MASTER'S THESIS

Jaakko Rämö

Poverty-efficient allocation of Official Development Assistance in 2011

University of Tampere
School of Management
Economics
December 2013

University of Tampere

School of Management

RÄMÖ, JAAKKO: **Poverty-efficient allocation of Official Development Assistance in 2011**

Master's Thesis

Economics, December 2013

Abstract

With the global aid flows stagnating or even decreasing over the next years, the only way to increase the impact of development aid is making the aid more efficient. A widely recognized and applied approach to improve the efficiency of aid is the framework of poverty-efficiency. This thesis analyzes the poverty-efficiency of Official Development Assistance in 2011 using a data from 58 developing countries. The marginal efficiency of the actual allocation is calculated as well as 16 poverty-efficient allocations using three estimates of the aid's impact on growth, four different poverty measures and, in four cases, a small country bias. In order to study whether donor behavior is in line with the principles of poverty-efficiency, a linear model is estimated. The bilateral development assistance of Finland is evaluated as a case study.

From the perspective of poverty-efficiency, the inefficiency of the actual allocation of aid is clear. The calculated marginal efficiencies reveal that some aid-receiving countries would greatly benefit from additional aid but some are receiving such high amounts of aid that it actually causes negative effects. When comparing the poverty-efficient allocations to the actual allocation of aid, the latter is clearly not in line with the principles of poverty-efficiency. Almost half of the countries in the data do not receive any aid under the poverty-efficient allocation regardless of the used approach. A number of countries could also be flagged under-funded based on the poverty-efficient allocations. Regarding the case study of Finland, a third of Finland's bilateral aid was not used efficiently from the perspective of poverty-efficiency.

The political feasibility of the poverty-efficient allocations is questionable: under the poverty-efficient allocations few populous countries receive very high shares of the global aid budget. In addition, an estimated linear model revealed that donors still prefer smaller countries over ones with a larger population. The calculated marginal efficiencies and poverty-efficient allocations are highly sensitive to aid-growth estimate choices. Hence, in contrast to some current practices, the choice of estimates should be thoroughly examined when using poverty-efficient allocations in practical applications.

Keywords: Development aid, developing countries, poverty-efficiency, aid effectiveness, aid efficiency

Contents

Acronyms

CPA Country Programmable Aid

CPIA Country Policy and Institutional Assessment

DAC Development Assistance Committee

GDP Gross Domestic Product

GNI Gross National Income

IDA International Development Association

LDC Least Developed Country

MIC Middle Income Country

ODA Official Development Assistance

OECD Organization for Economic Cooperation and Development

PPP Purchasing-Power-Parity

1. Introduction

Poverty reduction has been a success story among the United Nations' Millennium Development Goals. The target of decreasing extreme poverty by half was met five years ahead of the 2015 deadline. However, the progress has been uneven. The rapid economic growth in some Asian countries, with China being the greatest success story, has lifted hundreds of millions of people out of extreme poverty. On the other hand, widespread poverty still exists in sub-Saharan Africa and Southern Asia. At the moment, 1,2 billion people live in extreme poverty, and according to World Bank estimates, approximately 1 billion people will still be living on less than $1,25 a day in 2015, with four out of five of the global poor residing in sub-Saharan Africa and Southern Asia (United Nations 2013, 6 – 7). Development cooperation, including development assistance, is often seen as a tool which is important but not sufficient when the goal is alleviating poverty. However, in the aftermath of the financial crisis, the global aid flows are likely to stagnate or even decrease (DAC 2012a, 5). When the global aid budget is not growing, making the aid more efficient is the only way to increase the impact of development aid.

There are several quantitative approaches to increase the efficiency of development aid's country allocation and most of them are, to varying degrees, based on the concept of poverty-efficiency. Poverty-efficiency makes use of the linkages between aid receipts and economic growth and economic growth and poverty reduction in order to allocate aid efficiently. In this thesis, I focus on the concept of poverty-efficiency. How poverty-efficient is the 2011 allocation of aid? Is the poverty-efficient allocation sensitive to the choice of growth estimates or poverty measures? Which countries are under-aided from the perspective of poverty-efficiency? Can the framework of poverty-efficiency, usually used by large multilateral donors, be used when studying the efficiency of a small country's bilateral aid? If so, is Finnish bilateral development cooperation poverty-efficient? To answer these questions, I apply the Collier-Dollar model of poverty-efficient aid to development aid data from 2011.

Some scholars, for example Dambisa Moyo and William Easterly, have questioned the effectiveness of development aid in its current form. The debate around the effectiveness of development aid also has implications for the research topic of this study. The optimization process uses macroeconomic aid-growth estimates and is therefore reliant on research done on aid's effectiveness on the macroeconomic level. Fortunately, even though some critical opinions have been voiced, the most recent additions to the field show positive results.

The main addition of this study to the field of poverty-efficiency research is the inclusion of multiple sets of aid-growth estimates. Past research done in the field has mainly focused on a single set of aid-growth

estimates. The first two studies on poverty-efficient allocation done by Collier and Dollar (1999a; 1999b) introduce the poverty-efficiency framework and apply it to over a hundred countries using an aid-growth estimate set estimated in the studies. Later, Collier and Dollar (2002) restrict the data to include 59 countries for which high quality data is available. They also use a single set of aid-growth estimates estimated in the study. All the listed studies by Collier and Dollar use ODA data from 1996 and poverty data from World Bank's World Development Indicators. Lensink and White (2000) use the approach and data used by Collier and Dollar (1999a) but they also compare the results acquired using the Collier-Dollar estimates to results calculated using their own estimate set.

Beynon (2003) has run additional sensitivity tests on the basic Collier-Dollar (2002) model. In total, he tests 25 different scenarios using data from 1996. 9 scenarios test the sensitivity of the results to parameter estimates but 8 of the scenarios use estimates derived from the Collier and Dollar (2002) study. In scenarios 1-8, the used estimates are either parameter estimates acquired by Collier and Dollar or derived from these estimates by adding or subtracting standard deviations. Scenario 9 uses parameter estimates from a study by Dalgaard and Hansen (2001). However, these estimates are disregarded when the effects of the estimates are illustrated and the sensitivity of the allocation to poverty measures is studied. The main focus of the study by Beynon (2003) is on sensitivity testing the original Collier-Dollar results. The data choices are in line with the Collier-Dollar (2002) study with some minor exceptions (Beynon 2003, 44).

Anderson and Waddington (2007) have used the poverty-efficiency approach to analyze the amount of development aid needed to meet the MDG target of halving extreme poverty. They used three sets of aid-growth estimates in total but the study did not focus on analyzing the country allocations produced by different sets of estimates. Anderson (2007) has also proposed exploring the country allocations produced by using different sets of aid-growth estimates and, in a way, this study implements that research idea.

Even lately, the poverty-efficiency based practical approaches to identify under-aided countries have focused on a single set of estimates. The Development Assistance Committee (2012b) of OECD has used the poverty-efficiency approach as one of the quantitative measures to identify under-aided countries. They have used CPA data from 2010 and the methodology and a single set of estimates used by Collier and Dollar in 2001. However, they do not specify the source paper (DAC 2012b, 23).

In contrast to most recent practices, this thesis uses multiple aid-growth estimates to examine the effect of the estimate choices to the poverty-efficient allocation in 2011. In total, 16 poverty-efficient allocations are calculated using three different sets of aid-growth estimates, four poverty measures and four small country bias terms. The basic methodology of this study, as well as all poverty-efficiency research in general, closely follows the original mathematical methods used by Collier and Dollar (1999a; 1999b; 2001; 2002). Data

choices of this study are also in line with the Collier-Dollar (2002) choices with some exceptions. The data selection process is described in detail in subchapter 5.4.

In addition to the poverty-efficiency -focused empirical part of this thesis, some background information is presented. The second chapter focuses on the 2011 aid flows. In the chapter, the main donor countries and the current allocation of aid are presented. Some anomalies of the allocation are also highlighted in a cursory fashion. The third chapter presents views on the allocation of aid and focuses on the determinants of development aid and the approaches on making the aid more efficient. The fourth chapter presents research done on the impact of development aid focusing on the macroeconomic aid-growth studies. The aid-growth estimates affect the optimization process and have a significant impact on the poverty-efficient allocation.

The fifth chapter focuses on poverty-efficient allocation of development aid. In subchapter 5.1, a glance is taken at the academic literature dealing with poverty-efficiency. In 5.2, the methodology behind poverty-efficient allocation process is presented. The estimate and data choices are presented in subchapter 5.3. In addition, the effects of the estimates are shown by illustrating the properties of the growth function and the optimization problem. In 5.4, the country sample and data choices are presented. The main empirical results are presented in subchapters 5.5, 5.6 and 5.7. In these sections, the marginal productivities of aid and the calculated poverty-efficient allocations are presented. In addition, in line with previous research, I also consider the inclusion of the small country bias, a variable which mimics actual donor behavior, into the model. In order to see whether a small country bias still exists in the actual allocation, a linear regression model is estimated. The estimation also reveals other behavioral patterns of the donors. In 5.8, the poverty-efficiency of Finland's allocation of bilateral aid is studied as a case study and finally, in 5.9, some criticism and acclaim of poverty-efficiency principle is presented.

2. The current aid allocation

2.1 Official Development Assistance

The most important form of development aid in terms of size and impact is Official Development Assistance (ODA). The definition of official development assistance is given by the Development Assistance Committee (DAC) of the Organization for Economic Cooperation and Development (OECD). The Development Assistance Committee defines Official Development Assistance as the sum of grants and loans that meet certain criteria. First, grants and loans must be undertaken by the official sector of the donor country. Second, the main objective of the aid flows must be the promotion of economic development and welfare in the recipient countries. Third, ODA must be given on concessional financial terms and the grant element must equal to at least 25 per cent of the total. In addition to financial flows, technical co-operation costs are included in ODA. Grants, loans and credits for military purposes are excluded. Foreign direct investment, transfer payments to private individuals, donations from the public, and commercial loans are not included in the Official Development Assistance. The aid funded by non-governmental organizations has grown significantly in the last decades and now equals about one-third of official assistance. (Tarp 2010a, 3-4)

In this thesis, the main emphasis is on Official Development Assistance because it is the most recognized form of aid and the empirical work on aid effectiveness and efficiency is mostly based on ODA data.

2.2 The current Official Development Assistance figures

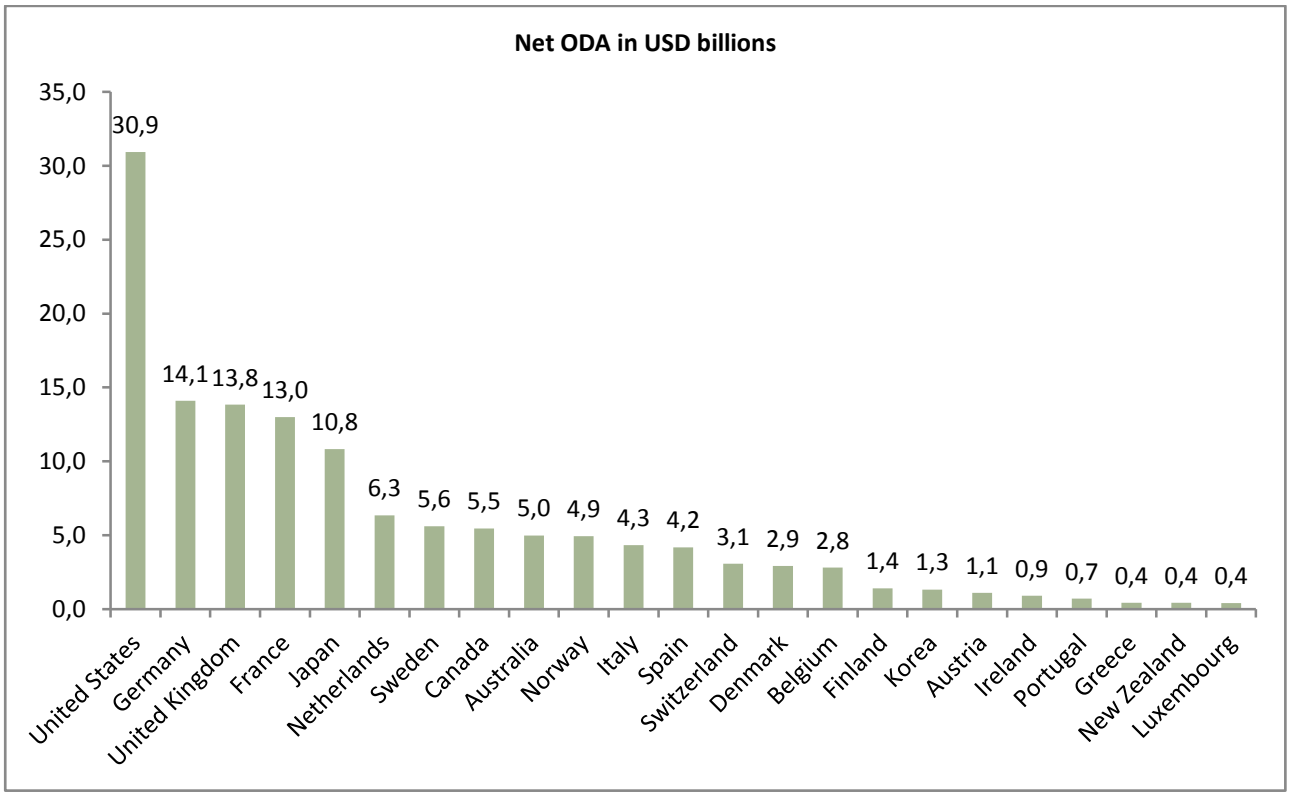
2.2.1 The donors

OECD released the final figures of the 2011 aid flows in March of 2013. The final figures show that the total net Official Development Assistance given by all donors was 156 USD billion and ODA given by DAC member countries was 134 USD billion. The figure of all donors includes ODA flows from multilateral institutions and non-DAC countries in addition to ODA from DAC member countries. (OECD 2013)

Figure 1 shows the net Official Development Assistance amounts given by DAC member countries in 2011. The largest donor countries by amount given were the United States, Germany, the United Kingdom, France and Japan. The total amount of aid given by the 17 EU member countries was 80,1 USD billion.

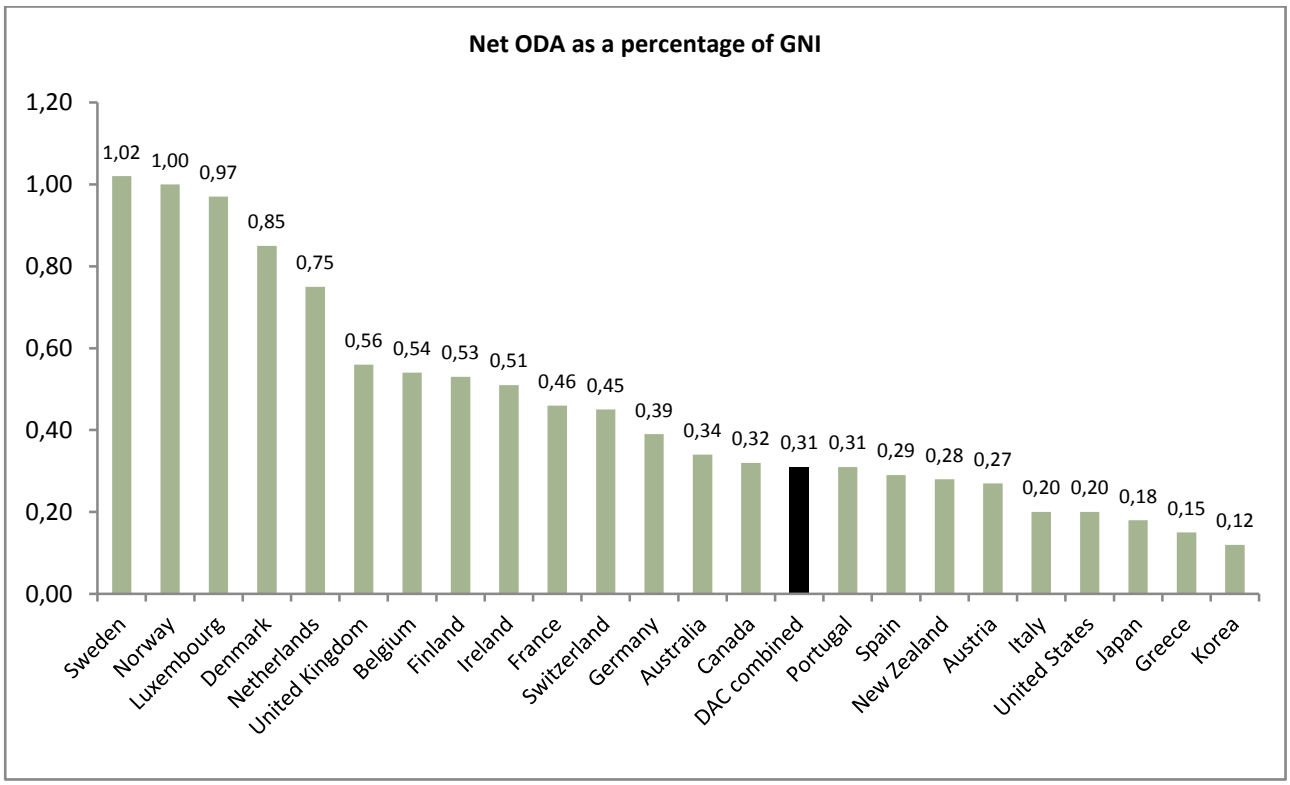
The net Official Development Assistance given by DAC member countries as a percentage of GNI in 2011 is shown in Figure 2. Sweden, Norway, Luxemburg, Denmark and the Netherlands were the only countries to exceed the United Nations' ODA target of 0,7% of GNI. ODA represented 0,31% of the donors' combined gross national income (GNI).

Figure 1. The net ODA given by DAC member countries in 2011



Source: OECD (2013) International Development Statistics

Figure 2. The net ODA given by DAC member countries as a percentage of GNI in 2011



Source: OECD (2013) International Development Statistics

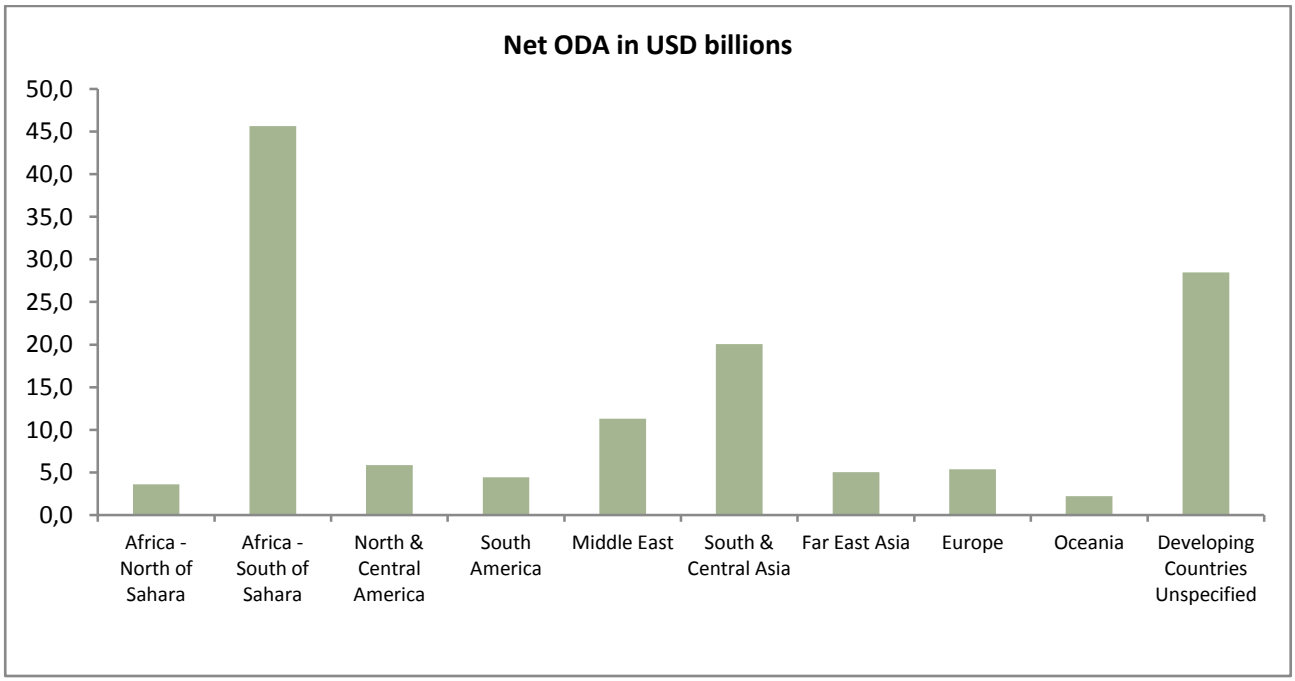
2.2.2 The receivers

The magnitude of the aid flow is highly dependent on the region. Unsurprisingly, most of the aid goes to South-Saharan Africa and South and Central Asia. The net ODA amounts received by region can be seen in Figure 3. In the figure, the category Developing Countries Unspecified is used if the aid flow benefits several regions.

Figure 4 shows that aid is not targeted exclusively to any income group. The income groups are based on a country grouping by the Development Assistance Committee (DAC 2013). Least developed countries (LDCs) receive the largest share of development aid but 31,2 USD billion is also targeted to Lower Middle-Income Countries. A large share of aid is also unallocated by income grouping. This grouping includes mainly aid flows to multilateral organizations. Because much of the aid given by multilateral organizations is also targeted to the LDCs, the actual aid flows to LDCs are higher than shown in the figure. At the moment, aid seems to be biased towards the LDCs.

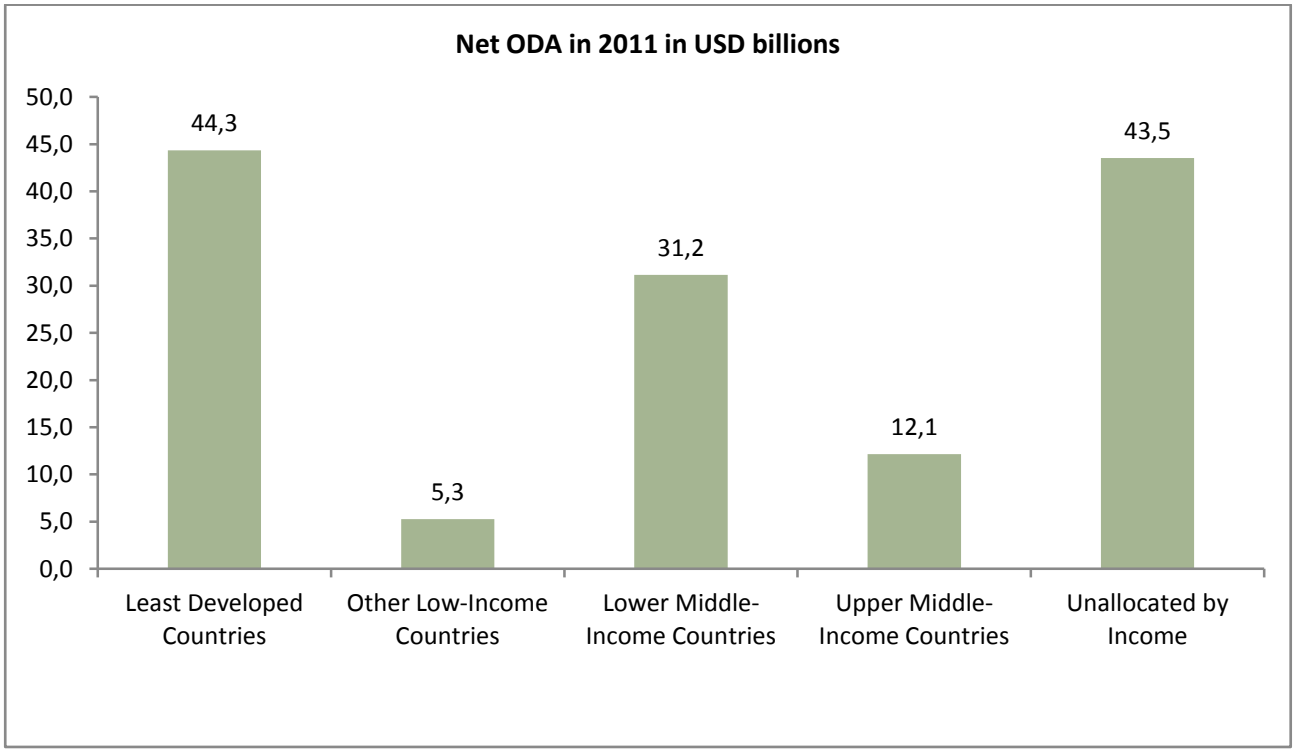
Because much of the global aid is given to the countries with the lowest per capita income levels, Kanbur (2011) has raised concern that aid may be disengaging from the bulk of the world's poor. Many of the people living in absolute poverty live in countries classified as Middle Income Countries by the World Bank. In the future, an even larger percentage of the world's poor will reside in MICs because some of the poorest countries are graduating to Middle Income status in the coming years. This can be problematic because most concessional development assistance is not available to MICs (Kanbur 2011, 2). In the future, this development will cause challenges for the international development community and the distribution of concessional development resources.

Figure 3. The net ODA amounts received by region in 2011



Source: OECD (2013) International Development Statistics

Figure 4. The net ODA amounts received by income group in 2011



Source: OECD (2013) International Development Statistics

Using the 2011 DAC list of LDCs and data from 2011, it can be seen that the differences in received aid amounts are large among the LDCs. Table 5 lists received aid per capita of different LDCs from which purchasing-power-parity adjusted GDP per capita data and recent survey-based $2-a-day poverty headcount ratio data was available. Only countries where the household surveys were conducted in the year 2000 or after are included in the list. The data is extracted from the World Bank database (World Bank 2013).

In the country list presented in Table 1, the per capita aid amounts range from USD 10,0 in Bangladesh to USD 455,5 in Sao Tome & Principe. A substantial amount of the differences in received aid per capita can be explained by the heterogeneity of the aid receiving countries. For example, the three countries receiving the most aid per capita are all small countries with a population of million or less. The most populous country on the list, Bangladesh, is also the one receiving the least aid per capita. However, a noteworthy aspect about the 2011 allocation of aid is that similar countries in terms of per capita GDP and poverty level may receive very different amounts of aid. For example, Bangladesh and Benin have similar levels of GDP per capita and poverty but Benin receives seven times more aid per capita than Bangladesh. However, the differences in other variables, namely population and location, may explain the differences in the case of Bangladesh and Benin. One significant example is also the case of Mozambique and Madagascar. Both countries are located in the same region, are similar in population size and have similar levels of poverty and GDP per capita. Despite these similarities, Mozambique receives more than four times more aid per capita than Madagascar.

GDP per capita and poverty level are not the perfect measures of countries' similarities but the data does raise questions about the allocation of development aid. Why do similar LDCs receive such different amounts of aid? Is the allocation efficient? Could it be improved? In the later chapters, I will address these questions by reviewing academic research done on the determinants of development aid and presenting different approaches to make the aid more efficient. However, the main focus of this thesis will be on poverty-efficiency which is the basis of most allocation models utilized by the donor community.

Table 1. Net ODA received per capita by LDCs in 2011

Country	Net ODA received per capita (current USD)	GDP per capita PPP (international dollars)	Poverty headcount ratio at $2 a day
Sao Tome & Principe	445,5	2077	54,2
Timor-Leste	241,3	1578	72,8
Bhutan	194,8	5846	29,8
Liberia	185,4	585	94,9
Haiti	169,1	1171	77,5
Lesotho	120,6	1691	62,3
Rwanda	116,8	1282	82,4
Mauritania	104,5	2532	47,7
Togo	90,5	1049	52,7
Mozambique	85,5	975	81,8
Senegal	82,4	1967	55,2
Congo, Dem. Rep.	81,5	373	95,2
Mali	80,2	1091	78,7
Zambia	79,6	1621	82,6
Guinea-Bissau	76,8	1270	78,0
Gambia	76,1	1809	55,9
Benin	74,4	1619	75,3
Sierra Leone	71,5	1131	76,1
Comoros	68,4	1110	65,0
Burundi	67,5	604	93,5
Laos	63,1	2790	66,0
Central African Rep.	60,6	810	80,1
Burkina Faso	58,3	1302	72,6
Cambodia	55,4	2358	49,5
Tanzania	52,9	1512	87,9
Malawi	51,9	893	90,5
Uganda	45,8	1345	64,7
Ethiopia	42,1	1109	66,0
Chad	40,9	1498	83,3
Niger	40,4	727	75,2
Nepal	29,3	1252	57,3
Guinea	20,3	1124	69,6
Yemen	19,2	2333	46,6
Madagascar	19,2	966	92,6
Angola	10,2	5920	70,2
Bangladesh	10,0	1777	76,5

Source: World Bank (2013) Development Indicators

3. Views on the allocation of aid

3.1 Determinants of aid allocation

As previously stated, similar countries may receive very different amounts of aid. Part of the explanation is that aid is given for very different purposes. Building infrastructure, strengthening education systems and responding to humanitarian emergencies are all common goals of development policy. On the other hand, it is often possible that aid is given primarily with the interests of the donor countries in mind. Aid can be seen as a tool to reach political or commercial goals of the donor countries. In this chapter, I briefly present research done on the determinants of development aid's allocation. The chapter is based on a paper by Anke Hoeffler and Verity Outram (2011).

A substantial amount of research has been done on the motivation behind foreign aid. McGillivray and White (1995) have written a survey of literature done before 1990. In addition, Berthélemy (2006) and Dollar and Levin (2006) have written survey articles on more recent studies done on the determinants of development aid. The studies have concluded that political and economic interests of donors are often more important than the developmental needs or merits of the aid receiving countries. (Hoeffler & Outram 2011, 238 – 239)

Maybe the best known aid allocation study to date was done by Alesina and Dollar in 2000 (Alesina & Dollar 2000). They state that bilateral donors find strategic and historical factors more important than the developmental needs of aid recipients. Major donors tended to give considerably more aid to ex-colonies than they should receive based on the efficient allocation of aid. In addition, Alesina and Dollar also demonstrated a link between the UN voting patterns and aid commitments. In more recent studies, Berthélemy and Tichit (2004) and Berthélemy (2006) have addressed some of the econometric problems in the estimation of aid allocation models. Despite using more sophisticated methods, they have reached the same conclusions as Alesina and Dollar. The self-interest of the donor countries is a significant determinant in the allocation of development aid. (Hoeffler & Outram 2011, 239)

In their study, Hoeffler and Outram use a large set of data covering the period 1980-2004. They control for time-invariant donor and recipient effects and analyze the differences in aid allocation between the top five donor countries. They also see how the top five donor countries differ from the average DAC member country. The main contribution of their paper is assessing the relative importance of recipient need and merit relative to donor self-interest. They show that unobserved recipient effects are very important. In some cases, fixed effects can scale up the aid allocation by a factor of 100. Hoeffler and Outram take this as a sign of poor understanding of donor behavior. When analyzing the effect of observed variables, they find strong evidence that donors act out of self interest. All donors give more aid to their trade partners. The

United Kingdom and the United States also provide more aid to countries who vote with them in the United Nations. Hoeffler and Outram find evidence that donors do consider the recipient need when allocating aid. However, Hoeffler and Outram report that they found only limited evidence that donors take the recipient merit into account when allocating aid. Hence, they conclude that recipients have very little incentive to initiate reform in order to receive more development aid. (Hoeffler & Outram 2011, 248 – 249)

All in all, it can be concluded that development aid is not given based on recipient need or merit only. All of the studies mentioned in this section have found that donor self-interest is a significant determinant of aid allocation. Hence, it is not surprising that similar countries may receive significantly different amounts of aid.

3.2 How should aid be allocated?

As stated earlier, similar LDCs can receive very different amounts of aid per capita. The allocation of aid is also only weakly based on the needs of the recipient countries. Hence, it is unlikely that the allocation of development aid is optimal at the moment. This raises questions about how aid should be allocated.

There are several approaches to aid allocation because identifying countries which receive too little or too much aid is not straightforward. Robert Utz (2010, 2 – 3) divides the approaches into three broad categories: needs, poverty-efficiency and equal-opportunity based allocations.

The *needs-based approach* focuses on the needs of the receiving country. The variables taken into account are, for example, per-capita income, life expectancy, literacy and a financing gap derived from macroeconomic models. According to Robert Utz, the UN's plan to achieve the Millennium Development Goals is an example of a country-level needs-based approach. Aid allocation is planned to minimize the gap between actual levels of MDG variables and their target values. If the gap is large, the country in question should receive more aid (McGillivray, 2006). Adrian Wood (2004) has criticized this approach because it does not take into account differences in marginal cost of poverty reduction across countries. Hence, it is fully possible that the approach may lead to an inefficient allocation. (Utz 2010, 2)

The *poverty-efficiency based approach* was first introduced in a published paper by Paul Collier and David Dollar in 2001 (Collier & Dollar 2001). In the paper, they derive an algorithm for the poverty-efficient allocation using the linkages between aid and economic growth and economic growth and poverty reduction. Collier and Dollar calculate the marginal cost of poverty reduction as a function of a country's poverty level and the quality of its policies. The global poverty reduction is maximized when the marginal impact of aid is equalized among the aid receiving countries. (Utz 2010, 3; Collier & Dollar 2001, 1476)

Another description of the poverty-efficient allocation is provided by Edward Anderson (Anderson 2007, 1 – 2). The poverty-efficient allocation of aid can be defined as an allocation of aid which maximizes the reduction of poverty at the global level. The principle of poverty-efficiency proposes that relatively more aid should be targeted to countries which have higher levels of poverty. In addition, the principle requires that relatively more aid is targeted to countries where the effectiveness of development aid is higher. If countries have similar levels of poverty, a poverty-efficient allocation targets more aid to the country where the effectiveness of aid is higher.

Unlike the other approaches, the *equal-opportunity based approach*, introduced by Llavador and Roemer (2001), does not focus on the outcomes of development aid. The objective of the approach is to provide equal opportunities to individual countries for achieving desired development outcomes. Hence, aid is allocated to offset the structural disadvantages of countries. Cogneau and Naudet (2004) have calculated allocations based on the equal-opportunity approach and found that the allocations, like the Collier-Dollar allocations, allocate more aid to the poorest countries. (Utz 2010, 3)

One of the most recent debates closely connected to the concept of poverty-efficiency approach is about the goals of development policy. Should aid be allocated to reach global or country-specific goals? The United Nations' Millennium Development Goals were originally specified as global targets but are now interpreted as country goals (Anderson 2007, 3). This means that the goal no longer is to achieve the largest possible reduction in global poverty. However, country-specific approach can be seen as being more ethical than the global target approach because countries where aid effectiveness is low, possibly due to instability of the country or bad policy environment, receive larger amounts of aid. Paul Collier (2012, 1) has described this as the uncomfortable trade-off between need and effectiveness. Aid money can either be used well in environments which are less needy or it can be targeted to the neediest countries where much of it will be used suboptimally. The concept of poverty-efficiency can also be seen as an attempt to formalize this trade-off (Collier 2012, 1).

Anderson and Waddington (2007) have studied the opportunity costs of the country goals approach and found that the opportunity cost of using the approach is likely more than 10 million people, and could be as high as 70 million people depending on the used aid-growth estimates. In their study, the opportunity cost is the additional reduction in global poverty before 2015 if a global approach is used instead of the current country-by-country approach.

3.3 The use of quantitative models in practice

The aid allocation practices differ vastly depending on the donor. Multilateral aid agencies generally use resource allocation formulas to determine their aid allocations. Development banks' concessional funds, for example, World Bank's International Development Association (IDA) and Asian Development Fund, use poverty-efficiency based formulas which take into account countries' needs and institutional performance. The United Nations agencies use mostly needs-based approaches. Some global funds, for example the Global Fund, have resource allocations which are driven by project-specific demand and programmed performance without country-specific limits. (DAC 2012b, 9)

Bilateral donors do not usually rely on resource allocation formulas. However, there are a few exceptions among the bilateral donors, such as the United Kingdom and Netherlands, which use aid allocation formulas as a determinant to guide their overall aid allocation decisions. A more common approach among the bilateral donors is to use a mix of criteria. These criteria can include, for example, a country's needs, institutional performance, historical and colonial ties and commercial and geopolitical interests. Most bilateral agencies also decide which countries are eligible to receive aid before choosing their priority countries. The decision can be made based on an income benchmark or political grounds. (DAC 2012b, 9)

In general, most quantitative aid allocation approaches are, to different degrees, based on the poverty-efficiency approach. Most multilateral development organizations use the framework of poverty-efficiency as a tool when making decisions on the allocation of aid. One of the best known users of the poverty-efficiency based allocation approach is World Bank's International Development Association (IDA).

Another typical feature of aid allocation approaches is that the decisions are generally unilateral. When making decisions on aid allocation, donors do not usually consider what other donors are doing at the time or planning to do in the future. This is not surprising considering that no framework or co-ordination mechanism exists at the moment. In a way, the concept of poverty-efficiency also provides a tool to address this issue. The poverty-efficient allocation helps to identify the countries receiving too little aid when the total amount of aid is considered. (DAC 2012b, 9 – 10)

4. The impact of development aid

In this chapter, I focus on the macroeconomic impact of aid. Aid-growth literature of the macroeconomic level is highly relevant to poverty-efficiency because the poverty-efficient allocation optimization process uses macroeconomic aid-growth estimates.

4.1 The micro-macro paradox

The impact of development aid remains a highly controversial topic. Some scholars are calling for an increase in development aid and others want to abolish a system they see as ineffective or even harmful. In 1987, Paul Mosley introduced the idea that while development aid seems to be effective at the microeconomic level, it is hard to identify a positive impact of aid in the aggregate macroeconomic level (Mosley 1987). He called this effect the *micro-macro paradox*. Even today the ongoing dispute is mainly about the aggregate impact of aid. Hence, it can be said that the micro-macro paradox, more than 20 years after it was first introduced, is still in the center of the debate about aid effectiveness.

At the microeconomic level, aid is generally seen as effective if the projects are well-designed. According to Finn Tarp (2010a, 9), the microeconomic evidence offers a reasonably positive picture of aid effectiveness. For example, the most rigorous evaluations are done by the World Bank's Independent Evaluation Group and the performance report of the World Bank group indicates that the outcome ratings for development policy operations were at least moderately satisfactory for 83 percent of operations completed between 2009 and 2011 (IEG 2013, 21 – 22). At the macroeconomic level, the impact of development aid remains a contentious issue despite forty years of research.

4.2 The macroeconomic literature on aid effectiveness

The literature on the impact of aid on growth has a long and diverse history. Channing Arndt, Sam Jones and Finn Tarp have identified four generations of literature in total (Arndt et al. 2010). The first generation of literature emerged in the 1970s and a leading paper of the latest generation was published in 2008. Differences between generations are mostly about theoretical paradigms of the time and empirical tools available. (Arndt et al. 2010, 2 – 4)

The first two generations of literature used simple growth models; for example, the Harrod-Domar model was used. The idea behind the model is a stable linear relationship between growth and physical capital. If it is assumed that all aid is invested, calculating how much aid is required to achieve a specific growth rate is straightforward. The effect of aid was assumed to be positive. Aid's function was to help fill a gap in the

savings or in the foreign exchange. Empirical research was mainly focused on the effect of aid to savings and investment in recipient countries. The first generation of research shows that aid increases total savings, but some of the aid is also consumed, and the increase in total savings is not as large as the aid flow. (Arndt et al. 2010, 2)

The second generation of research retained the focus on capital accumulation and explored the effect of aid on investment and growth. The studies in the 1980s and early 1990s consistently found a positive link between aid and investment. The majority of studies also found a positive impact of aid on growth. However, the studies were criticized on the basis that growth is less related to physical capital investment than often assumed (Easterly 1999). The second generation of literature also introduced the issue of endogeneity of aid. The problem is that poorly performing countries may receive more aid because of their poor growth performance. If studies do not take this into account, they will not reveal aid's causal impact on growth. (Arndt et al. 2010, 2)

Third generation of econometric studies started to appear in the early 1990s. This generation took advantage of the availability of panel data and new theories of economic growth. The aid-growth relationship was perceived as non-linear when needed and the endogeneity of aid was better taken into account. The idea of conditional aid effectiveness was also introduced in a third generation study by Burnside and Dollar (Burnside & Dollar 2000). According to Burnside and Dollar, aid only has a positive impact on growth in developing countries with good policy environment. However, the paper has received criticism from other researchers. Hansen and Tarp found that diminishing returns to aid are best captured by the non-linear relationship between aid and growth (Hansen & Tarp 2001). In 2004, Easterly, Levine and Roodman stated that the Burnside-Dollar conditional aid effectiveness result is also fragile when the dataset is expanded to include more years and countries (Easterly et al. 2004). Roodman has also argued in an analysis of the third generation aid-growth literature that all the results of the generation are very sensitive to methodological choices, and stated that while aid is likely to increase investment and growth, it is probably not a decisive factor for development (Roodman 2007). (Arndt et al. 2010, 2 – 3)

According to Arndt et al., the distinctive aspect of the fourth generation is the notion that aid does not have a positive aggregate impact on economic growth. They state that the leading paper to establish this result is a study by Rajan and Subramanian (2008). In this paper, the researchers find no systematic effect of aid on growth. The effect stays the same regardless of the estimation approach, the time period or the type of aid. The explanation for aid's non-positive aggregate effect on growth is often linked to political economy dynamics. Djankov, Montalvo and Reynal-Querol argue that aid's effect to a country is similar to the effect of natural resource curse (Djankov et al. 2008). In addition, Rajan and Subramanian find that the rate of growth of value added by the manufacturing sector has been eroded by the negative effect of aid inflows to

the quality of governance (Rajan & Subramanian 2007). Fourth generation researchers are also more skeptical about the ability of scholars to find causal effects behind economic growth. Scholars have criticized especially previous methods to deal with the aid endogeneity problem. The third generation researchers frequently used dynamic panel GMM models but it is now understood that this approach is not always rigorous enough. For example, weak instruments bias coefficient estimates towards their unadjusted counterparts in both panel GMM and cross-section estimators. (Arndt et al. 2010, 3)

In their paper, Arndt et al. (2010) also enhance some aspects of the fourth generation study, e.g. instrumentation strategy and the model specification, done by Rajan & Subramanian (2008). After applying their modifications they were able to find a positive, though not very large, impact of aid on economic growth.

At the moment, the total amount of studies done in the field is substantial. Mekasha and Tarp (2011, 3 – 4) have published a meta-analysis of the macroeconomic aid-growth research done between 1970-2004. In total, the number of published and unpublished studies listed in the paper is 68, each reporting one or more regressions. The total amount of regressions observed is 542. The Mekasha and Tarp study follows the approach by Doucouliagos and Paldam (2008) with slight improvements and corrections. Mekasha and Tarp have fixed some data issues of the original study as well as improved the econometric modeling and statistical choices.

First, Mekasha and Tarp (2011, 2) state that the original Doucouliagos and Paldam (2008) assumption that the random sampling error is the only factor behind variation in reported effects, is highly unrealistic. Therefore, they choose to reject this 'effect homogeneity' assumption and use random effects meta-analysis. Second, they criticize the treatment of papers that include non linear terms. The Doucouliagos and Paldam (2008) study mismeasures the partial effect of aid because it disregards non-linear effects of aid captured by interaction terms. These terms can include, for example, aid squared, aid-policy or aid-institution interaction terms. Mekasha and Tarp have not solved the issue but they have accounted for it by separating the studies with non-linear terms in their calculation process. Third, in contrast to Doucouliagos and Paldam (2008), they decide to use the inverse of the variance of estimates as weights when calculating the weighted average effect of aid on growth. The study by Doucouliagos and Paldam uses the sample size as the weight when calculating the weighted averages. In addition, Mekasha and Tarp corrected some mistakes in the research data. (Mekasha and Tarp 2011, 2)

Because of the modification of the research methodology, the conclusions of the two papers differ. Doucouliagos and Paldam conclude that aid's impact on growth is non-existent but Mekasha and Tarp find that the effect of aid on growth is positive and statistically significant. When using their methodology and focusing on studies without conditionality, i.e. without a non-linear term, their point estimate for the aid's

effect on growth is 0,138 and statistically significant. The 95% confidence interval associated with this point estimate had a lower limit of 0,113 and an upper limit of 0,162. When studies with conditionality are examined, the weighted average of the growth rates is 0,06. However, the information value of the latter is low because the calculation method disregards non linear terms. (Mekasha and Tarp 2011, 8)

All in all, the diversity and volume of aid-growth literature are significant. Many of the studies have reached contradictory conclusions about aid's impact on growth. However, some of the latest additions to the field by Arndt et al. (2010) and Mekasha and Tarp (2011) show positive results. The multitude of results is also problematic for the calculation of poverty-efficient allocations because the optimization process relies heavily on aid-growth estimates. In addition, taking into account the diversity of the aid-growth literature, it is noteworthy that the allocation models used currently by different organizations mostly use a single set of estimates, specifically the Collier-Dollar (2002, 1479) growth estimates which include an estimate for the interaction term of aid and policy.

5. Poverty-efficient allocation of aid

In this section, I present both the methodology behind poverty-efficiency as well as the empirical application to 2011 data. First, the academic literature about poverty-efficiency and the methodology behind poverty-efficiency are introduced. Second, the estimate and data choices are presented. It is noteworthy that three sets of estimates are used to calculate the poverty-efficient allocations in order to test the sensitivity of the framework to estimate choices. In previous literature and practical use, the poverty-efficient country allocations have been calculated mostly using the Collier-Dollar (2002) estimates with the exception of Lensink and White (2000). Anderson and Waddington (2007) use multiple sets of estimates when applying the framework of poverty-efficiency but their aim is not to evaluate differences in country allocations produced by the different estimate sets but to study the total amount of additional development aid needed to meet the MDG target of halving extreme poverty by 2015.The development banks which use poverty-efficient allocations as a guideline when allocating aid also rely on models which use the Collier-Dollar estimates as a basis. A recent DAC (2012b) study presents four quantitative allocation models, two of which are based on the Collier-Dollar set of aid-growth estimates. Hence, it is interesting to see how much using different sets of estimates affects the poverty-efficient country allocation. This is especially intriguing because of the diversity of the macroeconomic aid-growth research and the fact that there are so many sets of aid-growth estimates to choose from. Third, to study the effects of the different estimate sets, the properties of the growth function are illustrated using the three chosen sets of estimates. In addition, to simplify the logic behind the optimization, the properties of the optimization problem are explained using a specific set of estimates. Fourth, the country sample and data choices are presented.

Fifth, the actual empirical part starts with presenting the marginal productivities and the poverty-efficient allocations of aid using data from 2011 and three different sets of estimates and four different poverty measures. Sixth, in line with previous research, I also consider the inclusion of the small country bias, a variable which mimics actual donor behavior, into the model. In order to see if a small country bias still exists in the data, a linear regression model is estimated. The estimation also reveals other behavioral patterns of the donors with the main emphasis being on whether the actual allocation of 2011 is in line with the assumptions of poverty-efficiency. Because the linear model revealed that a small country bias still exist in the data, an optimization with the bias incorporated into the model is calculated.

Seventh, the poverty-efficiency of the bilateral development aid given by Finland is evaluated. Finland is also a good example of a small bilateral donor. Poverty-efficient allocations are widely used in multilateral development organizations but are much less utilized by small donors. Finally, the advantages and

disadvantages of the poverty-efficiency principle are presented. The section is based on academic literature and an interview with two senior staff members of the Foreign Ministry of Finland.

5.1 The literature

As stated in previous chapters, the concept of poverty-efficiency was first introduced by Paul Collier and David Dollar in 2001 (Collier & Dollar 2001). A working paper version of their paper was published in 1999. In 2002, Collier and Dollar (2002) apply the idea of poverty-efficiency to a different set of data using alternative estimates of the relationship between aid and growth. The main finding is that the actual allocation of aid differs radically from the poverty-efficient allocation and the poverty impact of aid could be roughly doubled if donors used the recent research findings in deciding their aid allocation (Collier & Dollar 2002, 1475).

In 2000, after the release of the Collier and Dollar working paper on poverty-efficient aid allocations, Lensink and White (2000) reviewed the methodology of Collier and Dollar. They mainly point out some methodological and empirical problems of the Collier and Dollar paper. First, they state that aid can reduce poverty through many channels, not just growth. Second, they question what constitutes good policy because Collier and Dollar use an estimate set which includes an estimate for the interaction term of aid and policy. Third, they point out that the empirical aid-growth estimates are highly sensitive to changes in model specification and the data sample. On these grounds, they argue against adopting the Collier-Dollar model to practical use.

Beynon (2003) subjects the Collier-Dollar aid allocation models to additional sensitivity tests and evaluates the robustness of the Collier-Dollar results. He also analyzes the relative efficiency of aid allocations over time and between donors. Beynon (2003, vii) concludes that the Collier-Dollar aid allocation models are useful in focusing attention to major anomalies in aid allocations, but require further development to include more variables with which aid interacts.

Anderson and Waddington (2007) apply the Collier-Dollar model to calculate the amount of development aid needed to meet the MDG target of halving extreme poverty by 2015. They also use three different sets of estimates of the relationship between aid and growth and use these different estimates to analyze the maximum amount of aid which can be absorbed by each country. They conclude that the choice of aid-growth estimates is important when deciding whether a substantial increase in existing aid levels is justified.

Adrian Wood (2008) develops the idea of poverty-efficiency further by creating a forward-looking allocation model based on the Collier-Dollar model. According to Wood, the Collier-Dollar approach to aid allocation

has not been fully implemented because it conflicts with the aid allocation implied by the Millennium Development Goals. The Collier-Dollar approach focuses on global poverty targets while the MDGs are generally seen as country-specific targets. Wood also argues that the Collier-Dollar approach and the MDG approach are just special cases of a more general model of aid allocation. Wood derives this general aid allocation formula which also takes into account the fact that donors care about future poverty as well as current poverty.

According to Wood (2008), the fact that donors care about future poverty is detectable from the donors' bias towards Sub-Saharan Africa. Sub-Saharan Africa receives more aid than would be efficient based on the Collier-Dollar approach because donors suspect that the economic growth of the region will remain relatively slow in the years to come. Hence, there is a need for a forward-looking allocation model which incorporates this donor behavior. Wood's forward-looking allocation formula has not been utilized by the donor community. Partly because of the low level of utilization of the Wood model, the focus of this thesis will be on the standard Collier-Dollar model of poverty-efficiency.

5.2 Methods

The intuition behind the Collier-Dollar approach for allocating aid is simple. Aid impacts the growth rate of the receiving country, and in turn, growth in low-income countries will lead to poverty reduction. Collier and Dollar state that a paper by Dollar and Kraay (Dollar & Kraay 2001) shows that average growth of per capita GDP is translated into proportional growth of the income of the poor. The policies that are good for growth are also good for the income of the poor. (Collier & Dollar 2002, 1482)

In order to maximize the reduction in poverty, aid should be targeted to countries that have large amounts of poverty and good policy. To formalize this idea, Collier and Dollar consider a world in which aid is given with the purpose of maximizing the reduction in poverty. In their model, aid effects growth, but policy and the distribution of income within recipient countries are exogenous from the point of view of aid donors[1]. (Collier & Dollar 2002, 1482 – 1483)

[1] Collier and Dollar note that in some cases aid may change the distribution of income. It is often targeted to the very poorest in a country. The assumption of the distribution of income and policy being exogenous is made based on past research. Research has found that aggregate aid tends to be fungible (Pack & Pack 1993; Feyzioglu et al. 1998). According to Collier and Dollar, aid also has distributional consequences similar to a general increase in public expenditure combined with a general decrease in taxation. They also state that evidence from developing countries suggests that such changes will not be very distributionally progressive. Public spending in developing countries is slightly progressive (van de Walle 1995; Devarajan & Hossain 1998), but according to Collier and Dollar the tax reduction effect of aid is likely to be regressive. Collier and Dollar also state that the distribution of income is fairly stable over time in the majority of countries (Li et al. 1998). All in all, they assume that the net impact of development aid is distributionally neutral. (Collier & Dollar 2002, 1482 – 1483)

The objective function of donors is to allocate aid among countries to

$$\text{Max poverty reduction} \qquad \sum_i G^i \alpha^i h^i N^i \qquad (1)$$

$$\text{subject to} \qquad \sum_i A^i y^i N^i = \bar{A}\,, \quad A^i \geq 0, \qquad (2)$$

where A^i is the net aid inflow per capita divided by GDP per capita, y^i is per capita income, $\bar{A}$ is total amount of aid, h^i is a measure of poverty, $\alpha^i$is the elasticity of poverty reduction with respect to income, N^i is population, and the superscript i indexes countries. Growth, G^i, is a function of a country's policy and the amount of aid it receives. (Collier & Dollar 2002, 1483; Beynon 2003, 44)

The optimization problem (1) & (2) results in equating the marginal productivity of aid in different countries. There is a simple way to interpret this result: donors want to allocate aid among countries to maximize a weighted average of their growth rates, where weights are population times a measure of poverty. If the poverty measure is the headcount index, the maximization has an especially simple interpretation: aid should be allocated so that the marginal cost of lifting a person above the poverty line is the same in every aid-receiving country. (Collier & Dollar 2002, 1484)

Collier and Dollar do not disclose the function form of the growth variable in the optimization problem (1) but based on my replication of their 2002 study I am sure that it is based on the same formula used in a study by Anderson and Waddington[2] (2007, 7). Therefore, the relationship between aid and growth follows the formula:

$$G^i = a^i + \left(b + dP^i\right)A^i + (c + eP^i)A^{i^2}, \qquad (3)$$

where G^i is the recipient country's rate of growth, A^i is its net aid inflow as a share of its GDP, P^i is the quality of the recipient country's policy, a^i is a country's 'underlying' growth rate, b, c, d and e are econometric estimates for parameters, and the superscript i indexes countries. The underlying growth rate, a^i, is the growth rate of a country if it receives no aid. (Anderson & Waddington 2007, 7)

[2] I decided to present the equation in a slightly different form to illustrate the impact of the negative econometric estimates.

5.3 Aid-growth estimates

5.3.1 The choice of estimates

One of the most important choices when calculating the poverty-efficient allocation is the choice of econometric estimates for the relationship between aid and economic growth. In a meta-analysis by Mekasha and Tarp (2011, 3 – 4), the authors study 68 published and unpublished aid-growth studies covering the period 1970-2004. Each of these studies reports one or more regressions, and the total amount of regressions observed is 542. There is, however, one important caveat which restricts the amount of applicable estimates: the regression equation must have a variable capturing the diminishing returns of aid and it must be statistically different from zero. If this not the case, the constrained optimization problem (1) & (2) does not generate an answer (Anderson & Waddington 2007, 14). In their meta-analysis, Mekasha and Tarp (2011, 8) observe 97 regressions which include the aid squared term which captures the diminishing returns of aid. The parameters for the diminishing returns of aid are denoted c and e in the formula for the relationship between aid and growth (3).

The natural starting point is to use the estimates from the study by Paul Collier and David Dollar (CD) (2002). These estimates are used in most of the formulas utilized by multilateral development organizations and are the usual starting point in poverty-efficiency literature. More specifically, I chose the estimates of the baseline regression (Collier & Dollar 2002, 1479) which are also the ones used by the authors. The most exact values of the Collier-Dollar estimates can be found in an annex of the study done by Jonathan Beynon (2003, 55). In addition, I wanted to examine the effects of different estimates to the poverty-efficient allocation. In order to do this, I selected three sets of econometric estimates in total. The other two sets of estimates chosen were from studies done by Lensink and White (LW) (2001) and Hansen and Tarp (HT) (2001). Both studies have been published in refereed academic journals, which gives credibility to the studies and the estimation results. The same choice of studies was also made by Anderson and Waddington (2007) when they studied the amount of additional aid needed to meet the MDG poverty target by 2015. However, deviating from the choices made by Anderson and Waddington, I chose a different set of estimates from the Collier and Dollar (2002) study to be in line with the choices made by Collier and Dollar.

One important distinction between the studies is the role of policy in the receiving country. Hansen and Tarp and Lensink and White do not find that the policy environment of the receiving country has a substantial impact on growth. However, Collier and Dollar (2002) find the quality of the receiving country's policy to be an important factor for aid's impact on growth. The most significant variable in their baseline regression is the interaction of aid and policy with a positive coefficient. Aid and aid squared have negative coefficients and are jointly significant. (Collier & Dollar 2002, 1480)

Choosing estimates from the study by Hansen and Tarp (2001) proved to be somewhat troublesome. Anderson and Waddington (2007, 14) state that they have used econometric estimates from this study. However, from the program files sent to me by Edward Anderson via email, it can be seen that the estimates used do not correspond with any of the estimates in the regressions reported in the paper by Hansen and Tarp. They are close to the estimates in specifications 1.1 and 1.2 in Table 1 but differ slightly (Hansen & Tarp 2001, 19). Since the differences are small enough to be negligible, I decided to use the estimates from specification 1.2. As an aside, the used estimates are from a section of the Hansen and Tarp study in which the authors themselves state that their goal is not to evaluate the effectiveness of aid and they only want to evaluate the regression specifications proposed by others. However, I wanted to follow the choices made by Anderson and Waddington and decided to include the set of estimates nonetheless.

In the study done by Lensink and White (2001), there is only one set of applicable estimates. The estimates are taken from specification 4 in Table 5 (Lensink & White 2001, 54).

Choosing which estimates to use for the relationship between aid and growth is not straightforward. The main problem is the rapid development in the methodology of aid-growth studies and differences between generations of research. All of the studies listed above have received criticism and the choice of estimates is always questionable to some extent when calculating poverty-efficient allocations. It would have also been interesting to include some fourth generation studies but this was not possible due to the fact that so few are published and the studies do not generally include a variable to capture the diminishing returns of aid.

The chosen sets of econometric estimates are listed in Table 2. The Hansen-Tarp estimate set differs from the other two because Hansen and Tarp have used the ratio of aid and GDP as the aid variable. The other two studies use aid as a percentage of GDP as the aid variable.

The newest and methodologically most robust linear treatment estimates by Arndt et al. (2010, 24) range from 0,12 to 0,30 with the final result being 0,16. They have used the ratio of aid and GDP as their treatment variable and the results can therefore be directly compared with the Hansen-Tarp estimates (Arndt et al. 2010, 24). The newest linear estimates by Arndt et al. are relatively close in magnitude to the chosen estimates by Hansen and Tarp and Lensink and White. Comparison to the Collier-Dollar estimates is difficult due to differences in model specification because the Collier-Dollar study incorporates the aid and policy interaction variable into the model. However, when the growth effect of aid is studied focusing on countries with relatively low policy scores from 2,5 to 3, the linear effect is relatively similar in the Collier-Dollar and Arndt et al. studies.

Table 2. Econometric estimates of the relationship between aid and economic growth

	Collier-Dollar	Hansen-Tarp	Lensink-White
A	-0,537	0,23	0,1466
A^2	-0,025	-0,737	-0,0013
A*P	0,313	0	0

5.3.2 Illustrating the properties of the aid-growth relationship

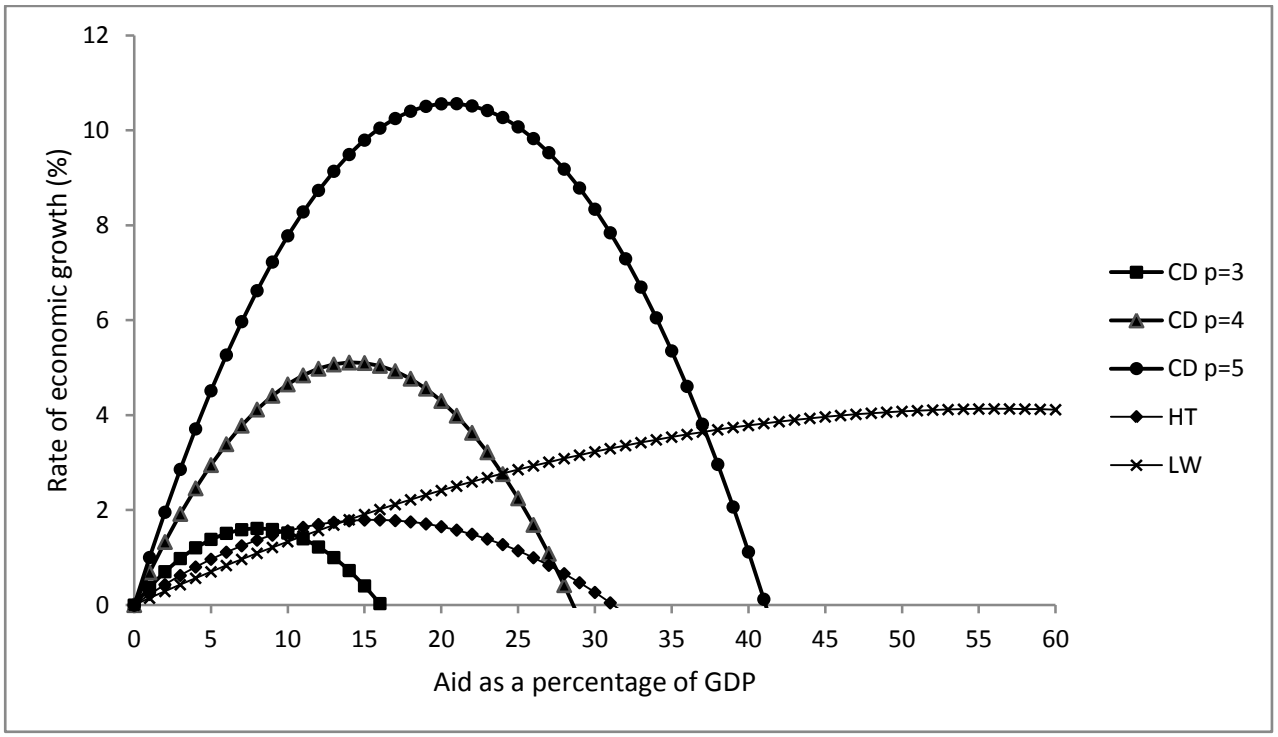
The estimates for the relationship between aid and growth affect growth as follows:

$$G^i = \left(b + dP^i\right)A^i + (c + eP^i)A^{i^2}. \qquad (4)$$

The variables have the same meanings as in equation (3).

The three sets of econometric estimates, listed in Table 2, provide very different estimates on aid's impact on economic growth. This relationship can be seen in Figure 5. Focusing on the optimal level of aid, the highest estimate of growth is acquired using Collier-Dollar estimates for countries with a high policy score. The lowest estimate is also acquired using the Collier-Dollar estimates but focusing on the countries with the lowest policy score. Specific values for the maximum growth using the optimal level of aid are 1,6 % (CD, policy level 3), 5,1 % (CD, policy level 4), 10,6% (CD, policy level 5), 1,8 % (HT) and 4,1 % (LW).

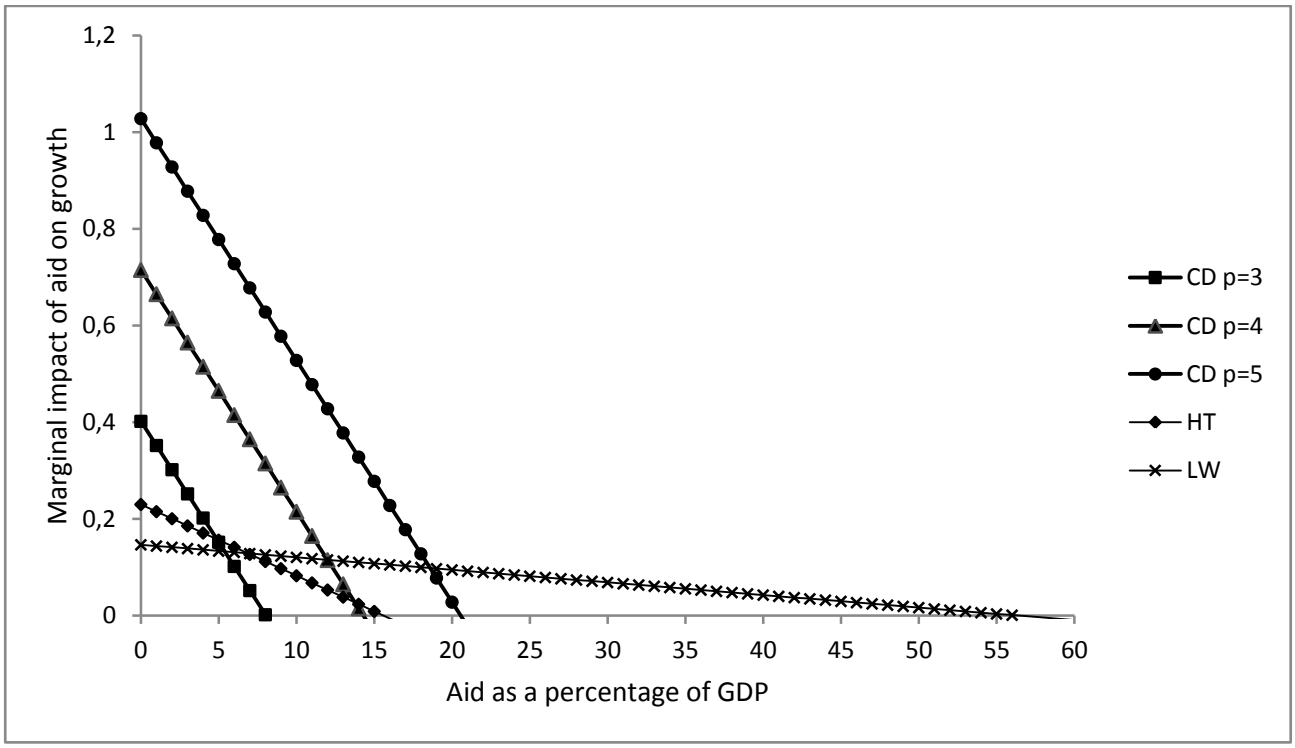
Figure 5. Estimates of the relationship between aid and growth



Source: Author's simulation

Different sets of estimates also provide very different estimates of the maximum amount of aid which can be absorbed in the recipient country. Specifically, the maximum amount of aid which is possible to be absorbed is the amount of aid as a percentage of GDP which maximizes the growth rate. The growth rate is maximized when the marginal impact of aid on growth is zero. Figure 6 shows the marginal impact of aid on growth. The lowest estimate of the absorptive capacity is acquired by using the Collier-Dollar estimates for countries with the lowest policy score, and the highest estimate for absorptive capacity is acquired by using estimates from the Lensink and White study. Specific values for the maximum amount of aid which is possible to absorb implied by different estimates are 8,0 % (CD, policy level 3), 14,3 % (CD, policy level 4), 20,6 % (CD, policy level 5), 15,6 % (HT) and 56,4 % (LW).

Figure 6. The marginal impact of aid on growth



Source: Author's simulation

It is evident that the differences in the maximum growth rate and the absorptive capacity are large and choice of estimates will certainly have a great impact on the following calculations. The most striking fact is that the absorptive capacity calculated using the Lensink-White estimates is very high. According to the estimates, a country could receive aid amounts which are over half of its GDP before aid starts to have negative effects. It is also interesting to note that almost all of the allocation models used currently by different organizations use the Collier-Dollar set of growth estimates which includes the interaction term for aid and policy.

When interpreting the figures, it is also noteworthy that different growth data is used in different studies: Lensink and White (2001, 53) and Hansen and Tarp (2001, 19) use the per capita growth rate of GDP, and Collier and Dollar (2002, 1479) use the per capita growth rate of GNP as the measure of economic growth.

5.3.3 The properties of the optimization problem

For the purpose of demonstrating the properties of the constrained optimization problem (1) & (2), a situation where each country gets some aid can be considered. In this case, the first order conditions for the maximum are:

$$G_a^i \alpha^i h^i N^i = \lambda y^i N^i, \qquad (5)$$

where λ is the shadow value of aid[3] and G_a^i is the aid's marginal impact on economic growth (Collier & Dollar 2002, 1484).

Using the derivative of growth with respect to aid derived from the equation (4), the previous equation (5) can be written to solve the efficient level of aid for each country as a function of its policy level, per capita income, poverty level and elasticity of poverty with respect to income:

$$A_{eff}^i = -\frac{(b+dP^i)}{2(c+eP^i)} + \frac{\lambda}{2(c+eP^i)\alpha^i}\left(\frac{h^i}{y^i}\right)^{-1}. \qquad (6)$$

First, let us look at a situation where the policy level of the receiving country affects the aid's impact on growth. By using the Collier-Dollar estimates of the aid-growth relationship, the previous equation (6) can be rewritten as follows:

$$A_{eff,CD}^i = -10{,}74 + 6{,}26P^i - \frac{\lambda}{0{,}05\alpha^i}\left(\frac{h^i}{y^i}\right)^{-1}. \qquad (7)$$

The negative sign before the constant can be ignored to make the interpretation simpler. This was done by Collier and Dollar (2002, 1484). The Collier-Dollar set of estimates was chosen because it also includes the estimate for the interaction variable of aid and policy. Hence, all the properties of the optimization problem can be shown because all the variables have values. As shown by Collier and Dollar (2002, 1484 – 1489), the properties of the function can be easily demonstrated. Figure 7, taken from the Collier-Dollar (2002, 1485) study, is used because it uses the same set of estimates as the Collier-Dollar estimates in this study, even though they have used less exact values of the estimates.

[3] The shadow value of aid is the amount of poverty reduction if the amount of aid resources were to increase by one unit (Anderson & Waddington 2007, 9).

If it is assumed that the elasticity of poverty reduction with respect to income is constant across countries, the previous function (7) defines a set of relationships among aid, policy and the poverty measure divided by per capita income. If each of these three variables is held constant in turn, the relationships can be presented in two dimensions. Holding the aid variable constant, the relationship between policy and poverty measure divided by per capita income can be shown given the shadow value of aid. This relationship is shown in the first graph of Figure 7. In the graph, each isoquant shows combinations of policy and poverty that would justify a certain level of aid if the shadow value of aid is taken as a given. For example, if the country is poor, lower policy quality is required to justify a certain volume of aid. The second graph in the Figure 7, shows the relationship between aid and poverty when holding policy constant. The relationship between aid and poverty is upward sloping, but aid has diminishing returns. The last graph in Figure 7 shows the optimal relationship between aid and policy for a given poverty level. The relationship between aid and policy is linear but kinked. Collier and Dollar state that there is a threshold of policy below which the first dollar of aid is not sufficiently productive in terms of poverty reduction. Above the threshold the poverty efficient aid allocation is monotonic in policy and happens to be linear because the relationship shows combinations of aid and policy that maintain G_a at a constant level. (Collier & Dollar 2002, 1484 – 1489)

In practice there are countries which receive no aid under the optimal allocation. Hence, it is not possible to use a single formula to calculate each country's optimal aid receipts. Instead, a mathematical program capable of optimization has to be used. In this thesis I used General Algebraic Modeling System (GAMS) to calculate the efficient allocation of development aid.

Figure 7. Properties of the optimization problem

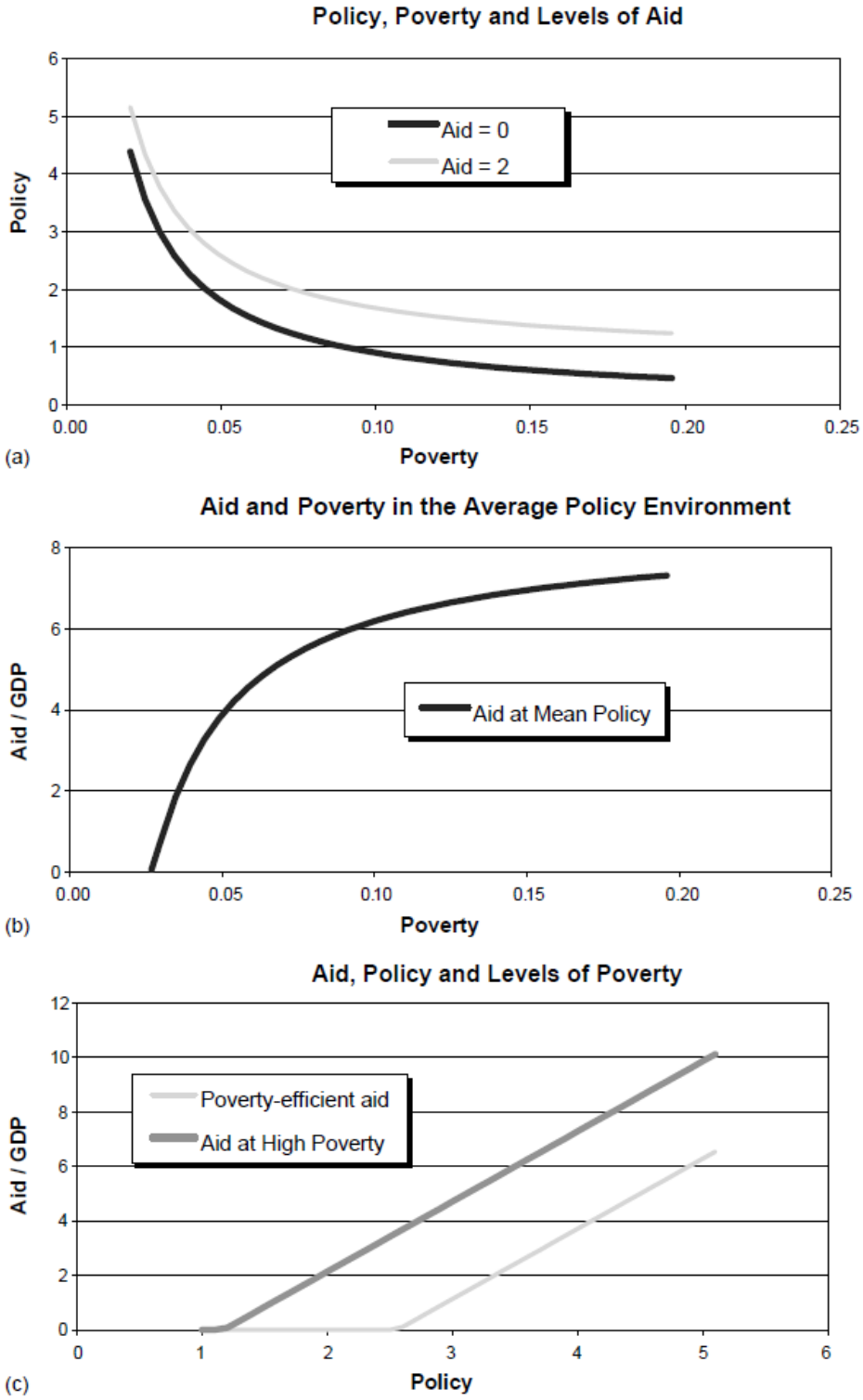


Fig. 1. Policy, poverty and aid.

Source: Collier and Dollar (2002, 1485)

5.4 Data

5.4.1 Country sample

The country sample is based on the World Bank's list of IDA eligible countries from 2011 (World Bank 2011a). The annual World Bank's Country Policy and Institutional Assessment (CPIA) exercise covers the IDA eligible countries, and CPIA data is necessary when using the Collier-Dollar estimates.

However, not all of the 78 IDA eligible countries could be included because no recent high quality poverty data is available from all IDA eligible countries. The final country list includes 58 countries with poverty data based on surveys done in the year 2000 or after. Table 3 shows the list of countries included in the analysis. Countries are grouped based on World Bank (2011b) region and income groupings. Half of the countries, 29 in total, are classified low income countries. 27 countries are classified lower middle income countries and 2 are in the upper middle income group. Over half of the countries, 36 in total, are located in Sub-Saharan Africa. The total amount of ODA received by all the countries combined is 59,6 USD billion.

Table 3. Countries included in the analysis

Low income				
East Asia & Pacific	Cambodia	Sub-Saharan Africa	Benin	Liberia
Europe & Central Asia	Kyrgyzstan		Burkina Faso	Madagascar
	Tajikistan		Burundi	Malawi
Latin America & Caribbean	Haiti		Central African Republic	Mali
South Asia	Bangladesh		Chad	Mozambique
	Nepal		Comoros	Niger
			Congo, Dem. Rep.	Rwanda
			Ethiopia	Sierra Leone
			Gambia, The	Tanzania
			Guinea	Togo
			Guinea-Bissau	Uganda
			Kenya	
Lower middle income				
East Asia & Pacific	Laos	Sub-Saharan Africa	Angola	
	Micronesia, Fed. Sts.		Cameroon	
	Vietnam		Cape Verde	
Europe & Central Asia	Armenia		Congo, Rep.	
	Georgia		Cote d'Ivoire	
	Moldova		Ghana	
Latin America & Caribbean	Bolivia		Lesotho	
	Honduras		Mauritania	
	Nicaragua		Nigeria	
Middle East & North Africa	Yemen, Rep.		Sao Tome and Principe	
South Asia	Bhutan		Senegal	
	India		Sudan	
	Pakistan		Zambia	
	Sri Lanka			
Upper middle income				
Europe & Central Asia	Bosnia and Herzegovina			
South Asia	Maldives			

5.4.2 Data selection

The data selection was done as far as possible in accordance with the Collier and Dollar (2002) study. In some instances different choices had to be made because of unavailability of data. In these cases, I present the data used and briefly describe the selection process.

The aid variable A, used in the paper by Collier and Dollar, is actually official development assistance divided by real gross domestic product adjusted for purchasing-power-parity (PPP) per capita (Collier & Dollar 2002, 1480). The specific nature of the aid is not defined in this instance. However, Jonathan Beynon (2003, 44) has managed to get the specific information of the aid/GDP data from David Dollar. The variable is derived by dividing the aid per capita in constant prices by GDP adjusted for PPP per capita in constant prices. Beynon (2003, 44) also notes that the reported figures are "virtually identical" to figures acquired by dividing aid in current millions by GDP PPP in current millions. For simplicity and easier access to data, I have chosen to use figures reported in current prices. The same approach is also used by Beynon (2003, 20). The aid/GDP variable I have used consists of official development assistance in current prices given by all donors to a specific country in 2011 divided by GDP PPP in current prices. The aid data I have used in the calculation is extracted from the OECD DAC database (OECD 2013). The GDP PPP data in current prices is from the World Bank database (World Bank 2013).

The form of per capita income data used by Collier and Dollar (2002) is again not explicitly defined in the paper. Beynon (2003, 44) has acquired the information by asking the authors, and reports the data is expressed in constant PPP dollars. However, because I chose to use different aid data from Collier and Dollar, I had to use a per capita income measure consistent with my choice of aid data. The per capita income data is acquired by dividing GDP PPP in current millions by population in millions. The data used is from the World Bank Development Indicators. Beynon (2003, 20) also uses this approach.

I decided to use four poverty measures. As a headcount poverty measures, I have used the poverty headcount ratio at $1,25 and at $2,00 a day at 2005 international prices. To capture the depth of poverty and to test the effect of the poverty measure, I decided to include two poverty gap measures: poverty gap at $1,25 a day (PPP) and at $2 a day (PPP). In the Collier and Dollar study, poverty data is taken from the World Bank World Development Indicators. The data is easy to access and I have used the same approach. The data used in the calculations is from the World Bank database and is based on household surveys (World Bank 2013). I decided to only include countries where the latest survey has been conducted in the year 2000 or after.

One of the variables needed in the calculations is elasticity of poverty reduction with respect to mean income. Collier and Dollar assume that the value for elasticity is 2,0 and is the same everywhere when headcount rate of poverty is used as a poverty measure. 2,0 is the median estimate of elasticity from a

study by Ravallion and Chen (1997). When using the poverty gap data, Collier and Dollar (2002, 1493) derive the country-specific elasticities from a formula by Datt and Ravallion (1993):

$$\alpha_{pg} = \frac{(pg-h)}{pg}, \qquad (8)$$

where α_{pg} is the elasticity of poverty reduction with respect to mean income for the poverty gap measure, pg is the value of the poverty gap measure and h is the rate of headcount poverty. I have used the same approach when assuming and calculating the elasticities.

As stated before, the policy data used is from the World Bank's Country Policy and Institutional Assessment (CPIA) (World Bank 2011a). The index has been renamed IDA Resource Allocation Index (IRAI) but the calculation is still based on the CPIA exercise (IDA 2013). The choice was obvious because the data is necessary when using the Collier-Dollar estimates (Collier & Dollar 2002, 1477). The scale of the index is 1 to 6, with 1 being the lowest and 6 being the highest. In the 58-country dataset, the mean level of policy is 3,35.

The main deviation from the Collier-Dollar data choices is the choice of the growth variable. Two of the three studies, Lensink and White (2001, 53) and Hansen and Tarp (2001, 19), used the per capita growth rate of GDP as the dependent variable in their estimation but Collier and Dollar (2002, 1479) decided to use growth rate of per capita GNP. The GNP data used by Collier and Dollar is sourced from the World Bank World Development Indicators and is no longer accessible because the World Bank no longer publishes GNP data. Because of the unavailability of GNP data and the fact that the three chosen studies use different data, I decided to use a simplified approach and use real per capita GDP as the measure of economic growth (World Bank 2013). A similar simplification appears to be made by Anderson and Waddington (2007), who use estimates from the same three studies.

5.5 Marginal productivities of aid in 2011

As a starting point, it is interesting to study the marginal productivities of the actual allocation of aid in 2011. This can be done by rewriting the equation (5) to solve the marginal product of aid in a specific country:

$$\lambda^i = G_a^i \alpha^i \frac{h^i}{y^i}. \quad (9)$$

Using the derivative of growth with respect to aid derived from equation (4), this can be written to solve the marginal product of aid using a specific set of estimates:

$$\lambda^i = (b + dP^i + 2(c + eP^i)A^i)\alpha^i \frac{h^i}{y^i}. \quad (10)$$

Following the Collier and Dollar (2002, 1490) study, the elasticity of poverty reduction with respect to income is assumed equal to 2 and the calculation is based on the $2 per day headcount rate of poverty measure. Using the 2$ poverty headcount as a poverty measure, the marginal efficiency of aid can be interpreted as the amount of people lifted above the 2$ poverty line by an additional million dollars in aid receipts. Table 4 shows the actual aid levels of specific countries in 2011 and the marginal efficiencies of the current aid allocation calculated using the three sets of estimates.

Examining the marginal efficiencies in Table 4, two things become apparent. First, the current allocation is inefficient. This is apparent because the marginal efficiency of aid differs considerably among countries regardless of the used set of estimates.

Second, the three sets of estimates provide very different estimates for the marginal efficiency of aid. This is especially evident when countries receiving large amounts of aid are considered. This result is expected because the estimated absorptive capacity differs when different sets of estimates are used. One important factor is also the importance of the policy environment of the receiving country. The formula gives significant weight to the policy environment of the receiving country when the Collier-Dollar estimates are used. However, the two others sets of estimates do not include an estimate of the interaction term of aid and policy. Hence, the policy environment of the receiving country is irrelevant when using the Hansen-Tarp and Lensink-White estimates.

When using the Collier-Dollar or Hansen-Tarp estimates, the highest marginal efficiency of aid was in Madagascar. Hence, the country would clearly benefit greatly from additional aid. However, when the Lensink-White estimates were used, the Democratic Republic of Congo had the highest marginal efficiency of aid even though the marginal efficiency calculated based on the two other sets of estimates was actually negative. This is due to the fact that the estimated absorptive capacity is by far the highest when the

Lensink-White estimates are used. This effect is especially significant when countries which receive high aid shares as a percentage of GDP are considered.

According to the estimates of marginal efficiency, some countries also receive so much aid that the aid is actually harmful. When using the Collier-Dollar estimates, aid has a negative marginal efficiency in nine countries. There are also four countries in which aid has negative marginal efficiency when the Hansen-Tarp estimates are used. However, using the Lensink-White estimates, aid has a positive marginal efficiency everywhere.

When using Collier-Dollar estimates, nine countries receive harmful amounts of aid. These countries are characterized by poorer than average policy environments and relatively high levels of aid receipts. When using the Hansen-Tarp estimates, the four countries receiving harmful amounts of aid are also countries with very high aid receipts as a percentage of GDP. However, drawing strong conclusions from the negative marginal efficiencies would be unwise because the high aid receipts are often the result of a disaster relief program targeted to remedy the effects of a specific catastrophe. In practice, this effect is sometimes counterbalanced with post-formula adjustments that allow for more resources to be targeted to post-conflict countries (DAC 2012b, 24). In this thesis, no post-formula adjustments were made.

Table 4. The marginal efficiency of aid

Country	2011 aid as a percentage of GDP	Marginal efficiency of aid		
		CD	HT	LW
Angola	0,17	70,4	53,9	34,7
Armenia	2,11	43,3	13,7	9,7
Bangladesh	0,56	398,4	190,9	125,0
Benin	4,56	297,6	151,4	125,3
Bhutan	3,33	51,1	18,4	14,1
Bolivia	1,42	50,7	20,4	14,0
Bosnia and Herzegovina	1,83	0,2	0,1	0,1
Burkina Faso	4,51	464,6	182,4	150,4
Burundi	11,18	-381,2	201,9	363,9
Cambodia	2,35	173,1	82,0	59,0
Cameroon	1,29	101,7	54,4	36,9
Cape Verde	12,24	21,1	9,9	22,9
Central African Republic	7,48	-94,0	237,0	251,6
Chad	2,71	96,1	211,3	155,2
Comoros	6,16	-18,4	163,0	152,9
Congo, Dem. Rep.	21,90	-4070,0	-473,5	457,8
Congo, Rep.	1,44	112,6	71,3	48,8
Cote d'Ivoire	3,98	83,4	88,6	70,5
Ethiopia	3,76	265,6	129,7	101,7
Gambia, The	4,19	209,2	104,0	83,9
Georgia	2,41	94,5	25,3	18,3
Ghana	3,85	271,9	95,9	75,6
Guinea	1,75	334,5	252,8	175,9
Guinea-Bissau	6,04	55,3	173,0	160,7
Haiti	14,44	-464,9	22,7	144,3
Honduras	1,99	73,4	29,6	20,8
India	0,07	234,4	86,2	55,1
Kenya	3,49	373,6	140,4	108,1
Kyrgyz Republic	3,95	71,4	31,0	24,6
Laos	2,26	189,8	93,0	66,6
Lesotho	6,99	138,7	93,6	94,6
Liberia	31,68	-3799,5	-768,5	208,3
Madagascar	2,14	705,4	380,5	270,5
Malawi	5,85	390,6	291,2	266,2
Maldives	1,62	11,6	5,7	3,9
Mali	7,35	339,6	175,5	183,9
Mauritania	4,25	95,0	63,1	51,1
Micronesia, Fed. Sts.	35,18	-379,5	-75,6	14,4
Moldova	3,91	11,6	4,4	3,5
Mozambique	8,87	284,6	166,4	207,2
Nepal	2,34	342,1	179,0	128,6
Nicaragua	3,11	76,6	30,6	23,0
Niger	5,53	518,7	307,2	273,5
Nigeria	0,43	342,6	149,2	97,1
Pakistan	0,72	169,6	96,2	63,5
Rwanda	9,00	267,1	125,2	158,4
Sao Tome and Principe	21,36	-339,5	-44,3	47,5
Senegal	4,18	244,5	94,5	76,2
Sierra Leone	6,26	250,0	185,5	175,5
Sri Lanka	0,52	46,7	19,0	12,4
Sudan	1,08	42,9	62,4	41,9
Tajikistan	2,19	95,9	47,1	33,6
Tanzania	3,59	528,9	212,1	164,4
Togo	8,63	-32,1	103,3	124,7
Uganda	3,41	453,6	172,9	132,5
Vietnam	1,20	145,4	54,0	36,5
Yemen, Rep.	0,87	140,1	86,8	57,7
Zambia	4,79	311,8	162,5	136,7

5.6 Poverty-efficient allocation of aid in 2011

In this section, I present the poverty-efficient allocations of aid using data from 2011. The allocations are calculated using three different sets of estimates and four different poverty measures. Table 5 shows the poverty-efficient benchmark allocations based on different sets of estimates and the $2 headcount rate of poverty measure. In the benchmark allocations, the elasticity of poverty reduction with respect to income is assumed equal to 2. Because the optimization problem (1) & (2) results in equating the marginal efficiencies, Table 5 also repots the equated marginal efficiency of aid calculated using different sets of estimates. A full table of calculated poverty-efficient allocations is reported in Appendix 3. Appendix 4 shows a correlation matrix of the poverty-efficient allocations based on different sets of aid-growth estimates and poverty measures.

The results are, in part, as expected. Regardless of which set of estimates is used, the efficient-allocations are radically different from the actual allocation of aid in 2011. When using the Collier-Dollar estimates, 30 out of the 58 countries receive at least some aid. The correlation coefficient between the actual allocation and poverty-efficient allocation which is based on the Collier-Dollar estimates is 0,21. A total of 29 countries receive aid when Hansen-Tarp estimates are used and the correlation coefficient between actual aid and allocation based on the Hansen-Tarp estimates is 0,37. However, only 21 countries receive aid when using the Lensink-White estimates but the allocation is still the one most correlated with the actual allocation, with a correlation coefficient of 0,43. All the correlation coefficients are relatively low and the poverty efficient allocations of aid are radically different from the actual allocation of aid. It is also eminent that there is a significant number of countries, 27 countries in total, not receiving any aid regardless of which set of estimates is used. This is also the most probable reason why all the poverty-efficient allocations are only mildly correlated with the actual allocation.

A more surprising finding is that the group of countries receiving at least some aid is remarkably similar when using Collier-Dollar and Hansen-Tarp estimates. There are 27 countries which receive aid under both allocations. The correlation coefficient between the allocations is 0,79 even though the allocation based on the Hansen-Tarp estimates is not affected by the policy environment of the receiving country. Therefore, the inclusion of the policy environment, a variable present in almost all literature dealing with the subject of poverty-efficiency, may not be a necessary prerequisite after all. One reason for the similarity of the allocations is that the mean level of policy in the dataset is 3,35. At this level of policy, the Collier-Dollar aid-growth estimates estimate the economic growth to be similar to the estimated growth calculated using Hansen-Tarp estimates. However, there are still major differences between the allocations when countries with especially low or high policy scores are considered. For example, the Democratic Republic of Congo

and the Central African Republic both receive more than two times more aid when the calculation is based on the Hansen-Tarp estimates because the relatively the poor policy scores of the countries do not affect the allocation based on Hansen-Tarp estimates. On the other hand, countries with relatively high policy scores, namely Senegal and Ghana, do not receive any aid in the Hansen-Tarp allocation even though the countries receive substantial amounts of aid when the Collier-Dollar estimates are used.

The allocation based on the Lensink-White estimates is not highly correlated with the allocation calculated using the Collier-Dollar estimates: the correlation coefficient between the allocations is only 0,54. However, the correlation between the allocation based on the Lensink-White estimates and the allocation calculated using Hansen-Tarp estimates is substantial with a correlation coefficient of 0,82. The relatively high correlation coefficient is most likely due to the fact that neither set of estimates includes an interaction term of aid and policy. It is surprising to note that even though the absorptive capacity differs substantially between the two sets of estimates, the allocations are relatively highly correlated. Because of the higher estimate of absorptive capacity, aid is concentrated to fewer countries when Lensink-White estimates are used. Many of these countries also receive high aid shares as a percentage of GDP.

Table 5. The benchmark allocations

Country	Actual aid	Poverty-efficient aid					
		CD		HT		LW	
	2011 aid (% GDP)	Reallocated aid (% GDP)	Marginal efficiency	Reallocated aid (% GDP)	Marginal efficiency	Reallocated aid (% GDP)	Marginal efficiency
Mozambique	8,87	9,18	259,0	10,09	136,3	24,89	137,4
Rwanda	9,00	9,12	259,0	8,41	136,3	15,28	137,4
Mali	7,35	8,47	259,0	9,20	136,3	19,76	137,4
Burkina Faso	4,51	8,19	259,0	7,32	136,3	9,02	137,4
Tanzania	3,59	8,10	259,0	7,89	136,3	12,28	137,4
Niger	5,53	8,04	259,0	11,13	136,3	30,84	137,4
Uganda	3,41	7,46	259,0	6,00	136,3	1,47	137,4
Malawi	5,85	7,15	259,0	11,04	136,3	30,31	137,4
Burundi	11,18	7,05	259,0	12,62	136,3	39,32	137,4
Madagascar	2,14	6,80	259,0	10,78	136,3	28,84	137,4
Liberia	31,68	6,65	259,0	12,75	136,3	40,09	137,4
Kenya	3,49	6,41	259,0	3,84	136,3	0	115,3
Sierra Leone	6,26	6,12	259,0	8,74	136,3	17,14	137,4
Zambia	4,79	5,83	259,0	6,53	136,3	4,56	137,4
Benin	4,56	5,39	259,0	5,67	136,3	0	136,4
Congo, Dem. Rep.	21,90	4,94	259,0	13,79	136,3	46,04	137,4
Ghana	3,85	4,32	259,0	0	127,3	0	81,2
Nepal	2,34	4,15	259,0	5,50	136,3	0	134,2
Ethiopia	3,76	3,94	259,0	3,16	136,3	0	108,9
Central African Republic	7,48	3,91	259,0	10,93	136,3	29,68	137,4
Bangladesh	0,56	3,80	259,0	4,87	136,3	0	126,2
Lesotho	6,99	3,72	259,0	3,06	136,3	0	108,0
Senegal	4,18	3,66	259,0	0	129,1	0	82,3
Haiti	14,44	3,50	259,0	8,62	136,3	16,46	137,4
Guinea	1,75	2,97	259,0	8,14	136,3	13,72	137,4
Nigeria	0,43	2,94	259,0	1,75	136,3	0	97,8
Togo	8,63	2,83	259,0	6,40	136,3	3,79	137,4
Guinea-Bissau	6,04	2,73	259,0	8,07	136,3	13,36	137,4
Gambia, The	4,19	2,58	259,0	0,65	136,3	0	90,6
Comoros	6,16	1,43	259,0	7,71	136,3	11,28	137,4
Chad	2,71	0	246,9	7,29	136,3	8,87	137,4
Angola	0,17	0	72,5	0	54,6	0	34,8
Armenia	2,11	0	50,6	0	15,8	0	10,1
Bhutan	3,33	0	68,1	0	23,5	0	14,9
Bolivia	1,42	0	57,6	0	22,5	0	14,3
Bosnia and Herzegovina	1,83	0	0,3	0	0,1	0	0,1
Cambodia	2,35	0	222,4	0	96,5	0	61,5
Cameroon	1,29	0	118,4	0	59,3	0	37,8
Cape Verde	12,24	0	143,4	0	45,9	0	29,3
Congo, Rep.	1,44	0	137,2	0	78,5	0	50,0
Cote d'Ivoire	3,98	0	186,4	0	119,0	0	75,9
Georgia	2,41	0	110,1	0	30,0	0	19,1
Honduras	1,99	0	88,0	0	33,9	0	21,6
India	0,07	0	235,8	0	86,6	0	55,2
Kyrgyz Republic	3,95	0	107,0	0	41,6	0	26,5
Laos	2,26	0	243,2	0	108,8	0	69,4
Maldives	1,62	0	13,9	0	6,3	0	4,0
Mauritania	4,25	0	175,1	0	86,7	0	55,2
Micronesia, Fed. Sts.	35,18	0	81,4	0	60,3	0	38,4
Moldova	3,91	0	16,6	0	5,9	0	3,8
Nicaragua	3,11	0	102,4	0	38,3	0	24,4
Pakistan	0,72	0	185,5	0	100,9	0	64,3
Sao Tome and Principe	21,36	0	218,0	0	120,0	0	76,5
Sri Lanka	0,52	0	48,9	0	19,7	0	12,6
Sudan	1,08	0	58,7	0	67,1	0	42,8
Tajikistan	2,19	0	121,9	0	54,8	0	34,9
Vietnam	1,20	0	160,7	0	58,5	0	37,3
Yemen, Rep.	0,87	0	157,5	0	91,9	0	58,6

Based on the correlation matrix reported in Appendix 4, the poverty measure does not have a substantial effect on the allocation of aid. Poverty-efficient allocations calculated using the same set of aid-growth estimates and different poverty measures are highly correlated with each other. The lowest correlation coefficient, 0,88, between the allocations is acquired when comparing the allocations based on Lensink-White estimates and using the $1,25 poverty headcount measure and the $2 poverty gap measure. For example, when using the Collier-Dollar estimates, the correlation coefficients between allocations based on different poverty measures range from 0,91 to 0,99.

When the poverty-efficient allocations are presented in actual USD, and not as a percentage of GDP, the results can be analyzed from a different perspective. It is, for example, meaningful to analyze the political feasibility of the poverty-efficient allocation. The benchmark allocations reported in USD millions are presented in Table 6. The allocation based on the Collier-Dollar estimates would direct 37 % of all aid to two countries, Nigeria and Bangladesh. The allocation based on the Hansen-Tarp estimates would also allocate 33 % to these two countries. The results are in line with previous research done on the poverty-efficient allocations. Countries with a large population, high poverty rates and, when using the Collier-Dollar estimates, relatively good policy environments tend to receive large shares of the total aid under the poverty-efficient allocation (Collier & Dollar 2002, 1490). This makes the political feasibility of the efficient allocation somewhat questionable. Donors tend to give relatively more aid to small countries and substantial aid shares directed to larger countries are often seen as politically infeasible. The same focusing effect can be seen when the allocation calculated using Lensink-White estimates is examined. However, because of the differences in absorptive capacity, the two countries receiving about a third of the total aid are the Democratic Republic of Congo and Tanzania.

Table 6. The benchmark allocations reported in USD millions

Country	Actual aid		Poverty-efficient aid					
			CD		HT		LW	
	2011 aid in USD millions	% of total aid	Reallocated aid in USD millions	% of total aid	Reallocated aid in USD millions	% of total aid	Reallocated aid in USD millions	% of total aid
Mozambique	2071	3,47	2142	3,59	2355	3,95	5809	9,74
Rwanda	1262	2,12	1280	2,15	1180	1,98	2144	3,60
Mali	1270	2,13	1463	2,45	1589	2,67	3415	5,73
Burkina Faso	996	1,67	1810	3,04	1616	2,71	1992	3,34
Tanzania	2436	4,09	5493	9,21	5349	8,97	8328	13,97
Niger	646	1,08	939	1,58	1301	2,18	3604	6,05
Uganda	1582	2,65	3460	5,80	2783	4,67	684	1,15
Malawi	804	1,35	983	1,65	1517	2,55	4165	6,99
Burundi	579	0,97	365	0,61	653	1,10	2036	3,42
Madagascar	441	0,74	1400	2,35	2220	3,72	5936	9,96
Liberia	765	1,28	161	0,27	308	0,52	969	1,63
Kenya	2484	4,17	4557	7,65	2735	4,59	0	0
Sierra Leone	424	0,71	415	0,70	592	0,99	1162	1,95
Zambia	1046	1,76	1273	2,13	1427	2,39	995	1,67
Benin	672	1,13	794	1,33	835	1,40	0	0
Congo, Dem. Rep.	5532	9,28	1248	2,09	3485	5,85	11632	19,51
Ghana	1800	3,02	2017	3,38	0	0	0	0
Nepal	892	1,50	1585	2,66	2101	3,52	0	0
Ethiopia	3532	5,93	3700	6,21	2972	4,99	0	0
Central African Republic	272	0,46	142	0,24	397	0,67	1078	1,81
Bangladesh	1498	2,51	10155	17,04	13016	21,84	0	0
Lesotho	259	0,43	138	0,23	113	0,19	0	0
Senegal	1049	1,76	919	1,54	0	0	0	0
Haiti	1712	2,87	415	0,70	1022	1,71	1952	3,27
Guinea	201	0,34	341	0,57	935	1,57	1576	2,64
Nigeria	1777	2,98	12083	20,27	7191	12,06	0	0
Togo	557	0,93	183	0,31	413	0,69	245	0,41
Guinea-Bissau	119	0,20	54	0,09	159	0,27	263	0,44
Gambia, The	135	0,23	83	0,14	21	0,03	0	0
Comoros	52	0,09	12	0,02	65	0,11	94	0,16
Chad	468	0,79	0	0	1259	2,11	1531	2,57
Angola	200	0,34	0	0	0	0	0	0
Armenia	378	0,63	0	0	0	0	0	0
Bhutan	144	0,24	0	0	0	0	0	0
Bolivia	729	1,22	0	0	0	0	0	0
Bosnia and Herzegovina	624	1,05	0	0	0	0	0	0
Cambodia	792	1,33	0	0	0	0	0	0
Cameroon	611	1,03	0	0	0	0	0	0
Cape Verde	251	0,42	0	0	0	0	0	0
Congo, Rep.	260	0,44	0	0	0	0	0	0
Cote d'Ivoire	1436	2,41	0	0	0	0	0	0
Georgia	590	0,99	0	0	0	0	0	0
Honduras	624	1,05	0	0	0	0	0	0
India	3221	5,40	0	0	0	0	0	0
Kyrgyz Republic	523	0,88	0	0	0	0	0	0
Laos	397	0,67	0	0	0	0	0	0
Maldives	46	0,08	0	0	0	0	0	0
Mauritania	381	0,64	0	0	0	0	0	0
Micronesia, Fed. Sts.	134	0,22	0	0	0	0	0	0
Moldova	469	0,79	0	0	0	0	0	0
Nicaragua	695	1,17	0	0	0	0	0	0
Pakistan	3509	5,89	0	0	0	0	0	0
Sao Tome and Principe	75	0,13	0	0	0	0	0	0
Sri Lanka	611	1,02	0	0	0	0	0	0
Sudan	1123	1,88	0	0	0	0	0	0
Tajikistan	355	0,59	0	0	0	0	0	0
Vietnam	3595	6,03	0	0	0	0	0	0
Yemen, Rep.	502	0,84	0	0	0	0	0	0

Identifying underfunded countries is one of the uses of the poverty-efficiency approach. The differences between the aid amounts received by Mozambique and Madagascar were highlighted earlier in this thesis as an example of similar countries receiving very different amounts of aid – Mozambique received more than four times more aid despite very similar key variables. When aid is allocated poverty-efficiently, the disparity almost disappears. Because of the higher policy score of Mozambique, the country receives 1,5 times the aid of Madagascar when the Collier-Dollar estimate set is used. When using the other two sets of estimates, the disparity disappears almost altogether. In order to find other underfunded countries, it is meaningful to study the countries which receive more aid under the poverty-efficient allocation than the actual allocation of aid. Table 7 reports the difference between the actual allocation of aid in 2011 and the poverty-efficient allocations. The difference is reported as a percentage of GDP as well as in USD millions. Countries receiving additional aid under each allocation are highlighted.

In addition to Madagascar, which receives significantly more aid under every poverty-efficient benchmark allocation, there are several countries receiving substantial sums of additional aid. In total, there are eight countries receiving additional aid under every poverty-efficient allocation: Burkina Faso, Guinea, Madagascar, Malawi, Mali, Mozambique, Niger and Tanzania. However, the amounts of additional aid vary significantly depending on which set of estimates the allocation is based on. The group of countries receiving additional aid under each allocation also differs radically. Hence, the flagging of underfunded countries is highly dependent on the chosen set of econometric estimates.

The allocation based on Lensink-White estimates allocates much higher aid shares to individual countries than the other two because of the higher estimate of the absorptive capacity. If the allocation based on the Lensink-White estimates is disregarded, seven more countries could be classified as under-aided. Bangladesh, Benin, Kenya, Nepal, Nigeria, Uganda and Zambia receive additional aid under the poverty-efficient allocation when Collier-Dollar and Hansen-Tarp estimates are used.

Table 7. Difference between poverty-efficient and actual allocations

Country	Actual aid		Poverty-efficient aid					
			CD		HT		LW	
			Difference to actual allocation		Difference to actual allocation		Difference to actual allocation	
	2011 aid (% GDP)	2011 aid in USD millions	% of GDP	in USD millions	% of GDP	in USD millions	% of GDP	in USD millions
Mozambique	8,87	2071	0,30	71,1	1,22	284,7	16,02	3737,9
Rwanda	9,00	1262	0,13	17,6	-0,59	-82,1	6,29	881,9
Mali	7,35	1270	1,12	193,0	1,85	319,1	12,41	2145,1
Burkina Faso	4,51	996	3,69	814,5	2,81	620,2	4,51	995,9
Tanzania	3,59	2436	4,51	3056,8	4,29	2913,4	8,69	5892,3
Niger	5,53	646	2,51	293,3	5,61	654,9	25,32	2957,7
Uganda	3,41	1582	4,05	1877,7	2,59	1200,2	-1,94	-898,5
Malawi	5,85	804	1,30	178,5	5,19	712,8	24,46	3360,2
Burundi	11,18	579	-4,14	-214,1	1,44	74,5	28,14	1457,4
Madagascar	2,14	441	4,66	958,3	8,64	1778,3	26,69	5494,3
Liberia	31,68	765	-25,03	-604,8	-18,93	-457,3	8,41	203,3
Kenya	3,49	2484	2,91	2072,9	0,35	250,7	-3,49	-2484,3
Sierra Leone	6,26	424	-0,13	-9,1	2,48	168,2	10,88	737,9
Zambia	4,79	1046	1,04	226,2	1,74	380,6	-0,24	-51,6
Benin	4,56	672	0,83	122,1	1,10	162,4	-4,56	-672,4
Congo, Dem. Rep.	21,90	5532	-16,96	-4284,6	-8,10	-2047,3	24,14	6099,8
Ghana	3,85	1800	0,46	216,9	-3,85	-1800,0	-3,85	-1800,0
Nepal	2,34	892	1,82	693,2	3,17	1208,2	-2,34	-892,3
Ethiopia	3,76	3532	0,18	167,6	-0,60	-560,5	-3,76	-3532,4
Central African Republic	7,48	272	-3,57	-129,6	3,45	125,5	22,21	806,7
Bangladesh	0,56	1498	3,24	8656,8	4,31	11517,8	-0,56	-1497,8
Lesotho	6,99	259	-3,27	-121,2	-3,93	-145,8	-6,99	-259,3
Senegal	4,18	1049	-0,52	-129,8	-4,18	-1049,3	-4,18	-1049,3
Haiti	14,44	1712	-10,94	-1297,5	-5,82	-690,5	2,02	239,3
Guinea	1,75	201	1,22	140,0	6,39	733,9	11,96	1375,0
Nigeria	0,43	1777	2,50	10305,9	1,32	5414,3	-0,43	-1776,7
Togo	8,63	557	-5,80	-374,3	-2,23	-143,8	-4,84	-312,5
Guinea-Bissau	6,04	119	-3,32	-65,2	2,03	39,9	7,31	143,8
Gambia, The	4,19	135	-1,61	-51,8	-3,55	-113,9	-4,19	-134,7
Comoros	6,16	52	-4,74	-39,6	1,55	13,0	5,12	42,8
Chad	2,71	468	-2,71	-468,4	4,58	790,4	6,15	1062,8
Angola	0,17	200	-0,17	-199,9	-0,17	-199,9	-0,17	-199,9
Armenia	2,11	378	-2,11	-378,2	-2,11	-378,2	-2,11	-378,2
Bhutan	3,33	144	-3,33	-143,9	-3,33	-143,9	-3,33	-143,9
Bolivia	1,42	729	-1,42	-728,7	-1,42	-728,7	-1,42	-728,7
Bosnia and Herzegovina	1,83	624	-1,83	-623,7	-1,83	-623,7	-1,83	-623,7
Cambodia	2,35	792	-2,35	-792,3	-2,35	-792,3	-2,35	-792,3
Cameroon	1,29	611	-1,29	-611,0	-1,29	-611,0	-1,29	-611,0
Cape Verde	12,24	251	-12,24	-250,8	-12,24	-250,8	-12,24	-250,8
Congo, Rep.	1,44	260	-1,44	-259,8	-1,44	-259,8	-1,44	-259,8
Cote d'Ivoire	3,98	1436	-3,98	-1436,1	-3,98	-1436,1	-3,98	-1436,1
Georgia	2,41	590	-2,41	-590,0	-2,41	-590,0	-2,41	-590,0
Honduras	1,99	624	-1,99	-624,1	-1,99	-624,1	-1,99	-624,1
India	0,07	3221	-0,07	-3221,1	-0,07	-3221,1	-0,07	-3221,1
Kyrgyz Republic	3,95	523	-3,95	-522,9	-3,95	-522,9	-3,95	-522,9
Laos	2,26	397	-2,26	-396,7	-2,26	-396,7	-2,26	-396,7
Maldives	1,62	46	-1,62	-46,0	-1,62	-46,0	-1,62	-46,0
Mauritania	4,25	381	-4,25	-381,1	-4,25	-381,1	-4,25	-381,1
Micronesia, Fed. Sts.	35,18	134	-35,18	-133,9	-35,18	-133,9	-35,18	-133,9
Moldova	3,91	469	-3,91	-469,3	-3,91	-469,3	-3,91	-469,3
Nicaragua	3,11	695	-3,11	-695,0	-3,11	-695,0	-3,11	-695,0
Pakistan	0,72	3509	-0,72	-3508,6	-0,72	-3508,6	-0,72	-3508,6
Sao Tome and Principe	21,36	75	-21,36	-74,8	-21,36	-74,8	-21,36	-74,8
Sri Lanka	0,52	611	-0,52	-610,6	-0,52	-610,6	-0,52	-610,6
Sudan	1,08	1123	-1,08	-1122,8	-1,08	-1122,8	-1,08	-1122,8
Tajikistan	2,19	355	-2,19	-354,5	-2,19	-354,5	-2,19	-354,5
Vietnam	1,20	3595	-1,20	-3595,2	-1,20	-3595,2	-1,20	-3595,2
Yemen, Rep.	0,87	502	-0,87	-501,5	-0,87	-501,5	-0,87	-501,5

5.7 Small country bias and donor behavior

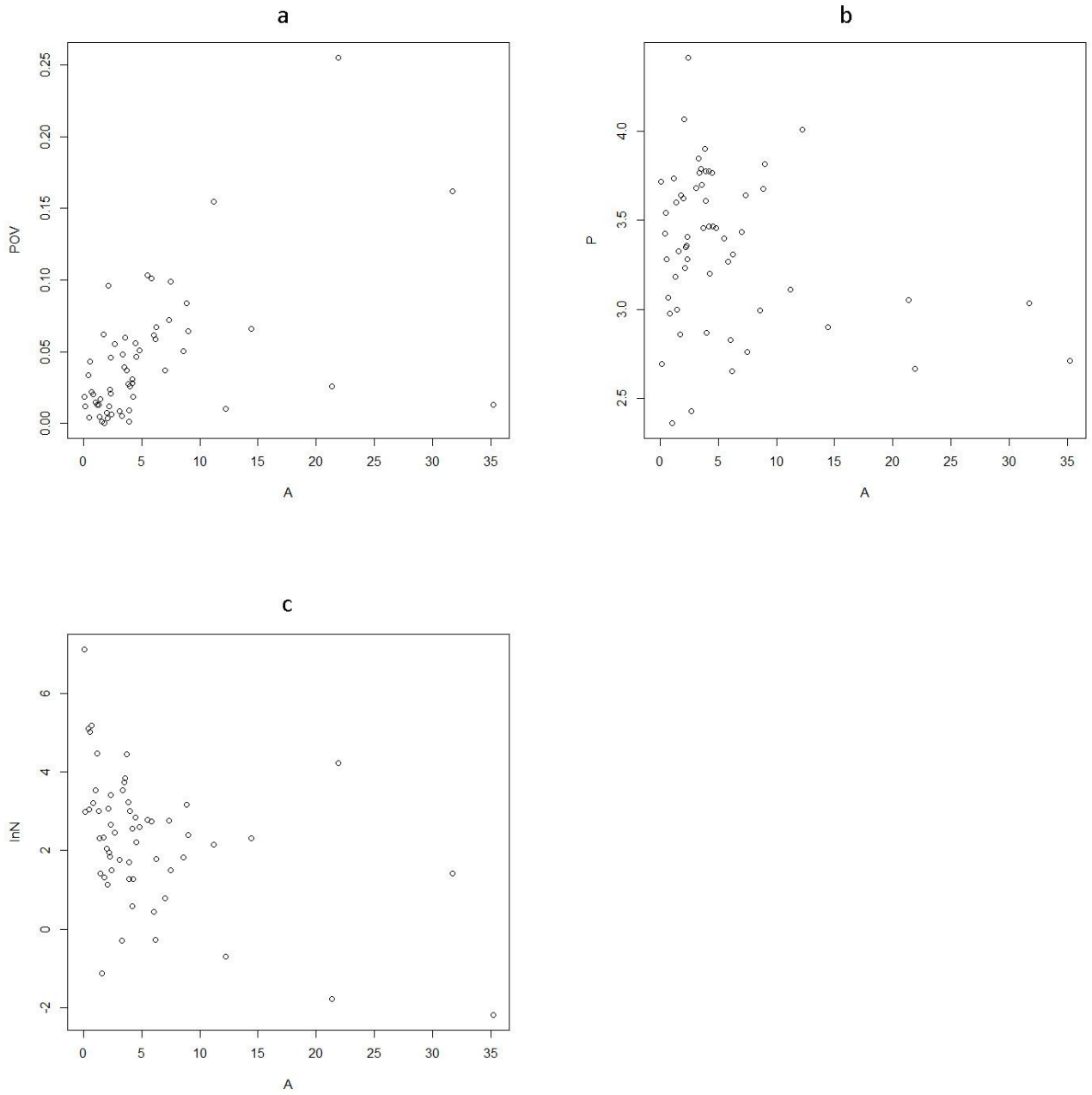
5.7.1 Revealing the small country bias and other donor behavior

In order to see if a small country bias is present in the data and to examine other donor behavior, a simple linear model is estimated. The focus of this estimation is on the small county bias but the model also reveals other behavioral patterns of the donors. A particularly interesting point of view, in addition to the small country bias, is if the actual allocation of aid is in line with the efficiency conditions of poverty-efficiency

In the Collier-Dollar model of poverty-efficient aid, the aid received as a share of GDP should be a monotonic but non-linear function of headcount index divided by per capita income. It should also be a monotonic increasing function of the policy environment of the receiving country when using a set of estimates which includes the aid-policy interaction term. The relationships are presented mathematically in formula (6) of this thesis. (Collier & Dollar 2002, 1495)

First, a cursory view of the data is taken in the form of scatter plot graphs presented in Figure 8. Poverty headcount index divided by per capita income is denoted POV, policy environment, measured with CPIA, is denoted P and lnN is the natural logarithm of population in millions. Aid data is reported as a percentage of GDP. It seems possible there is a linear relationship between population and aid as well as POV and aid. The relationship between policy environment and aid, however, is unlikely to be linear. Any specific data points can be identified by using the dataset included as Appendix 5 to this thesis.

Figure 8. Data used in the estimation



The model specification is based on a model by Collier and Dollar (2002, 1496). In the estimated model, poverty headcount index divided by per capita income is denoted POV. To capture the nonlinear effects, POV is also included as quadratic. The policy environment, measured with CPIA, is denoted P and is also included as quadratic. Finally, to check if the small country bias still exists in the dataset, the natural logarithm of population in millions is added to the equation. The results are presented in Table 8.

Table 8. Estimation results

Dependent variable: ODA as a percentage of GDP in 2011[a]		
Specification	1	2
Constant	10,65	4,62
	(0,34)	(0,33)
POV	53,39	91,53**
	(1,46)	(3,49)
POV²	170,34	-234,89
	(1,00)	(-1,14)
P	-1,13	-2,41
	(-0,06)	(-0,28)
P²	0,055	0,59
	(0,02)	(0,45)
Ln (N)	-2,14***	-0,93***
	(-5,36)	(-4,43)
N	58	54
R²	0,53	0.54
Adjusted R²	0,49	0,50

[a]t-statistics in parentheses
**Significant at the 0,1 percent level
***Significant at the 0,01 percent level

The first specification includes all 58 countries and the only statistically significant variable is the natural logarithm of population which enters with a negative coefficient and high statistical significance. Hence, the small country bias is still easily detectable. It seems donors still allocate relatively more aid to smaller countries. However, even though the poverty variables, POV and POV², are independently statistically insignificant, they are jointly significant. The joint significance was tested using the F-test. Hypotheses were placed as follows:

$$H_0\colon\ \beta_{POV} = \beta_{POV^2} = 0$$
$$H_1\colon\ \beta_{POV} \neq 0\ or\ \beta_{POV^2} \neq 0.$$

The results of the F-test are presented in Table 9. The acquired F-value, 15,891, is high enough to reject the null hypothesis and conclude that at least one of coefficients of the poverty variables is different from zero.

Table 9. Results of the F-test

Model 1	Restricted model					
Model 2	Unrestricted model					
	Res.Df	RSS	Df Sum Sq	Sum of Sq	F	Pr(>F)
1	54	2056,2				
2	52	1276,2	2	779,99	15,891	4,114e-06***

***Statistically significant at 0,01 percent level

To examine the effect of the outliers, four countries with aid to GDP ratios above 20% were omitted. The second specification presented in Table PPP excludes Micronesia, Liberia, Sao Tome & Principe and the Democratic Republic of Congo. When the outliers are omitted, the poverty variable POV enters with a positive coefficient and high statistical significance. Hence, poorer countries do receive relatively more aid. However, the quadratic of POV remains statistically insignificant and the relationship between aid and the poverty headcount index divided by per capita income appears to be a linear relationship. The population variable retains a negative coefficient and high statistical significance. The R^2 values are not very high in either of the model specifications but are in line with the ones acquired by Collier and Dollar (2002, 1496).

5.7.2 Application of the small country bias

In line with the tradition of the literature (Collier & Dollar 2001, 1792; Beynon 2003, 14), I also consider the incorporation of a small country bias into the optimization because the bias was still present in the dataset. Small country bias is added to the models because the poverty-efficient allocation of aid is often seen politically infeasible. The bias mimics actual donor behavior by allocating relatively more aid to countries with a smaller population.

As the results in the previous section show, donors still prefer smaller countries over countries with larger populations. In order to make the poverty-efficient allocation more attractive to donors, a small country bias can be incorporated into the allocation model. This can be achieved by re-writing the objective function (1) & (2) as follows:

$$\text{Max poverty reduction} \qquad \sum_i G^i \alpha^i h^i N^i N^{i^{-\beta}} \qquad (11)$$

$$\text{subject to} \qquad \sum_i A^i y^i N^i = \bar{A}\,, \;\; A^i \geq 0, \qquad (12)$$

where $N^{i^{-\beta}}$ is the population bias term (Collier & Dollar 2001, 1792). The value for β was acquired by trial and error. The selected β generates a poverty-efficient allocation which is correlated with the log of

population identically to the actual aid. In the 2011 dataset, the correlation between aid as a share of GDP and log population was -0,44. Hence, large countries received less aid.

Using the Collier-Dollar estimates and the $2 poverty headcount as the poverty measure, the acquired value of β is 0,75. The population bias term in 2011 is therefore significantly larger than the 0,32 acquired by Collier and Dollar (2001, 1793) using data from 1996. However, it must be noted that the Collier and Dollar (2001) study based the calculations on a different set of estimates than the one used in this thesis. However, small differences in the estimates are not likely to cause such a large disparity.

As can be seen in Table 10, the small country bias transforms the poverty-efficient allocation. 16 additional countries receive at least some aid when the allocation is compared to an allocation calculated without the small country bias but using the same set of aid-growth estimates and the same poverty measure. The two large countries, Nigeria and Bangladesh, which received a substantial share of the global aid budget when no population bias was incorporated in the model, receive no aid when the population bias is included in the optimization problem. From the correlation table included in Appendix 4, it can be seen that there is also only a mild correlation, with a coefficient of 0,54, between the poverty-efficient allocation without the bias and the allocation with the small country bias. Unsurprisingly, the small country bias makes the poverty-efficient allocation more correlated with the actual allocation of aid. The correlation coefficient between the allocations is 0,32. When no population bias is included, the poverty-efficient allocation is less correlated with the actual allocation, with a coefficient of 0,21. When the population bias is calculated using data from 2011 and the approach proposed by Collier and Dollar (2001, 1793), the high value of β, 0,75, transforms the poverty-efficient allocation. The usability of a poverty-efficient allocation calculated with such a large bias term is also questionable because the allocation is largely different from the optimal poverty-efficient allocation.

To study the effect of a smaller β, three alternative allocations are calculated. The calculated allocations are included in Appendix 3. The smallest alternative β value, 0,25, is taken from a DAC study where the value was calculated using Country Programmable Aid which differs from Official Development Assistance (DAC 2012b, 23). Hence, the value is not fully comparable to values acquired using ODA. The other alternative β values are 0,32 which is used by Collier and Dollar (2001, 1793) and 0,50 which is an arbitrary value included to analyze the sensitivity of the poverty-efficient allocation to β values.

From the correlation table included in Appendix 4, it can be seen that the allocations that correlate most with the actual allocation of aid are the ones calculated using β values 0,32 and 0,50 with a correlation coefficient of 0,37. The correlation coefficient for the β value of 0,25 is 0,34. With the highest β value of 0,75, the correlation coefficient is 0,32 as stated before. Hence, very high β values do not make the poverty-efficient allocation more correlated with the actual allocation. In fact, the allocation calculated

using the highest β value is the least correlated with the actual allocation. However, all of the poverty-efficient allocations which include the small country bias are significantly more correlated with the actual allocation of aid than the allocations calculated with no small country bias included.

When the poverty-efficient allocation is calculated using the smallest β value, 0,25, nine additional countries receive at least some aid when the allocation is compared to the poverty-efficient allocation calculated without the small country bias. With β value 0,32, there are 12 additional countries receiving aid, and with the arbitrary β value of 0,50, 16 more countries receive aid. Poverty-efficient allocations corrected with the small country bias are correlated with the efficient allocations calculated without the small country bias to different degrees. The correlation coefficients vary from 0,54 to 0,88. As expected, the allocations calculated using the smallest β values are the most correlated with the unbiased poverty-efficient allocation.

Even though the small country bias corrected poverty-efficient allocations are relatively highly correlated with each other and the poverty-efficient allocation calculated without the bias, it is important to note that the small country bias term is only included to the optimization to make the approach more attractive to donors. From the point of view of poverty-efficiency, every step away from the unbiased poverty-efficient allocation makes aid more inefficient.

Table 10. Poverty-efficient allocation with a small country bias

Country	Actual aid			Poverty-efficient aid					
				CD			CD with small country bias		
	2011 aid (% GDP)	2011 aid in USD millions	2011 aid % of total aid	Reallocated aid (% GDP)	Reallocated aid in USD millions	% of total aid	Reallocated aid (% GDP)	Reallocated aid in USD millions	% of total aid
Cape Verde	12,2	251	0,4	0,0	0	0,0	13,5	277	0,5
Rwanda	9,0	1262	2,1	9,1	1280	2,1	11,9	1663	2,8
Bhutan	3,3	144	0,2	0,0	0	0,0	11,2	483	0,8
Burkina Faso	4,5	996	1,7	8,2	1810	3,0	10,8	2377	4,0
Mali	7,3	1270	2,1	8,5	1463	2,5	10,5	1820	3,1
Mozambique	8,9	2071	3,5	9,2	2142	3,6	10,5	2445	4,1
Georgia	2,4	590	1,0	0,0	0	0,0	10,4	2538	4,3
Gambia, The	4,2	135	0,2	2,6	83	0,1	10,3	330	0,6
Lesotho	7,0	259	0,4	3,7	138	0,2	10,1	374	0,6
Senegal	4,2	1049	1,8	3,7	919	1,5	9,6	2400	4,0
Niger	5,5	646	1,1	8,0	939	1,6	9,5	1106	1,9
Benin	4,6	672	1,1	5,4	794	1,3	9,4	1385	2,3
Sierra Leone	6,3	424	0,7	6,1	415	0,7	9,2	623	1,0
Zambia	4,8	1046	1,8	5,8	1273	2,1	9,0	1965	3,3
Uganda	3,4	1582	2,7	7,5	3460	5,8	8,7	4055	6,8
Malawi	5,9	804	1,3	7,2	983	1,6	8,6	1188	2,0
Tanzania	3,6	2436	4,1	8,1	5493	9,2	8,3	5644	9,5
Burundi	11,2	579	1,0	7,0	365	0,6	8,3	428	0,7
Sao Tome and Principe	21,4	75	0,1	0,0	0	0,0	8,2	29	0,0
Ghana	3,9	1800	3,0	4,3	2017	3,4	8,1	3776	6,3
Madagascar	2,1	441	0,7	6,8	1400	2,3	8,1	1661	2,8
Liberia	31,7	765	1,3	6,7	161	0,3	8,0	193	0,3
Laos	2,3	397	0,7	0,0	0	0,0	8,0	1396	2,3
Mauritania	4,2	381	0,6	0,0	0	0,0	7,4	663	1,1
Kenya	3,5	2484	4,2	6,4	4557	7,6	7,2	5136	8,6
Togo	8,6	557	0,9	2,8	183	0,3	6,9	446	0,7
Guinea-Bissau	6,0	119	0,2	2,7	54	0,1	6,6	130	0,2
Kyrgyz Republic	3,9	523	0,9	0,0	0	0,0	6,3	838	1,4
Haiti	14,4	1712	2,9	3,5	415	0,7	6,2	738	1,2
Central African Republic	7,5	272	0,5	3,9	142	0,2	6,1	221	0,4
Nicaragua	3,1	695	1,2	0,0	0	0,0	6,0	1350	2,3
Micronesia, Fed, Sts,	35,2	134	0,2	0,0	0	0,0	6,0	23	0,0
Nepal	2,3	892	1,5	4,2	1585	2,7	5,9	2246	3,8
Guinea	1,8	201	0,3	3,0	341	0,6	5,9	675	1,1
Maldives	1,6	46	0,1	0,0	0	0,0	5,8	165	0,3
Cambodia	2,3	792	1,3	0,0	0	0,0	5,7	1936	3,2
Congo, Rep,	1,4	260	0,4	0,0	0	0,0	5,7	1026	1,7
Comoros	6,2	52	0,1	1,4	12	0,0	5,7	47	0,1
Armenia	2,1	378	0,6	0,0	0	0,0	5,3	951	1,6
Tajikistan	2,2	355	0,6	0,0	0	0,0	5,2	850	1,4
Congo, Dem, Rep,	21,9	5532	9,3	4,9	1248	2,1	4,7	1180	2,0
Honduras	2,0	624	1,0	0,0	0	0,0	3,2	1007	1,7
Chad	2,7	468	0,8	0,0	0	0,0	2,9	498	0,8
Cote d'Ivoire	4,0	1436	2,4	0,0	0	0,0	2,1	761	1,3
Ethiopia	3,8	3532	5,9	3,9	3700	6,2	0,5	463	0,8
Yemen, Rep,	0,9	502	0,8	0,0	0	0,0	0,2	100	0,2
Bangladesh	0,6	1498	2,5	3,8	10155	17,0	0	0	0
Nigeria	0,4	1777	3,0	2,9	12083	20,3	0	0	0
Angola	0,2	200	0,3	0,0	0	0	0	0	0
Bolivia	1,4	729	1,2	0,0	0	0	0	0	0
Bosnia and Herzegovina	1,8	624	1,0	0,0	0	0	0	0	0
Cameroon	1,3	611	1,0	0,0	0	0	0	0	0
India	0,1	3221	5,4	0,0	0	0	0	0	0
Moldova	3,9	469	0,8	0,0	0	0	0	0	0
Pakistan	0,7	3509	5,9	0,0	0	0	0	0	0
Sri Lanka	0,5	611	1,0	0,0	0	0	0	0	0
Sudan	1,1	1123	1,9	0,0	0	0	0	0	0
Vietnam	1,2	3595	6,0	0,0	0	0	0	0	0

5.8 Poverty-efficiency of Finland's bilateral development cooperation

As a DAC member country, Finland endorses the commitments stated in the Accra Agenda for Action in 2008. These commitments include improving the allocation of resources within and across developing countries and addressing the issue of countries that receive insufficient amounts of aid (OECD 2008, 3). The 2011 Busan High Level Forum on Aid Effectiveness has also suggested that donor countries will accelerate efforts to address the issue of countries that receive insufficient aid (OECD 2011, 7). To take on these challenges, a recent DAC support paper presents a practical approach based on four established allocation models, two of which are based on poverty-efficiency (DAC 2012b, 3). Hence, poverty-efficiency is widely recognized as a relevant framework to improve the country allocation of development aid. In this section, I apply this framework to Finland's bilateral development cooperation.

The total amount of bilateral aid given by Finland is relatively small. Finland provided USD 329 million in bilateral aid to the 58 countries included in the dataset of this thesis in 2011 (OECD 2013). All of Finland's long-term partner countries, i.e. Ethiopia, Kenya, Mozambique, Nepal, Tanzania, Vietnam and Zambia, are included in the dataset.

One way to allocate Finnish aid poverty-efficiently would be to constrain all aid receiving countries to a minimum aid amount which would be equal to the actual amount they would receive if Finland gave no aid. If only Finnish aid would then be allocated poverty-efficiently and all other aid would be held at its actual level, all Finnish aid would go to Madagascar. The result is acquired using Collier-Dollar aid-growth estimates and $2 per day poverty headcount as the poverty measure. The result is somewhat interesting because it also shows that the first step in making the actual allocation of aid more poverty-efficient would be to divert considerably more aid to Madagascar. However, the result tells little about the poverty efficiency of Finnish aid in general and is politically unfeasible.

A better way to study the extent to which the allocation of Finland's bilateral aid, shown in Table 11, follows the principles of poverty-efficiency, is to compare it against the efficient allocations calculated in this thesis. The table also shows the poverty-efficient allocations based on the $2 poverty headcount measure and different sets of estimates. It is clear that Finland gives considerable amounts of aid to countries which do not receive any aid under the poverty-efficient allocation. In total, there are 24 countries which receive aid from Finland but do not receive aid under the poverty-efficient allocation regardless of which set of estimates is used. The total amount of aid to these countries is USD 105 million which is about a third of Finland's bilateral aid. Hence, the allocation of Finnish bilateral aid is clearly not in line with the principles of poverty-efficiency. When considering Finland's long-term partner countries, the only country which receives no aid under the poverty-efficient allocation is Vietnam.

From the point of view of poverty-efficiency, Finnish aid could be made more efficient by concentrating resources to countries receiving substantial amounts of aid under the poverty-efficient allocations. As a small donor Finland could, for example, focus its aid to the countries flagged under-aided in the poverty-efficient allocations. Burkina Faso, Guinea, Madagascar, Malawi, Mali, Mozambique, Niger and Tanzania were found under-aided regardless of which set of aid-growth estimates was used. Disregarding the estimate set with the highest estimate of the absorptive capacity, Bangladesh, Benin, Kenya, Nepal, Nigeria, Uganda and Zambia could be added to the list of under-funded countries. In Table 11, the first group of under-aided countries is shaded dark grey and the second group light gray.

Focusing on the under-aided countries could also be a way to coordinate Finnish aid as a part of the global development cooperation system. From the point of view of a single donor, poverty-efficient allocation can also work as a tool to take the actions of other donor organizations into account. However, it is widely recognized that it would be unwise to use the concept of poverty-efficiency as a practical allocation tool without considering the allocation of aid from a wider perspective. The main role of poverty-efficiency in practical work is to identify anomalies in the allocation of aid.

Table 11. Finnish bilateral aid in 2011

Country	Finnish bilateral aid		Poverty-efficient aid		
			CD	HT	LW
	2011 aid in USD millions	% of Finnish bilateral aid	Aid as a percentage of total aid	Aid as a percentage of total aid	Aid as a percentage of total aid
Mozambique	34,63	10,53	3,59	3,95	9,74
Rwanda	0,15	0,05	2,15	1,98	3,60
Mali	1,17	0,36	2,45	2,67	5,73
Burkina Faso	0	0	3,04	2,71	3,34
Tanzania	54,54	16,58	9,21	8,97	13,97
Niger	1,67	0,51	1,58	2,18	6,05
Uganda	4,89	1,49	5,80	4,67	1,15
Malawi	1,97	0,60	1,65	2,55	6,99
Burundi	0,62	0,19	0,61	1,10	3,42
Madagascar	0,39	0,12	2,35	3,72	9,96
Liberia	1,99	0,61	0,27	0,52	1,63
Kenya	21,82	6,63	7,65	4,59	0
Sierra Leone	3,67	1,12	0,70	0,99	1,95
Zambia	18,81	5,72	2,13	2,39	1,67
Benin	0,37	0,11	1,33	1,40	0
Congo, Dem. Rep.	8,08	2,46	2,09	5,85	19,51
Ghana	0,9	0,27	3,38	0	0
Nepal	26,09	7,93	2,66	3,52	0
Ethiopia	23,65	7,19	6,21	4,99	0
Central African Republic	1,91	0,58	0,24	0,67	1,81
Bangladesh	0,82	0,25	17,04	21,84	0
Lesotho	0,06	0,02	0,23	0,19	0
Senegal	1,04	0,32	1,54	0	0
Haiti	8,24	2,51	0,70	1,71	3,27
Guinea	0,02	0,01	0,57	1,57	2,64
Nigeria	1,28	0,39	20,27	12,06	0
Togo	0,32	0,10	0,31	0,69	0,41
Guinea-Bissau	0,83	0,25	0,09	0,27	0,44
Gambia, The	0,19	0,06	0,14	0,03	0
Comoros	0	0	0,02	0,11	0,16
Chad	4,31	1,31	0	2,11	2,57
Angola	1,57	0,48	0	0	0
Armenia	0,24	0,07	0	0	0
Bhutan	0,26	0,08	0	0	0
Bolivia	1,06	0,32	0	0	0
Bosnia and Herzegovina	2,16	0,66	0	0	0
Cambodia	3,08	0,94	0	0	0
Cameroon	0,45	0,14	0	0	0
Cape Verde	0	0	0	0	0
Congo, Rep.	0,02	0,01	0	0	0
Cote d'Ivoire	1,45	0,44	0	0	0
Georgia	4,19	1,27	0	0	0
Honduras	8,54	2,60	0	0	0
India	1,36	0,41	0	0	0
Kyrgyz Republic	1,53	0,47	0	0	0
Laos	9,65	2,93	0	0	0
Maldives	0,25	0,08	0	0	0
Mauritania	0,24	0,07	0	0	0
Micronesia, Fed. Sts.	0	0	0	0	0
Moldova	1,25	0,38	0	0	0
Nicaragua	15,72	4,78	0	0	0
Pakistan	10,55	3,21	0	0	0
Sao Tome and Principe	0	0	0	0	0
Sri Lanka	2,92	0,89	0	0	0
Sudan	9,65	2,93	0	0	0
Tajikistan	0,86	0,26	0	0	0
Vietnam	23,17	7,04	0	0	0
Yemen, Rep.	4,32	1,31	0	0	0

5.9 Criticism and acclaim of the poverty-efficiency framework

According to Timo Olkkonen and Ulla Järvelä-Seppinen (2013) from the Finnish Foreign Ministry, the use of poverty-efficient allocations offers benefits as well as challenges. In their opinion, the concept of poverty-efficiency is a good way to simplify the highly politicized discussion about the allocation of development aid. It also targets the poor and disregards political decision-making. In addition, the poverty-efficient allocation also reveals structural shifts in the allocation of development aid. However, they also stated that GDP is a limited measure of development progress and poverty-efficiency may sometimes contradict the target of predictable aid. This might sometimes be the case because poverty-efficient allocations may change rapidly from year to year depending on the key variables of the aid receiving countries. In addition, eradicating absolute poverty is not the only target of development policy and there are many policy targets which the poverty-efficiency framework does not address.

The main critique highlighted in this thesis is that the poverty-efficient allocation is highly sensitive to aid-growth estimate choices. Efficient allocation varies radically depending on which set of estimates is used. In addition, research done on the macroeconomic impact of development aid is by no means conclusive. Lensink and White (2000) have pointed out the same problem when calculating the poverty-efficient allocation based on their own aid-growth estimates from 1999. Furthermore, a point estimate is always associated with a confidence interval. In theory, this uncertainty should be included in the analysis.

One of the most common criticisms presented in academic literature is that poverty-efficiency puts too much weight on GDP growth as a measure of development progress. There are a lot of ways in which aid affects countries and the growth of gross domestic product is merely one of them. It would also be reasonable to question the Collier-Dollar (2002, 1482 – 1483) assumption that the net impact of development aid is distributionally neutral. Aid is often targeted to the poorest part of the population in a developing country. In principle, this should have implications for the distributional effects of development aid.

It is also problematic that the Collier-Dollar model assumes the link between economic growth and poverty reduction to be equal in all cases. Ravallion (2012, 521) has concluded that countries with a higher initial poverty rate tend to have a lower rate of growth. In addition, Ravallion (2012, 521) finds that high levels of poverty tend to make it harder for a developing country to achieve any reduction in poverty through a growth in the mean income. Hence, the link between economic growth and poverty reduction is most likely not equal across countries.

It is widely recognized that it would be unwise to use the concept of poverty-efficiency as a practical allocation tool without strict scrutiny. There are also multiple ways to criticize the choices made in this thesis. The dataset only includes 58 countries and the total amount of aid targeted to those countries is 56 USD billion, about a third of ODA given by all donors. The choice of aid-growth estimates could also be questioned: there are numerous sets of applicable estimates for the relationship between aid and growth. In addition, some simplifications made in the data choices, specifically the choice to use GDP growth as the only growth measure, could have an impact on the results.

6. Conclusions

This thesis studied the poverty-efficiency of development aid in 2011. The marginal efficiency of development aid in 2011 was calculated as well as 16 poverty-efficient allocations based on three sets of aid-growth estimates, four poverty measures, and in four cases, a small country bias term.

From the perspective of poverty-efficiency, the inefficiency of the actual allocation of aid is apparent. This inefficiency was clearly visible in the calculated marginal efficiencies as well as in the poverty-efficient allocations. The marginal efficiencies calculated based on the actual allocation of aid revealed large disparities between countries. Some countries received so much aid that the marginal efficiency of aid was actually negative while others would have benefited greatly from additional aid. The calculated poverty-efficient allocations were also radically different from the actual allocation of aid in 2011. A total of 27 out of the 58 countries did not receive any aid in the poverty-efficient benchmark allocations regardless of which set of estimates was used, and the correlation coefficients between the actual allocation and the poverty-efficient allocations were low.

There were a number of countries which received more aid under the poverty-efficient allocation and thus could be flagged under-aided. Burkina Faso, Guinea, Madagascar, Malawi, Mali, Mozambique, Niger and Tanzania were found under-aided regardless of which set of aid-growth estimates was used. When the estimate set with the highest estimate of the absorptive capacity was disregarded, Bangladesh, Benin, Kenya, Nepal, Nigeria, Uganda and Zambia were also found to be under-funded from the perspective of poverty-efficiency.

However, the poverty-efficient allocations are unlikely to be politically feasible. Under the poverty-efficient allocations, some countries receive very high shares of the global aid budget. Two countries, Nigeria and Bangladesh, received about a third of the total aid when the poverty-efficient allocation was calculated based on Collier-Dollar or Hansen-Tarp estimates. When Lensink-White estimates were used, about a third of the total aid was directed to the Democratic Republic of Congo and Tanzania.

To increase the attractiveness of poverty-efficiency-based allocations to donors, a small country bias term can be added to the optimization process. A linear model revealed that a small country bias was still clearly visible in the data as well as a donor bias towards poorer countries. Using data from 2011 and the approach proposed by Collier and Dollar, the small country bias transforms the poverty-efficient allocation. Using this approach and data from 2011, the deviation from the poverty-efficient allocation is so significant that the allocation which includes the small country bias term is not a viable option. However, a smaller population bias term could be included in the optimization to make the approach more attractive to donors.

Calculating marginal efficiencies and poverty-efficient allocations are processes which are sensitive to aid-growth estimate choices. Aid-growth estimate sets provide very different estimates of the absorptive capacity of developing countries. However, it is noteworthy that the Collier-Dollar and the Hansen-Tarp estimate sets produced similar poverty-efficient allocations even though the Hansen-Tarp estimate set does not take into account the policy environment of the receiving country. While the allocation based on the Lensink-White estimates differs considerably from the allocation calculated using the Collier-Dollar estimates, it was somewhat similar to the one calculated using the Hansen-Tarp estimates even though the estimates of the absorptive capacity differ significantly. This is most likely due to the fact that neither set of estimates takes into account the policy environment of the receiving country. All in all, however, the choice of aid-growth estimates had a large impact on the poverty-efficient allocation.

The fact that aid-growth estimate choices are such a significant factor when poverty-efficient allocations are considered is problematic. There are so many sets of estimates to choose from and many studies have reached contradictory results. The most recent advances in the study of the macroeconomic impact of aid are also not compatible with the poverty-efficiency approach because the model specifications do not include all the necessary variables. Despite this multitude of results, some form of the Collier-Dollar estimates are often the basis on which practical approaches are built. For example, a recent DAC study from last year only studied poverty-efficient allocations calculated using the Collier-Dollar estimates when it used the poverty-efficiency approach to identify under-aided countries.

Even though the framework of poverty-efficiency has mainly been adopted by large multilateral donors, it is also useful for small donors. The framework can be utilized as a method of making the global aid better coordinated by focusing aid to the under-aided countries. Finland's bilateral development cooperation is not very efficient when it is compared to the poverty-efficient allocations. About a third of Finland's bilateral aid goes to countries which receive no aid under the poverty-efficient allocation regardless of which set of estimates is used.

Poverty-efficiency can be a useful approach when identifying under-aided countries. However, the sensitivity to estimate choices should be noted when using the approach in practical applications. With this caveat noted, there is significant room for improving the poverty-efficiency of development aid.

References

Alesina, A. & Dollar, D. Who gives foreign aid to whom and why? Journal of Economic Growth, Vol. 5, pp. 33 – 63.

Anderson, E. (2007). Aid allocation and the MDGs. ODI Briefing paper April of 2007.

Anderson, E. & Waddington, H. (2007). Aid and the Millennium Development Goal poverty target: How much is required and how should it be allocated? Oxford Development Studies, Vol. 35, No. 1, pp. 1 – 31.

Arndt, C., Jones, S. & Tarp, F. (2010) Aid, growth, and development: Have We Come Full Circle? Journal of Globalization and Development, Vol. 1, No. 2, Article 5.

Berthélemy, J.-C. (2006). Aid allocation: comparing donor behavior. Swedish Economic Policy Review, Vol. 13, pp. 75 – 109.

Berthélemy, J.-C & Tichit, A. (2004). Bilateral donors' aid allocation decisions: a three-dimensional panel analysis. International Review of Economics and Finance, Vol. 13, pp. 253 – 274.

Beynon, J. (2003). Poverty efficient aid allocations – Collier/Dollar revisited. ESAU Working paper 2, Overseas Development Institute.

Burnside, G. & Dollar, D. (2000). Aid, policies, and growth. The American Economic Review, Vol. 90, No. 4, pp. 847 – 868.

Cogneau, D. & Naudet, D. (2004). Who deserves aid? Equality of opportunity, international aid and poverty reduction. DIAL Working Paper No. 2004/10.

Collier, P. (2012). How to spend it - the organization of public spending and aid effectiveness. UNU-WIDER Working Paper No. 2012/05.

Collier, P. & Dollar, D. (1999a). Aid allocation and poverty reduction. Policy research working paper 2041, Development Research Group, World Bank, Washington DC.

Collier, P. & Dollar, D. (1999b). Aid allocation and poverty reduction. Development Research Group, World Bank, Washington, DC, 11.4. mimeo.

Collier, P. & Dollar, D. (2001). Can the world cut poverty in half? How policy reform and effective aid can meet international development goals. World Development Vol. 29, No. 11, pp. 1787 – 1802.

Collier, P. & Dollar, D. (2002). Aid allocation on poverty reduction. European Economic Review, Vol. 46, pp. 1475 – 1500.

DAC (2012a). 2012 DAC Report on Aid Predictability: Survey on Donors' Forward Spending Plans 2012-2015 and efforts since HLF-4.http://www.oecd.org/dac/aid-architecture/2012_DAC_Report_on_Aid_Predictability.pdf

DAC (2012b). Improved identification and monitoring of potentially under-aided countries. Discussion paper DCD/DAC(2012)43/REV1 for DAC High Level Meeting December 2012. London, United Kingdom.

DAC (2013). DAC List of ODA Recipients. http://www.oecd.org/dac/stats/DAC%20List%20used%20for%202011%20flows.pdf

Dalgaard, C-J. & Hansen, H. (2001). On aid, growth and good policies. Journal of development studies, Vol. 37, No. 6, pp. 17 – 41.

Datt, G. & Ravallion, M. (1993). Regional disparities, targeting, and the poverty in India. In: Lipton, M., van der Gaag, J. (Eds.). Including the poor. World Bank, Washington, DC.

Devarajan, S. & Hossain, S.I. (1998). The combined incidence of taxes and public expenditures in the Philippines. World Development, Vol. 26, No. 6, pp. 963 – 977.

Djankov, S., Montalvo, J. & Reynal-Querol, M. (2008). The curse of aid. Journal of Economic Growth, Vol. 13, No. 3, pp. 169-194.

Dollar, D. & Kraay, A. (2001). Growth is good for the poor. Policy research working paper no. 2587, World Bank, Washington DC.

Dollar, D. & Levin, V. (2006). The increasing selectivity of foreign aid, 1984-2003. World Development, Vol. 34, pp. 2034 – 2046.

Doucouliagos, H. & Paldam, M. (2008). Aid effectiveness on growth: a meta study. European Journal of Political Economy, 114: F191 – 216.

Easterly, W. (1999). The Ghost of Financing Gap: Testing the Growth Model Used in the International Financial Institutions. Journal of Development Economics, Vol. 60, No. 2, pp 423-438.

Easterly, W., Levine, R. & Roodman, D. (2004). Aid, policies and growth: Comment. American Economic Review, Vol. 94, No. 3, pp. 774 – 780.

Feyzioglu, T., Swaroop, V. & Zhu, M. (1998). A panel data analysis of the fungibility of foreign aid. World Bank Economic Review Vol. 12, No. 1, pp. 29 – 58.

Hansen, H. & Tarp, F. (2001). Aid and growth regressions. Journal of Development Economics, Vol. 64, No. 2, pp. 547 – 570.

Hoeffler, A. & Outram, V. (2011). Need, merit or self-interest – what determines the allocation of aid? Review of Development Economics, Vol. 15, No. 2, pp. 237 – 250.

IDA 2013. IDA Resource Allocation Index (IRAI) – 2011. http://www.worldbank.org/ida/IRAI-2011.html

IEG (Independent Evaluation Group) (2013). Results and performance of the World Bank group 2012. Washington, DC: World Bank.

Kanbur, R. (2001). Economic policy, distribution and poverty: the nature of disagreements. World Development, Vol. 29, No 6, pp. 1083 – 1094.

Kanbur, R. (2011). Aid to the poor in middle income countries and the future of IDA. October, 2011. http://kanbur.dyson.cornell.edu/papers/YorkPaperAidToThePoorInMiddleIncomeCountriesAndTheFutureOfIDA.pdf

Lensink, R. & White, H. (2000). Aid allocation, poverty reduction and the Assessing aid report. Journal of International Development, Vol. 12, pp 399 – 412.

Lensink, R. & White, H. (2001). Are there negative returns to aid? Journal of Development Studies, Vol. 37, No. 6, pp. 42 – 65.

Li, H., Squire, L. & Zou, H. (1998). Explaining the international and intertemporal variations in income inequality. The Economic Journal, Vol. 108, pp. 1 – 18.

McGillivray, M. (2006). Aid allocation and fragile states. UNU-WIDER Discussion paper No. 11.

McGillivray, M. & White, H. (1995). How well is aid allocated? Descriptive measures of aid allocation: a survey of methodology and results. Development and Change, Vol. 26, pp. 163 – 183.

Mekasha, T. J. & Tarp, F. (2011). Aid and growth. What meta-analysis reveals. UNU-WIDER Working Paper No. 2011/22.

Mosley, P. (1987). Overseas aid: its defence and reform. Brighton: Wheatshead books.

OECD (2008). Accra Agenda for Action. OECD Publishing. http://dx.doi.org/10.1787/9789264098107-en

OECD (2011). Busan partnership for effective development cooperation. In Fourth High Level Forum on Aid Effectiveness, Busan, South Korea. http://www.oecd.org/dac/effectiveness/49650173.pdf

OECD (2013). International development statistics. http://stats.oecd.org/qwids/

Olkkonen, T. & Järvelä-Seppinen, U. (2013). Interview at the Foreign Ministry of Finland. 20.8.2013.

Pack, H. & Pack, J.R. (1993). Foreign aid and the question of fungibility. Review of Economics and Statistics, Vol. 75, pp. 258 – 265.

Rajan, R. & Subramanian, A. (2007). Does aid effect governance? AEA Papers and Proceedings, Vol. 97, No. 2, pp. 322 – 327.

Rajan, R. & Subramanian, A. (2008). Aid and growth: what does the cross-country evidence really show? The Review of Economics and Statistics, Vol. 90, No. 4, pp. 643 – 665.

Ravallion, M. (2012). Why Don't we See Poverty Convergence? American Economic Review, Vol. 102, No. 1, pp. 504 – 523.

Ravallion, M. & Chen, S. (1997). What can new survey data tell us about recent changes in distribution and poverty? World Bank Economic Review, Vol. 11, No. 2, pp. 357 – 382.

Roodman, D. (2007). The anarchy of numbers: aid, development and cross-country empirics. World Bank Economic Review, Vol. 21, No. 2, pp. 255 – 277.

Tarp, F. (2010a). Aid effectiveness. Lecture note. UN Office, New York, 19.4.2010.

Tarp, F. (2010b). Aid, Growth and Development: For or Against Official Development Assistance. Slide show. UNU-ONY Event, New York, 19.4.2010. www.ony.unu.edu/worldwideny/UNU-ONY_Event_April_2010.ppt

United Nations (2013). Millennium Development Goals Report 2013. http://www.un.org/millenniumgoals/pdf/report-2013/mdg-report-2013-english.pdf

Utz, R. (2010). Will countries that receive insufficient aid please stand up? CFP Working Paper Series No. 7.

van de Walle, D. (1995). The distribution of subsidies through public health services in Indonesia, 1978 – 1987: in van de Walle & Nead, Public Spending and the Poor. Johns Hopkins University Press for the World Bank.

Wood, A. (2004). UN Millennium project report: comments on 23/9/04 draft. Mimeo. DFID: London.

Wood, A. (2008). Looking ahead optimally in allocating aid. World Development, Vol. 36, No. 7, pp. 1135 – 1151.

World Bank (2011a). Summary Table: 2011 IDA Resource Allocation Index (IRAI). http://www.worldbank.org/ida/IRAI/2011/IRAI2011Table1.pdf

World Bank (2011b). World Bank list of economies (July 2011). http://www.ics.org/Documents/DocumentsDownload.aspx?DocumentID=474&FileID=1926

World Bank (2013). World Development Indicators. http://data.worldbank.org/indicator

Appendix 1: Basic country data

Country	Source Symbol Country code	WB WDI N Population in millions	WB WDI G Real GDP per capita growth	WB IRAI P Policy	OECD DAC Total ODA in current millions	WB WDI GDP PPP in current millions	OECD DAC Bilateral aid from Finland in current millions
Angola	AGO	19,62	1,08	2,69	199,94	116133,4	1,57
Armenia	ARM	3,10	4,32	4,07	378,18	17948,4	0,24
Bangladesh	BGD	150,49	5,43	3,28	1497,75	267411,1	0,82
Benin	BEN	9,10	0,69	3,47	672,37	14731,3	0,37
Bhutan	BTN	0,74	3,81	3,85	143,85	4315,6	0,26
Bolivia	BOL	10,09	3,52	3,60	728,68	51440,2	1,06
Bosnia and Herzegovina	BIH	3,75	1,93	3,64	623,72	34056,8	2,16
Burkina Faso	BFA	16,97	1,14	3,77	995,66	22089,4	0
Burundi	BDI	8,58	1,85	3,11	578,99	5178,6	0,62
Cambodia	KHM	14,31	5,82	3,41	792,25	33738,3	3,08
Cameroon	CMR	20,03	1,96	3,18	611,01	47247,3	0,45
Cape Verde	CPV	0,50	4,08	4,01	250,81	2049,7	0
Central African Republic	CAF	4,49	1,32	2,76	271,61	3632,5	1,91
Chad	TCD	11,53	-1,03	2,43	468,41	17270,3	4,31
Comoros	COM	0,75	-0,38	2,65	51,57	836,8	0
Congo, Dem. Rep.	COD	67,76	4,05	2,67	5532,48	25267,1	8,08
Congo, Rep.	COG	4,14	1,00	3,00	259,79	18049,4	0,02
Cote d'Ivoire	CIV	20,15	-6,69	2,87	1436,05	36060,8	1,45
Ethiopia	ETH	84,73	5,04	3,46	3532,39	93960,0	23,65
Gambia, The	GMB	1,78	-6,87	3,47	134,7	3212,6	0,19
Georgia	GEO	4,49	6,16	4,42	590,02	24516,4	4,19
Ghana	GHA	24,97	11,76	3,90	1800,03	46714,6	0,9
Guinea	GIN	10,22	1,47	2,86	201,19	11491,6	0,02
Guinea-Bissau	GNB	1,55	3,52	2,83	118,78	1965,5	0,83
Haiti	HTI	10,12	4,23	2,90	1712,41	11858,7	8,24
Honduras	HND	7,75	1,56	3,63	624,07	31382,5	8,54
India	IND	1241,49	4,88	3,72	3221,12	4531655,4	1,36
Kenya	KEN	41,61	1,62	3,79	2484,28	71132,2	21,82
Kyrgyz Republic	KGZ	5,51	4,67	3,61	522,88	13245,9	1,53
Laos	LAO	6,29	6,54	3,36	396,67	17544,3	9,65
Lesotho	LSO	2,19	3,13	3,43	259,25	3709,5	0,06
Liberia	LBR	4,13	5,88	3,03	765,49	2416,3	1,99
Madagascar	MDG	21,32	-1,86	3,23	441,32	20583,8	0,39
Malawi	MWI	15,38	1,09	3,27	804,32	13740,4	1,97
Maldives	MDV	0,32	6,06	3,33	46,01	2839,5	0,25
Mali	MLI	15,84	-0,35	3,64	1270,1	17282,7	1,17
Mauritania	MRT	3,54	1,55	3,20	381,05	8966,2	0,24
Micronesia, Fed. Sts.	FSM	0,11	1,61	2,71	133,88	380,6	0
Moldova	MDA	3,56	6,51	3,78	469,31	11990,6	1,25
Mozambique	MOZ	23,93	4,69	3,68	2070,79	23339,2	34,63
Nepal	NPL	30,49	2,09	3,28	892,32	38172,4	26,09
Nicaragua	NIC	5,87	3,59	3,68	694,99	22373,7	15,72
Niger	NER	16,07	-1,25	3,40	645,97	11683,4	1,67
Nigeria	NGA	162,47	4,68	3,43	1776,67	411547,0	1,28
Pakistan	PAK	176,75	1,12	3,07	3508,56	485136,4	10,55
Rwanda	RWA	10,94	5,12	3,82	1262,24	14029,9	0,15
Sao Tome and Principe	STP	0,17	2,99	3,05	74,78	350,0	0
Senegal	SEN	12,77	-0,05	3,78	1049,28	25115,5	1,04
Sierra Leone	SLE	6,00	3,72	3,31	424,21	6780,9	3,67
Sri Lanka	LKA	20,87	7,13	3,54	610,55	116484,2	2,92
Sudan	SDN	34,32	2,18	2,36	1122,81	103786,5	9,65
Tajikistan	TJK	6,98	5,89	3,35	354,52	16216,3	0,86
Tanzania	TZA	46,22	3,29	3,70	2435,84	67834,0	54,54
Togo	TGO	6,15	2,70	2,99	557,15	6458,3	0,32
Uganda	UGA	34,51	3,35	3,77	1582,37	46412,1	4,89
Vietnam	VNM	87,84	4,79	3,73	3595,16	299674,8	23,17
Yemen, Rep.	YEM	24,80	-13,18	2,98	501,5	57860,7	4,32
Zambia	ZMB	13,47	2,13	3,46	1046,37	21838,1	18,81

Appendix 2: Poverty data

Source: World Bank WDI

Country	Country code	Pop < $1,25 a day (%)	Pov gap $1,25/day (%)	Pop < $2 a day (%)	Pov gap $2/day (%)	Survey year	Pov gap $1,25/day elasticity	Pov gap $2/day elasticity
Angola	AGO	54,3	29,9	70,2	42,4	2000	-0,82	-0,66
Armenia	ARM	2,5	0,5	19,9	4,0	2010	-4,49	-4,04
Bangladesh	BGD	43,3	11,2	76,5	30,4	2010	-2,86	-1,52
Benin	BEN	47,3	15,7	75,3	33,5	2003	-2,01	-1,25
Bhutan	BTN	1,7	0,3	29,8	8,5	2012	-5,38	-2,49
Bolivia	BOL	15,6	8,6	24,9	13,1	2008	-0,81	-0,90
Bosnia and Herzegovina	BIH	0,0	0,0	0,2	0,1	2007	-1,00	-2,80
Burkina Faso	BFA	44,6	14,7	72,6	31,7	2009	-2,04	-1,29
Burundi	BDI	81,3	36,4	93,5	56,1	2006	-1,23	-0,67
Cambodia	KHM	18,6	3,5	49,5	15,1	2009	-4,30	-2,29
Cameroon	CMR	9,6	2,3	30,4	8,2	2007	-3,21	-2,70
Cape Verde	CPV	21,0	6,1	40,9	15,2	2002	-2,47	-1,69
Central African Republic	CAF	62,8	31,3	80,1	46,8	2008	-1,01	-0,71
Chad	TCD	61,9	25,6	83,3	43,9	2003	-1,42	-0,90
Comoros	COM	46,1	20,8	65,0	34,2	2004	-1,22	-0,90
Congo, Dem. Rep.	COD	87,7	52,8	95,2	67,6	2006	-0,66	-0,41
Congo, Rep.	COG	54,1	22,8	74,4	38,8	2005	-1,37	-0,92
Cote d'Ivoire	CIV	23,8	7,5	46,3	17,8	2008	-2,17	-1,60
Ethiopia	ETH	18,84	5,3	41,2	14,58	2002	-2,56	-1,83
Gambia, The	GMB	33,6	11,7	55,9	24,4	2003	-1,87	-1,29
Georgia	GEO	18,0	5,8	35,6	13,7	2010	-2,09	-1,60
Ghana	GHA	28,6	9,9	51,8	21,3	2006	-1,89	-1,43
Guinea	GIN	43,3	15,0	69,6	31,0	2007	-1,89	-1,25
Guinea-Bissau	GNB	48,9	16,6	78,0	34,9	2002	-1,95	-1,23
Haiti	HTI	61,7	32,3	77,5	46,7	2001	-0,91	-0,66
Honduras	HND	17,9	9,4	29,8	14,9	2009	-0,92	-1,01
India	IND	32,7	7,5	68,7	24,5	2010	-3,36	-1,80
Kenya	KEN	43,4	16,9	67,2	31,8	2005	-1,57	-1,11
Kyrgyz Republic	KGZ	6,7	1,5	21,7	6,4	2010	-3,56	-2,42
Laos	LAO	33,9	9,0	66,0	24,8	2008	-2,79	-1,66
Lesotho	LSO	43,4	20,8	62,3	33,1	2003	-1,09	-0,88
Liberia	LBR	83,8	40,9	94,9	59,6	2007	-1,05	-0,59
Madagascar	MDG	81,3	43,3	92,6	60,1	2010	-0,88	-0,54
Malawi	MWI	73,9	32,3	90,5	51,8	2004	-1,29	-0,75
Maldives	MDV	1,48	0,1	12,22	2,53	2004	-9,57	-3,83
Mali	MLI	50,4	16,4	78,7	35,2	2010	-2,08	-1,24
Mauritania	MRT	23,4	6,8	47,7	17,7	2008	-2,45	-1,69
Micronesia, Fed. Sts.	FSM	31,15	16,32	44,7	24,54	2000	-0,91	-0,82
Moldova	MDA	0,4	0,1	4,4	0,7	2010	-3,88	-4,96
Mozambique	MOZ	59,6	25,1	81,8	42,9	2008	-1,37	-0,91
Nepal	NPL	24,8	5,6	57,3	19,0	2010	-3,47	-2,02
Nicaragua	NIC	11,9	2,4	31,7	9,6	2005	-4,04	-2,32
Niger	NER	43,6	12,4	75,2	30,8	2008	-2,51	-1,44
Nigeria	NGA	68,0	33,7	84,5	50,2	2010	-1,01	-0,68
Pakistan	PAK	21,0	3,5	60,2	17,9	2008	-5,03	-2,36
Rwanda	RWA	63,2	26,6	82,4	44,6	2011	-1,38	-0,85
Sao Tome and Principe	STP	28,2	7,9	54,2	20,6	2001	-2,58	-1,63
Senegal	SEN	29,6	9,1	55,2	21,9	2011	-2,24	-1,52
Sierra Leone	SLE	53,4	20,3	76,1	37,5	2003	-1,63	-1,03
Sri Lanka	LKA	4,1	0,7	23,9	5,4	2010	-5,32	-3,45
Sudan	SDN	19,8	5,5	44,1	15,4	2009	-2,63	-1,87
Tajikistan	TJK	6,6	1,2	27,7	7,0	2009	-4,66	-2,97
Tanzania	TZA	67,9	28,1	87,9	47,5	2007	-1,42	-0,85
Togo	TGO	28,2	8,8	52,7	20,9	2011	-2,20	-1,52
Uganda	UGA	38,0	12,2	64,7	27,4	2009	-2,11	-1,36
Vietnam	VNM	16,9	3,8	43,4	13,5	2008	-3,49	-2,21
Yemen, Rep.	YEM	17,5	4,18	46,6	14,8	2005	-3,19	-2,15
Zambia	ZMB	68,5	37	82,6	51,8	2006	-0,85	-0,59

Appendix 3: Poverty-efficient allocations in 2011 (as a percentage of GDP)

Country	Actual aid		1	2	3	4	5	6
		Estimate Set	CD	CD	CD	CD	HT	HT
		Poverty Measure	Pop < $1,25 a day (%)	Pov gap $1,25/day (%)	Pop < $2 a day (%)	Pov gap $2/day (%)	Pop < $1,25 a day (%)	Pov gap $1,25/day (%)
		Small Country Bias	N/A	N/A	N/A	N/A	N/A	N/A
Angola	0,17		0	0	0	0	0	0
Armenia	2,11		0	0	0	0	0	0
Bangladesh	0,56		2,94	4,13	3,80	4,10	2,91	0
Benin	4,56		5,24	5,71	5,39	5,22	5,03	6,16
Bhutan	3,33		0	0	0	0	0	0
Bolivia	1,42		0	0	0	0	0	0
Bosnia and Herzegovina	1,83		0	0	0	0	0	0
Burkina Faso	4,51		7,96	8,38	8,19	8,12	6,58	7,58
Burundi	11,18		7,48	7,34	7,05	6,32	13,31	13,12
Cambodia	2,35		0	0	0	0,45	0	0
Cameroon	1,29		0	0	0	0	0	0
Cape Verde	12,24		0	0	0	0	0	0
Central African Republic	7,48		4,37	3,90	3,91	2,92	11,62	10,87
Chad	2,71		0,39	0,21	0	0	8,12	7,99
Comoros	6,16		1,82	1,35	1,43	0,51	8,16	7,51
Congo, Dem, Rep,	21,90		5,24	4,86	4,94	3,95	14,29	13,63
Congo, Rep,	1,44		0	0	0	0	0	0
Cote d'Ivoire	3,98		0	0	0	0	0	0
Ethiopia	3,76		1,06	2,52	3,94	4,73	0	0,51
Gambia, The	4,19		1,96	2,49	2,58	2,45	0	0,37
Georgia	2,41		0	0	0	0	0	0
Ghana	3,85		2,73	3,43	4,32	4,58	0	0
Guinea	1,75		2,81	3,08	2,97	2,84	7,58	8,28
Guinea-Bissau	6,04		2,60	2,91	2,73	2,58	7,58	8,35
Haiti	14,44		4,24	3,33	3,50	1,78	9,74	8,26
Honduras	1,99		0	0	0	0	0	0
India	0,07		0	0	0	0,29	0	0
Kenya	3,49		6,41	6,38	6,41	5,84	3,43	3,71
Kyrgyz Republic	3,95		0	0	0	0	0	0
Laos	2,26		0	0	0	0,25	0	0
Lesotho	6,99		4,23	3,08	3,72	2,17	3,56	1,80
Liberia	31,68		7,08	6,85	6,65	5,79	13,45	13,09
Madagascar	2,14		7,51	6,90	6,80	5,10	11,93	10,92
Malawi	5,85		7,69	7,51	7,15	6,29	11,87	11,64
Maldives	1,62		0	0	0	0	0	0
Mali	7,35		8,44	8,77	8,47	8,34	8,92	9,70
Mauritania	4,25		0	0	0	0	0	0
Micronesia, Fed, Sts,	35,18		0	0	0	0	0	0
Moldova	3,91		0	0	0	0	0	0
Mozambique	8,87		9,53	9,36	9,18	8,55	10,55	10,38
Nepal	2,34		1,37	3,15	4,15	4,97	0,01	3,62
Nicaragua	3,11		0	0	0	0	0	0
Niger	5,53		7,76	8,15	8,04	8,12	10,45	11,31
Nigeria	0,43		4,47	3,12	2,94	0	4,09	1,96
Pakistan	0,72		0	0	0	0	0	0
Rwanda	9,00		9,76	9,56	9,12	8,12	9,34	9,14
Sao Tome and Principe	21,36		0	0	0	0	0	0
Senegal	4,18		1,77	3,04	3,66	4,14	0	0
Sierra Leone	6,26		6,43	6,47	6,12	5,63	9,06	9,30
Sri Lanka	0,52		0	0	0	0	0	0
Sudan	1,08		0	0	0	0	0	0
Tajikistan	2,19		0	0	0	0	0	0
Tanzania	3,59		8,81	8,64	8,10	7,04	8,92	8,80
Togo	8,63		1,76	2,44	2,83	3,10	4,11	5,62
Uganda	3,41		6,92	7,49	7,46	7,50	4,67	5,99
Vietnam	1,20		0	0	0	0	0	0
Yemen, Rep,	0,87		0	0	0	0	0	0
Zambia	4,79		6,95	5,63	5,83	3,11	8,29	6,11

Appendix 3 (Continued)

Country	Actual aid		7	8	9	10	11	12
		Estimate Set	HT	HT	LW	LW	LW	LW
		Poverty Measure	Pop < $2 a day (%)	Pov gap $2/day (%)	Pop < $1,25 a day (%)	Pov gap $1,25/day (%)	Pop < $2 a day (%)	Pov gap $2/day (%)
		Small Country Bias	N/A	N/A	N/A	N/A	N/A	N/A
Angola	0,17		0	0	0	0	0	0
Armenia	2,11		0	0	0	0	0	0
Bangladesh	0,56		0	0	0	0	0	2,76
Benin	4,56		5,67	6,37	0	0	0	2,50
Bhutan	3,33		0	0	0	0	0	0
Bolivia	1,42		0	0	0	0	0	0
Bosnia and Herzegovina	1,83		0	0	0	0	0	0
Burkina Faso	4,51		7,32	8,01	0	8,10	9,02	12,07
Burundi	11,18		12,62	11,75	42,02	41,45	39,32	33,92
Cambodia	2,35		0	0	0	0	0	0
Cameroon	1,29		0	0	0	0	0	0
Cape Verde	12,24		0	0	0	0	0	0
Central African Republic	7,48		10,93	9,81	31,47	27,91	29,68	22,56
Chad	2,71		7,29	6,54	9,57	10,54	8,87	3,47
Comoros	6,16		7,71	7,01	9,83	7,67	11,28	6,25
Congo, Dem, Rep,	21,90		13,79	12,38	48,16	44,52	46,04	37,59
Congo, Rep,	1,44		0	0	0	0	0	0
Cote d'Ivoire	3,98		0	0,63	0	0	0	0
Ethiopia	3,76		3,16	5,67	0	0	0	0
Gambia, The	4,19		0,65	1,91	0	0	0	0
Georgia	2,41		0	0	0	0	0	0
Ghana	3,85		0	0,98	0	0	0	0
Guinea	1,75		8,14	8,66	6,17	12,27	13,72	15,86
Guinea-Bissau	6,04		8,07	8,58	6,14	12,70	13,36	15,37
Haiti	14,44		8,62	6,54	19,67	12,14	16,46	3,47
Honduras	1,99		0	0	0	0	0	0
India	0,07		0	0	0	0	0	0
Kenya	3,49		3,84	4,09	0	0	0	0
Kyrgyz Republic	3,95		0	0	0	0	0	0
Laos	2,26		0	0	0	0	0	0
Lesotho	6,99		3,06	1,80	0	0	0	0
Liberia	31,68		12,75	11,65	42,88	41,23	40,09	33,32
Madagascar	2,14		10,78	8,52	33,41	28,19	28,84	15,04
Malawi	5,85		11,04	10,10	33,01	32,54	30,31	24,27
Maldives	1,62		0	0	0	0	0	0
Mali	7,35		9,20	9,62	14,54	20,82	19,76	21,49
Mauritania	4,25		0	0	0	0	0	0
Micronesia, Fed, Sts,	35,18		0	0	0	0	0	0
Moldova	3,91		0	0	24,73	24,94	24,89	21,50
Mozambique	8,87		10,09	9,63	0	0	0	0
Nepal	2,34		5,50	7,81	0	0	0	10,90
Nicaragua	3,11		0	0	0	0	0	0
Niger	5,53		11,13	11,70	24,15	30,51	30,84	33,60
Nigeria	0,43		1,75	0	0	0	0	0
Pakistan	0,72		0	0,13	0	0	0	0
Rwanda	9,00		8,41	7,52	17,15	17,48	15,28	9,19
Sao Tome and Principe	21,36		0	0,87	0	0	0	0
Senegal	4,18		0	1,52	0	0	0	0
Sierra Leone	6,26		8,74	8,62	15,44	18,45	17,14	15,63
Sri Lanka	0,52		0	0	0	0	0	0
Sudan	1,08		0	0	0	0	0	0
Tajikistan	2,19		0	0	0	0	0	0
Tanzania	3,59		7,89	6,94	14,58	15,43	12,28	5,84
Togo	8,63		6,40	7,74	0	0	3,79	10,47
Uganda	3,41		6,00	7,01	0	0	1,47	6,26
Vietnam	1,20		0	0	0	0	0	0
Yemen, Rep,	0,87		0	0	0	0	0	0
Zambia	4,79		6,53	3,06	10,63	0	4,56	0

Appendix 3 (Continued)

Country	Actual aid		13	14	15	16
		Estimate Set	CD	CD	CD	CD
		Poverty Measure	Pop < $2 a day (%)	Pop < $2 a day (%)	Pop < $2 a day (%)	Pop < $2 a day (%)
		Small Country Bias	0,25	0,32	0,50	0,75
Angola	0,17		0	0	0	0
Armenia	2,11		0	0	0	5,30
Bangladesh	0,56		2,71	2,37	0,92	0
Benin	4,56		7,70	8,15	8,94	9,40
Bhutan	3,33		0	1,89	8,10	11,20
Bolivia	1,42		0	0	0	0
Bosnia and Herzegovina	1,83		0	0	0	0
Burkina Faso	4,51		9,66	9,98	10,53	10,76
Burundi	11,18		7,75	7,89	8,13	8,27
Cambodia	2,35		2,51	3,41	4,97	5,74
Cameroon	1,29		0	0	0	0
Cape Verde	12,24		7,00	9,18	12,14	13,53
Central African Republic	7,48		5,24	5,47	5,86	6,10
Chad	2,71		1,55	1,91	2,54	2,88
Comoros	6,16		4,46	4,84	5,39	5,66
Congo, Dem, Rep,	21,90		4,97	4,98	4,95	4,67
Congo, Rep,	1,44		0,74	2,09	4,32	5,68
Cote d'Ivoire	3,98		0,06	0,70	1,79	2,11
Ethiopia	3,76		3,78	3,73	3,18	0,49
Gambia, The	4,19		7,70	8,46	9,62	10,27
Georgia	2,41		0	0,92	6,76	10,35
Ghana	3,85		6,63	7,16	8,04	8,08
Guinea	1,75		4,63	4,96	5,54	5,87
Guinea-Bissau	6,04		5,36	5,74	6,31	6,63
Haiti	14,44		5,06	5,37	5,91	6,23
Honduras	1,99		0	0	0,15	3,21
India	0,07		0	0	0	0
Kenya	3,49		7,36	7,59	7,88	7,22
Kyrgyz Republic	3,95		0	0	3,74	6,33
Laos	2,26		4,44	5,38	6,98	7,96
Lesotho	6,99		7,87	8,50	9,50	10,07
Liberia	31,68		7,48	7,62	7,86	8,00
Madagascar	2,14		7,54	7,71	8,00	8,07
Malawi	5,85		8,00	8,18	8,50	8,65
Maldives	1,62		0	0	0	5,79
Mali	7,35		9,64	9,90	10,34	10,53
Mauritania	4,25		2,94	4,17	6,18	7,39
Micronesia, Fed, Sts,	35,18		2,36	3,78	5,42	6,01
Moldova	3,91		0	0	0	0
Mozambique	8,87		9,96	10,14	10,45	10,48
Nepal	2,34		5,33	5,61	6,05	5,88
Nicaragua	3,11		0	0	3,23	6,03
Niger	5,53		8,85	9,03	9,33	9,47
Nigeria	0,43		1,36	0,86	0	0
Pakistan	0,72		0	0	0	0
Rwanda	9,00		10,68	11,00	11,55	11,86
Sao Tome and Principe	21,36		6,21	6,96	7,86	8,21
Senegal	4,18		7,01	7,71	8,92	9,56
Sierra Leone	6,26		7,94	8,27	8,83	9,18
Sri Lanka	0,52		0	0	0	0
Sudan	1,08		0	0	0	0
Tajikistan	2,19		0	0,17	3,32	5,24
Tanzania	3,59		8,62	8,75	8,88	8,32
Togo	8,63		5,25	5,69	6,45	6,91
Uganda	3,41		8,44	8,68	9,03	8,74
Vietnam	1,20		0	0	0	0
Yemen, Rep,	0,87		0	0	0,10	0,17
Zambia	4,79		7,63	8,00	8,66	9,00

Appendix 4: Poverty-efficient allocation correlation table

	Estimate Set	CD	CD	CD	CD	HT	HT	HT	HT	LW	LW	LW	LW	CD	CD	CD	CD
	Poverty Measure	Pop < $1,25 a day (%)	Pov gap $1,25/day (%)	Pop < $2 a day (%)	Pov gap $2/day (%)	Pop < $1,25 a day (%)	Pov gap $1,25/day (%)	Pop < $2 a day (%)	Pov gap $2/day (%)	Pop < $1,25 a day (%)	Pov gap $1,25/day (%)	Pop < $2 a day (%)	Pov gap $2/day (%)	Pop < $2 a day (%)	Pop < $2 a day (%)	Pop < $2 a day (%)	Pop < $2 a day (%)
	Small Country Bias	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0,25	0,32	0,50	0,75
	Actual aid	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Actual aid	1																
1	0,23	1															
2	0,21	0,99	1														
3	0,21	0,97	0,99	1													
4	0,18	0,91	0,96	0,97	1												
5	0,37	0,83	0,79	0,77	0,68	1											
6	0,37	0,83	0,81	0,79	0,73	0,98	1										
7	0,37	0,82	0,80	0,79	0,74	0,97	0,99	1									
8	0,35	0,78	0,80	0,80	0,79	0,90	0,96	0,98	1								
9	0,45	0,56	0,52	0,50	0,43	0,82	0,79	0,79	0,71	1							
10	0,42	0,59	0,56	0,54	0,49	0,82	0,82	0,80	0,76	0,97	1						
11	0,43	0,58	0,55	0,54	0,48	0,84	0,83	0,82	0,78	0,98	0,99	1					
12	0,40	0,56	0,57	0,56	0,55	0,77	0,80	0,80	0,81	0,88	0,94	0,95	1				
13	0,34	0,85	0,87	0,88	0,87	0,67	0,70	0,70	0,73	0,40	0,43	0,43	0,45	1			
14	0,37	0,80	0,82	0,83	0,82	0,62	0,65	0,66	0,69	0,36	0,39	0,40	0,42	0,99	1		
15	0,37	0,67	0,68	0,69	0,69	0,50	0,54	0,54	0,56	0,27	0,30	0,30	0,32	0,89	0,93	1	
16	0,32	0,53	0,54	0,54	0,53	0,39	0,42	0,41	0,42	0,19	0,22	0,22	0,23	0,75	0,80	0,94	1

Appendix 5: Data used in the estimation of the linear model

Country	lnN	P	A	POV
Angola	2,98	2,69	0,17	0,012
Armenia	1,13	4,07	2,11	0,003
Bangladesh	5,01	3,28	0,56	0,043
Benin	2,21	3,47	4,56	0,047
Bhutan	-0,30	3,85	3,33	0,005
Bolivia	2,31	3,60	1,42	0,005
Bosnia and Herzegovina	1,32	3,64	1,83	0,000
Burkina Faso	2,83	3,77	4,51	0,056
Burundi	2,15	3,11	11,18	0,155
Cambodia	2,66	3,41	2,35	0,021
Cameroon	3,00	3,18	1,29	0,013
Cape Verde	-0,69	4,01	12,24	0,010
Central African Republic	1,50	2,76	7,48	0,099
Chad	2,44	2,43	2,71	0,056
Comoros	-0,28	2,65	6,16	0,059
Congo, Dem. Rep.	4,22	2,67	21,90	0,255
Congo, Rep.	1,42	3,00	1,44	0,017
Cote d'Ivoire	3,00	2,87	3,98	0,026
Ethiopia	4,44	3,46	3,76	0,037
Gambia, The	0,57	3,47	4,19	0,031
Georgia	1,50	4,42	2,41	0,007
Ghana	3,22	3,90	3,85	0,028
Guinea	2,32	2,86	1,75	0,062
Guinea-Bissau	0,44	2,83	6,04	0,061
Haiti	2,31	2,90	14,44	0,066
Honduras	2,05	3,63	1,99	0,007
India	7,12	3,72	0,07	0,019
Kenya	3,73	3,79	3,49	0,039
Kyrgyz Republic	1,71	3,61	3,95	0,009
Laos	1,84	3,36	2,26	0,024
Lesotho	0,79	3,43	6,99	0,037
Liberia	1,42	3,03	31,68	0,162
Madagascar	3,06	3,23	2,14	0,096
Malawi	2,73	3,27	5,85	0,101
Maldives	-1,14	3,33	1,62	0,001
Mali	2,76	3,64	7,35	0,072
Mauritania	1,26	3,20	4,25	0,019
Micronesia, Fed. Sts.	-2,19	2,71	35,18	0,013
Moldova	1,27	3,78	3,91	0,001
Mozambique	3,18	3,68	8,87	0,084
Nepal	3,42	3,28	2,34	0,046
Nicaragua	1,77	3,68	3,11	0,008
Niger	2,78	3,40	5,53	0,103
Nigeria	5,09	3,43	0,43	0,033
Pakistan	5,17	3,07	0,72	0,022
Rwanda	2,39	3,82	9,00	0,064
Sao Tome and Principe	-1,78	3,05	21,36	0,026
Senegal	2,55	3,78	4,18	0,028
Sierra Leone	1,79	3,31	6,26	0,067
Sri Lanka	3,04	3,54	0,52	0,004
Sudan	3,54	2,36	1,08	0,015
Tajikistan	1,94	3,35	2,19	0,012
Tanzania	3,83	3,70	3,59	0,060
Togo	1,82	2,99	8,63	0,050
Uganda	3,54	3,77	3,41	0,048
Vietnam	4,48	3,73	1,20	0,013
Yemen, Rep.	3,21	2,98	0,87	0,020
Zambia	2,60	3,46	4,79	0,051