this implies fewer eligible recipient countries. This is due to a considerably lower coefficient of the quadratic term, which means that the effect of diminishing returns kicks in at a later point.

The allocations are quite similar however; many of the same countries receive large amounts of aid in both allocations, and the rank correlation[31] between them is high (Lensink & White, 2000, p. 409).

From equation (4.5), when excluding the policy term, we have the following expression for the marginal effect of aid on growth in per capita GNI:

$$G_a = \beta_3 + 2\beta_4 A^i$$

Using the estimates from FE4 this equals:

$$G_a = 0.312 - 0.008A^i$$

Comparing this marginal effect to those of the two other studies, the marginal effect of Collier & Dollar (2002, p. 1497) is:

$$G_a = 0.31\mathrm{P} - 0.54 - 0.02A^i$$

Lensink & White (2000, p. 406) use the following estimate:

$$G_a = 0.1736 - 0.0035A^i$$

As seen from these equations my regression results are much closer to those of Lensink & White (2000) than the ones by Collier & Dollar (2002), especially with respect to the quadratic term. Because of the similarity of the coefficients I would expect my allocation to be somewhat in line with theirs. It should also be kept in mind that poverty rates and GDP per capita levels may have changed considerably during the past ten to fifteen years. Therefore it would not be strange if the allocations were somewhat different. The main purpose of making the allocation is however not to compare it to the poverty-efficient allocations of others. It is more interesting to compare it to the current aid allocation by donors, and in particular to the allocation of Norwegian aid across recipient countries.

[31] The Spearman rank correlation is a correlation coefficient that is calculated based on the ranking of observations, not on the basis of their absolute values.

9.3 The allocation rule

Since my aid variable in the regressions is ODA as percentage of GDP, the budget constraint of the maximization problem needs to be modified in order to give the dollar amount of aid. The maximization problem from chapter 4 thus becomes:

Max poverty reduction $\sum_i G^i \alpha^i h^i N^i$

Subject to $\sum_i \frac{A^i y^i N^i}{100} = \overline{A}$, $A^i \geq 0$

The first order condition is almost the same as before, but with one important difference, namely that the last part is divided by 100:

$$G_a^i \alpha^i h^i N^i - \frac{\lambda y^i N^i}{100} = 0$$

Inserting for the marginal effect of aid on growth gives the following allocation rule[32] for poverty-efficient aid:

$$A^i = -\frac{\beta_3}{2\beta_4} + \frac{\lambda y^i}{2\beta_4 100 \alpha^i h^i}$$

This is a less complex allocation rule than the one derived in the modeling chapter. Here, poverty-efficient aid receipts are determined by only two factors; per capita income, y^i, and poverty level, h^i. The coefficients from the regression, the shadow value of aid, λ, and the elasticity of poverty reduction with respect to income growth, α^i, are the same for every country. When inserting the coefficients from the FE4 growth regression into the allocation rule for poverty-efficient aid, I end up with the following expression:

$$A^i = 39 - 1.25\left(\frac{y^i}{h^i}\right)\frac{\lambda}{\alpha} \tag{9.1}$$

[32] The derivation of this expression is posted in Appendix B.

This is my allocation rule for poverty-efficient aid. Intuitively it makes sense that countries with a low per capita income and high rates of poverty should be receiving more aid and the other way around, as is apparent from the equation. The constant term gives the maximum value of A^i, which is the percentage of its own GDP that a country could receive in aid. This point is determined by setting the derivative of the growth equation with respect to aid equal to zero and solving for A^i. Looking at the second order derivative, which is $2\beta_4 < 0$, I know that this point gives the maximum of the function. A larger A^i than this will imply that aid starts to have a negative impact on the growth rate.

9.4 Constructing the allocation

From here I can insert data for the poverty elasticity of growth, the poverty rate and per capita income. This will however not provide me with the solution directly because the unknown shadow value of aid, λ, is still in the expression. I thus end up with a set of equations, one for each country, which should be calculated simultaneously using the budget constraint:

$$\sum_i \frac{A^i y^i N^i}{100} = \overline{A}$$

Summing all expressions for *Ai* and inserting them into the budget constraint together with figures for the total aid budget, I can now calculate the value of λ. This λ will not be the correct one, because the non-negativity constraint imposed on each *Ai* also needs to be taken into account. This is implemented in an Excel spreadsheet, inserting λ back into the A^i of each country. Some countries, notably the ones having the largest ratio of $\frac{y^i}{h^i}$, will now be allocated a negative amount of aid. The optimal A^i for these countries is thereby 0. By removing the countries with a negative A^i from the budget constraint and calculating λ again I can continue allocating the same size aid budget across a smaller number of countries. Repeating this exercise, the allocation eventually converges, and in the end all the remaining countries receive a positive amount of aid. This is the poverty-efficient allocation of aid.

9.5 The poverty-efficient allocation of aid

In the following I go with the approach of Collier & Dollar (2002) and Lensink & White (2000) and use the $2 poverty line as the benchmark against which the other allocations are assessed. Calculating the poverty-efficient allocation using the $2 headcount poverty measure, 32 out of 111 countries in the dataset are found to be eligible for aid receipts. The rest of the countries receive 0 in the optimal allocation. This is posted in Table 9.2 below. In order to make the table more readable I post only the first part of it here, including the first few countries that are allocated 0. The ordering of countries is identical to the ordering in Table 9.1 and Table 9.4. The complete table for the poverty-efficient allocation is posted in Appendix I.

Table 9.2: Poverty-efficient allocation for different poverty measures in 2010

Country	Benchmark allocation, $2 hc		Poverty-efficient allocation, % of recipient GDP		
	% of GDP	$ million	$2 pov.gap	$1.25 hc	$1.25 pov.gap
Congo, Dem. Rep.	34.41	4511.03	30.61	35.70	34.30
Burundi	33.34	675.72	31.25	34.71	34.46
Liberia	33.30	328.96	30.60	34.74	34.13
Malawi	30.54	1543.57	28.87	31.80	31.85
Niger	28.89	1562.86	29.48	27.57	29.56
Sierra Leone	28.76	549.22	28.57	28.60	29.64
Madagascar	28.72	2504.63	25.52	30.59	29.78
Mozambique	28.50	2624.31	26.74	29.55	29.35
Central African Republic	26.72	530.25	22.59	28.74	26.94
Tanzania	25.85	6102.73	23.27	27.72	27.72
Rwanda	25.37	1427.05	21.40	27.81	26.93
Ethiopia	24.44	7254.16	27.72	6.98	15.93
Guinea	23.92	1133.06	24.00	22.96	24.61
Guinea-Bissau	23.44	195.79	23.46	22.56	24.39
Uganda	23.09	3971.72	22.97	22.43	24.07
Burkina Faso	23.00	2029.72	23.17	21.99	24.03
Togo	22.38	710.88	23.56	19.44	22.65
Mali	21.82	2055.86	21.30	21.80	23.49
Nepal	21.05	3370.83	22.94	16.45	20.91
Haiti	20.64	1369.30	12.61	24.07	20.09
Bangladesh	20.23	20300.09	21.30	18.30	22.28
Benin	16.96	1112.08	17.37	15.34	18.35
Chad	15.62	1334.33	15.26	14.75	16.86
Timor-Leste	15.34	134.20	18.48	7.43	14.87
Comoros	14.82	80.19	10.25	16.93	14.98
Gambia, The	14.57	153.03	15.21	11.95	14.76

Kenya	12.14	3908.89	11.30	10.99	12.30
Nigeria	6.74	13272.04	0	12.27	8.40
Cambodia	6.44	723.57	12.12	0	1.45
Zambia	5.25	850.02	0	11.97	5.13
Pakistan	2.07	3664.81	9.77	0	0
Lao PDR	0.72	51.69	4.91	0	0
Lesotho	0	0	0	0.87	0
India	0	0	0	0	0
Senegal	0	0	0	0	0

The largest recipient in terms of the size of A^i is the Democratic Republic of Congo, with 34.4 percent of its own GDP in aid receipts, closely followed by two other countries with extremely high poverty rates; Burundi and Liberia. The last country to receive aid in the benchmark allocation is Laos, with 0.72 percent of its GDP in aid. In the tables the countries are ranked by the ratio of y^i to h^i, from smallest to largest. This means that the countries on top of the list are expected to be allocated the largest A^i, as can be seen from the allocation rule in equation (9.1). India, which would by far be the largest recipient in Collier & Dollar's allocation, and whose aid receipts they constrain to its actual level, is one of the first countries to receive 0 in my benchmark allocation. This may be partly explained by the country's steady economic growth and poverty reduction the past decade, but could also be due to differences in the estimates from the growth regression.[33] In absolute dollar terms, a few populous countries are the largest recipients in the benchmark allocation. These are Bangladesh and Nigeria, which combined receive more than one third of the total aid budget of $90.4 billion. The dollar amounts are shown for the $2 headcount allocation in table 9.2 together with aid as percentage of GDP. The share of the total aid budget pertaining to each country in the benchmark allocation is shown in table 9.4, where it is compared to the actual allocations of donors. I get back to this comparison in section 9.7

9.6 Sensitivity analysis

I now take a look at what happens when using different poverty measures to calculate the poverty-efficient allocation of aid. I am interested in whether applying the $2 poverty gap, the

[33] An extreme allocation using the estimates from the growth regression minus two standard deviations for the aid term and plus two standard deviations for the quadratic term gave the same kind of result, with India receiving more than half the total aid budget. The results are not posted here.

$1.25 headcount ratio or the $1.25 poverty gap changes the allocation in any significant way. The benchmark allocation and the three allocations for different poverty measures are posted in table 9.2. These modifications do not change the overall picture, but they do have large implications for allocations to a few of the countries.

9.6.1 The consequence of country-specific elasticities

Most of the countries that receive large shares of aid to GDP in the benchmark allocation are also allocated a large share using the $2 poverty gap as poverty measure. There are however a few notable exceptions. Nigeria, one of the largest recipients of aid in absolute terms using the $2 headcount measure receives 0 in the optimal allocation using the corresponding poverty gap. The same is the case for Zambia. Pakistan, which receives a rather modest 2.07 percent of GDP using the $2 poverty headcount measure, receives 9.77 percent of GDP once switching to the poverty gap. This makes it one of the largest recipients in absolute terms. Laos and Cambodia are also allocated considerably larger amounts of aid using this poverty measure. To find the reason for this, we can look at the sizes of the poverty gaps and the elasticities of the countries, and there is our answer.

Table 9.1 shows that Nigeria and Zambia both have very large poverty gaps and low elasticities compared to the three Asian countries mentioned. These two properties make it more costly to reduce poverty in Nigeria and Zambia than in Pakistan, Laos or Cambodia. In Pakistan, a one percent increase in the rate of economic growth will reduce the poverty rate three to four times more than in the two African countries. The poor in Pakistan are also much closer to the poverty line, which makes it easier to lift them above it. One should think that having a large poverty gap, as is the case for Nigeria and Zambia, would make them eligible for aid receipts. However, the same mechanism that makes the poverty gap so large, inequality, also has the effect of lowering the elasticity of poverty reduction with respect to growth. Recalling that it is the product of these two sizes that enters the denominator of the allocation rule, the low elasticity cancels out the effect of a large poverty gap. Other than these few exceptions, the allocation is still very much like the benchmark, and the rank correlation between the two allocations is as high as 0.97.

Table 9.3: Spearman correlation matrix of different poverty-efficient allocations of aid

	Benchmark, $2 hc	$2 pov.gap	$1.25 hc	$1.25 pov.gap
Benchmark, $2 hc	1			
$2 pov.gap	0.97	1		
$1.25 hc	0.95	0.91	1	
$1.25 pov.gap	0.98	0.95	0.97	1
Actual aid	0.63	0.63	0.63	0.62

9.6.2 The significance of the poverty line used

Of special interest here is also the allocation associated with the $1.25 headcount measure. The first of the United Nations' Millennium Development Goal is to halve the proportion of people in the world living below this line by 2015.[34] Table 9.1 shows that applying this measure assigns even more weight to the poorest countries, which receive larger shares of aid to GDP than in the benchmark case. One surprising result in this allocation is that Ethiopia is allocated only 6.98 percent of its GDP in aid. This is a quite remarkable change from the $2 headcount allocation where it receives 24.4. This is a result of a large difference between the $1.25 and $2 poverty measures for Ethiopia. Whereas more than fifty percent of the population lives below the $2 headcount poverty line, the corresponding number for the $1.25 line is 15.98.[35]

The aid receipts of Nepal and Timor-Leste are also considerably reduced in this allocation due to much lower poverty rates for this measure. The most dramatic change occurs for the largest recipients in the $2 poverty gap allocation. Pakistan, Cambodia and Laos all are allocated 0 using the $1.25 headcount measure. Lesotho is a new country receiving aid in the optimal allocation when this poverty line is applied, as its poverty rate for the $1.25 line is considerably larger compared to the surrounding countries than its $2 rate. Zambia and Nigeria get considerably larger A^i in this allocation than in the benchmark allocation, and this makes Nigeria the largest recipient in terms of the dollar amount of aid with Bangladesh following right behind. Their combined share of the aid budget is even larger in this allocation than in the benchmark allocation.

[34] http://www.un.org/millenniumgoals/poverty.shtml

[35] This number is suspiciously low. I have cross-checked the estimates with the PovcalNet database, and these are the numbers reported there. The latest estimates reported in WDI are 38.96 for the $1.25 headcount and 77.63 for $2 headcount. The discrepancy between the two could be due to a large update of poverty rates in PovcalNet in February 2012.

For the $1.25 poverty gap, the allocation is very similar to the benchmark case, with the exceptions of much lower disbursements to Ethiopia and Cambodia. Pakistan and Laos are found not to be eligible for aid receipts when using this poverty measure due to their very low poverty gaps for the $1.25 poverty line. The two allocations that differ the most are the $2 poverty gap and the $1.25 headcount allocations, with a rank correlation of 0.91. This correlation is still very high.

For the overall picture the poverty measure used for constructing the poverty-efficient allocation does not have a large impact on the ranking of countries or the amounts of aid they receive. However, it does make an enormous difference to a few countries. Some actually go from being the largest recipients in dollar terms to receiving 0, depending on which poverty line and measure is applied when constructing the allocation.

9.7 Comparing the poverty-efficient allocation to actual allocation of ODA

This whole exercise enables me to finally compare the poverty-efficient allocation to the actual allocation of aid across countries. For total aid from all donors, A^i can be reasonably compared to the poverty-efficient allocation. The first two columns of Table 9.4 show the benchmark allocation for the $2 headcount and actual allocation as percentage of recipient country GDP. For the rest of the donors; DAC, Norway and multilateral agencies, it makes more sense to compare the share of their total aid budgets pertaining to each recipient country with the share each country would be allocated in the poverty-efficient allocation. These figures are also posted in Table 9.4. One note to the table is that 0 means 0, whereas 0.0 indicates that the country does receive aid, but a share smaller than 0.05 percent of the total budget of the donor.

The allocations of donors will be compared to the poverty-efficient benchmark allocation by calculating the Spearman rank correlation between them. I will briefly comment on which countries are over- and underfunded compared to the optimal allocation. Thereafter the Norwegian allocation will be devoted special attention. I take a closer look at the largest recipient countries and the most distinct differences between the benchmark and the Norwegian allocation. As anticipated from the beginning there are some significant discrepancies.

Table 9.4: Poverty-efficient allocation compared to actual allocations in 2010

Country	Percent of recipient GDP		Allocation as percentage of total aid budget				
	Benchmark	All donors	Benchmark	All donors	DAC	Norway	Multilateral
Congo, Dem. Rep.	34.41	27.01	5.0	3.9	4.1	1.5	3.9
Burundi	33.34	31.08	0.8	0.7	0.5	1.0	1.2
Liberia	33.30	143.66	0.4	1.6	1.2	1.2	2.4
Malawi	30.54	20.24	1.7	1.1	0.9	3.4	1.7
Niger	28.89	13.76	1.7	0.8	0.6	0.2	1.2
Sierra Leone	28.76	24.45	0.6	0.5	0.3	0.2	0.9
Madagascar	28.72	5.39	2.8	0.5	0.4	0.7	0.8
Mozambique	28.50	21.19	2.9	2.2	2.3	3.9	2.0
Central African Republic	26.72	13.15	0.6	0.3	0.2	0.0	0.5
Tanzania	25.85	12.53	6.8	3.3	2.8	6.5	4.4
Rwanda	25.37	18.35	1.6	1.1	0.9	0.2	1.6
Ethiopia	24.44	11.87	8.1	3.9	3.3	1.7	5.3
Guinea	23.92	4.60	1.3	0.2	0.2	0	0.4
Guinea-Bissau	23.44	16.68	0.2	0.2	0.1	0	0.3
Uganda	23.09	10.02	4.4	1.9	1.8	3.7	2.3
Burkina Faso	23.00	12.00	2.3	1.2	0.8	0.0	2.0
Togo	22.38	13.19	0.8	0.5	0.4	0.0	0.6
Mali	21.82	11.55	2.3	1.2	1.2	0.8	1.4
Nepal	21.05	5.11	3.7	0.9	0.8	2.5	1.2
Haiti	20.64	46.19	1.5	3.4	4.0	3.5	2.4
Bangladesh	20.23	1.41	22.5	1.6	1.5	0.9	1.8
Benin	16.96	10.51	1.2	0.8	0.6	0.0	1.2
Chad	15.62	5.69	1.5	0.5	0.5	0.1	0.7
Timor-Leste	15.34	33.31	0.1	0.3	0.4	0.4	0.1
Comoros	14.82	12.42	0.1	0.1	0.0	0	0.1
Gambia, The	14.57	11.45	0.2	0.1	0.1	0.0	0.3
Kenya	12.14	5.06	4.3	1.8	2.0	0.7	1.6
Nigeria	6.74	1.05	14.7	2.3	1.4	0.7	4.1
Cambodia	6.44	6.53	0.8	0.8	0.9	0.2	0.7
Zambia	5.25	5.65	0.9	1.0	1.0	2.8	1.1
Pakistan	2.07	1.70	4.1	3.3	4.1	4.4	1.3
Lao PDR	0.72	5.76	0.1	0.5	0.5	0.1	0.4
Lesotho	0	11.76	0	0.3	0.2	0.1	0.5
India	0	0.17	0	3.1	3.8	1.3	2.0
Senegal	0	7.22	0	1.0	0.9	0.0	1.3
Papua New Guinea	0	5.39	0	0.6	0.7	0.1	0.2
Mauritania	0	10.36	0	0.4	0.2	0.0	0.8
Cote d'Ivoire	0	3.69	0	0.9	0.7	0.1	1.4
Tajikistan	0	7.61	0	0.5	0.3	0.2	0.9
Sao Tome and Principe	0	24.52	0	0.1	0.1	0	0.1
Yemen, Rep.	0	2.14	0	0.7	0.5	0.0	1.0
Vietnam	0	2.76	0	3.3	3.1	1.1	3.7
Ghana	0	5.26	0	1.9	1.5	0.2	2.7

Sudan	0	3.96	0	2.3	2.6	6.1	1.6
Cameroon	0	2.40	0	0.6	0.5	0.0	0.9
Congo, Rep.	0	10.93	0	1.5	2.1	0.0	0.3
Kyrgyz Republic	0	7.77	0	0.4	0.3	0.3	0.4
Nicaragua	0	9.42	0	0.7	0.7	1.0	0.8
Philippines	0	0.27	0	0.6	0.8	0.9	0.3
Swaziland	0	2.47	0	0.1	0.1	0.1	0.2
Indonesia	0	0.20	0	1.5	1.7	2.2	1.4
Micronesia, Fed. Sts.	0	42.09	0	0.1	0.2	0	0.0
Angola	0	0.29	0	0.3	0.3	0.7	0.3
Honduras	0	3.74	0	0.6	0.5	0.1	1.0
Bhutan	0	8.64	0	0.1	0.1	0.1	0.2
Bolivia	0	3.43	0	0.7	0.8	0.3	0.7
Georgia	0	5.37	0	0.7	0.6	0.5	0.8
Sri Lanka	0	1.17	0	0.6	0.7	1.5	0.6
Guatemala	0	0.95	0	0.4	0.6	0.5	0.1
Namibia	0	2.30	0	0.3	0.4	-0.2	0.1
Cape Verde	0	19.76	0	0.4	0.4	0	0.3
Iraq	0	2.70	0	2.4	3.4	0.4	0.5
China	0	0.01	0	0.7	1.2	1.2	-0.4
Belize	0	1.77	0	0.0	0.0	0	0.0
Egypt, Arab Rep.	0	0.27	0	0.7	0.6	0.0	0.5
Fiji	0	2.41	0	0.1	0.1	0.0	0.0
Guyana	0	6.78	0	0.2	0.1	1.5	0.3
Paraguay	0	0.57	0	0.1	0.1	0.1	0.1
St. Lucia	0	3.43	0	0.0	0.0	0	0.1
Morocco	0	1.11	0	1.1	1.0	0.0	1.3
South Africa	0	0.28	0	1.1	1.4	1.3	0.7
Moldova	0	8.05	0	0.5	0.2	0.2	1.2
Armenia	0	3.62	0	0.4	0.3	0.2	0.4
El Salvador	0	1.32	0	0.3	0.4	0.1	0.2
Botswana	0	1.05	0	0.2	0.2	0.0	0.2
Colombia	0	0.31	0	1.0	1.3	0.7	0.4
Ecuador	0	0.26	0	0.2	0.2	0.2	0.0
Algeria	0	0.12	0	0.2	0.2	0.1	0.2
Peru	0	-0.17	0	-0.3	-0.5	0.2	0.2
Syrian Arab Republic	0	0.23	0	0.1	0.1	0.1	0.4
Suriname	0	2.38	0	0.1	0.1	0	0.1
Dominican Republic	0	0.34	0	0.2	0.2	0.0	0.3
Panama	0	0.48	0	0.1	0.2	0.1	0.0
Gabon	0	0.79	0	0.1	0.1	0	0.1
Tunisia	0	1.24	0	0.6	0.6	0	0.7
Albania	0	2.84	0	0.4	0.4	0.1	0.3
Thailand	0	0.00	0	0.0	-0.2	0.0	0.3
Brazil	0	0.03	0	0.7	1.0	12.9	0.2
Maldives	0	5.34	0	0.1	0.1	0.0	0.2

Macedonia, FYR	0	1.94	0	0.2	0.2	0.4	0.2
Jamaica	0	1.02	0	0.2	0.0	0.0	0.5
Venezuela, RB	0	0.01	0	0.1	0.1	0.0	0.0
Costa Rica	0	0.26	0	0.1	0.2	0.0	0.0
Mexico	0	0.05	0	0.5	0.7	0.0	0.2
Jordan	0	3.61	0	1.1	0.7	0.0	1.5
Azerbaijan	0	0.29	0	0.2	0.1	0.2	0.2
Turkey	0	0.14	0	1.2	1.2	0.0	1.0
Argentina	0	0.03	0	0.1	0.2	0.0	0.0
Turkmenistan	0	0.22	0	0.0	0.0	0.0	0.0
Malaysia	0	0.00	0	0.0	0.0	0.0	0.1
Seychelles	0	5.82	0	0.1	0.0	0	0.0
Chile	0	0.09	0	0.2	0.3	0.7	0.1
Uruguay	0	0.12	0	0.1	0.1	0.0	0.0
Serbia	0	1.69	0	0.7	0.5	1.1	1.1
Kazakhstan	0	0.15	0	0.2	0.2	0.2	0.2
Trinidad and Tobago	0	0.02	0	0.0	0.0	0	0.0
Montenegro	0	1.88	0	0.1	0.1	0.2	0.1
Ukraine	0	0.46	0	0.7	0.7	0.2	0.6
Bosnia and Herzegovina	0	2.95	0	0.5	0.4	1.0	0.7
Belarus	0	0.25	0	0.2	0.1	0.1	0.1
Croatia	0	0.24	0	0.2	0.4	0	0

9.7.1 Number of recipient countries and their shares of the aid budget

One of the main features of this model is that it will concentrate aid disbursements to a small number of countries. As already mentioned only 32 countries receive aid in the benchmark allocation whereas the number of recipients of aid from all donors presented here is well over one hundred. This in itself is likely to result in inefficiencies in the allocations. Many countries that are allocated 0 in the optimal allocation in reality receive large amounts of aid. The top recipients in the optimal allocation will be seriously under-funded because policies would not allow one third of the total aid budget to be allocated to two countries. Within the framework of this model the poverty-efficiency of aid could be increased by reallocating disbursements to countries like Bangladesh, Nigeria, Ethiopia, Tanzania or Uganda, which receive less than their poverty-efficient amount. The main challenge is that this money would then have to be taken from the shares of other countries. In practice this is a very difficult task. Countries which receive more than their proportionate share of the budget, or get large amounts of aid but should receive 0 in the poverty-efficient allocation include India, Vietnam, Sudan, Iraq, China and South Africa. Within the framework of this model the total aid budget is given. In reality this budget is increasing. This could allow the allocation rule to be implemented to some degree by letting the increase in the aid budget be allocated to the countries where its poverty-reducing potential is largest.

The largest share allocated to a single country by multilateral donors or DAC is about 5 percent of the total budget. Ethiopia, Tanzania, Nigeria, DR Congo and Vietnam are among the countries receiving the largest shares of the multilateral aid budget, and the only ones receiving more than 3 percent of the total aid budget. This is not such a surprise, knowing that this budget is spread to well over one hundred countries. DR Congo, Pakistan, India and Iraq are the largest recipients in terms of the share of the total DAC budget, in addition to Ethiopia and Vietnam.

The results of the Spearman rank correlation between the different allocations and the poverty-efficient one is given in Table 9.5. Norway's correlation with the benchmark allocation, 0.42, is by far the smallest. All the other donors' allocations are correlated 0.63 or higher to the poverty-efficient allocation. This suggests that Norway's allocation of aid in 2010 is less in line with the poverty-efficient allocation than the allocation of the DAC donors or multilateral agencies. Multilateral aid can reasonably be expected to have higher poverty-efficiency than that of bilateral donors because fewer distortions in form of political, economic or military self-interest are likely to be involved. The Scandinavian donors in general, and Norway in particular, have been known for not letting self-interest guide aid disbursements, but rather respond to recipient needs and allocate a large share of their budgets to low income countries (Gates & Hoeffler, 2004). Collier & Dollar (2001b, p.13) found Norwegian aid to be about 50 percent more efficient at reducing poverty than average ODA in 1999. They compared the marginal impact of an additional million dollars in aid when allocated proportionately to the allocations of different donors. I will not be doing such an exercise, but I note that as it appears here, the allocation of Norwegian aid is now less poverty-efficient than aid from the average donor.

Table 9.5: Spearman correlation matrix, different donors compared to benchmark

	Benchmark	All donors	DAC	Norway	Multilateral
Benchmark	1				
All donors	0.63	1			
DAC	0.63	0.97	1		
Norway	0.42	0.45	0.47	1	
Multilateral	0.64	0.93	0.85	0.47	1

9.8 The Norwegian allocation

I now take a closer look at the Norwegian allocation of aid compared to the poverty-efficient benchmark. As already noted the rank correlation between the two allocations is 0.42. The number of countries receiving Norwegian aid in 2010 was 113. In the poverty-efficient allocation 32 countries are found to be eligible for aid receipts. This is likely to be a large source of the apparent inefficiency of the Norwegian allocation, a point also made in the latest DAC Peer Review of Norway (Patrick & Taylor, 2009). This does however not explain the large difference between the poverty-efficiency of the Norwegian allocation and that of the other donors. By the shares of the total budget allocated to the top recipient countries we see that Norwegian aid disbursements are more concentrated than DAC or multilateral aid.

9.8.1 Some common large recipient countries

Table 9.6 below displays the countries receiving the largest shares of the Norwegian bilateral aid budget and the top recipients in the poverty-efficient allocation. Four out of the top ten recipient countries by share of total aid budget in the benchmark allocation are also among Norway’s largest recipients. These are Tanzania, Pakistan, Mozambique and Uganda. The shares of the budget they receive in the two allocations are actually quite similar. Two other large recipients of Norwegian aid, Malawi and Haiti,[36] are also among the countries receiving aid in the optimal allocation. Malawi is one of the largest recipients in the benchmark allocation in terms of the size of ODA to GDP. Norwegian disbursements to this country are actually larger than the share it receives in the poverty-efficient allocation. All of this suggests that quite a few of the Norwegian top ten are also eligible recipients in the poverty-efficient allocation.

[36] The large disbursement to Haiti is due to emergency relief after the earthquake in January 2010. This country is not among the largest Norwegian recipient in the years before and after 2010.

Table 9.6: Top ten recipients in 2010, percent of total bilateral aid budget

Norwegian allocation		**Poverty-efficient allocation**	
Brazil	12.9	Bangladesh	22.5
Tanzania	6.5	Nigeria	14.7
Afghanistan	6.3	Ethiopia	8.1
Sudan	6.1	Tanzania	6.8
West Bank and Gaza	5.7	Congo, Dem. Rep.	5.0
Pakistan	4.4	Uganda	4.4
Mozambique	3.9	Kenya	4.3
Uganda	3.7	Pakistan	4.1
Haiti	3.5	Nepal	3.7
Malawi	3.4	Mozambique	2.9

In the poverty-efficient allocation the top recipients are allocated a very large share of the total budget. Bangladesh, Nigeria and Ethiopia are the largest recipients in my poverty-efficient benchmark allocation. The three combined receive 45.3 percent of the total budget. None of these countries are in the list of Norway's top ten recipients. Ethiopia is the country receiving the most of the three, more precisely 1.7 percent of the total Norwegian bilateral aid budget. This is much lower than the poverty-efficient 8.1 percent and also considerably lower than the shares of the multilateral budget and the DAC budget devoted to this country.

9.8.2 Recipients not present in the poverty-efficient allocation

I also note that two of the Norwegian top ten recipients are not present in the poverty-efficient allocation due to lack of data. These are Afghanistan and the West Bank and Gaza. The per capita income of Afghanistan is very low, about $500 a year, which suggests that a large share of the population is living below the poverty line. Other countries with similar per capita income are Guinea, Rwanda, Togo, Tanzania and Uganda. All of these countries receive large amounts of aid in the poverty-efficient allocation. This suggests that if poverty data were available, Afghanistan would be among the countries receiving aid in the optimal allocation. The West Bank and Gaza lack data on per capita income after 2005. The latest available figure is around $1100, which would place it close to Laos, Senegal and Comoros in the allocation. It would thereby be in the borderline area of receiving aid or not. Perhaps the inclusion of Afghanistan in the poverty-efficient allocation could have made a difference for Norway's poverty-efficiency, but most likely not.

9.8.3 Large shares to the "wrong" countries

The most prominent difference between the poverty-efficient allocation and the largest Norwegian recipients is Brazil. On top of the Norwegian list, receiving 12.9 percent of the bilateral aid budget, is an upper middle income country. In the poverty-efficient allocation this country is allocated 0, and is also quite far down the list. This suggests that Brazil would not be found eligible for aid receipts even if the estimates from the growth regression were significantly different. Disbursing large shares of the aid budget to few countries is likely to be good for poverty-efficiency in this model, but they need to be the "right" countries. Brazil is definitely not.

9.8.4 Integration of environmental policy, foreign policy and aid

Some of the explanation for the lower poverty-efficiency of Norwegian aid can probably be found in the current integration of environmental policy, foreign policy and aid. Many countries that receive considerable portions of the Norwegian budget are not eligible for aid receipts in the optimal allocation. Apart from Brazil these include Sudan (6.1 percent of bilateral budget), Indonesia (2.2 percent), Sri Lanka (1.5 percent), Guyana (1.5 percent), Serbia (1.1 percent) and Bosnia and Herzegovina (1.0 percent). All of these countries are either rainforest preservation countries (Indonesia and Guyana) or post-conflict areas, where the focus of aid disbursements is on conflict prevention and support to government and civil society. The Norwegian government has stated continued and increased priority to environment and conflict prevention in their most recent aid budget. The change in recipient countries that has occurred during the past decade is therefore somewhat intended. It does however appear to have a negative impact on the poverty-efficiency of Norwegian aid. Perhaps this is an indication that combining poverty reduction with other priorities is a difficult task, and that the government needs to choose its priorities: devoting aid to reduce poverty or devoting aid to solve conflict and climate issues.

Another question is whether funds for rainforest preservation should at all come from the aid budget. As briefly mentioned in the introduction there are several aspects of poverty reduction. One is the trade-off between current and future poverty reduction, temporary and sustainable poverty reduction. The argument of the Norwegian government that prevention of climate change through forest preservation is a way of preventing future rises in poverty is not assigned weight within the framework of this model. An increasing portion of the world's poor also live in post-conflict societies. In this way conflict prevention might also be a valid and important way of reducing future poverty. If these arguments had been taken into consideration, the poverty-efficiency of the current Norwegian aid allocation would probably be evaluated as larger. This priority of future over current poverty reduction could be part of the reason why Norwegian aid is found not to be very poverty-efficient, and in particular less poverty-efficient than the aid of other donors.

10 Conclusion

The aim of this master thesis has been to make an assessment of the current Norwegian aid allocation's potential for poverty reduction. This has been done using a model developed by Collier & Dollar (2002) to construct a so-called poverty-efficient allocation of aid across recipient countries. Within the framework of this model poverty reduction occurs as a result of economic growth, and this is the only factor donors can affect by their aid allocation. In my analysis, firstly the effect of aid on economic growth was estimated by panel regression. I found a positive and significant marginal effect of aid on growth in per capita GNI, and the effect is subject to diminishing returns. These estimates were then used in construction of the poverty-efficient allocation of aid. It should be noted that the regression results are sensitive to small changes in specification, especially to the exclusion of outliers. As such, caution should be taken using these results as basis for policy recommendations.

In my poverty-efficient allocation of aid, 32 countries are found eligible for aid receipts. The top recipients are allocated just above 30 percent of their own GDP in aid. Compared to actual disbursements this is not an unreasonable figure. In the poverty-efficient allocation the countries with the highest ratios of poverty to per capita GDP are allocated the largest amount of aid when measured in percentage of GDP. A few populous countries receive very large amounts in absolute terms. Notably, more than one third of the total aid budget is allocated to Bangladesh and Nigeria. Most of the countries that are found eligible for aid receipts in the poverty-efficient allocation are least developed countries or other low income countries.

When comparing the optimal benchmark allocation to the current allocation of aid, large discrepancies are apparent. The current allocation of total aid has a rank correlation of 0.63 with the optimal allocation, and similar estimates are found for DAC donors and multilateral agencies. The Norwegian allocation of ODA is correlated at only 0.42 with the optimal allocation, thereby being evaluated as substantially less poverty-efficient than the ODA of other donors. This is a somewhat surprising result. Twelve years ago Norwegian aid was found to be about 50 percent *more* efficient than average ODA when looking at its potential for reducing poverty (Collier & Dollar, 2001b). Returning to the research questions posed in the introduction: to what extent is the Norwegian aid allocation in line with the poverty-efficient allocation of aid? My answer would be: to a surprisingly low extent. There are generally two sources of inefficiency in actual allocations compared to the optimal allocation:

the number of recipient countries and their character. Norwegian aid unfortunately scores low in both categories.

The difference in the poverty-efficiency of the Norwegian allocation and those of other donors, and the fact that it is now turned around, could indicate that average ODA has become more efficient at reducing poverty the past decade. It could also suggest that Norwegian aid has become less poverty-efficient. Based on the share of Norwegian aid allocated to low income countries and the list of top recipients in 2000 and 2010, I am inclined to believe that the latter is the case. Significant changes have occurred in the Norwegian aid portfolio the past decade. Since 2004 there has been a considerable decline in the share of the total aid budget devoted to least developed countries, coinciding with a major increase in disbursements to the environment and energy sector. Most of this increase is allocated to forest preservation in middle income countries. The most notable example of this development is that the upper middle income country Brazil as from 2009 is the largest recipient of Norwegian aid.

The recent integration of Norwegian aid with environmental and foreign policy could be some of the reason for the apparent weakening of the poverty-efficiency of Norwegian aid. It is of course difficult to establish any causal relationship, but I do note that the two coincide. This development has been intended from the side of the Norwegian government. We can only assume that the possible trade-offs between poverty reduction and other goals has been taken into consideration. It seems like the desire to be a leading player in the field of climate change and conflict prevention has had negative implications for the poverty-efficiency of Norwegian aid the past decade, at least within the framework of this model. As already mentioned the results might have been different if the potential for future poverty reduction had been taken into account when assessing aid allocations.

11 Appendix

Appendix A: DAC List of ODA recipient countries by income group

Least Developed Countries	**Other Low Income countries** (per capita GNI <= $1 005 in 2010)	**Lower Middle Income Countries and Territories** (per capita GNI$ 1 006-$3 975 in 2010)	**Upper Middle Income Countries and Territories** (per capita GNI$3 976-$12 275 in 2010)
Afghanistan	Kenya	Armenia	Albania
Angola	Korea, Dem. Rep.	Belize	Algeria
Bangladesh	Kyrgyz Rep.	Bolivia	*Anguilla
Benin	South Sudan	Cameroon	Antigua and Barbuda
Bhutan	Tajikistan	Cape Verde	Argentina
Burkina Faso	Zimbabwe	Congo, Rep.	Azerbaijan
Burundi		Cote d'Ivoire	Belarus
Cambodia		Egypt	Bosnia and Herzegovina
Central African Rep.		El Salvador	Botswana
Chad		Fiji	Brazil
Comoros		Georgia	Chile
Congo, Dem. Rep.		Ghana	China
Djibouti		Guatemala	Colombia
Equatorial Guinea		Guyana	Cook Islands
Eritrea		Honduras	Costa Rica
Ethiopia		India	Cuba
Gambia		Indonesia	Dominica
Guinea		Iraq	Dominican Republic
Guinea-Bissau		Kosovo (1)	Ecuador
Haiti		Marshall Islands	FYR Macedonia
Kiribati		Micronesia, Federated States	Gabon
Laos		Moldova	Grenada
Lesotho		Mongolia	Iran
Liberia		Morocco	Jamaica
Madagascar		Nicaragua	Jordan
Malawi		Nigeria	Kazakhstan
Mali		Pakistan	Lebanon
Mauritania		Papua New Guinea	Libya
Mozambique		Paraguay	Malaysia
Myanmar		Philippines	Maldives
Nepal		Sri Lanka	Mauritius
Niger		Swaziland	Mexico
Rwanda		Syria	Montenegro
Samoa		*Tokelau	*Montserrat
Sao Tomé and Príncipe		Tonga	Namibia
Senegal		Turkmenistan	Nauru

Sierra Leone		Ukraine	Niue
Solomon Islands		Uzbekistan	Palau
Somalia		Vietnam	Panama
Sudan		West Bank and Gaza Strip	Peru
Tanzania			Serbia
Timor-Leste			Seychelles
Togo			South Africa
Tuvalu			*St. Helena
Uganda			St. Kitts-Nevis
Vanuatu			St. Lucia
Yemen			St. Vincent and Grenadines
Zambia			Suriname
			Thailand
			Tunisia
			Turkey
			Uruguay
			Venezuela
			*Wallis and Futuna

* Territory
(1) This is without prejudice to the status of Kosovo under international law.

Appendix B: Deriving the first order conditions of the maximization problem.

We have the following maximization problem:

Max poverty reduction $\sum_i G^i \alpha^i h^i N^i$ (2.1)

Subject to $\sum_i A^i y^i N^i = \overline{A}$, $A^i \geq 0$

From here we construct the Lagrangian function:

$$L = G^i \alpha^i h^i N^i - \lambda\left(A^i y^i N^i - \overline{A}\right)$$

Growth is assumed to be a function of aid and policy. The derivative of the Lagrangian with respect to A^i is then:

$$\frac{\partial L}{\partial A^i} = G_a^i \alpha^i h^i N^i - \lambda y^i N^i$$

The first order condition for a maximum is fulfilled when setting this expression equal to zero, so we get:

$$G_a^i \alpha^i h^i N^i - \lambda y^i N^i = 0 \Leftrightarrow G_a^i \alpha^i h^i N^i = \lambda y^i N^i$$

In this equation G_a^i represents the derivative of growth with respect to aid. Since both sides of the equation are multiplied with N^i, we can eliminate this from the equation, and we are then left with the expression in equation (2.2).

$$G_a^i \alpha^i h^i = \lambda y^i$$

The modified version of the maximization problem, used for my calculations:

Max poverty reduction $\quad \sum_i G^i \alpha^i h^i N^i \quad$ (2.1)

Subject to $\quad \sum_i \frac{A^i y^i N^i}{100} = \overline{A}, \qquad A^i \geq 0$

From here we construct the Lagrangian function:

$$L = G^i \alpha^i h^i N^i - \lambda \left(\frac{A^i y^i N^i}{100} - \overline{A} \right)$$

The derivative of the Lagrangian with respect to A^i is then:

$$\frac{\partial L}{\partial A^i} = G_a^i \alpha^i h^i N^i - \frac{\lambda y^i N^i}{100}$$

When setting this expression equal to zero, we get:

$$G_a^i \alpha^i h^i N^i - \frac{\lambda y^i N^i}{100} = 0 \Leftrightarrow G_a^i \alpha^i h^i N^i = \frac{\lambda y^i N^i}{100}$$

$$G_a^i \alpha^i h^i = \frac{\lambda y^i}{100} \Leftrightarrow G_a^i = \frac{\lambda y^i}{100\alpha^i h^i}$$

From here we can insert for the marginal effect of aid on growth, in my case $\beta_3 + 2\beta_4 A$

$$\beta_3 + 2\beta_4 A = \frac{\lambda y^i}{100\alpha^i h^i} \Leftrightarrow A^i = -\frac{\beta_3}{2\beta_4} + \frac{\lambda y^i}{2\beta_4 100\alpha^i h^i}$$

Appendix C: Principal component analysis for constructing the policy variable

With principal component analysis (PCA) in theory we start out with a covariance matrix including the variance of each variable and the covariance between them, which in my case would be a 3x3 matrix. Stata takes care of the whole construction of the new variable, and will generate as many principal components as the number of variables included. When receiving the PCA command the software directly generates the *eigenvalues* and *eigenvectors*[37] for the variables included. These are shown in the table below:

pca infldum govdum tradedum

Principal components/correlation Number of obs = 1134
Number of comp. = 3
Trace = 3
Rotation: (unrotated = principal) Rho = 1.0000

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.3284	0.439245	0.4428	0.4428
Comp2	0.88915	0.106696	0.2964	0.7392
Comp3	0.782454	.	0.2608	1

Principal components (eigenvectors)

Variable	Comp1	Comp2	Comp3	Unexplained
infldum	0.5581	-0.6671	0.4934	0
govdum	0.5389	0.7436	0.3958	0
tradedum	0.6309	-0.0450	-0.7745	0

[37] Definition from Verbeek (2012, p.445): "Let A be a symmetric *n* x *n matrix.* Consider the following problem of finding combinations of a vector *c* (other than the null vector) and a scalar λ that satisfy $Ac = \lambda c$. In general there are *n* solutions $\lambda_{1,...,} \lambda_n$ called the **eigenvalues** (characteristic roots) of A, corresponding to *n* vectors $c_1, ..., c_n$ called the **eigenvectors** (characteristic vectors)".

From here we can use the predict command which gives us three new variables that are linear combinations of the original variables included. The constructed variables are now ready to be used in regressions. The variable with the highest eigenvalue is the one that captures the most of the variation in the dataset, and is called the first principal component (Smith, 2002). The next two are calculated on the basis of capturing as much as possible of the variation in the data while not being correlated to the first (or second) principal component, and will therefore have lower eigenvalues than the first principal component. There are a number of ways to decide which and how many of the principal components to keep. The most widely used is the Kaiser criterion, which states that we should retain only the factors with an eigenvalue larger than one (StatSoft, 2012). This would leave me with one principal component to be used as a policy variable in my analysis.

Appendix D: Descriptive statistics

Variables included in the regression and the poverty-efficient allocation of aid

Variable	Description of variable	Obs	Mean	Std. Dev.	Min	Max	Source
GNI per capita growth	Growth rate of per capita GNI, averaged over four years	429	2.05	3.89	-12.89	35.72	WDI
Initial GNI	Per capita GNI for the first year of each four year period	429	2191	2946	78.52	19793	WDI
Log Initial GNI	Log of initial GNI	429	7.04	1.15	4.36	9.89	WDI
Policy	Value constructed by PCA, includes dummy variables for trade, government consumption and Inflation rate	429	-0.26	1.19	-4.58	0.69	WDI
ODA/GDP percent	ODA (net disbursements) % of recipient country GDP	429	4.92	7.86	-0.12	85.84	OECD.Stat/WDI
(ODA/GDP percent)^2	Squared value of ODA/GDP percent	429	97.10	503.81	0.00	8972.61	OECD.Stat/WDI
Institutional Quality	International Country Risk	429	0.46	0.15	0.06	0.89	QoG Standard dataset

(ICRG)	Guide measure of Quality of Governance						
Policy x ODA/GDP percent	Interaction term between Policy and ODA/GDP percent	429	-1.88	9.02	-72.38	85.73	WDI
ICRG x ODA/GDP percent	Interaction term between ICRG and ODA/GDP percent	429	2.03	3.17	-0.09	25.93	QoG Standard dataset
CDaid	ODA (net disbursements) divided by real PPP per capita GDP	429	0.52	1.09	-0.05	15.34	OECD.Stat/PWT 7.1
(CDaid)^2	Squared value of CDaid	429	1.78	17.54	0.00	354.67	OECD.Stat/PWT 7.1
Policy x CDaid	Interaction term between Policy and CDaid	429	-0.42	1.34	-18.29	1.41	WDI
ICRG x CDaid	Interaction term between ICRG and CDaid	429	0.20	0.34	-0.02	2.24	QoG Standard dataset
Indicators used in Policy variable							
Trade	Trade, % of GDP	429	70.79	42.75	13.14	334.04	WDI
Government Consumption	Government consumption, % of GDP	429	13.37	4.66	3.92	27.76	WDI
Inflation rate	Percentage annual change in CPI	429	61.47	387.25	-3.24	6251.50	WDI

Poverty data		**Obs**	**Mean**	**St.dev**	**Min**	**Max**	**Source**
Headcount poverty $1.25/day (%)	Percentage of population living below the $1.25 poverty line	112	22.1	23.2	0.0	86.2	PovcalNet
Poverty gap $1.25/day (%)	Mean shortfall of the poverty line, % of poverty line	112	8.4	10.9	0.0	50.5	PovcalNet
Squared poverty gap $1.25/day	Mean shortfall of the poverty line, % of poverty line, squaring every observation	112	4.5	6.6	0.0	33.9	PovcalNet

	before calculating the mean						
Headcount poverty $2/day (%)	Percentage of population living below the $2 poverty line	114	36.8	29.9	0.1	94.7	PovcalNet
Poverty gap $2/day (%)	Mean shortfall of the poverty line, % of poverty line	114	16.3	16.5	0.0	65.8	PovcalNet
Squared poverty gap $2/day	Mean shortfall of the poverty line, % of poverty line, squaring every observation before calculating the mean	114	9.4	11.0	0.0	49.5	PovcalNet
GDP per capita	Gross domestic product divided by midyear population Current US$	111	3578.4	3488.5	198.7	15613.7	WDI

Time dummies

Time dummy	Years included
Period1	1974-1977
Period2	1978-1981
Period3	1982-1985
Period4	1986-1989
Period5	1990-1993
Period6	1994-1997
Period7	1998-2001
Period8	2002-2005
Period9	2006-2009

Regional Dummies

Eastern Europe & post Soviet Union	Latin America	North Africa & the Middle East	Sub-Saharan Africa	Western Europe & North America
Albania	Argentina	Cyprus	Burkina Faso	Malta
Armenia	Bolivia	Algeria	Botswana	
Azerbaijan	Brazil	Egypt	Cote d'Ivoire	
Belarus	Colombia	Iran	Comoros	
Croatia	Costa Rica	Jordan	Ethiopia	
Kazakhstan	Dominican Rep.	Lebanon	Gabon	
Moldova	Ecuador	Morocco	Guinea	
Serbia	Guatemala	Oman	Gambia	
Slovenia	Honduras	Saudi Arabia	Kenya	
Ukraine	Mexico	Syria	Liberia	
	Nicaragua	Tunisia	Madagascar	
	Panama	Turkey	Mali	
	Peru	Yemen	Mozambique	
	Paraguay		Namibia	
	El Salvador		Sudan	
	Uruguay		Senegal	
	Venezuela		Togo	
			Tanzania	
			Uganda	
			South Africa	
			Congo, Dem. Rep.	
			Zambia	
			Zimbabwe	
East Asia	**South-East Asia**	**South Asia**	**The Pacific**	**The Caribbean**
China	Brunei	Bangladesh	Papua New Guinea	Bahamas
Korea, Rep.	Indonesia	India		Trinidad and Tobago
	Malaysia	Sri Lanka		
	Philippines	Pakistan		
	Singapore			
	Thailand			
	Vietnam			

Appendix E: Assumptions for OLS, FE and RE estimation models

Gauss-Markov assumptions for OLS estimation

Assumption OLS.1: Linear in parameters

The model in the population can be written as $y = \beta_0 + \beta_1 x_1 + ... + \beta_k x_k + u$, *where* $\beta_0, \beta_1, ..., \beta_k$ *are the unknown parameters (constants) of interest and u is an unobservable random error or disturbance term.*

Assumption OLS.2: Random sampling

We have a random sample of n observations, $\{(x_{i1}, x_{i2}, ..., x_{i3}, y_i) : i = 1, ..., n\}$ *following the population model in Assumption MLR.1.*

Assumption OLS.3: No perfect collinearity

In the sample (and therefore in the population), none of the independent variables is constant, and there are no exact linear relationship among the independent variables.

Assumption OLS.4: Zero conditional mean

The error u has an expected value of zero given any values of the explanatory variables. In other words, $E(u|x_1, x_2, ..., x_k)=0$.

Under the first four assumptions the OLS estimator is unbiased, which means that its expected value is equal to the true population value of the parameter (Wooldridge, 2009, p. 847)

Assumption OLS.5: Homoskedasticity

The error u has the same variance given any values of the explanatory variables. In other words,

$Var(u \mid x_1, x_2, ..., x_k) = \sigma^2$.

Assumption OLS.6: Normality

The population error u is independent of the explanatory variables $x_1, x_2, ..., x_k$ *and is normally distributed with zero mean and variance* $\sigma^2 : u \sim Normal(0, \sigma^2)$.

Adding assumption OLS.5 the OLS estimator is also efficient or BLUE. Assumption OLS.6 is added to obtain the exact sampling distributions of t-statistics and F-statistics, so that exact hypothesis testing can be carried out.

Assumptions for fixed and random effects estimation

Assumption FE.1:

For each i, the model is $y_{it} = \beta_1 x_{it1} + ... + \beta_k x_{itk} + \alpha_i + u_{it}$, $t = 1,....,T$, *where the* β_j *are the parameters to estimate and* α *is the unobserved effect.*

Assumption FE.2:

We have a random sample from the cross section

Assumption FE.3:

Each explanatory variable changes over time (for at least some i), and no perfect collinear relationships exist among the explanatory variables.

Assumption FE.4:

For each t, the expected value of the idiosyncratic error given the explanatory variables in ***all*** *time periods and the unobserved effect is zero:* $E(u_{it} \mid X_i, \alpha_i) = 0$.

Under these four assumptions the fixed effects estimator is unbiased. The key assumption here is FE.4, which requires so-called strict exogeneity. The idiosyncratic (time-varying) error term, u_{it}, should be uncorrelated with the explanatory variables not just in the same time period as the assumption is for OLS estimation, but in *all* periods. This is a rather strong assumption.

Assumption FE.5:

$Var(u_{it} \mid X_i, \alpha_i) = Var(u_{it}) = \sigma_u^2$, *for all* $t = 1,....,T$

Assumption FE.6

For all $t \neq s$, *the idiosyncratic errors are uncorrelated (conditional on all explanatory variables and* α_i*):* $Cov(u_{it}, u_{is} \mid X_i, \alpha_i) = 0$

When all of the six FE conditions are satisfied the fixed effects estimator is the best linear unbiased estimator (BLUE). Adding another, seventh, assumption to the set, the FE estimator is normally distributed, and the *t* and *F* statistics have the exact *t* and *F* distributions.

Assumption FE.7

Conditional on X_i and α_i, the u_{it} are independent and identically distributed as Normal $\left(0, \sigma_u^2\right)$

For the random effects estimator some of the assumptions are the same; that is FE.1, FE.2, FE.4, FE.5 and FE.6. Since the random effects estimator allows for variables that are constant over time, FE.3 is replaced with

Assumption RE.3

There are no perfect linear relationships among the explanatory variables.

Assumption RE.4

In addition to FE.4 the expected value of α_i given all explanatory variables is constant:

$$E(\alpha_i \mid X_i,) = \beta_0$$

This is the key distinction between the fixed and random effects estimators, as RE does not allow for correlation between the unobserved effect and the explanatory variables.

Assumption RE.5

In addition to FE.5, the variance of α_i given all explanatory variables is constant:

$$Var(\alpha_i \mid X_i) = \sigma_\alpha^2$$

Appendix F: Countries and time periods included in the regressions

Code	Country	1982-1985	1986-1989	1990-1993	1994-1997	1998-2001	2002-2005	2006-2009	Number of obs
ALB	Albania	-	-	-	1	1	1	1	4
ARG	Argentina	-	1	1	1	1	1	1	6
ARM	Armenia	-	-	-	-	1	1	1	3
AZE	Azerbaijan	-	-	-	-	1	1	1	3
BFA	Burkina Faso	1	1	1	1	1	1	-	6
BGD	Bangladesh	-	1	1	1	1	1	1	6
BHS	Bahamas	-	-	1	1	-	-	-	2
BLR	Belarus	-	-	-	-	-	1	1	2
BOL	Bolivia	1	1	1	1	1	1	1	7
BRA	Brazil	1	1	1	1	1	1	1	7
BRN	Brunei	-	-	1	1	-	-	-	2
BWA	Botswana	1	1	1	1	1	1	1	7
CHN	China	-	1	1	1	1	1	1	6
CIV	Cote d' Ivoire	1	1	1	1	1	1	1	7
CMR	Comoros	1	1	1	1	1	1	1	7
COL	Colombia	1	1	1	1	1	1	1	7
CRI	Costa Rica	1	1	1	1	1	1	1	7
CYP	Cyprus	1	1	1	1	-	-	-	4
DOM	Dominican Republic	1	1	1	1	1	1	1	7
DZA	Algeria	1	1	1	1	1	1	1	7
ECU	Ecuador	1	1	1	1	1	1	1	7
EGY	Egypt	1	1	1	1	1	1	1	7
ETH	Ethiopia	-	-	1	1	1	1	1	5
GAB	Gabon	1	1	1	1	1	1	1	7
GIN	Guinea	-	-	-	-	-	1	1	2
GMB	Gambia	-	1	1	1	1	1	1	6
GTM	Guatemala	1	1	1	1	1	1	1	7
HND	Honduras	1	1	1	1	1	1	1	7
HRV	Croatia	-	-	-	-	1	1	1	3
IDN	Indonesia	1	1	1	1	1	1	1	7
IND	India	1	1	1	1	1	1	1	7
IRN	Iran	1	1	1	1	1	1	1	7
JOR	Jordan	1	1	1	1	1	1	1	7
KAZ	Kazakhstan	-	-	-	-	1	1	1	3
KEN	Kenya	1	1	1	1	1	1	1	7
KOR	Korea, Republic	1	1	1	1	1	-	-	5
LBN	Lebanon	-	-	-	-	-	-	1	1
LBR	Liberia	-	-	-	-	-	1	1	2
LKA	Sri Lanka	-	1	1	1	1	1	1	6
MAR	Morocco	1	1	1	1	1	1	1	7
MDA	Macedonia	-	-	-	-	1	1	1	3
MDG	Madagascar	1	1	1	1	1	1	1	7
MEX	Mexico	1	1	1	1	1	1	1	7

MLI	Mali	-	-	1	1	1	1	1	5
MLT	Malta	-	1	1	1	1	1	-	5
MOZ	Mozambique	-	1	1	1	1	1	1	6
MYS	Malaysia	1	1	1	1	1	1	1	7
NAM	Namibia	-	-	-	-	-	1	1	2
NIC	Nicaragua	-	-	-	-	1	1	1	3
OMN	Oman	-	-	-	-	1	1	-	2
PAK	Pakistan	1	1	1	1	1	1	1	7
PAN	Panama	1	1	1	1	1	1	1	7
PER	Peru	1	1	1	1	1	1	1	7
PHL	Philippines	1	1	1	1	1	1	1	7
PNG	Papua New Guinea	1	1	1	1	1	1	-	6
PRY	Paraguay	1	1	1	1	1	1	1	7
SAU	Saudi Arabia	-	-	-	-	1	1	1	3
SDN	Sudan	1	1	1	1	1	1	1	7
SEN	Senegal	1	1	1	1	1	1	1	7
SGP	Singapore	1	1	1	1	-	-	-	4
SLV	El Salvador	1	1	1	1	1	1	1	7
SRB	Serbia	-	-	-	-	-	-	1	1
SVN	Slovenia	-	-	-	-	1	1	-	2
SYR	Syria	1	1	1	1	1	1	1	7
TGO	Togo	1	1	1	1	1	1	1	7
THA	Thailand	1	1	1	1	1	1	1	7
TTO	Trinidad and Tobago	1	1	1	1	1	1	-	6
TUN	Tunisia	1	1	1	1	1	1	1	7
TUR	Turkey	-	-	1	1	1	1	1	5
TZA	Tanzania	-	-	1	1	1	1	1	5
UGA	Uganda	1	1	1	1	1	1	1	7
UKR	Ukraine	-	-	-	-	-	1	1	2
URY	Uruguay	1	1	1	1	1	1	1	7
VEN	Venezuela	-	-	-	-	-	-	1	1
VNM	Vietnam	-	-	-	1	1	1	1	4
YEM	Yemen	-	-	1	1	1	1	1	5
ZAF	South Africa	-	-	1	1	1	1	1	5
ZAR	Congo, Dem. Rep	1	1	1	1	1	1	1	7
ZMB	Zambia	-	1	1	1	1	1	1	6
ZWE	Zimbabwe	1	1	1	1	1	1	1	7
Total		45	53	61	63	66	72	69	431

Appendix G: Statistical tests

Wooldridge test for autocorrelation

Using the Stata command *xtserial* and including all the variables that are in the regressions we can test for autocorrelation in the data. The results are posted below. Here we reject the null hypothesis of zero autocorrelation in the error terms for both aid variables. This will not have consequences for the unbiasedness of the estimators, but can cause inference problems because the standard deviations will not be correct, and thus hypothesis testing might give incorrect conclusions.

Wooldridge test for autocorrelation in panel data

H0: no first-order autocorrelation

F(1, 67) = 4.517

Prob > F = 0.0373

Breusch and Pagan Lagrangian multiplier test for the suitability of OLS

The Stata command *xttest0* when used after running a random effects model performs a Breusch and Pagan Lagrangian multiplier test on the estimates. This test detects the possibility of heteroskedasticity in the errors, and thereby the inefficiency of the OLS estimator.

Breusch and Pagan Lagrangian multiplier test for random effects

gnipc_growth[id,t] = Xb + u[id] + e[id,t]

Estimated results:

	Var	sd = sqrt(Var)
GNI per capita growth	15.04948	3.879367
e	6.71642	2.591606
u	2.195074	1.481578

Test: Var(u) = 0

chibar2(01) = 10.28

Prob > chibar2 = 0.0007

Hausman test for fixed versus random effects

The Hausman test for fixed versus random effects entails running the same specification with the two different estimators, storing the estimates and then running a Hausman test for detecting difference between the estimates. A rejection of H_0 indicates that RE will give biased estimators, and this is the conclusion reached performing the test on my data.

hausman fixed random

	---- Coefficients ----			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	fixed	random	Difference	S.E.
lninitial GNI	-3.16607	-0.67513	-2.49094	0.713735
Policy	0.562694	0.217293	0.345401	0.056455
ODA/GDP percent	0.313332	0.407486	-0.09415	0.012867
(ODA/GDP percent)^2	-0.00442	-0.00189	-0.00254	0.000275
PolicyxODA/GDP percent	-0.02311	0.008831	-0.03194	0.003657
ICRG	5.69829	6.37867	-0.68038	0.296339
ICRGxODA/GDP percent	-0.34294	-0.6423	0.299362	.
period4	1.27228	1.299042	-0.02676	.
period5	1.484898	1.271604	0.213294	.
period6	2.454599	2.312594	0.142005	.
period7	1.491421	1.222339	0.269082	.
period8	3.503918	3.360616	0.143303	.
period9	3.834669	3.224967	0.609702	0.114886

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(13) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 112.78
Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)

Appendix H: Regression results

Regression results from OLS and RE regression for the ODA/GDP percent variable

OLS Regression results, calculated with cluster robust standard errors. Dependent variable: Growth in per capita GNI. Aid variable: ODA as percentage of GDP

	OLS1	OLS2	OLS3	OLS4
Log Initial GNI	0.591**	-0.302	-0.287	-0.384
	(0.247)	(0.313)	(0.330)	(0.302)
ODA/GDP percent	0.186**	0.074	0.087	0.326
	(0.080)	(0.096)	(0.116)	(0.276)
(ODA/GDP percent)^2	-0.001	0.000	0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Eastern Europe	-0.541	2.390**	2.352**	2.638**
	(0.956)	(1.137)	(1.145)	(1.151)
Latin America	-2.512***	-0.941*	-1.047*	-0.662
	(0.357)	(0.565)	(0.617)	(0.533)
North Africa and Middle East	-2.164***	-0.895*	-0.936*	-0.685
	(0.401)	(0.523)	(0.528)	(0.499)
Sub-Saharan Africa	-3.510***	-2.604***	-2.654***	-2.417***
	(0.637)	(0.840)	(0.852)	(0.833)
East Asia	4.137***	4.983***	4.982***	4.945***
	(1.361)	(0.677)	(0.668)	(0.677)
South-East Asia	0.093	0.633	0.611	0.695
	(0.629)	(0.789)	(0.780)	(0.750)
South Asia	0.051	0.374	0.313	0.455
	(0.733)	(0.889)	(0.879)	(0.860)
Pacific	-5.160***	-3.725***	-3.882***	-3.249***
	(0.560)	(0.584)	(0.718)	(0.618)
Caribbean	-2.620***	-1.452***	-1.441***	-1.281**
	(0.392)	(0.524)	(0.530)	(0.544)
Period 4	-0.644	1.282**	1.306**	1.282**
	(0.467)	(0.613)	(0.616)	(0.609)
Period 5	-1.488**	1.274*	1.293*	1.191*
	(0.643)	(0.694)	(0.692)	(0.680)
Period 6	0.365	2.320***	2.353***	2.211***
	(0.599)	(0.653)	(0.659)	(0.661)
Period 7	-0.142	1.269**	1.300**	1.155**
	(0.320)	(0.537)	(0.548)	(0.526)
Period 8	1.647***	3.582***	3.621***	3.447***
	(0.495)	(0.727)	(0.766)	(0.685)
Period 9	1.511***	3.257***	3.289***	3.212***
	(0.396)	(0.581)	(0.589)	(0.601)
Policy		0.150	0.067	0.113
		(0.157)	(0.224)	(0.201)
Institutional quality (ICRG)		3.902**	3.921**	6.568***
		(1.716)	(1.696)	(1.952)
Policy x ODA/GDP percent			0.018	0.006
			(0.029)	(0.027)
ICRG x ODA/GDP percent				-0.543

				(0.475)
R^2	0.161	0.312	0.313	0.327
Observations	780	431	431	431

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

Random effects regression results, calculated with robust standard errors. Dependent variable: Growth in per capita GNI. Aid variable: ODA as percentage of GDP.

	RE1	RE2	RE3	RE4
Log Initial GNI	0.517**	-0.555*	-0.543	-0.682**
	(0.234)	(0.333)	(0.345)	(0.301)
ODA/GDP percent	0.225***	0.123	0.138	0.404
	(0.083)	(0.135)	(0.147)	(0.284)
(ODA/GDP percent)^2	-0.001**	-0.001	-0.001	-0.002
	(0.001)	(0.001)	(0.002)	(0.002)
Eastern Europe	-0.721	1.715	1.664	1.984
	(2.391)	(2.248)	(2.280)	(2.375)
Latin America	-2.583	-1.232	-1.362	-0.935
	(2.166)	(2.070)	(2.116)	(2.211)
North Africa and Middle East	-2.304	-1.279	-1.328	-1.057
	(2.175)	(2.072)	(2.103)	(2.215)
Sub-Saharan Africa	-3.900*	-3.152	-3.216	-2.938
	(2.246)	(2.121)	(2.152)	(2.261)
East Asia	4.005*	4.645**	4.640**	4.543*
	(2.298)	(2.237)	(2.268)	(2.395)
South-East Asia	-0.057	0.272	0.239	0.246
	(2.208)	(2.131)	(2.156)	(2.261)
South Asia	-0.121	-0.293	-0.370	-0.281
	(2.243)	(2.143)	(2.174)	(2.281)
Pacific	-5.624**	-4.732	-4.921	-4.145
	(2.683)	(2.959)	(3.017)	(3.137)
Caribbean	-2.821	-1.686	-1.678	-1.514
	(2.311)	(2.968)	(2.994)	(3.071)
Period 4	-0.731	1.314**	1.339**	1.303**
	(0.507)	(0.593)	(0.594)	(0.603)
Period 5	-1.541**	1.358**	1.383**	1.276**
	(0.622)	(0.624)	(0.624)	(0.639)
Period 6	0.321	2.421***	2.462***	2.304***
	(0.579)	(0.534)	(0.546)	(0.547)
Period 7	-0.153	1.360**	1.399**	1.206**
	(0.365)	(0.541)	(0.555)	(0.540)
Period 8	1.602***	3.511***	3.560***	3.336***
	(0.486)	(0.670)	(0.701)	(0.623)
Period 9	1.505***	3.280***	3.322***	3.197***
	(0.397)	(0.549)	(0.562)	(0.568)
Policy		0.306*	0.213	0.254
		(0.169)	(0.231)	(0.218)
Institutional quality (ICRG)		3.326**	3.343**	6.337***
		(1.661)	(1.650)	(2.029)

Policy x ODA/GDP percent			0.021	0.007
			(0.026)	(0.023)
ICRG x ODA/GDP percent				-0.639
				(0.407)
R^2				
Observations	780	431	431	431

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

Results from FE regression excluding observations at the country level

Results from fixed effects regression, calculated with robust standard errors. Dependent variable: Growth in per capita GNI. Aid variable: ODA as percentage of GDP.

	66 countries	Group 7&8 included	Group 2 included	Group 3&5 included	Group 4 included	Full sample
Log Initial GNI	-2.831***	-2.823**	-2.842**	-2.880**	-3.166***	-3.166***
	(1.023)	(1.126)	(1.124)	(1.103)	(1.123)	(1.109)
Policy	0.472*	0.457*	0.454*	0.526*	0.570**	0.563**
	(0.238)	(0.261)	(0.263)	(0.269)	(0.271)	(0.269)
ODA/GDP percent	0.266**	0.273*	0.303**	0.298**	0.256*	0.313**
	(0.126)	(0.139)	(0.138)	(0.133)	(0.139)	(0.135)
(ODA/GDP percent)^2	-0.003*	-0.003*	-0.003*	-0.003*	-0.003*	-0.004***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Policy x ODA/GDP percent	-0.015	-0.014	-0.018	-0.021	-0.019	-0.023
	(0.021)	(0.024)	(0.023)	(0.024)	(0.024)	(0.023)
Institutional quality (ICRG)	6.553***	6.664***	6.620***	6.659***	5.701***	5.698***
	(1.784)	(1.963)	(1.947)	(1.874)	(1.916)	(2.048)
ICRG x ODA/GDP percent	-0.391**	-0.399**	-0.410**	-0.409**	-0.352*	-0.343
	(0.159)	(0.175)	(0.170)	(0.168)	(0.182)	(0.240)
Period 4	1.385**	1.386**	1.365**	1.072	1.138*	1.272*
	(0.612)	(0.661)	(0.661)	(0.678)	(0.663)	(0.674)
Period 5	1.426*	1.395	1.371	1.427*	1.419*	1.485*
	(0.772)	(0.836)	(0.838)	(0.807)	(0.800)	(0.804)
Period 6	2.391***	2.447***	2.443***	2.293***	2.262***	2.455***
	(0.694)	(0.751)	(0.748)	(0.746)	(0.744)	(0.767)
Period 7	1.274**	1.287*	1.401*	1.320*	1.329*	1.491**
	(0.635)	(0.695)	(0.703)	(0.698)	(0.702)	(0.715)
Period 8	3.515***	3.534***	3.527***	3.394***	3.301***	3.504***
	(0.748)	(0.823)	(0.829)	(0.814)	(0.819)	(0.809)
Period 9	3.744***	3.764***	3.737***	3.656***	3.665***	3.835***
	(0.816)	(0.901)	(0.912)	(0.892)	(0.896)	(0.914)
R^2	0.247	0.250	0.245	0.247	0.233	0.308
Observations	381	387	395	413	422	431

Standard errors in parentheses, * p<0.1, ** p<0.05, *** p<0.01

Results from FE regressions excluding outliers

Fixed effects regression results, excluding outliers, calculated with robust standard errors. Dependent variable: Growth in per capita GNI. Aid variable: ODA as percentage of GDP.

	Excluding ODA/GDP outliers	Excluding growth outliers	Excluding all outliers
Log Initial GNI	-2.995**	-3.646***	-3.364***
	(1.139)	(1.121)	(1.132)
Policy	0.534**	0.538**	0.513*
	(0.258)	(0.260)	(0.258)
ODA/GDP percent	0.122	0.206	0.151
	(0.181)	(0.156)	(0.176)
(ODA/GDP percent)^2	-0.004	-0.002	-0.004
	(0.003)	(0.002)	(0.003)
Policy x ODA/GDP percent	-0.004	-0.005	-0.003
	(0.033)	(0.030)	(0.034)
Institutional quality (ICRG)	4.053*	5.572***	4.350**
	(2.061)	(1.883)	(1.999)
ICRG x ODA/GDP percent	-0.009	-0.291	-0.021
	(0.259)	(0.199)	(0.254)
Period 4	1.354*	1.305*	1.336*
	(0.683)	(0.673)	(0.682)
Period 5	1.605**	1.538*	1.597*
	(0.800)	(0.791)	(0.803)
Period 6	2.531***	2.468***	2.541***
	(0.745)	(0.756)	(0.749)
Period 7	1.516**	1.578**	1.633**
	(0.687)	(0.701)	(0.683)
Period 8	3.402***	3.555***	3.558***
	(0.799)	(0.813)	(0.801)
Period 9	3.811***	3.816***	3.830***
	(0.854)	(0.914)	(0.879)
R^2	0.219	0.251	0.232
Observations	426	429	424

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

Regression results using the CDaid variable

Regression results, different estimation models, calculated with robust standard errors. Dependent variable: Growth in per capita GNI. Aid variable: CDaid.

	OLS4	RE4	FE4
Log Initial GNI	-0.391	-1.054**	-3.299**
	(0.288)	(0.411)	(1.288)
Policy	0.152	0.303*	0.432**
	(0.163)	(0.183)	(0.208)
CDaid	-0.078	-0.102	-0.452
	(0.360)	(0.443)	(0.843)
(CDaid)^2	0.006	0.021	0.034
	(0.014)	(0.017)	(0.028)
Policy x CDaid	0.122	0.232	0.238*
	(0.145)	(0.144)	(0.140)
Institutional quality (ICRG)	3.166*	3.097*	3.572**
	(1.831)	(1.749)	(1.762)
ICRG x CDaid	1.198	0.249	-0.201
	(0.958)	(1.001)	(1.487)
Eastern Europe	2.336*	1.189	.
	(1.211)	(2.860)	.
Latin America	-1.070	-1.602	.
	(0.649)	(2.649)	.
North Africa and Middle East	-1.074*	-1.660	.
	(0.578)	(2.664)	.
Sub-Saharan Africa	-2.477***	-3.339	.
	(0.851)	(2.695)	.
East Asia	4.407***	3.958	.
	(0.376)	(2.839)	.
South-East Asia	0.361	-0.315	.
	(0.798)	(2.703)	.
South Asia	-0.096	-1.029	.
	(0.842)	(2.740)	.
Pacific	-3.563***	-5.133	.
	(0.703)	(3.965)	.
Caribbean	-1.544***	-1.788	.
	(0.508)	(3.888)	.
Period 4	1.427**	1.432**	1.386**
	(0.605)	(0.582)	(0.673)
Period 5	1.463**	1.566***	1.650**
	(0.658)	(0.589)	(0.761)
Period 6	2.463***	2.498***	2.527***
	(0.663)	(0.523)	(0.695)
Period 7	1.330**	1.342***	1.488**
	(0.542)	(0.519)	(0.634)
Period 8	3.648***	3.365***	3.500***
	(0.758)	(0.600)	(0.738)
Period 9	3.328***	3.136***	3.583***
	(0.584)	(0.525)	(0.854)

R^2	0.296		0.206
Observations	431	431	431

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

Fixed effects regression results, calculated with robust standard errors. Dependent variable: Growth in per capita GNI. Aid variable: CDaid.

	FE1	FE2	FE3	FE4
Log Initial GNI	-2.825*	-3.258**	-3.284**	-3.299**
	(1.585)	(1.296)	(1.298)	(1.288)
CDaid	-0.135	-0.580	-0.510	-0.452
	(0.685)	(0.805)	(0.703)	(0.843)
(CDaid)^2	0.020	0.032	0.035	0.034
	(0.028)	(0.030)	(0.025)	(0.028)
Period 4	-0.866	1.353**	1.388**	1.386**
	(0.524)	(0.664)	(0.671)	(0.673)
Period 5	-1.309**	1.625**	1.653**	1.650**
	(0.655)	(0.758)	(0.758)	(0.761)
Period 6	0.328	2.477***	2.534***	2.527***
	(0.622)	(0.681)	(0.684)	(0.695)
Period 7	-0.127	1.448**	1.496**	1.488**
	(0.324)	(0.613)	(0.621)	(0.634)
Period 8	1.628***	3.487***	3.504***	3.500***
	(0.436)	(0.732)	(0.736)	(0.738)
Period 9	1.840***	3.584***	3.587***	3.583***
	(0.456)	(0.832)	(0.844)	(0.854)
Policy		0.551***	0.432**	0.432**
		(0.203)	(0.208)	(0.208)
Institutional quality (ICRG)		3.649**	3.454**	3.572**
		(1.738)	(1.686)	(1.762)
Policy x CDaid			0.239*	0.238*
			(0.142)	(0.140)
ICRG x CDaid				-0.201
				(1.487)
R^2	0.077	0.202	0.206	0.206
Observations	781	431	431	431

Standard errors in parentheses, * p<0.1, ** p<0.05, *** p<0.01

Fixed effects regression results, excluding outliers, calculated with robust standard errors. Dependent variable: Growth in per capita GNI. Aid variable: CDaid.

	Excluding ODA/GDP outliers	Excluding growth outliers	Excluding all outliers
Log Initial GNI	-3.674**	-3.869***	-4.549***
	(1.410)	(1.263)	(1.187)
Policy	0.558*	0.419*	0.377*
	(0.288)	(0.211)	(0.225)
CDaid	2.468	-0.226	2.016
	(3.797)	(0.532)	(3.957)
(CDaid)^2	-3.387	0.023	-0.990
	(2.903)	(0.018)	(2.040)
Policy x CDaid	-0.158	0.299**	0.348
	(0.601)	(0.134)	(0.431)
Institutional quality (ICRG)	2.284	3.992**	3.990**
	(2.363)	(1.630)	(1.832)
ICRG x CDaid	3.316	-0.157	-0.941
	(5.770)	(1.346)	(3.480)
Period 4	1.234	1.382**	1.231
	(0.753)	(0.673)	(0.750)
Period 5	1.966**	1.651**	1.914**
	(0.815)	(0.765)	(0.820)
Period 6	2.667***	2.540***	2.652***
	(0.781)	(0.705)	(0.746)
Period 7	1.423*	1.631**	1.681**
	(0.743)	(0.646)	(0.696)
Period 8	3.497***	3.497***	3.623***
	(0.835)	(0.751)	(0.800)
Period 9	3.684***	3.840***	4.035***
	(0.959)	(0.848)	(0.861)
R^2	0.199	0.251	0.230
Observations	399	429	397

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

Results from fixed effects regression, calculated with robust standard errors. Dependent variable: Growth in per capita GNI. Aid variable: CDaid.

	66 countries	Group 7&8 included	Group 2 included	Group 3&5 included	Group 4 included	Full sample
Log Initial GNI	-2.910**	-2.922**	-2.996**	-3.061**	-3.344**	-3.299**
	(1.362)	(1.337)	(1.334)	(1.303)	(1.317)	(1.288)
Policy	0.338	0.327	0.319	0.394*	0.433*	.
	(0.213)	(0.210)	(0.209)	(0.218)	(0.222)	.
CDaid	0.082	0.115	0.111	0.082	-0.098	-0.452
	(0.512)	(0.497)	(0.494)	(0.497)	(0.547)	(0.843)
(CDaid)^2	0.014	0.013	0.014	0.014	0.020	0.034
	(0.017)	(0.017)	(0.016)	(0.016)	(0.018)	(0.028)
Policy x CDaid	0.239**	0.240**	0.253**	0.218*	0.230*	0.238*
	(0.117)	(0.117)	(0.118)	(0.122)	(0.123)	(0.140)
Institutional quality (ICRG)	4.465**	4.596**	4.433**	4.600***	3.843**	3.572**
	(1.773)	(1.758)	(1.753)	(1.685)	(1.717)	(1.762)
ICRG x CDaid	-0.323	-0.380	-0.346	-0.403	-0.174	-0.201
	(1.350)	(1.346)	(1.348)	(1.365)	(1.391)	(1.487)
Period 4	1.526**	1.523**	1.525**	1.213*	1.260*	1.386**
	(0.684)	(0.668)	(0.670)	(0.692)	(0.674)	(0.673)
Period 5	1.594*	1.550*	1.558*	1.604**	1.584**	1.650**
	(0.835)	(0.822)	(0.824)	(0.793)	(0.783)	(0.761)
Period 6	2.565***	2.614***	2.625***	2.467***	2.425***	2.527***
	(0.727)	(0.715)	(0.714)	(0.713)	(0.709)	(0.695)
Period 7	1.429**	1.433**	1.551**	1.465**	1.466**	1.488**
	(0.657)	(0.653)	(0.663)	(0.654)	(0.656)	(0.634)
Period 8	3.528***	3.541***	3.534***	3.410***	3.313***	3.500***
	(0.772)	(0.770)	(0.774)	(0.751)	(0.758)	(0.738)
Period 9	3.815***	3.828***	3.795***	3.730***	3.745***	3.583***
	(0.854)	(0.856)	(0.862)	(0.831)	(0.835)	(0.854)
R^2	0.240	0.243	0.236	0.237	0.228	0.206
Observations	379	385	393	413	422	431

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

Appendix I: The poverty-efficient allocation of ODA in 2010

Country	Benchmark allocation, $2 hc		Poverty-efficient allocation, % of recipient GDP		
	% of GDP	$ million	$2 pov.gap	$1.25 hc	$1.25 pov.gap
Congo, Dem. Rep.	34.41	4511.03	30.61	35.70	34.30
Burundi	33.34	675.72	31.25	34.71	34.46
Liberia	33.30	328.96	30.60	34.74	34.13
Malawi	30.54	1543.57	28.87	31.80	31.85
Niger	28.89	1562.86	29.48	27.57	29.56
Sierra Leone	28.76	549.22	28.57	28.60	29.64
Madagascar	28.72	2504.63	25.52	30.59	29.78
Mozambique	28.50	2624.31	26.74	29.55	29.35
Central African Republic	26.72	530.25	22.59	28.74	26.94
Tanzania	25.85	6102.73	23.27	27.72	27.72
Rwanda	25.37	1427.05	21.40	27.81	26.93
Ethiopia	24.44	7254.16	27.72	6.98	15.93
Guinea	23.92	1133.06	24.00	22.96	24.61
Guinea-Bissau	23.44	195.79	23.46	22.56	24.39
Uganda	23.09	3971.72	22.97	22.43	24.07
Burkina Faso	23.00	2029.72	23.17	21.99	24.03
Togo	22.38	710.88	23.56	19.44	22.65
Mali	21.82	2055.86	21.30	21.80	23.49
Nepal	21.05	3370.83	22.94	16.45	20.91
Haiti	20.64	1369.30	12.61	24.07	20.09
Bangladesh	20.23	20300.09	21.30	18.30	22.28
Benin	16.96	1112.08	17.37	15.34	18.35
Chad	15.62	1334.33	15.26	14.75	16.86
Timor-Leste	15.34	134.20	18.48	7.43	14.87
Comoros	14.82	80.19	10.25	16.93	14.98
Gambia, The	14.57	153.03	15.21	11.95	14.76
Kenya	12.14	3908.89	11.30	10.99	12.30
Nigeria	6.74	13272.04	0	12.27	8.40
Cambodia	6.44	723.57	12.12	0	1.45
Zambia	5.25	850.02	0	11.97	5.13
Pakistan	2.07	3664.81	9.77	0	0
Lao PDR	0.72	51.69	4.91	0	0
Lesotho	0	0	0	0.87	0
India	0	0	0	0	0
Senegal	0	0	0	0	0
Papua New Guinea	0	0	0	0	0
Mauritania	0	0	0	0	0
Cote d'Ivoire	0	0	0	0	0
Tajikistan	0	0	0	0	0
Sao Tome and Principe	0	0	0	0	0
Yemen, Rep.	0	0	0	0	0
Vietnam	0	0	0	0	0

Ghana	0	0	0	0	0
Sudan	0	0	0	0	0
Cameroon	0	0	0	0	0
Congo, Rep.	0	0	0	0	0
Kyrgyz Republic	0	0	0	0	0
Nicaragua	0	0	0	0	0
Philippines	0	0	0	0	0
Swaziland	0	0	0	0	0
Indonesia	0	0	0	0	0
Micronesia, Fed. Sts.	0	0	0	0	0
Angola	0	0	0	0	0
Honduras	0	0	0	0	0
Bhutan	0	0	0	0	0
Bolivia	0	0	0	0	0
Georgia	0	0	0	0	0
Sri Lanka	0	0	0	0	0
Guatemala	0	0	0	0	0
Namibia	0	0	0	0	0
Cape Verde	0	0	0	0	0
Iraq	0	0	0	0	0
China	0	0	0	0	0
Belize	0	0	0	0	0
Egypt, Arab Rep.	0	0	0	0	0
Fiji	0	0	0	0	0
Guyana	0	0	0	0	0
Paraguay	0	0	0	0	0
St. Lucia	0	0	0	0	0
Morocco	0	0	0	0	0
South Africa	0	0	0	0	0
Moldova	0	0	0	0	0
Armenia	0	0	0	0	0
El Salvador	0	0	0	0	0
Botswana	0	0	0	0	0
Colombia	0	0	0	0	0
Ecuador	0	0	0	0	0
Algeria	0	0	0	0	0
Peru	0	0	0	0	0
Syrian Arab Republic	0	0	0	0	0
Suriname	0	0	0	0	0
Dominican Republic	0	0	0	0	0
Panama	0	0	0	0	0
Gabon	0	0	0	0	0
Tunisia	0	0	0	0	0
Albania	0	0	0	0	0
Thailand	0	0	0	0	0
Brazil	0	0	0	0	0

Maldives	0	0	0	0	0
Macedonia, FYR	0	0	0	0	0
Jamaica	0	0	0	0	0
Venezuela, RB	0	0	0	0	0
Costa Rica	0	0	0	0	0
Mexico	0	0	0	0	0
Jordan	0	0	0	0	0
Azerbaijan	0	0	0	0	0
Turkey	0	0	0	0	0
Argentina	0	0	0	0	0
Turkmenistan	0	0	0	0	0
Malaysia	0	0	0	0	0
Seychelles	0	0	0	0	0
Chile	0	0	0	0	0
Uruguay	0	0	0	0	0
Serbia	0	0	0	0	0
Kazakhstan	0	0	0	0	0
Trinidad and Tobago	0	0	0	0	0
Montenegro	0	0	0	0	0
Ukraine	0	0	0	0	0
Bosnia and Herzegovina	0	0	0	0	0
Belarus	0	0	0	0	0
Croatia	0	0	0	0	0

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