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Aid and the MDG poverty target: How much is required and how should it be allocated?

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Abstract

This paper uses econometric estimates of the link between aid and economic growth to shed light on the joint question of how much additional aid is required to meet the Millennium Development Goal of halving global poverty by 2015, and how this aid should be allocated across countries. It first shows that a large increase in existing aid levels can be justified to meet a target of halving $1-a-day poverty on a country-by-country basis by 2015 under the econometric estimates obtained by Hansen and Tarp (2001) and Lensink and White (2001), although not those obtained by Collier and Dollar (2002). The paper then shows that, even where an increase in existing aid levels can be justified, a much larger number of people – up to around 70 million – could be lifted out of poverty by 2015 if aid was instead allocated on a poverty-efficient basis. This cautions against the use of a country-by-country target approach when allocating aid across recipient countries. The paper argues that a poverty-efficient aid allocation using either the poverty gap or squared poverty gap measure of poverty would be a better approach.

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Annexes 1-4 referred to in the paper are available on request.

1 Introduction

This paper examines the joint question of how much additional aid is required to meet the target, associated with Millennium Development Goal (MDG) No.1, of halving the 1990 $1-a-day poverty headcount by 2015, and how this aid should be allocated across recipient countries.

It has been argued recently that a substantial increase in current aid levels is required to meet this target: an additional $50 billion per year, or a doubling of current levels of assistance according to one recent estimate (Devarajan et al., 2002). This figure is based on meeting the target on a country-by-country basis, rather than at the global level.[1] Nevertheless, this country-by-country interpretation of the MDGs has been given a lot of emphasis, for example in the recent report of the UN Millennium Project, or 'Sachs Report' (UN Millennium Project, 2005).

At the same time however, concerns have been expressed about the potential to absorb more aid for many countries which are currently 'off-track' in halving $1-a-day poverty. Furthermore, even if additional aid can be absorbed in off-track countries, this aid could possibly have a much larger impact on poverty reduction at the global level if it was instead allocated on a 'poverty-efficient' basis. This would involve allocating additional aid to those countries in which it would have the greatest impact on poverty reduction, which may differ from those which are off-track in meeting the MDG poverty target. Previous work (e.g. Collier and Dollar, 2001) has suggested that the impact of a more poverty-efficient aid allocation on poverty reduction could be substantial.

The main aim of this paper is to shed light on this issue, and to calculate how much additional poverty reduction could be achieved by 2015 at the global level, if additional aid was allocated on a poverty-efficient basis, rather than being allocated so as to halve, or get as close as possible to halving, poverty by 2015 in individual countries. Knowing the likely magnitude of this amount is clearly an important consideration in deciding which of the two allocation rules donors should prefer: the higher the opportunity cost of the country-by-country approach in terms of foregone poverty reduction at the global level, the less appealing it will be to many donors.

The paper proceeds as follows. Section 2 briefly discusses three sets of literature which inform our approach: on aid effectiveness, optimal aid allocation and the determination of total aid volumes. Section 3 then outlines the methods used to calculate: i) the amount of aid required to halve poverty by 2015 in each individual country; ii) the amount of aid that countries would receive if this total was instead allocated on a poverty-efficient basis; and iii) projected levels of poverty through to 2015 under these alternative aid scenarios.

Section 4 describes the data sources used, and the three econometric studies used for evidence on the impact of aid on economic growth (Hansen and Tarp, 2001; Lensink and White, 2001; Collier and Dollar, 2002). Although studies of this kind are far from achieving a consensus, they remain arguably the best source of evidence on the extent to which aid effectiveness differs across countries, and on the amounts of aid which recipient countries can absorb before it begins to have negative effects. (More recent studies are available, but for the time being we restrict our attention to these three well-known studies.) We also use publicly available, World Bank household survey-based estimates of $1-a-day poverty in the developing world to calculate the effects of our alternative aid allocations on $1-a-day poverty at the global, regional and country level.

Section 5 presents the main findings. We first show that, under the econometric estimates obtained by Hansen and Tarp (2001) and Lensink and White (2001), a target of halving $1-a-day poverty by 2015 on a country-by-country basis would justify an increase in existing aid levels of between 36% and 168%. These figures are broadly consistent with the 'doubling of aid' figure quoted frequently in recent

[1] The main reason for this is strong rates of economic growth in the world's two most populous countries, India and China, which are driving down global poverty figures and making it likely that the MDG poverty target will be met at the global level, despite lagging progress elsewhere (see, for example, Chen and Ravallion, 2004).

debate. However, under the estimates obtained by Collier and Dollar (2002), no increase in current aid levels would be justified, as the econometric estimates of countries' absorptive capacities for aid obtained in this study are lower than those obtained by Hansen and Tarp (2001) and Lensink and White (2001). So much so that, under Collier and Dollar's (2002) estimates, most countries which are off-track towards halving their 1990 poverty headcount by 2015, and therefore require additional aid, are already receiving more than their absorptive capacities for aid.

Secondly, we show that a much larger number of people could be lifted out of poverty if aid was allocated on a poverty-efficient basis, rather than so as to halve the $1-a-day poverty headcount in individual countries. The amount of additional poverty reduction varies, depending on which estimates of the relationship between aid and economic growth are used, and which particular measure of poverty is used when calculating the poverty-efficient allocation. Nevertheless, in each case it is large, varying between 26 and 69 million people (1.0% and 2.6% of total population) when using the $1-a-day poverty headcount, and between 10 million and 59 million people (0.4% and 2.3% of total population) when using the $1-a-day squared poverty gap. These gains are achieved mainly as a result of the poverty-efficient aid allocations allocating, in comparison with the country-by-country poverty target allocation, a greater share of total aid to South Asia and a smaller share to sub-Saharan Africa.

There are certain drawbacks with the poverty-efficient aid allocations however. This paper shows that, in comparison with the country-by-country poverty target allocation, the poverty-efficient aid allocations generally imply a slower reduction in $1-a-day poverty in the poorest region, sub-Saharan Africa (between 16 and 28 million people, or 2.8% and 4.5% of the region's population, under the poverty-headcount-efficient allocation), and also in the poorest individual countries. This might reduce the relative appeal of poverty-efficient aid allocations to many donors. However, we demonstrate that this tendency is relatively minor when using the poverty gap and squared poverty gap measures in determining the efficient allocations, rather than the poverty headcount. The reason is that these allocate a larger share of aid, relative to the poverty-headcount-efficient allocation, to sub-Saharan Africa and to the poorest individual countries.

Section 6 presents our additional findings. We first show that the main results in Section 5, which are based on those low-income countries for which household survey-based estimates of $1-a-day poverty are available (representing approximately 89% of the total population of all low-income countries), are robust to a larger sample that includes approximately 95% of the total population of all low-income countries. We then show that the costs (in terms of foregone poverty reduction) of a country-by-country poverty target aid allocation are as high as, if not higher than, the costs of two more well-known constraints that donors have placed (albeit implicitly) on their aid allocation decisions: firstly, the constraint that around one-third of total aid goes to middle-income countries, which we estimate will reduce the poverty-reducing effect of aid from 2002 to 2015 by between 14 and 21 million people at the global level (0.3% and 0.4% of total population); and secondly, the constraint that no single country, however large its size, receives more than about 10% of the total aid budget, which we estimate could reduce the poverty-reducing effect of aid over the same period at the global level by up to 82 million people (1.6% of total population).

Finally, Section 7 concludes and discusses the policy implications. The main policy implication arising from the study is to caution against the use of a country-by-country poverty target approach when allocating aid across recipient countries. For donors concerned with the amount of poverty reduction achieved from their aid, the paper suggests that either a poverty-gap-efficient allocation or a squared-poverty-gap-efficient allocation would be more desirable. These allocations would achieve, in comparison with a country-by-country poverty target allocation, a similar reduction in $1-a-day poverty headcount in the poorest region and countries of the world, but a much larger reduction in the $1-a-day poverty headcount at the global level. They would also achieve, in comparison with a poverty-headcount-efficient allocation, a larger reduction in the depth (the poverty-gap-efficient allocation) or the severity (the squared poverty-gap-efficient allocation) of $1-a-day poverty at the global level.

2 Background

Three sets of literature form the background to our analysis: on aid effectiveness, optimal aid allocations and amounts of aid required to meet the MDGs.

2.1 The effects of aid

Determining optimal levels and allocations of aid across countries requires information on what impacts aid has in recipient countries, and through which channels. Fortunately, there is a large and growing literature on this issue which policy-makers can draw on. The following sets of issues covered by this literature are particularly relevant to this paper:

a) the impact of aid on economic growth in recipient countries, and the extent to which this varies according to recipient country characteristics;

b) the impact of aid on the 'quality' of policy in recipient countries;

c) the impact of aid on the distribution of income in recipient countries, and on the relationship between income and non-income welfare indicators.

Evidence on (a) is provided by a large number of recent studies that calculate the effect of aid on economic growth using econometric methods. It is fair to say that these studies have not arrived at a consensus, even if one restricts one's attention to studies that have been published in academic journals. Instead, three quite different sets of results have been found: i) that aid increases economic growth in all countries, but only up to a certain point (e.g. Hansen and Tarp, 2001; Lensink and White 2001); ii) that aid increases economic growth, but only in countries with 'good' economic policies, and even then only up to a certain point (e.g. Burnside and Dollar, 2000; Collier and Dollar, 2002); and iii) that aid has no effect on economic growth at all (e.g. Easterly, 2003).

Evidence on (b) is more limited, although the conventional wisdom is that the quantity of aid does not systematically affect the 'quality' of policies (see, for example, Collier and Dollar, 2002). Evidence on (c) is also more limited. It has been commonly held that, because aid resources are typically fungible, it is difficult for donors to target them to particular groups within a country, and therefore to alter the distribution of income (see again, Collier and Dollar, 2002). Some recent work has challenged this view however; there is evidence that aid has shifted the distribution of income in some recipient countries towards greater equality, mainly by promoting a more 'pro-poor' pattern of public expenditure (e.g. Mosley et al*.,* 2004). There is also evidence that aid has a direct effect on non-income welfare indicators, in addition to its effect via economic growth (e.g. Gomanee et al*.,* 2003).

Research on each of these three issues is continuing; see, for example, Clemens et al. (2004a) and Rajan and Subramanian (2005) for the most recent estimates of the effect of aid on economic growth. We do not attempt to say which of these various econometric studies of aid effectiveness are to be preferred. Instead, we simply document the amount by which optimal aid allocations and volumes differ, depending on which set of estimates are used. If the estimates are very different, this would suggest the need for further work to find out which of the studies, if any, can be considered more accurate and therefore reliable.

2.2 Optimal aid allocations

The literature on 'poverty-efficient' aid allocations is now quite well known (see, for example, Collier and Dollar, 2001, 2002; Beynon, 2003). A poverty-efficient aid allocation is one which lifts the largest possible number of people out of poverty, given a fixed total volume of aid. Such an allocation requires that more aid (as a share of recipient country GDP) goes to countries in which the effectiveness of aid in lifting people out of poverty is higher.

Certain features of poverty-efficient aid allocations command widespread support: for example, aid should not be systematically related to commercial or geo-political interests between donors and recipients, and a much smaller proportion of the total should go to middle-income countries. Much advocacy work is being done by NGOs and individual donors towards making existing allocations more poverty efficient in these senses (see, for example, OECD-DAC, 2005; Action Aid, 2005).

However, certain other features of poverty-efficient aid allocations do not command widespread support. On the one hand, there is disagreement about whether donors should give more aid to countries with better policies than others (all else being constant). This mainly reflects a lack of consensus in the academic literature about precisely which factors increase the effectiveness of aid in reducing poverty. Burnside and Dollar (2000) and Collier and Dollar (2001, 2002), for example, both find that the 'quality' of policy in recipient countries increases the positive effect of aid on economic growth.[2] Similar studies by Hansen and Tarp (2001) and Lensink and White (2001), however, find no such link.

On the other hand there is a view that, although efficient, poverty-efficient allocations are in some sense inequitable. Most people would accept that, ideally, more aid (either on a per capita basis or as a share of recipient country GDP) should go to countries with higher levels of poverty. Under a poverty-efficient allocation however, this may well not be the case. The main reason is that countries with higher levels of poverty are often (although not necessarily) those in which aid is less effective in reducing poverty: it either has less impact on economic growth, or economic growth has less impact on poverty. It is even possible that, under a poverty-efficient allocation, some countries with high levels of poverty but in which the effectiveness of aid in reducing poverty is particularly low (although still positive) will be by-passed by aid altogether.

An alternative allocation system which has been proposed recently, and is discussed further in Section 2.3 below, is a 'country-by-country target allocation'. This aims to achieve the same reduction in poverty (or some other measure of deprivation), from a given start date, in each recipient country. Under this system, recipient countries are not penalised for low levels of aid effectiveness: in fact, they are allocated relatively more aid so that they can achieve the same reduction in poverty as countries with higher levels of aid effectiveness. However, this comes at the expense of a smaller reduction in poverty at the global level, since it does not allow for relatively more aid to be allocated to countries where it is relatively more effective in reducing poverty. Which of these aid allocation systems is to be preferred is a normative issue about which there is likely to be disagreement.

2.3 Total aid volumes

The most well-known rule for determining total aid volumes is the guideline established by the United Nations in 1970: that all rich countries should provide at least 0.7% of their GNP in external aid.[3] This

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[2] Burnside and Dollar (2000) measure the quality of policy by a combined index of trade openness, inflation and the fiscal deficit. Collier and Dollar (2001, 2002) use World Bank Country Policy and Institutional Assessment (CPIA) scores.

[3] The General Assembly Resolution, affirmed by UN member states in 1970, was as follows: 'In recognition of the special importance of the role which can be fulfilled only by official development assistance, a major part of financial resource transfers to the developing countries should be provided in the form of official development assistance. Each economically advanced country will progressively increase its official development assistance to the developing countries and will exert its best efforts to reach a minimum net amount of 0.7% of its gross national product at market prices by the middle of the decade' (UN, 1970: 43). The precise figure of 0.7% was recommended by the Commission on International Development in its 1969 report *Partners in Development: Report of the Commission on International Development*. The Commission was set up by Robert S. McNamara, then President of the World Bank, to review the previous 20 years of development assistance, assess the results, and make recommendations for the future, and was chaired by former Canadian Prime Minister Lester B. Pearson. Copies of the report are available in the World Bank's Joint, Fiscal, and Translation and Interpretation Services Libraries, as well as the Sectoral and IT Resource Centre.

rule was re-affirmed more recently at the UN International Conference on Financing for Development held in Monterrey in 2002 – one element of the so-called 'Monterrey Consensus'.[4]

A more recent approach to determining total aid volumes has been to estimate the total amount of aid which is required to meet the MDGs. One of the first such estimates was provided by the 'Zedillo Report', a report commissioned by the UN Secretary General in preparation for the Monterrey Conference.[5] The report concluded 'that meeting the International Development Goals alone would require an extra $50 billion per year of official development assistance – almost double the ODA that is currently provided' (UN, 2001: 20).[6]

Since the Zedillo report there have been several other attempts to estimate the amount of additional financing required to meet the MDGs.[7] Broadly speaking, two sets of methods have been used. The first involves calculating the rate of economic growth required to halve the poverty headcount in each developing country, and then estimating the additional amount of aid required to achieve this level of growth.[8] Devarajan et al. (2002), using this approach, estimate that between $54bn and $62bn of additional aid per year from donor countries would be required to meet the poverty MDG of halving the 1990 $1-a-day poverty headcount by 2015.[9] The second approach involves calculating the amount of public expenditure required to meet the targets for education, health, water and sanitation in each individual country, using a unit cost approach. The report of the UN Millennium Project (2005) estimates on this basis that in order to meet the MDGs, total aid volumes will need to rise to 0.54% of rich countries' GNI in 2015, up from 0.23% in 2002.

As the authors of these various studies are keen to point out, estimates of the amount of aid required to meet the MDGs are subject to several important caveats. As with any forecasting exercise, the future may not turn out in the way one expects. There is also disagreement, as discussed in the previous section, about what the relationship between aid and welfare outcomes has been in the past,[10] as well as uncertainty about whether the MDGs can in fact be achieved by increased levels of aid. Some argue that they cannot be achieved (unless one considers only progress at the global level), mainly because of the problem of absorptive capacity (e.g. Clemens et al., 2004b). In particular, it is argued that 'those that need [external assistance] most are frequently the ones least able to use it effectively (ibid.: 11).

In addition, the methods used to estimate MDG aid requirements are typically inconsistent with the principles of optimal aid allocation described in Section 2.2. The estimates of Devarajan et al. (2002), for example, are based on the assumption that donors do not allocate any of the additional aid to countries which are currently on track to meet the poverty MDG, and that, among the remaining 65 countries, additional aid is allocated in such a way as to achieve a 50% reduction in poverty in each

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4 'We urge developed countries that have not done so to make concrete efforts toward the target of 0.7% of gross national product (GNP) as ODA to developing countries, and 0.15% to 0.20% of GNP of developed countries to least developed countries.'

5 Earlier studies which the Zedillo report draws on include Gottschalk (2000).

6 This figure was not intended to replace the 0.7% target, since the report also argued that there are other roles that ODA must fulfil in addition to helping to meet the development targets (e.g. coping with humanitarian crises and providing and/or preserving the supply of global public goods).

7 Good surveys of such attempts have also been provided by Vandermootele (2002), Naschold (2002), Christiansen et al. (2002) and Clemens et al. (2004b).

8 The former are derived from household survey-based estimates of income poverty and income distribution. The latter is derived from a so-called 'two-gap' growth model, in which the growth rate is assumed to be proportional to the ratio of domestic investment to income, and in which aid is assumed to contribute 'one-for-one' to domestic investment.

9 The smaller figure ($54bn) is based on the assumption that 22 countries with current poor policy environments improve their policy to the average level in the 43 countries with current good policy environments (which are assumed to remain unchanged). The larger figure ($62bn) is based on the assumption that there is no such improvement. They assume that donors do not allocate any of the additional aid to countries which are currently on track to meet the poverty MDG, or in which aid is small compared to the size of the economy. They report 86 such countries, including India and China, with a combined population of 4 billion people.

10 With regard to the first approach, many have challenged the use of the 'two-gap' model as a reliable predictor of economic growth rates in developing countries, most notably Easterly (2001). With regard to the second, there is little consistent evidence that increases in public resources lead to improvements in education and health outcomes: see, for example, Al-Samarrai (2002) on education spending, and Filmer and Pritchett (1997) on health spending.

one. Such an allocation system will, however, almost invariably be poverty-inefficient, because it does not allow for more aid to be allocated to countries where it is relatively more effective in reducing poverty.

An alternative way of determining total aid volumes could be described as a market-based approach. In a free market, citizens would give aid up to the point that their willingness to donate in order to lift one more person out of poverty was equal to the cost of lifting one more person out of poverty. The job of the government is therefore to elicit information about citizens' willingness to donate money for poverty reduction. They should then increase total aid volumes if that willingness is observed to be significantly above estimates of the cost of reducing poverty.

2.4 Summary

The ability to calculate optimal aid volumes and allocations across recipient countries accurately has increased in recent years, due to increasing evidence about the effects of aid on poverty. There is nevertheless continued disagreement about which criteria should be used in determining the cross-country aid allocations. In part this reflects a lack of consensus about the precise effects of aid, but it also reflects more fundamental disagreement about what is meant by a fair or equitable allocation. Recent estimates of the amount of aid required to meet the MDGs on a country-by-country basis provide one way of determining total aid requirements and the required and/or optimal allocation of that total across countries, but this is not the only way. In this context, documenting the likely effects of alternative allocation systems on outcomes of interest is an important task for research.

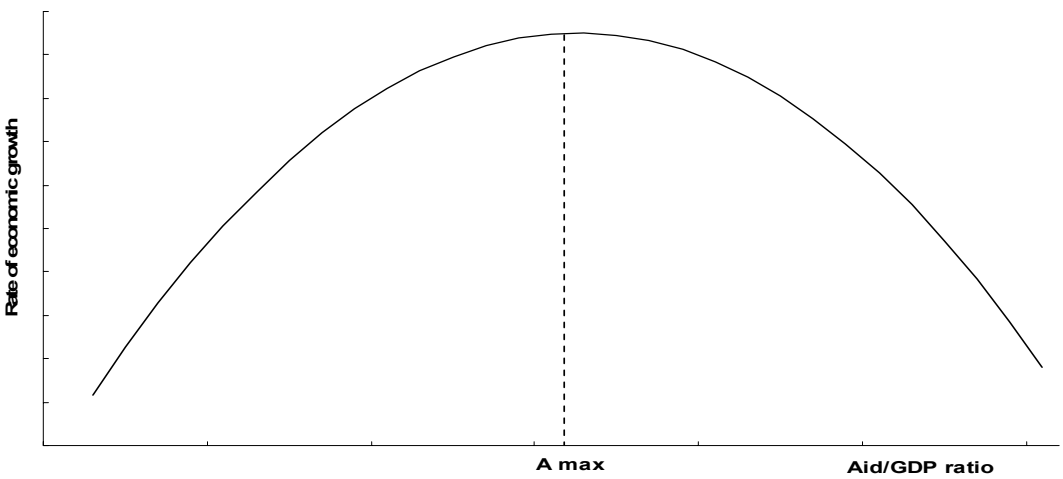
3 Methods

This section outlines the methods used to calculate the aid volumes, aid allocations and resulting levels of poverty presented in Sections 5 and 6. We assume throughout that the relationship between aid and economic growth is given by the following formula:

$$G_i = a_i + (b + dP_i)A_i - (c - eP_i)A_i^2 \qquad (1)$$

where G_i is the aid-recipient country's rate of economic growth, A_i is its net aid inflow as a share of its GNP, P_i is a set of variables measuring different characteristics of the recipient country (e.g. the quality of policy), a_i is its 'underlying' growth rate (i.e. its growth rate if it receives no aid), *b*, *c*, *d* and *e* are parameters to be estimated econometrically, and $i=1,\ldots,N$ denotes each aid-recipient country. This relationship can be shown graphically (see Figure 1). We also assume, based on the evidence discussed in Section 2.1, that aid has no effect on the distribution of income in the recipient country. This implies that the effect of aid on poverty is given by multiplying the effect of aid on economic growth by the effect of economic growth on poverty. We further assume, again based on the evidence discussed in Section 2.1, that aid has no effect on the quality of policy in the recipient country.

Figure 1: The assumed relationship between aid and economic growth



Source: Authors' simulation.

3.1 Aid required to halve poverty, country by country

The first step is to calculate the amount of aid required for each country to halve the 1990 level of its poverty headcount by 2015. This interprets the MDG poverty target as applying to each individual country, which is the way in which it has been interpreted by many (e.g. UN Millennium Project, 2005; Devarajan et al., 2002).

To do this, we first calculate the rate of economic growth each country requires to halve the 1990 level of its poverty headcount by 2015. This is done using a technique outlined by Ravallion and Chen (1998) (Annex 1). The two main assumptions are that a) each country's distribution of income remains constant, between the most recent survey year and 2015; and b) rates of growth in real household income (or expenditure) per capita are four-fifths of those in real GDP per capita. This rate of growth is denoted as G_i^*. The amount of aid required to attain the rate of growth G_i^* is then calculated, assuming that the values of *b*, *c*, *d*, *e* and P_i remain constant. This is denoted $A_{i,mdg}$ and is given by the following equation:

$$A_{i,mdg} = \frac{(b+dP_i)}{2(c-eP_i)} - \frac{\sqrt{(b+dP_i)^2 - 4(c-eP_i)(G_i^* - \hat{a}_i)}}{2(c-eP_i)} \quad (2)$$

where $\hat{a}_i$ is the each country's predicted underlying rate of growth.[11] To calculate $\hat{a}_i$, each country's underlying rate of growth between 1997 and 2002 is first calculated. This is given by:

$$\tilde{a}_i = \tilde{G}_i - (b+dP_i)\tilde{A}_i + (c-eP_i)\tilde{A}_i^2 \quad (3)$$

where $\tilde{A}_i$ is the average ratio of aid to GDP between 1997 and 2002, $\tilde{A}_i^2$ is the average squared ratio of aid to GDP between 1997 and 2002, and $\tilde{G}_i$ is the actual rate of growth between 1997 and 2002. We then assume that individual country values of $\hat{a}_i$ gradually converge between 2002 and 2015 towards a common value of 3% per year, as follows:

$$\hat{a}_{i,2002-6} = 0.03 + \gamma(\tilde{a}_i - 0.03) \quad (4)$$

$$\hat{a}_{i,2006-10} = 0.03 + \gamma(\hat{a}_{i,2002-6} - 0.03) \quad (5)$$

$$\hat{a}_{i,2010-15} = 0.03 + \gamma(\hat{a}_{i,2006-10} - 0.03) \quad (6)$$

where γ is a convergence parameter set equal to 0.5. The value of $A_{i,mdg}$ is therefore calculated for three separate periods, 2002-06, 2006-10 and 2010-15, each of which is based on a different value of $\hat{a}_i$. All other parameters in Equation (2), including G_i^*, remain constant between 2002 and 2015.

For some countries in our sample, Equation (2) is undefined. These are the countries which cannot halve the 1990 level of their poverty target (assuming the values of $\hat{a}_i$, b, c, d, e and P_i do not change), even with unlimited aid. In these cases, we allocate the maximum amount of aid which a country can absorb before that aid begins to reduce, rather than increase, economic growth. This is typically referred to as a country's 'absorptive capacity' for aid, and is given by the following formula:

$$A_{i,\max} = \frac{(b+dP_i)}{2(c-eP_i)} \quad (7)$$

This amount is shown graphically in Figure 1. It is obtained by differentiating equation (1) with respect to A_i, and setting the resulting expression equal to zero.

For some other countries in our sample, the value of $A_{i,mdg}$ given by Equation (2) is less than the amount received in 2002. These are the countries which do not, according to our assumptions, require additional aid to halve the 1990 value of their poverty headcount by 2015. In these cases, we allocate the same amount of aid (as a share of GDP) that they received in 2002, unless that amount was greater than $A_{i,\max}$, in which case we allocate $A_{i,\max}$.

3.2 Poverty-efficient aid

The second step is to calculate the amount of aid each country would receive if the total amount of aid required to halve (or get as close as possible to halving) each country's poverty headcount were instead allocated on a 'poverty-efficient' basis. These amounts are given by the solution to the following optimisation problem:

[11] Equation (2) is the solution to the following equation: $(c-eP_i)A_i^2 - (b+dP_i)A_i + (G_i^* - \hat{a}_i) = 0$. There are in fact two solutions to this equation; we choose the lower as the higher is inefficient.

Maximise $G_i \alpha_i h_i N_i$

subject to:

$$\sum_i A_i y_i N_i = \sum_i A_{i,mdg} y_i N_i$$

and

$$A_i \geq 0$$

where h_i is some measure of poverty (e.g. the poverty headcount, or the poverty gap), α_i is the elasticity of that measure of poverty with respect to mean income or expenditure, y_i is GDP per capita, and N_i is population. If there are no corner solutions (meaning that, under the most efficient allocation, each country receives at least some aid), the solutions to this problem, which is denoted $A_{i,eff}$, are given by the following formula:

$$A_{i,eff} = \frac{(b + dP_i)}{2(c - eP_i)} - \lambda \frac{y_i}{2(c - eP_i)\alpha_i h_i} \qquad (8)$$

where λ is the shadow price of aid.[12] In practice there are corner solutions (in that the efficient aid allocation for some countries is zero), and in this case it is not possible to use a single formula for each country's allocation. Instead, the allocations are obtained using specialist optimisation software.[13]

The values of $A_{i,eff}$ are calculated using three different measures of poverty: the poverty headcount, the poverty gap and the squared poverty gap. The poverty headcount reflects only the incidence of poverty, but the poverty gap and squared poverty gap also reflect the depth and/or severity of poverty. In each case the $1-a-day international poverty line is used.

3.3 Projections to 2015

The third and final step is to forecast the amounts of aid received, and the resulting levels of poverty and per capita income, in each country and each year between 2003 and 2015, for the above three aid allocation systems. We continue to assume that the distribution of income in each country, and the relationship between aid and economic growth, remain constant; that rates of growth in real household income or expenditure per capita are four-fifths of those in real GDP per capita; and that each country's 'underlying' rate of growth between 2002 and 2015 is equal to the equivalent rate observed between 1990 and 2002. The values of real household income or expenditure per capita (u_i) and GDP per capita (y_i) in each future year are therefore given by the following formulae:

$$y_{it} = y_{i,t-1}(1 + \hat{G}_i) \qquad (9)$$

$$u_{it} = u_{i,t-1}(1 + \hat{G}_i * 0.8) \qquad (10)$$

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[12] The shadow price of aid is the amount by which poverty would be reduced if the amount of aid resources were to increase by one unit.

[13] This is the standard optimisation program used by economists, the General Algebraic Modelling System (GAMS). Details of the program files used to generate the results in the paper, and the various output files containing the results, are available on request.

where $\hat{G}_i$ is the rate of growth obtained from equation (1) when $a_i = \hat{a}_i$ and $A_i = A_{i,mdg}$ or $A_{i,eff}$, depending on which aid allocation system is being used. Future levels of h_i and α_i are then obtained using the values of u_i derived from equation (6), and the formulae for h_i and α_i contained in Datt (1998). Future levels of N_i are obtained using UN/World Bank projections. Finally, the poverty projections are compared against an ideal scenario in which each country receives the maximum amount of aid it can absorb, as given by equation (7).

3.4 Summary

To summarise, our approach involves calculating the amount of aid countries receive, and the resulting values of $1-a-day poverty, in each year between 2002 and 2015, under four different aid allocation 'systems':

a) each low-income country receives the amount of aid required to halve, or get as close as possible to halving, the 1990 level of its $1-a-day poverty headcount;
b) the total amount of aid required to halve, or get as close as possible to halving, the 1990 $1-a-day poverty headcount in each low-income country is re-allocated across countries to achieve the largest reduction in the aggregate $1-a-day poverty headcount;
c) as (b), except that aid is re-allocated so as to achieve the largest possible reduction in the aggregate $1-a-day poverty gap;
d) as (b), except that aid is re-allocated so as to achieve the largest possible reduction in the aggregate $1-a-day squared poverty gap.

This is done under four key assumptions:

1. that each country's distribution of income remains constant, between the most recent survey year and 2015;
2. that rates of growth in average household income (or expenditure) per capita are four-fifths of those in GDP per capita;
3. that the relationship between aid and economic growth remains constant between 2002 and 2015;
4. that each country's 'underlying' rate of growth between 2002 and 2015 is related to its observed rate between 1997 and 2002, but gradually converges towards a common rate of 3% per year.

We regard these four assumptions to be plausible and therefore justifiable. Nevertheless, the calculations could be replicated, without difficulty, under any other set of assumptions.

4 Data

4.1 Country sample

Countries included in the analysis are shown in Table 1. The middle column shows those countries with national household survey-based estimates of poverty. These are the same set of countries as used by Chen and Ravallion (2004) to construct the most recent estimates of global $1-a-day and $2-a-day poverty, with just four exceptions.[14] In 2002 they accounted for 92% of the total population of low- and middle-income countries, and received 78% of the total amount of aid to low- and middle-income countries.[15]

Although countries with national household survey-based estimates of poverty clearly account for a high share of the total population in low- and middle-income countries, there are nonetheless some significant omissions. In SSA, they accounted in 2002 for a much lower (although still high) 77% of the total population of all low- and middle-income countries in the region. Moreover, many countries which do not have national household survey-based estimates of poverty still receive significant amounts of aid, and it is important to ask whether these amounts are either sufficient and/or optimal. We therefore extend the analysis to include countries which lack national household survey-based estimates of poverty, but which nonetheless possess other sources of information which can be used to guide aid allocation decisions (described further in Section 6.1). These are shown in Table 1, column 3. This brings the proportion of the total population of low- and middle-income countries covered (in 2002) to 97%, and the proportion of the total amount of aid received (in 2002) to 98%.

Table 1: Countries included in the analysis

	Countries with national household survey-based estimates of poverty		Other countries included
Low-income			
East Asia and Pacific	Cambodia Indonesia Laos	Mongolia Vietnam*	Papua New Guinea
Eastern Europe and Central Asia	Azerbaijan Georgia Kyrgyz Republic	Moldova Tajikistan Uzbekistan	
Latin America and Caribbean	Nicaragua		Haiti
Middle East and North Africa	Yemen		
South Asia	Bangladesh India	Nepal Pakistan	
Sub-Saharan Africa	Burkina Faso Burundi Cameroon Central African Rep. Côte d'Ivoire Ethiopia Gambia Ghana Kenya Lesotho Madagascar Malawi	Mali Mauritania Mozambique Niger Nigeria Rwanda Senegal Tanzania Uganda Zambia Zimbabwe	Angola Benin Chad Dem. Rep. of Congo Republic of Congo Eritrea Guinea Guinea-Bissau Sierra Leone Sudan Togo

[14] These are Argentina, Sierra Leone, St Lucia and Slovenia.

[15] The figures for low-income countries are 89% and 80% respectively, while those for middle-income countries are 95% and 76% respectively.

Table 1: cont'd

	Countries with national household survey-based estimates of poverty		Other countries included
Middle-income			
East Asia and Pacific	China Malaysia*	Philippines Thailand*	
Latin America and Caribbean	Bolivia Brazil Chile* Colombia Costa Rica* Dominican Rep.* Ecuador El Salvador Guatemala Guyana	Honduras Jamaica* Mexico Panama Paraguay Peru Trinidad and Tob.* Uruguay* Venezuela	
Middle East and North Africa	Algeria* Egypt Iran*	Jordan* Morocco* Tunisia*	Lebanon Saudi Arabia Syria
South Asia	Sri Lanka*		
Sub-Saharan Africa	Botswana Namibia	South Africa Swaziland	Gabon Mauritius

Notes: * indicates that the $1-a-day poverty headcount was estimated to be effectively zero (less than 0.1% of the population) in 2002.

4.2 Poverty data

Data on poverty are taken from the World Bank's PovcalNet website.[16] The site provides national-level estimates of the poverty headcount, the poverty gap and the squared poverty gap, and the elasticities of each measure with respect to mean income and the Gini coefficient, for each country and survey year.[17] It also provides the coefficients of the two specifications of Lorenz curve, beta and generalised quadratic, on which the calculations are based. Our estimates are based on the generalised quadratic specification, due to its greater tractability in our calculations.[18]

Each country's poverty estimate is specific to a particular survey year. We project each country's most recent estimate of $1-a-day poverty forward to 2002 using the approach used by Chen and Ravallion (2004). This involves applying the growth rate in real household consumption per capita (obtained from national accounts data) between the latest survey year and 2002 to the level of the mean income or expenditure (from household survey data) in the latest survey year, and recalculating $1-a-day poverty in 2002 using the Lorenz curve coefficients from the latest survey year. Each country's poverty estimate is also projected back to 1990 using this method.[19]

[16] http://iresearch.worldbank.org/PovcalNet/jsp/index.jsp

[17] The exceptions are India and China, for which PovcalNet provides poverty data separately for rural and urban areas. In each case we combine the two sets of data to create nationally-representative estimates.

[18] While the beta Lorenz curve specification, by providing a better fit at the lower end of the distribution (see Datt, 1998), usually gives more accurate poverty estimates for countries with low incidence, in the vast majority of cases beta and GQ estimates lie within one percentage point of each other. In all cases in which the beta specification would otherwise be preferable to GQ, according to Datt's (1998) method of distinguishing them, the estimates of the poverty headcount are within 2 percentage points.

[19] This is done so that aggregate poverty can be estimated in our sample of countries in 1990, and it can be stated whether or not a halving of the 1990 $1-a-day poverty headcount is likely to be met (under the assumptions outlined in this paper) by 2015 at the aggregate level. These estimated values are not used, however, to calculate the rates of growth required to halve poverty on a country-by-country basis. Instead, each country's poverty estimate in the year closest to 1990 is used as the '1990' level of poverty to be halved within a twenty-five year period. For example, if the survey year closest to 1990 is 1995, the rate of growth and amount of aid required to halve the 1995 $1-a-day poverty headcount by 2020 is calculated.

Our estimates of poverty in 1990 and 2002 for each major region are shown in Table 2. (Estimates for each individual country are shown in Annex 2.) There are, it should be noted, differences between these figures and those of Chen and Ravallion (2004), however these remain relatively small in size.[20] Our poverty estimates for 1990 and 2002 therefore provide a reasonable baseline from which to calculate poverty projections through to 2015, under alternative aid allocation scenarios.

Table 2: $1-a-day poverty estimates for 1990 and 2002

	Million people		% of population	
	1990	2002	1990	2002
Low-income and middle-income countries				
EAP	536	235	35.0	13.4
– China	458	202	40.3	15.8
EECA	10	5	2.2	1.2
LAC	42	48	11.0	10.3
MENA	3	2	1.5	1.1
SA	458	408	41.5	29.7
– India	364	334	42.8	31.9
SSA	168	238	42.5	44.7
Total	1,216	942	33.9	21.6
Low-income countries only				
EAP	60	21	23.1	6.8
EECA	0	5	0.7	10.0
LAC	3	2	67.9	43.0
MENA	0	2	3.9	11.5
SA	457	408	42.1	30.1
– India	364	334	42.8	31.9
SSA	164	232	46.1	48.2
Total	684	671	39.9	30.9

Notes: Sample includes all countries with national household survey-based estimates of poverty (middle column of Table 1). Estimates for individual countries are shown in Annex 2.

4.3 Estimates of the effect of aid on growth

Three different econometric studies are used to obtain estimates of the parameters *b*, *c*, *d* and *e*: Hansen and Tarp (2001) (HT), Collier and Dollar (2002) (CD) and Lensink and White (2001) (LW). Each of these studies has been published in a refereed academic journal, which provides one way of filtering out higher-quality estimates of these parameters from lower quality ones. More studies fulfilling this condition are available, but for the time being we restrict our attention to these well-known studies.

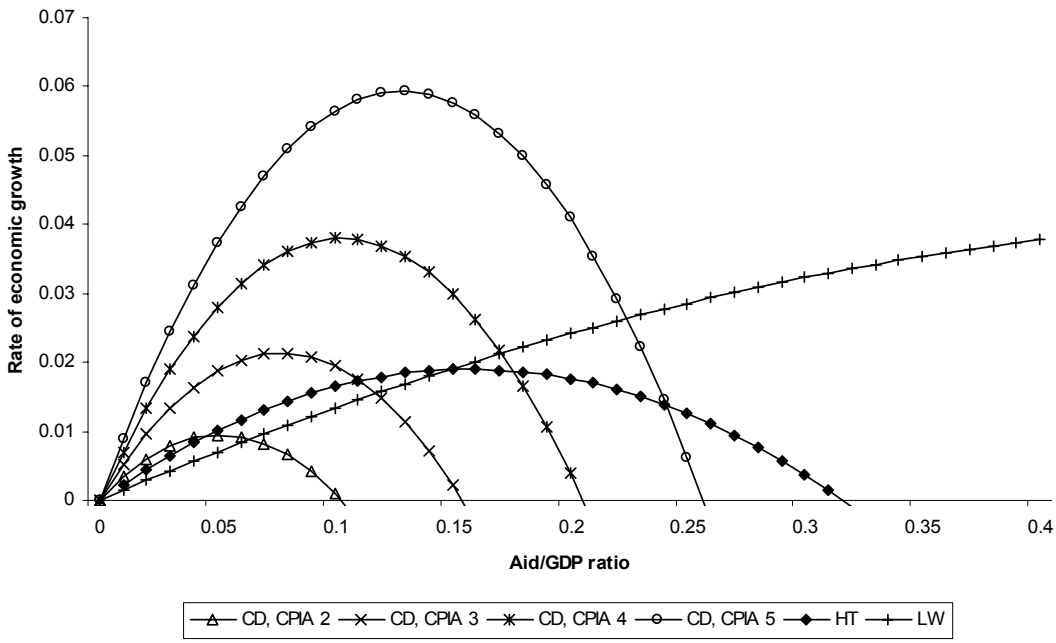
The relationship between aid and economic growth estimated by each of these different studies is shown in Figure 2. They clearly differ in certain important ways. First, the estimates of Collier and Dollar (2002) depend on recipient country characteristics, and in particular the quality of domestic government policy, while those of Hansen and Tarp (2001) and Lensink and White (2001) do not. Second, they provide different estimates of the maximum amount of aid which can be absorbed in recipient countries, as a fraction of GDP. The lowest estimate is obtained when using the Collier and

[20] There are three main reasons for these differences. First, all of our estimates are based on group-based tabulations, while some of the Chen and Ravallion (2004) estimates are based on micro-data. Second, of the group-based tabulations, all of our estimates are based on the GQ lorenz curve specification, while Chen and Ravallion (2004) use the GQ or the beta lorenz curve specification, depending on which provides a better fit to the group-based data. Third, when estimating poverty in 1990 we use household data only from the survey year closest to 1990, whereas Chen and Ravallion (2004) use household survey data (where available) from surveys either side of 1990. Finally, the estimates in Table 2 refer to the sample of countries with nationally-representative household surveys only, whereas the Chen and Ravallion (2004) estimates refer to all developing countries, on the assumption that the incidence of poverty in countries without nationally-representative household surveys is equal to the average incidence of poverty in the regions in which they are located.

Dollar (2002) results for countries with the lowest CPIA score, while the highest estimates are obtained when using the Lensink and White (2001) results.

We do not wish to downplay the size of these differences. Clearly there is a need to understand why there are such large differences between existing econometric estimates of the relationship between aid and economic growth, and to identify factors which can increase countries' absorptive capacity for aid. Particular controversy surrounds the size and statistical significance of the interaction between domestic government policy and aid (e.g. Burnside and Dollar, 2000; Easterly et al., 2003).[21] One might also test the assumption, common to all three sets of estimates, that the relationship between aid and economic growth is quadratic, and not some other functional form (e.g. logarithmic or logistic). These are avenues for further research. Our aim here is simply to use a range of existing econometric estimates to inform current debates about aid requirements and aid allocations.

Figure 2: Existing estimates of the relationship between aid and economic growth



Notes: The precise level of A_{max} implied by each set of estimates is 0.57 (LW), 0.16 (HT), 0.05 (CD, CPIA 2), 0.08 (CD, CPIA 3), 0.103 (CD, CPIA 4) and 0.128 (CD, CPIA 5). The slope of each curve at any given aid-GDP ratio gives the estimated marginal impact of aid on economic growth at that aid-GDP ratio.
Source: Authors' simulation.

This analysis could be replicated using any other set of econometric estimates of the relevant parameters *b*, *c*, *d* and *e* in Equation (1), subject to one important caveat: that at least one of the parameters *c* and *e* are found to be statistically different from zero. If not, the constrained optimisation problem in Section 3.2 does not generate a solution. Some econometric estimates of Equation (1) do in fact find both *c* and *e* to be insignificantly different from zero (e.g. Burnside and Dollar, 2000); in these cases, the constrained optimisation problem underlying the poverty-efficient aid allocation must be framed in some other way.

[21] Burnside and Dollar (2000) found that the interaction between a composite index of domestic policy and aid had a positive and significant impact on growth. However, Easterly et al. (2003) updated and extended the approach of Burnside and Dollar (2000) over a broader range of countries and found no significant effect of the interaction between aid and this policy index and aid. We do not use the Burnside and Dollar (2000) estimates partly because of this controversy, but also because of the caveat noted in the following paragraph.

4.4 Other data

The precise measure of the quality of domestic government policy found by Collier and Dollar (2002) to influence the effect of aid on economic growth is the World Bank's Country Policy and Institutional Assessment (CPIA) index. Values of this index in 1999 are used here, which are provided in Table 3 of Collier and Dollar (2001: 1795-6). Finally, data on GDP per capita, real household consumption per capita, population (including projections), and existing (2002) levels of aid as a share of GDP are taken from the *World Development Indicators* (WDI) (World Bank, 2004).

5 Main results

This section presents the results when considering low-income countries with national household survey-based measures of poverty. This paper focuses on low-income countries because using aid to halve poverty within each low-income country has been suggested (albeit often implicitly) as a suitable objective for the donor community (e.g. UN Millennium Project, 2005). It is important therefore to ask how much additional poverty reduction could be achieved by allocating the same amount of aid to low-income countries on a poverty-efficient basis. Using aid to halve poverty within each low- and middle-income country has not been suggested as a suitable objective for the donor community, and is unlikely to be given the very large amounts of additional aid which would be required to do so.[22] We extend the analysis in Section 6.1 to include low-income countries which lack national household survey-based estimates of poverty. We then consider the balance of aid between low- and middle-income countries in Section 6.2.

5.1 Aid volumes and allocations

Table 3 shows our estimates of the amount of aid required to halve, or get as close as possible to halving, the 1990 $1-a-day poverty headcount by 2015 in each individual low-income country. The results are shown separately for each of our three estimates of the relationship between aid and economic growth (HT, LW, and CD respectively). These results are compared against the amounts actually received in 2002, which amounted to a total of US$23.6 billion.

When using the HT estimates, the target would require an immediate increase of 36% in 2002 aid levels to these countries. The majority of the increase would be directed towards countries in sub-Saharan Africa, which would see their share of total aid to all countries in the sample rise from 54% to 62%. When using the LW estimates, the target would require an immediate increase in aid of 168% (equivalent to a factor of 2.68). This is higher than the HT figure simply because the increase in aid is much less limited by absorptive capacity: under the LW estimates, more countries can halve their poverty by 2015, and those which still cannot achieve the target can nonetheless get closer to achieving it. Again, the majority of the increase would be directed towards countries in sub-Saharan Africa, which would see their share of total aid rise from 54% to 79%.

Despite the differences between the HT and LW results, both are broadly consistent with the 'doubling of aid' figure obtained by Devarajan et al. (2002) and quoted frequently in recent debate. However, a quite different picture emerges when using the CD estimates. In this case, a reduction in current aid levels of 13% maximises countries' progress towards halving poverty on a country-by-country basis. The reason is that, under the CD estimates, countries' estimated absorptive capacities for aid are much lower, and there are as a result more countries in which a reduction in the aid-GDP ratio raises economic growth and progress toward the poverty target.[23]

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[22] We estimate the immediate required increase to lie between a factor of 1.8 (using the CD estimates) and 7.1 (using the LW estimates) (details available on request). A much larger volume of aid would be required to halve poverty in each middle-income as well as low-income country, mainly because higher levels of GDP per capita in middle-income countries raise the amount of aid dollars required to raise aid as a share of their GDP, which is necessary if aid is to increase economic growth and reduce poverty. This offsets the fact that middle-income countries have a higher average CPIA score than low-income countries, which (at least according to the CD estimates) reduces the level of aid as a share of GDP required to reach a given growth target.

[23] This broad conclusion holds even if off-track countries were to do all they can to improve the quality of their policy (as measured by the World Bank CPIA score), and therefore increase their capacity to absorb aid. To show this, we re-calculate the total amount of aid required to halve, or get as close as possible to halving, the 1990 $1-a-day poverty headcount by 2015 in each individual low-income country using the CD estimates but assuming that all recipient countries had the maximum CPIA score. Under this scenario, a marginal increase in total aid of 3% would be required.

Table 3: Aid required to halve $1-a-day poverty, country by country

	HT	LW	CD	Actual level (2002)
US$bn				
EAP	3.5	3.6	3.1	3.6
EECA	2.5	3.6	1.6	1.3
LAC	0.5	0.5	0.3	0.5
MENA	0.6	0.6	0.6	0.6
SA	4.9	4.9	4.8	4.9
– India	1.5	1.5	1.5	1.5
SSA	20.0	49.9	10.2	12.7
Total	32.0	63.1	20.6	23.6
% of total				
EAP	11.0	5.7	15.3	15.1
EECA	7.9	5.7	7.6	5.7
LAC	1.6	0.8	1.5	2.2
MENA	1.8	1.0	2.8	2.5
SA	15.3	7.7	23.3	20.7
– India	4.6	2.3	7.1	6.2
SSA	62.4	79.0	49.4	53.8
Total	100.0	100.0	100.0	100.0

Notes: Sample includes all with national household survey-based estimates of poverty shown in Table 1. Estimates for each individual country can be found in Annex 3.

The figures in Table 3 refer to 2002 only, and, under each set of estimates, the total required amount of aid (in US$) rises between 2002 and 2015, because of economic growth in recipient countries, which raises the amount of aid in US$ required to maintain the same level of aid as a share of GDP. This is despite the fact that some countries in our sample require a gradually smaller amount of aid as a share of GDP between 2002 and 2015, because of our assumption that underlying rates of growth converge over the period towards 3% per year. This slows the increase in aid requirements in US$, but is not sufficient to offset it altogether. The size of the increase in aid requirements ranges from 3.8% per year (using the LW estimates) to 6.0% per year (using the CD estimates).

Table 4 shows the allocations across regions which result when allocating the total amounts of aid shown in Table 3 on a poverty-efficient basis. Our interest lies in observing the extent to which the allocation across regions differs from those shown in Table 3. If they are different, it is important to ask which of the different allocation systems is to be preferred.

The first panel in Table 4 shows the results when using the headcount measure of poverty in determining the poverty-efficient allocation. Clearly, the inter-regional allocations are in this case very different from those in Table 3. The share of total aid to sub-Saharan Africa is between 42 and 61 percentage points lower, while the share to South Asia is between 67 and 73 percentage points higher. The main reason for the difference is that the impact of additional aid on $1-a-day poverty in the sub-Saharan African countries which require additional aid to halve poverty is relatively low, at least when using the headcount measure of poverty.

The second panel in Table 4 shows the results when using the poverty gap measure in determining the poverty-efficient allocation. The inter-regional allocations are again different from those shown in Table 3, in that the share of aid to sub-Saharan Africa is lower and the share to South Asia is higher. However, the differences are now smaller. This reflects the higher average depth of poverty in sub-Saharan Africa compared to South Asia, which raises its share of the efficient allocation. When using the HT estimates for example, the share of aid to sub-Saharan Africa is 29 percentage points lower than in Table 3, compared to 46 percentage points when using the poverty headcount.

Table 4: Poverty-efficient reallocations of the amount of aid required to halve poverty, country by country (% of total)

	HT	LW	CD	Actual (2002)
$1-a-day poverty headcount				
EAP	1.1	1.4	0.6	15.1
EECA	0.5	0.0	0.0	5.7
LAC	0.0	0.0	0.0	2.2
MENA	0.0	0.0	0.0	2.5
SA	82.4	80.3	92.0	20.7
– India	65.0	59.9	79.0	6.2
SSA	16.0	18.3	7.4	53.8
Total	100.0	100.0	100.0	100.0
$1-a-day poverty gap				
EAP	1.1	1.3	0.7	15.1
EECA	0.0	0.0	0.0	5.7
LAC	0.0	0.0	0.0	2.2
MENA	0.0	0.0	0.0	2.5
SA	65.6	46.3	82.8	20.7
– India	53.8	29.9	71.1	6.2
SSA	33.3	52.3	16.5	53.8
Total	100.0	100.0	100.0	100.0
$1-a-day squared poverty gap				
EAP	1.2	1.5	0.9	15.1
EECA	0.0	0.0	0.0	5.7
LAC	0.5	0.3	0.1	2.2
MENA	0.0	0.0	0.0	2.5
SA	56.8	28.6	75.3	20.7
– India	46.2	14.5	64.6	6.2
SSA	41.5	69.5	23.7	53.8
Total	100.0	100.0	100.0	100.0
*Country-by-country poverty target**				
EAP	11.0	5.7	15.3	15.1
EECA	7.9	5.7	7.6	5.7
LAC	1.6	0.8	1.5	2.2
MENA	1.8	1.0	2.8	2.5
SA	15.3	7.7	23.3	20.7
– India	4.6	2.3	7.1	6.2
SSA	62.4	79.0	49.4	53.8
Total	100.0	100.0	100.0	100.0

Notes: Sample includes all with national household survey-based estimates of poverty shown in Table 1. Estimates for each individual country can be found in Annex 3. *Repeated from Table 3.

Finally, the third panel in Table 4 shows the results when using the squared poverty gap measure. The results in this case are fairly similar to those obtained when using the poverty gap measure. The share of aid going to sub-Saharan Africa is still lower than in Table 3, and the share of aid going to South Asia higher, but by smaller amounts than when using the headcount measure of poverty.

Table 5 repeats the figures in Table 4 in absolute terms (US$). Of most interest here are the HT and LW estimates, which both support an increase in total aid volumes to meet the MDG poverty target on a country-by-country basis. Table 5 shows that, if aid were instead allocated on a poverty-efficient basis, the vast majority of that increase would in most cases be directed to South Asia. Sub-Saharan Africa would, by contrast, in most cases receive either less than or approximately the same amount of aid as it does currently. The two exceptions are when using the LW estimates and the gap and squared gap measures of poverty, in which case large increases in aid to sub-Saharan Africa are poverty-efficient.

Table 5: Poverty-efficient re-allocations of the total amount of aid required to halve poverty, country by country (US$ billion)

	HT	LW	CD	Actual (2002)
$1-a-day poverty headcount				
EAP	0.3	0.9	0.1	3.6
EECA	0.2	0.0	0.0	1.3
LAC	0.0	0.0	0.0	0.5
MENA	0.0	0.0	0.0	0.6
SA	26.5	50.6	19.0	4.9
- India	20.9	37.8	16.3	1.5
SSA	5.1	11.5	1.5	12.7
Total	32.2	63.0	20.7	23.6
$1-a-day poverty gap				
EAP	0.3	0.8	0.1	3.6
EECA	0.0	0.0	0.0	1.3
LAC	0.0	0.0	0.0	0.5
MENA	0.0	0.0	0.0	0.6
SA	21.1	29.3	17.2	4.9
- India	17.3	18.9	14.8	1.5
SSA	10.7	33.1	3.4	12.7
Total	32.2	63.2	20.8	23.6
$1-a-day squared poverty gap				
EAP	0.4	1.0	0.2	3.6
EECA	0.0	0.0	0.0	1.3
LAC	0.15	0.2	0.02	0.5
MENA	0.00	0.0	0.00	0.6
SA	18.2	18.1	15.5	4.9
- India	14.8	9.2	13.3	1.5
SSA	13.3	44.0	4.9	12.7
Total	32.0	63.3	20.5	23.6
*Country-by-country poverty target**				
EAP	3.5	3.6	3.1	3.6
EECA	2.5	3.6	1.6	1.3
LAC	0.5	0.5	0.3	0.5
MENA	0.6	0.6	0.6	0.6
SA	4.9	4.9	4.8	4.9
- India	1.5	1.5	1.5	1.5
SSA	20.0	49.9	10.2	12.7
Total	32.0	63.1	20.6	23.6

Notes: Sample includes all low-income countries with national household survey-based estimates of poverty shown in Table 1. Estimates for each individual country can be found in Annex 3.* Repeated from Table 3.

The results in Tables 4 and 5 refer to 2002 only. Under our assumptions, the differences between the country-by-country poverty target allocations and the poverty-efficient allocations become smaller between 2002 and 2015, because of higher underlying rates of economic growth in South Asia than in sub-Saharan Africa. When using the HT results for example, the share of poverty-headcount-efficient aid to sub-Saharan Africa rises from 16% in 2002 to 27% in 2015, while the share going to South Asia falls from 82% to 72%. Similarly, the share of squared poverty-gap-efficient aid going to sub-Saharan Africa rises from 42% in 2002 to 54% in 2015, while the share going to South Asia falls from 57% to 42%. Nevertheless, the differences between the allocations clearly remain significant.

To summarise therefore, there are, in most cases, significant differences between the country-by-country poverty target aid allocation and the poverty-efficient aid allocations, particularly when basing poverty-efficient allocations on the $1-a-day poverty headcount. These are apparent both now and, in

all likelihood, in the foreseeable future. It is therefore important to ask which of the different allocation systems is preferable, which we turn to in the next section.

5.2 Implications for poverty

Table 6 shows projections of the total number and proportion of people in our sample of countries living under the $1-a-day poverty line in 2015 under the above aid allocation systems. Under the country-by-country MDG allocation, we project that there will be in 2015 between 337 and 365 million people in our sample of low-income countries living below the $1-a-day poverty line, corresponding to between 12.8% and 13.8% of the population. This represents a decline in the number of people living on less than $1-a-day of between 17 and 18 percentage points between 2002 and 2015, which compares with a decline of 9 percentage points in the same set of countries between 1990 and 2002 (see Table 2).

Under poverty-efficient (headcount) aid, projected levels of poverty in 2015 are lower, reflecting the opportunities to re-allocate aid towards countries where it is relatively more effective. The additional amount of poverty reduction over the period 2002-15 is 26 million people when using the LW estimates, 32 million people when using the HT estimates, and 69 million people when using the CD estimates. These figures correspond to additional reductions in $1-a-day poverty of 1.0, 1.1 and 2.6 percentage points respectively. Expressed either way, the figures represent different estimates of the opportunity cost of a country-by-country MDG allocation system: the additional number of people who could have been lifted out of poverty had that aid been instead allocated on a poverty-efficient basis.

Under poverty-efficient (poverty gap) and poverty-efficient (squared poverty gap) aid, the projected number and proportion of people living below $1-a-day in 2015 is higher than under poverty-efficient (headcount) aid. This is because emphasis in these cases is also placed on lifting people closer to the poverty line, particularly, in the case of the squared poverty gap measure, those furthest away from it. Nevertheless, more people are still lifted out of poverty under this allocation system than under MDG-aid. Under the poverty-efficient (squared poverty gap) allocation, the additional amount is 10 million people (0.4 percentage points) when using the LW estimates, 26 million people (0.9 percentage points) when using the HT estimates, and 59 million people (2.3 percentage points) when using the CD estimates.

Table 6: Projected levels of $1-a-day poverty in 2015, total sample

	HT	LW	CD
Million people			
Country by country MDG aid	365	342	337
Poverty-efficient aid (headcount)	333	316	268
Poverty-efficient aid (gap)	335	321	269
Poverty-efficient aid (squared gap)	339	332	278
Maximum aid	240	147	191
% of population			
MDG-aid	13.8	13.0	12.8
Poverty-efficient aid (headcount)	12.7	12.0	10.2
Poverty-efficient aid (gap)	12.7	12.2	10.2
Poverty-efficient aid (squared gap)	12.9	12.6	10.5
Maximum aid	9.1	5.6	7.2

Notes: Sample includes all low-income countries with national household survey-based estimates of poverty shown in Table 1.

Clearly, there are large differences in the additional amount of poverty reduction stemming from the poverty-efficient aid allocations across the three sets of parameters. The amount is higher under the CD or HT estimates, mainly because the differences between the poverty-efficient aid allocations and the country-by-country MDG aid allocation are in these cases larger, as illustrated at the regional level in Table 5. Of these, the amount is higher under the CD estimates, mainly because there is in this case much more variation in the marginal impact of aid on economic growth at different levels of the aid-GDP ratio (see Figure 1), and more scope for a re-allocation of aid to increase growth and poverty reduction.

It is possible to compare the estimates of the additional amount of poverty reduction stemming from a poverty-efficient aid allocation in Table 6 with previous estimates. Collier and Dollar (2001), for example, find that, for the developing world as a whole, efficient aid makes only a small difference to poverty reduction: around one percentage point to the global $2-a-day poverty headcount by 2015 (ibid: 1797), even though it makes a large difference for particular regions, e.g. sub-Saharan Africa. By comparison, the estimates in Table 6 suggest that it makes a larger difference, at least when using the CD parameters. The method underlying the estimates in Table 6 differs in various ways from that used by Collier and Dollar (2001), but the main reason for the difference is probably that the calculations of Collier and Dollar (2001) assume that donors maintain 'small-country bias' in their aid allocation decisions, whereas the results in Table 6 assume that, in the poverty-efficient allocation, all such bias is eliminated. (We return to this issue in Section 6.2.)

A further point to note is that, under our 'maximum aid' scenario, i.e. when aid is set equal to each country's absorptive capacity for aid as given by equation (7), there are between 147 and 240 million people living on less than $1-a-day in 2015, corresponding to between 5.6% and 9.1% of the total population. The differences in these projections across the three sets of parameters reflect their different estimates of the total (not marginal) effect of aid on growth, when aid is set at its maximum level: 1.9% per year under the HT estimates, 4.2% per year under the LW estimates, and between 1.0% and 5.9% per year under the CD estimates according to the country's CPIA score.

We now consider the results at regional level. Table 7 shows our projections of $1-a-day poverty in 2015 for the poorest low-income country region in 2002, sub-Saharan Africa. Under the country-by-country MDG allocation, we project that in 2015 there will be in our sample between 166 and 193 million people in sub-Saharan Africa living below the $1-a-day poverty line, corresponding to between 27.0% and 31.3% of the total population. Under the poverty-headcount-efficient aid allocation, the projections are higher, by 16 million people (2.8 percentage points) when using the HT estimates, 23 million people (3.8 percentage points) when using the CD estimates, and 28 million people (4.5 percentage points) when using the LW estimates. The reason is that the region gets much less aid under this allocation than under the country-by-country MDG allocation. In this case there is therefore a conflict between the allocation which achieves the greatest reduction in poverty at the global level (the poverty-efficient allocation), and the allocation which achieves the largest reduction in poverty in the poorest region (the country-by-country MDG allocation).

Under the poverty-gap and squared poverty-gap-efficient allocations however, the results are slightly different. Under the HT and CD parameters, the projections of $1-a-day poverty in 2015 are still generally higher in sub-Saharan Africa than they are under the country-by-country aid allocation, but the differences are now much smaller. Under the LW parameters, the projections of poverty in 2015 are now lower than they are under the country-by-country MDG allocation. The implication is that the apparent conflict, between the allocation system which achieves the greatest reduction in poverty at the global level and that which achieves the largest reduction in poverty in the poorest region, becomes a lot smaller, or disappears altogether, when using the poverty gap or the squared poverty gap to calculate the poverty-efficient allocation.

Table 7: Projected levels of poverty in sub-Saharan Africa in 2015 (% of population)

	HT	LW	CD
Million people			
Country by country MDG aid	193	166	182
Poverty-efficient aid (headcount)	209	194	205
Poverty-efficient aid (gap)	198	163	190
Poverty-efficient aid (squared gap)	195	158	187
Maximum aid	190	143	181
% of population			
Country by country MDG aid	31.3	27.0	29.5
Poverty-efficient aid (headcount)	34.1	31.5	33.3
Poverty-efficient aid (gap)	32.1	26.5	30.9
Poverty-efficient aid (squared gap)	31.7	25.6	30.4
Maximum aid	30.9	23.2	29.5

Notes: Sample includes all low-income countries with national household-survey based estimates of poverty shown in Table 1.

A further point to note is that the estimates in Table 7 can be compared with previous estimates. Collier and Dollar (2001), for example, estimate that efficient aid would increase the reduction in $2-a-day poverty in sub-Saharan Africa by 2015 by 8 percentage points, although it would have little impact on poverty reduction in South Asia (ibid: 1797). The estimates in Table 7 suggest, by contrast, that efficient aid allocation (relative to country-by-country poverty target allocation) reduces the amount of poverty reduction in sub-Saharan Africa, even though it increases the amount of poverty reduction at the global level (as shown by Table 6). Once again, the reason for this difference is that Collier and Dollar (2001) assume that donors maintain small-country bias in their aid allocation decisions. This assumption limits the amount of aid which can be efficiently re-allocated from sub-Saharan Africa to South Asia so as to increase poverty reduction at the global level.

Finally, we consider the results for individual countries. Table 8 shows the results for the four poorest countries in our sample, as measured by the poverty headcount (corresponding to the bottom decile) in 2002. These were Mali, Nigeria, Central African Republic and Uganda, with estimated $1-a-day poverty headcounts in 2002 of 69%, 69%, 70% and 84% respectively. Under the country-by-country target allocation, we project that these values would in 2015 be between 39% and 50% in Mali, 44-55% in Nigeria, 53-60% in Central African Republic, and 47-63% in Uganda, depending on the assumed parameters summarising the relationship between aid and economic growth (HT, LW or CD).

Under the poverty-headcount-efficient allocation, the projections of poverty in each country are higher, under all three sets of parameters. The size of the difference in each country is between 3 and 10 percentage points, with the LW parameters generating the largest differences. As at the regional level, the reason is that these countries get less aid under a poverty-headcount-efficient allocation than under the country-by-country MDG allocation, which translates into less poverty reduction. There is therefore a conflict between the allocation which achieves the greatest reduction in poverty at the global level, and the allocation which achieves the largest reduction in poverty in the countries with the highest levels of poverty.

Also as at the regional level however, this conflict becomes a lot smaller under the poverty-gap and squared poverty-gap-efficient allocations. When using the HT and CD estimates, the projections of poverty are now no more than 1 percentage point higher in 2015 under the poverty-efficient allocations than under the country-by-country MDG allocation. When using the LW estimates, the projections are no more than 2.5 percentage points higher, and in two countries (Nigeria and Central African Republic)

are in fact lower under the poverty-efficient allocations than under the country-by-country MDG allocation.

5.3 Summary

To summarise, under our projections a poverty-headcount-efficient aid allocation lifts a much larger number of people out of $1-a-day poverty at the global level than a country-by-country MDG allocation: between 26 and 69 million people, equivalent to between 1.0% and 2.6% of the total population. It does so, however, at the expense of lifting a much smaller number of people out of $1-a-day poverty in the poorest region, sub-Saharan Africa, than the country-by-country MDG allocation: between 16 and 28 million people, or between 2.8% and 4.5% of the region's population. It also lifts less people out of $1-a-day poverty in the countries in which the incidence of $1-a-day poverty is currently highest (as a proportion of population), such as Mali, Nigeria, Central African Republic and Uganda. However, this tendency is much less significant for the poverty-gap and squared poverty-gap-efficient aid allocations. These still lift a much larger number of people out of $1-a-day poverty at the global level than a country-by-country MDG allocation: between 10 and 59 million people, equivalent to between 0.4% and 2.3% of the total population. However, they do so at a much smaller expense, or no expense at all, in terms of slower poverty reduction in the poorest region (sub-Saharan Africa) and the poorest countries. There is the added advantage that the poverty-gap and squared poverty-gap-efficient aid allocations achieve the largest possible reductions in, respectively, the depth and severity of global $1-a-day poverty.

Table 8: Projected levels of poverty in selected individual countries, 2015

	HT	LW	CD
Mali			
Country-by-country MDG aid	49.6	39.1	46.2
Poverty-efficient aid (headcount)	53.3	50.4	51.8
Poverty-efficient aid (gap)	50.1	41.3	47.0
Poverty-efficient aid (squared gap)	49.7	39.9	46.5
Maximum aid	49.6	39.1	46.2
Nigeria			
Country-by-country MDG aid	50.3	44.1	55.1
Poverty-efficient aid (headcount)	54.3	51.4	59.1
Poverty-efficient aid (gap)	51.0	42.0	56.0
Poverty-efficient aid (squared gap)	50.5	40.4	55.4
Maximum aid	50.3	39.4	55.1
Central African Republic			
Country-by-country MDG aid	57.7	52.9	59.6
Poverty-efficient aid (headcount)	61.8	61.2	62.6
Poverty-efficient aid (gap)	58.2	52.1	60.3
Poverty-efficient aid (squared gap)	57.8	50.7	59.8
Maximum aid	57.7	50.2	59.6
Uganda			
Country-by-country MDG aid	63.4	50.3	47.1
Poverty-efficient aid (headcount)	66.6	60.5	52.1
Poverty-efficient aid (gap)	63.7	51.4	47.2
Poverty-efficient aid (squared gap)	63.5	50.6	46.7
Maximum aid	63.4	50.1	46.6

6 Additional results

6.1 Extended low-income country sample

As noted in Section 4.1, although the low-income countries with national household survey-based estimates of poverty account for a high share (89%) of the total population in all low-income countries, there are nonetheless some significant omissions. In this section, therefore, we extend the analysis to include countries which lack national household survey-based estimates of poverty, but which possess other sources of information that can be used to guide aid allocation decisions. In particular, we use widely available information on countries' GDP per capita, measured at purchasing power parity (PPP) exchange rates, to estimate poverty for countries lacking household survey data. This raises the proportion of the total population of low-income countries (in 2002) covered in our sample to 95%.

We proceed as follows. First, a 'representative' country in each region is chosen.[24] The mean household income (or expenditure) in the representative country (measured in 1993 PPP dollars and obtained from PovcalNet) is then multiplied by the ratio of GDP per capita (measured in 1995 PPP dollars and obtained from World Bank, 2004) in countries lacking household survey data to the representative country. This gives an estimate of mean household income (or expenditure), measured in 1993 PPP dollars, in the countries lacking household survey data. The required rates of growth to halve poverty by 2015 are then calculated, and the values of the $1-a-day poverty headcount, poverty gap and squared poverty gap (including the elasticity of each with respect to mean income), on the assumption that the Lorenz curve parameters of countries lacking household survey data can be approximated by those of the representative country in the respective region. Finally, the aid allocations and resulting projections of $1-a-day poverty in 2015 for the larger sample of countries are re-calculated.

The results are shown in Annex 4. These should be treated with caution, since there is no real way of estimating income-distribution parameters in countries lacking household survey data. Nevertheless, they do provide a relatively straightforward and transparent way of testing the robustness of the main results in the previous section when applied to a larger sample of countries. The main message is that the key results from Section 5 are qualitatively unchanged when considering the larger sample.

First, under the HT and LW estimates, a target of halving the 1990 $1-a-day poverty headcount by 2015 in each individual low-income country would require an immediate and significant increase in total aid volumes of 31% when using the HT estimates, and 161% when using the LW estimates. By contrast, under the CD estimates, a reduction in current aid levels of 18% maximises countries' progress towards halving poverty on a country-by-country basis.

Second, a much larger reduction in $1-a-day poverty could be achieved at the global level if the total amount of aid required to halve $1-a-day poverty on a country-by-country basis was instead allocated on a poverty-headcount-efficient basis. This amounts to 31 million people (1.0 percentage point) when using the LW estimates, 33 million people (1.1 percentage points) when using the HT estimates, and 75 million people (2.6 percentage points) when using the CD estimates. This comes at the expense, however, of a much smaller reduction in $1-a-day poverty in the poorest region, sub-Saharan Africa, of 16 million people (1.9 percentage points) when using the HT estimates, and 22 million people (2.7 percentage points) when using the LW or CD estimates.

Finally, a much larger reduction in $1-a-day poverty could also be achieved at the global level if the total amount of aid required to halve $1-a-day poverty on a country-by-country basis was instead allocated on a poverty-gap or squared poverty-gap-efficient basis. However, there is in most cases only a marginally smaller reduction, or in fact a slightly larger reduction in $1-a-day poverty in sub-Saharan Africa.

[24] These are as follows: Vietnam (East Asia and Pacific), Nicaragua (Latin America and Caribbean) and Zambia (sub-Saharan Africa).

6.2 Other aid allocation constraints

Sections 5 and 6.1 show that an aid allocation system which seeks to halve poverty in every single country carries a cost, in that a much greater reduction in poverty at the global level could be achieved by re-allocating the same amount of aid on a poverty-efficient basis. In this section we compare the size of this cost with the costs of certain other constraints that donors have included implicitly in their aid allocation decisions. We focus on two such constraints that have been given attention in the recent literature. First, we impose the constraint that a certain share of aid goes to middle-income countries. This share is set at 32%, which was the amount received by middle-income countries in 2002.[25] Second, we impose a maximum limit of 10% on the share of total aid going to any one individual country. This reflects the view (expressed, for example, in Collier and Dollar, 2001) that there are political constraints to giving a large share of aid to any one country, however large its population or high the incidence of poverty may be.

We compare the projected amount of poverty in 2015 when these constraints are placed on aid allocation, with the projected amount when no constraints are imposed (i.e. aid allocation is done on a purely poverty-efficient basis). In effect, we calculate the cost, in terms of the number of people not lifted above the $1-a-day poverty line, of each of the above constraints. To facilitate comparisons, a common total volume of aid to be allocated across countries is used in each case, which we set equal to the actual amount given in 2002, followed by real increases of 5% per year in each subsequent year through to 2015.[26] The squared poverty gap measure is used when calculating the poverty-efficient allocation (subject to constraints where relevant), and all 93 low- and middle-income countries with national household survey-based estimates of poverty shown in Table 1 are included.

The results are shown in Table 9. The first rows in the upper and lower panels show the projected number and proportion of people living below the $1-a-day poverty line in 2015 when aid increases by 5% per year in real terms and no additional constraints are imposed on the allocation: it is allocated on a purely poverty-efficient basis. To facilitate comparisons, the total number of people in this sample of countries living below the $1-a-day poverty line was 1,216 million (33.9% of total population) in 1990, and 942 million (21.6% of total population) in 2002. Under our assumptions, the total number of people living below the $1-a-day poverty line falls to between 285 and 429 million people (between 5.6% and 8.4% of the population) under this aid scenario.

The second rows show the equivalent projections when requiring that at least 32% of total aid is allocated to current middle-income countries (as defined by the World Bank in 2004). The opportunity cost of this constraint, in terms of the number of people not lifted above the $1-a-day poverty line, is 14 million people (0.3% of the population) when using the LW estimates, 19 million people (0.4% of the population) when using the CD estimates, and 21 million people (0.4% of the population) when using the HT estimates. These figures are on average somewhat smaller than the opportunity costs of a country-by-country poverty target allocation reported in the previous section.

The third rows show the projections of poverty in 2015 when requiring that no more than 10% of total aid is allocated to any one individual country. The opportunity cost of this constraint is zero when using the LW estimates, but is 24 million people (0.5% of the population) when using the HT estimates and 82 million people (1.6% of the total population) when using the CD estimates. These figures are also on average somewhat smaller than the opportunity costs of a country-by-country poverty target allocation reported in the previous section.

Overall therefore, the evidence in Table 9 suggests that the opportunity costs of a country-by-country poverty target aid allocation are as high as, if not higher than, the costs of other more well-known

[25] This figure differs across individual donors. The UK Department for International Development sets a more explicit target that no more than 10% of its own bilateral aid should go to middle-income countries (DFID, 2004).

[26] This figure lies in the middle of the range of estimates of the increase in total aid required to halve poverty on a country-by-country basis by 2015 (see Section 5.1).

constraints that donors have placed (albeit often implicitly) on their aid allocation decisions. These include the constraints that a significant share of total aid goes to middle-income countries, and that no single country receives more than about 10% of the total aid budget, however large its size.

Table 9: Projected levels of poverty in 2015 under alternative aid allocation constraints

	HT	LW	CD
Million people			
Poverty-efficient aid (squared poverty gap), no additional constraints	398	429	285
Poverty-efficient aid (squared poverty gap), and at least 32% of total aid to MICs	419	443	304
Poverty-efficient aid (squared poverty gap), and 10% max share of total aid to any one country	422	429	367
% of total population			
Poverty-efficient aid (squared poverty gap), no additional constraints	7.8	8.4	5.6
Poverty-efficient aid (squared poverty gap), and at least 32% of total aid to MICs	8.2	8.7	6.0
Poverty-efficient aid (squared poverty gap), and 10% max share of total aid to any one country	8.3	8.4	7.2

Notes: Sample includes all 93 low- and middle-income countries with national household survey-based estimates of poverty shown in Table 1.

7 Conclusion

This paper examines the joint question of how much additional aid is required to meet the target, associated with Millennium Development Goal (MDG) No.1, of halving the 1990 $1-a-day poverty headcount by 2015, and how that aid should be allocated across recipient countries. Our main results may be summarised as follows.

First, a large increase in existing aid levels can be justified to meet a target of halving $1-a-day poverty on a country-by-country basis by 2015 under the econometric estimates of the relationship between aid and economic growth obtained by Hansen and Tarp (2001) and Lensink and White (2001). Such an increase would not, however, be justified under the econometric estimates obtained by Collier and Dollar (2002), which suggest that countries' absorptive capacities for aid are much lower, particularly in countries with low CPIA scores.

Second, even where a large increase in existing aid levels can be justified to halve the $1-a-day poverty headcount in each individual country, a much larger number of people could be lifted out of poverty if aid was instead allocated on a poverty-efficient basis. The additional amount of poverty reduction could be up to 69 million people, equivalent to 2.6% of total world population. This is similar to the additional amount of poverty reduction that could be achieved at the global level if donors were to allocate less aid to middle-income relative to low-income countries, or to remove so-called 'small-country bias' in aid allocation patterns.

Third, while a poverty-efficient aid allocation achieves more poverty reduction at the global level, relative to the country-by-country poverty target allocation, it is likely to imply a slower reduction in poverty in the poorest region of the world (sub-Saharan Africa), and in the poorest individual countries. However, this tendency is much reduced, or eliminated altogether, under the poverty-gap and squared poverty-gap-efficient allocations. These allocations allocate a larger share of aid, relative to the poverty-headcount-efficient allocation, to sub-Saharan Africa and to the poorest individual countries. They also have the advantage of achieving the largest possible reduction in the depth (the poverty-gap-efficient allocation) and severity (the squared poverty-gap-efficient allocation) of global $1-a-day poverty.

Our analysis can be extended in various ways. First, it could include other estimates of the relationship between aid and economic growth (subject to the caveat noted in Section 4.3). Second, one could investigate the extent to which our estimates of the costs and benefits of the different aid allocation systems, as well as the aid allocations themselves, change when using alternative assumptions about rates of economic growth and changes in the distribution of income between 2002 and 2015, or when using an alternative poverty line (e.g. $2-a-day). Third, our analysis has considered just one MDG target, that of halving income poverty, and could be extended to include other targets.

The main policy implication arising from this study is to caution against the use of a country-by-country poverty target approach when allocating aid across recipient countries. For donors concerned with the amount of poverty reduction achieved from their aid, this paper suggests that either a poverty-gap-efficient allocation or a squared poverty-gap-efficient allocation would be more desirable. These allocations would achieve, in comparison with a country-by-country poverty target allocation, a similar reduction in the $1-a-day poverty headcount in the poorest region and countries of the world, but a much larger reduction in the $1-a-day poverty headcount at the global level. They would also achieve, in comparison with a poverty-headcount-efficient allocation, a larger reduction in the depth or severity of $1-a-day poverty at the global level, and would require a less radical alteration to current allocation patterns.

Adopting a poverty-efficient allocation is clearly not something that can be achieved overnight. Nevertheless, the following would serve as useful and necessary first-steps:

- compare the poverty-gap and squared poverty-gap-efficient aid allocations derived in this paper with the results of existing aid allocation models used by bilateral and multilateral donors;
- think carefully about the objective function to be maximised by aid: for example, whether it should include not just current but future poverty reduction as well (e.g. Wood, 2006);
- investigate further why there are large differences between different econometric estimates of the relationship between aid and economic growth;
- support the World Bank in their attempts to improve the quality and expand the coverage of household survey-based estimates of $1-a-day and $2-a-day poverty.

Abandoning the country-by-country poverty target approach to allocating aid across countries would also require abandoning its use to calculate total aid requirements. How else then can total aid volumes be calculated, and, in particular, how else could a large increase in aid be justified? Here there are two possible options. The first would start by noting that although the MDG poverty target is likely to be met at the global level without any additional aid, the same cannot be said for all the MDG targets. At current rates of progress, for example, the child mortality target – that of reducing the 1990 global under-5 mortality rate by two-thirds by 2015 – is unlikely to be met. One alternative would therefore be to calculate the amount of additional aid required to achieve the child mortality MDG at the global level. Such a calculation could maintain the principles of poverty efficiency in determining the cross-country allocation. The second option would be a 'market-based' approach, which would stress that consumers' current willingness to donate money for poverty reduction, in all likelihood, significantly exceeds the current cost of reducing poverty. Both options would likely justify a large increase in aid, and would remain consistent with the principle of efficiency in the allocation of aid across countries.

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