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IFN Working Paper No. 1415, 2021

# **Kill Your Darlings? Do New Aid Flows Help Achieve a Poverty Minimizing Allocation of Aid?**

Sven Tengstam and Ann-Sofie Isaksson

# Kill your darlings?

## Do new aid flows help achieve a poverty minimizing allocation of aid?\*

Sven Tengstam<sup>†</sup> and Ann-Sofie Isaksson<sup>‡</sup>

### Abstract

In this study, we derive a poverty-minimizing allocation rule, based on which we assess the poverty-efficiency of actual aid allocations, with a special focus on the comparative impact of new donors and new non-aid flows. The results suggest a substantial misallocation of aid. Our benchmark estimates indicate that donors should reallocate nearly half the total aid budget from aid darlings (countries receiving more aid than the allocation rule specifies) to aid orphans (countries receiving less aid than the allocation rule specifies). The estimated poverty-reducing efficiency varies considerably across donors. Whereas new global actors such as the Gates foundation perform well above average, the non-DAC bilateral donors perform clearly worse. Overall, neither the new donors nor the new financial flows alleviate the observed misallocation of aid. While the new donors stand for a non-negligible share of overall poverty reduction, together they perform below average in terms of poverty reduction per aid dollar. Similarly, rather than counteracting the relative neglect of countries identified as particularly underfunded in terms of aid, the non-aid financial flows add to the inequitable distribution. Based on an extensive battery of alternative model calibrations, we establish upper and lower bounds on our estimates, allowing for clear policy recommendations.

**JEL classification:** D63; E61; F35; O11

**Keywords:** Aid allocation; Poverty; Donors; Official development assistance; Other official flows

### Introduction

Among official donor objectives, poverty reduction takes center stage. In 2015, world leaders adopted the 2030 Agenda for Sustainable Development. On top of its list of goals is the objective to ‘end poverty in all its forms everywhere’ (United Nations, 2019b). No less grand is the World Bank’s mission, carved in stone at their Washington headquarters: ‘Our Dream is a World Free of Poverty’ (World Bank, 2019). While priorities vary across bilateral donors, the overarching objective of the Organization for Economic Co-operation and Development's

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(OECD) Development Assistance Committee (DAC), consisting of 30 influential donors, is to contribute to the implementation of the 2030 Agenda and thus its goal to end poverty. Yet, despite being roughly ten times richer in per capita terms, Tunisia receives nearly five times as much foreign aid per person than the Democratic Republic of Congo (DRC).

This is not necessarily surprising. The allocation of aid among countries clearly reflects multiple objectives, some legitimate, others arguably less so. Aid may be used to rebuild post-conflict societies and to meet humanitarian emergencies, or for that matter, to reward allies, punish enemies, build coalitions and more generally support the strategic or commercial interests of the donor (Collier and Dollar, 2002; Dreher et al., 2018). Indeed, ample evidence from the last couple of decades suggests that when allocating aid across countries, donors tend to be motivated as much by political strategy and economic interests, as by the needs and policy performance of the recipient countries (e.g. Alesina and Dollar, 2000; Alesina and Weder, 2002; Dollar and Levin, 2006; Kuziemko and Werker, 2006; Hoeffler and Outram, 2011; Dreher et al., 2018.) Justifiable or not, this allocation pattern goes against the official donor emphasis on poverty reduction.

At the same time, however, the aid landscape has changed dramatically over the period: new sources of development finance have emerged and the development cooperation arena has seen continued diversification of actors, instruments and delivery mechanisms (Kharas and Rogerson, 2012; Mawdsley et al, 2014). The role of traditional official development assistance (ODA) in development cooperation is becoming less dominant (OECD, 2014). In parallel, the dominance of aid from the OECD-DAC countries is declining, with recent years seeing a sharp increase in development finance from non-Western donors, with China at the forefront (see e.g. Strange et al., 2015; Dreher et al., 2011; Dreher et al., 2015). The changing circumstances call for a renewed focus on the implications and challenges of development cooperation in general, and for an understanding of the implications of the rise of new actors and financial flows in particular.

The aim of this paper is to derive a poverty-minimizing – or poverty-efficient – allocation of aid and, based on this, assess the poverty-efficiency of actual aid allocations, with a special focus on the comparative impact of new donors and new (non-aid) financial flows on the most under-funded countries. We first look at aggregate flows, and ask how much poverty could be reduced if aid was allocated according to the specified rule. Next, we break down the analysis by donor groups and flow types and assess the poverty-efficiency of the respective allocations. On the recipient side, we identify winners and losers – aid darlings and aid orphans – and assess

to what extent new donors and new financial flows (NFFs) contribute to a more or less poverty-efficient allocation.

The results suggest a substantial misallocation of aid. Our benchmark estimates indicate that donors should reallocate nearly half the total aid budget from darling to orphan countries. The estimated poverty-reducing efficiency varies considerably across donors. In terms of average poverty reduction per aid dollar, new global actors such as the Gates foundation perform well above average and the non-DAC bilateral donors clearly below. Overall, neither the new donors nor the new financial flows alleviate the observed misallocation of aid. While the new donors stand for a non-negligible share of overall poverty reduction, together they perform below average in terms of poverty reduction per aid dollar. Similarly, rather than counteracting the relative neglect of the particularly underfunded countries in the allocation of aid, the non-aid financial flows add to the inequitable distribution. For the countries that we identify as aid orphans, these flows are not significant enough to substitute for the lack of aid.

Previous studies in this vein, e.g. the seminal work of Collier and Dollar (2001 and 2002), demonstrate that the actual allocation of aid is radically different from the poverty-efficient allocation, and thus that reallocating aid can come with significant improvements in terms of poverty reduction. Our contribution to this literature is twofold.

First, given the changing aid landscape, we incorporate new donors and new (non-aid) financial flows into the poverty minimizing aid allocation literature, investigating explicitly how these donors and flows matter for the poor underfunded countries. NFF is clearly a very heterogeneous category including flows that take place for widely different reasons. As such, NFFs are not directly comparable to aid, and we thus cannot apply the same analytical framework as that used to assess the poverty reducing efficiency of aid (see Section 2 and 3). Nonetheless, it is interesting to explore the distributional profiles of the new financial flows, and in particular, whether they help counteract the observed misallocation of aid.

We thus base our estimations on a more comprehensive dataset than previous studies. In particular, we compile aid data for a large group of new donors and on alternative sources of development finance. On top of the traditional multilateral and DAC bilateral donors, we incorporate a wide range of non-DAC bilateral donors,<sup>4</sup> as well as a group of donors that are DAC members today, but were not for most of the period we study (2009-2013).<sup>5</sup> Moreover,

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<sup>4</sup> Brazil, Bulgaria, Chile, China, Colombia, Croatia, Estonia, India, Israel, Kazakhstan, Kuwait, Latvia, Liechtenstein, Lithuania, Monaco, Qatar, Russia, Saudi Arabia, South Africa, Taiwan, Thailand, Turkey and the United Arab Emirates.

<sup>5</sup> The Czech Republic, Hungary, Iceland, Poland, the Slovak Republic and Slovenia.

we include data on a wide range of non-aid NFFs, namely ‘Other Official Flows’, Personal remittances, FDI, as well as on aid from International NGOs and new global actors.<sup>6</sup>

Second, acknowledging that optimal aid allocation estimations are sensitive to model calibrations and different measures of need, we thoroughly investigate how robust our benchmark results are to alternative calibrations and measures. Based on this, we establish upper and lower bounds on our estimates, allowing for more solid policy recommendations.

## 2 Optimal aid allocation

In their simplest form, optimal aid allocation rules tend to consider two characteristics of recipient countries: their need for aid and their ability to use it (Carter, 2014). The literature has to a large extent been built around the pioneering work of Collier and Dollar (2001, 2002), who in line with this, argue that aid should be allocated to countries that are poor and well-governed. They propose that aid should be distributed so as to maximize poverty reduction, via growth. Based on a growth regression (in turn based on Burnside and Dollar, 2000), they estimate that aid is more efficient at reducing poverty when government effectiveness is higher. Hence, according to their logic, holding the level of poverty constant, aid should increase with policy, and holding policy constant, it should increase with poverty.

The idea that the effect of aid is conditional on the institutional/political framework in the recipient country (Burnside and Dollar, 2000; Collier and Dollar, 2001, 2002) has been influential in donor circles. Notably, however, comparatively little weight is given to poverty. Consider the ‘Performance Based Allocation’ (PBA) rule used by the World Bank (and other multilateral development banks) to allocate its concessional International Development Association (IDA) funds. Funds are allocated based on performance (CPR) and income (GNI) per capita:

$$IDA \text{ country allocation} = CPR^3 * GNI \text{ per capita}^{-0.125} * population$$

CPR is a country performance rating focusing on macroeconomic management, structural policies, social policies, public sector management and institutions, and the quality of management of IDA’s projects and programs.<sup>7</sup> Need is taken into account via the fact that IDA

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<sup>6</sup> The following new global actors are included: The Bill and Melinda Gates Fund (BMGF), The Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM), the Global Alliance for Vaccines and Immunization (GAVI), and the Global Environment Facility (GEF).

<sup>7</sup> Specifically, the CPR is calculated as follows:  $CPR = 0.24CPIA_{A \text{ to } C} + 0.68CPIA_D + 0.08PPR$ , where the country policy and institutional assessment (CPIA) index is based on indicators focusing on (A) macroeconomic management, (B) structural policies, (C) social policies, and (D) public sector management and institutions, and

is only given to countries with a GNI/cap below a certain threshold. But apart from that, overwhelming weight is given to performance, or the institutional/policy environment of the recipient country. While the weight given to CPR has in fact been reduced (the exponent has been lowered in steps from 5 to 3) over the last couple of years in order to increase the poverty-orientation of the formula (IDA, 2016), the rule is still very much performance focused.

While very influential, the optimal aid allocation rule of Collier and Dollar (2001, 2002) has been criticized on several grounds (for an overview, see Sterck et al., 2017). Below we discuss proposed developments that we seek to incorporate in our allocation formula.

### *2.1 An uncomfortable trade-off between need and effectiveness*

First, the objective function of Collier and Dollar (2001, 2002) can, just as the PBA rule of the World Bank, be criticized on fairness grounds. As noted by McGillivray and Pham (2017, p. 1) it contains an “uncomfortable trade-off between need and effectiveness”. The poorest countries often have the lowest levels of performance and are thus allocated less aid.

To begin with, one could question the overwhelming weight given to performance, or policy/institutional environment, in the PBA rule. In the aid effectiveness literature, the leading proponents of the view that the impact of aid is conditional on policy are Burnside and Dollar, who in an often-cited study from the turn of the millennium (Burnside and Dollar, 2000) found that aid has a positive effect on growth only in countries with sound fiscal, monetary and trade policies. As noted, Collier and Dollar’s allocation rule (2001, 2002) is based on this estimation. The Burnside and Dollar results were later called into question, however, and have been found to be sensitive to specification and sample (Hansen and Tarp, 2001; Easterly, 2003; Easterly et al., 2004; Dalgaard et al., 2004; Roodman, 2007). In more recent accounts, the consensus is rather that the aggregate aid-growth literature offers no empirical evidence of aid effectiveness being conditional on policy (Arndt et al., 2010; Clemens et al., 2012; Bourguignon and Gunning, 2016; Guillaumont, et al., 2017; Mekasha and Tarp, 2019).

A lack of aggregate evidence of aid effectiveness being conditional on policy should of course not be interpreted as the recipient country policy environment being irrelevant; few researchers and practitioners would dispute the merits of a sound policy environment. That said, though, an aid allocation rule placing a significantly higher weight on the policy

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PPR is the IDA portfolio performance rating. As one can see, the cluster focusing on institutions and public sector management is given the highest weight.

dimension compared to the need dimension can hardly be motivated with reference to the empirical literature on the relationship between aid and growth.

Furthermore, one can argue that poor countries should not receive less aid due to structural handicaps beyond their control. Llavador and Roemer (2001) propose an equality of opportunity approach to aid allocation, arguing that poor countries should not be penalized for a growth-adverse environment for which they cannot be deemed responsible. According to this line of thinking, aid should compensate countries for inherited disadvantages while allowing effort to produce differential rewards. Cogneau and Naudet (2007) also adopt an equal opportunities approach, but argue that aid should focus on equalizing future poverty risks across developing countries. Similarly, Wood (2008, p. 1135) argues that, “donors and people care—for intellectually and morally defensible reasons—about both current and future levels of poverty”, and therefore propose to minimize the discounted sum of future poverty, rather than, as Collier and Dollar, current poverty.

Relatedly, but focusing on how these ideas have been put to use among donors in practice, Guillaumont et al. (2017a,b) argue that the performance based allocation rule of the World Bank fails to take account of key structural handicaps to development facing countries independent of present political will and efforts. In its current form, the PBA rule does not allow countries performing badly due to e.g. conflict or natural disasters to receive a level of aid in accordance with their needs. Rather, considering that ‘performance’, as measured in the PBA, is likely to be pro-cyclical, the impact of a negative exogenous shock will according to this allocation rule be magnified by lower aid. Instead of incorporating vulnerability into their allocation formula, the World Bank currently makes exceptions to the PBA rule, offering special treatment to different categories of fragile states. Similarly, Guillaumont and co-authors argue that low levels of human capital is a structural handicap that a country should not be penalized for. Despite the best of intentions and significant efforts, countries with low levels of human capital are likely to score poorly on the PBA.

On top of fairness considerations, an allocation rule that better captures the vulnerability of recipient countries can be justified with reference to efficiency. Exogenous sources of instability, and the growth volatility they induce, lowers average growth and is harmful to poor and vulnerable groups (Guillaumont and Wagner, 2013). The stabilizing impact of aid – i.e. that it dampens the negative impact of exogenous shocks on growth and development – should increase growth as well as make it more pro-poor (Guillaumont et al. (2017a,b). Similarly, not penalizing countries with low levels of human capital can be motivated in terms of efficiency. Aid tends to have a knowledge content and is often targeted at human capital development, and



it is reasonable to argue that the marginal impact of aid on growth via human capital will be higher when the initial level of human capital is lower.

The implication of these arguments is, according to Guillaumont et al. (2017a), that the marginal poverty reduction per aid dollar is higher in countries with high vulnerability and low human capital. For this reason, they propose the use of an ‘augmented PBA’ where the measurement of performance by policy indicators is adjusted for the impact of structural handicaps, namely vulnerability and low human capital. Specifically, they propose an ‘Augmented Country Policy Rating’ (ACPR) that is a weighted average of the original CPR and the Economic Vulnerability Index (EVI) and Human Assets Index (HAI) used by the UN to identify LDCs. EVI is a composite index capturing the exposure to natural or external exogenous shocks. HAI is a composite index of health and educational components. The higher ACPR, the higher is the presumed aid effectiveness. Therefore, in an optimal aid allocation, countries with high poverty and high ACPR should be favored.

To integrate structural economic vulnerability and low human capital into the allocation formula we will follow Guillaumont et al. (2017a) and use the ACPR as policy measure in our benchmark calibration, but will also evaluate how sensitive the results are to using CPR instead of ACPR.

## *2.2 Focusing on growth or consumption*

Another concern has to do with the focus on growth. As noted, Collier and Dollar (2001, 2002) use an estimated empirical relationship between aid and growth to derive an allocation rule that maximizes poverty reduction via growth. This can be questioned on both theoretical and empirical grounds.

Arguing that aid can only reduce poverty by increasing growth has been criticized for being ‘reductionist’ and not ‘sufficiently nuanced’ (McGillivray and Pham, 2017). In particular, giving no weight to aid-funded consumption and investment is arguably problematic considering that most aid does not have growth as its main purpose, but rather private and public consumption and investment intended to be welfare enhancing in itself.

An alternative is to derive an allocation that seeks to maximize recipient welfare rather than growth (Carter, 2014). In line with Bourguignon and Platteau (2017), one can focus on aid-consumption, i.e. the effect aid has directly on consumption, instead of aid-growth-consumption, i.e. the effect aid has on growth, and the effect aid has on consumption via growth.

Empirically, there are also reasons to focus on consumption rather than growth. While the aggregate effect of aid on growth is difficult to measure, yielding fragile estimates (see Clemens et al. 2012); it is easier to show that aid increases consumption and welfare ‘there and then on the ground’ (the so called micro-macro paradox). This is not to say that there is no effect of aid on economic growth. Even though endogeneity concerns and low statistical power make it difficult to get reliable estimates, the most ambitious attempts (see Clemens et al. 2012) suggests that there is indeed a positive impact. Nevertheless, considering a more direct effect of aid rather than its effect via growth appears warranted.

As it turns out, the Collier and Dollar (2002) model is easily extended to allow aid to have a direct effect on income. Doing so, we assume that an increase in national income resulting from an inflow of aid trickles down to the poor in the same way as would an increase in national income instead resulting from growth, which appears reasonable.

### *2.3 Diminishing returns to aid*

Assuming that aid has diminishing returns is standard in the optimal aid allocation literature. The argument is that recipient countries, due to e.g. institutional constraints, have limited absorptive capacity, i.e. ability to absorb and use aid in a way that achieves a given objective. With large aid volumes, a recipient country will thus reach a point where they can no longer absorb or spend aid efficiently.

The existence of diminishing returns is a robust finding in the aid-growth literature (see e.g. Burnside and Dollar, 2000; Hansen and Tarp, 2001; Dalgaard et al., 2004; Easterly et al., 2004; Clemens et al 2012). Specifically, these results indicate that aid is positively related to growth up to a certain level of aid relative to recipient GDP – often referred to as the saturation point – and even negatively related thereafter. Considering the robustness of this finding, the question is not so much whether to assume diminishing returns, but rather to specify the saturation point. Below we develop our theoretical framework, discussing theoretical assumptions like this one.

## **3 Theoretical framework**

In this section, we derive a poverty minimizing allocation of aid. Our model builds on the pioneering work of Collier and Dollar (2001, 2002), but incorporates a number of

developments discussed in Section 2. In particular, rather than deriving an allocation rule that maximizes poverty reduction via growth, we allow aid to have a direct effect on income, while taking into account that aid has diminishing returns in terms of poverty reduction.<sup>8</sup> Having derived a poverty minimizing allocation of aid, we are able to compare actual aid levels to optimal aid levels among aid receiving countries. Hence, in a next step, we assess the poverty reduction that donors could hypothetically achieve by reallocating aid from darling countries (that have received more aid than our allocation rule recommends) to orphan countries (that have received less aid than our allocation rule recommends). Finally, we break down the analysis by donors / donor groups and assess their comparative poverty reducing efficiency.

### *3.1 Deriving the poverty minimizing allocation of aid*

Collier and Dollar (2002) formulate a model assuming that the objective function of donors is to allocate aid among countries so as to

$$\begin{aligned} \text{Max poverty reduction} \quad & \sum_i G_i \alpha_i h_i^0 N_i \\ \text{subject to} \quad & \sum_i A_i y_i N_i = a_{tot}, \quad A_i \geq 0 \end{aligned} \tag{1}$$

where  $y_i$  is GDP per capita in country  $i$ ,  $A_i$  is aid/GDP,  $N_i$  is population,  $G_i$  is the growth rate of per capita income,  $h_i^0$  is a measure of initial (before aid) poverty, and  $\alpha_i$  is the (negative) elasticity of poverty with respect to income. The total amount of aid is denoted  $a_{tot}$ .

As discussed in Section 2, deriving an aid allocation rule that maximizes poverty reduction via growth can be questioned on both theoretical and empirical grounds. As also noted, however, one can easily extend the Collier and Dollar (2002) setup to allow aid to have a direct effect on national income. Recall that  $\alpha_i$  is the income elasticity of poverty. Income, in this context, can refer to any income. An increase in national income has an effect on poverty, no matter if this change in income is due to growth, or to an inflow of aid.

Against this background, we now depart from the Collier and Dollar setup. In particular, instead of letting aid affect poverty only via growth, we formulate a model considering the direct effect of aid on income (which allows public and private consumption) and thereby on

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<sup>8</sup> Worth emphasizing, the below framework applies to aid rather than new financial flows. We return to the NFFs in the results section, where we assess to what extent non-aid flows help counteract the observed misallocation of aid.

poverty. From an accounting perspective, the effect of aid on income is straightforward. Aid simply constitutes an inflow of resources that adds to the recipient country's pre-aid-income. We slightly modify this perspective and consider 'realized income', taking into account that aid has diminishing returns. One way to put this is that an increasing fraction of the aid received is lost due to transaction costs. The aid that remains, net of transaction costs, adds to the recipient country's pre-aid-income, and forms realized income. Just as the standard assumption of diminishing returns in the aid-growth literature, we thus assume a quadratic relationship between aid and realized income, i.e. that recipient country governments have limited absorptive capacity when it comes to delivering consumption (realized per capita income), just as in delivering economic growth.

Hence, with large aid volumes, a recipient country will reach a point where they can no longer absorb or spend aid efficiently. Indeed, after this point aid even has a negative effect. Denoting this saturation point  $\beta_i$ , and the fraction of the first aid-dollar that is not lost due to transaction costs  $\varepsilon_i$ , realized per capita income, denoted  $x_i$ , is given by:

$$x_i = y_i q_i \quad (2)$$

Where  $q_i$  is the factor for the aid – realized per capita income relationship:

$$q_i = 1 + \varepsilon_i \left( A_i - \frac{A_i^2}{2\beta_i} \right) \quad (3)$$

Like Collier and Dollar, we let  $\varepsilon_i$  and  $\beta_i$  vary with policy. For a more detailed discussion of the functional form and calibration of  $\varepsilon_i$  and  $\beta_i$ , see Appendix B. Under ideal policy conditions,  $\varepsilon_i$  would equal one, implying that none of the first aid-dollar is lost due to transaction costs. In our benchmark calibration, we assume that the saturation point for a country with average policy score, denoted  $\beta_0$ , occurs when aid constitutes 25 percent of GDP. We base this figure on the estimates in Clemens et al (2012), who find inflection points for the aid-growth relationship when aid exceeds about 20-25 percent of GDP (which we adjust for differences in aid flow coverage and for our use of commitments rather than disbursements). As such, we assume that the saturation point for consumption-aid is the same as for growth-aid. We are not aware of any equivalent estimates for consumption-aid, and it is arguably reasonable that the amount of aid a recipient country can handle gives a similar pattern of diminishing returns for different economic outcomes. In the robustness analysis, we explore the sensitivity of results to using alternative saturation points.

Poverty (post aid), denoted  $h_i$ , is a function of realized per capita income, assuming a constant realized per capita income elasticity of poverty:

$$h_i = h_i^0 \left( \frac{x_i}{y_i} \right)^{-\alpha_i} \quad (4)$$

Furthermore, we assume that  $\alpha_i = \alpha$ , i.e., that the elasticity of poverty with respect to realized per capita income is the same in all countries. Since the empirical estimates of elasticities tend to vary considerably based on the poverty measure used (e.g. based on the specific poverty line chosen and whether using a headcount measure or an indicator capturing the depth of poverty), we argue that it is more transparent to use the same elasticity across the board. Based on previous empirical studies (e.g. Bourguignon, 2000; Collier and Dollar, 2002; Bigsten and Shimeles, 2007) we use  $\alpha=1.5$  in the benchmark calibration, but explore the sensitivity of results to using alternative elasticities ( $\alpha=1$  and  $\alpha=2$ ).<sup>9</sup>

Equations (2) – (4) allow us to write the poverty function of country  $i$  as:

$$h_i = h_i^0 \left( 1 + \varepsilon_i \left( A_i - \frac{A_i^2}{2\beta_i} \right) \right)^{-\alpha} \quad (5)$$

We frame the optimization problem as one of minimizing poverty rather than, as Collier and Dollar (2012), of maximizing poverty reduction. Hence, the objective function for donors is to allocate aid among countries so as to:

$$\text{Min total poverty } \sum_i h_i N_i \quad (6)$$

$$\text{subject to } \sum_i A_i y_i N_i = a_{tot}, \quad A_i \geq 0$$

Our formulation takes into account that aid has diminishing returns on poverty not only through the quadratic relationship between aid and national income, but also through the poverty function being a decreasing but convex function of national income (taking into account the aid portion of national income). This contrasts with the set up used in Collier and Dollar (2002), and in most of this literature, where the convexity of the poverty function is ignored, and poverty reduction achieved from growth in country  $i$  is assumed to be given by  $G_i \alpha h_i^0 N_i$ . With low levels of growth, this is a fairly accurate approximation of the correct expression  $\left( 1 - \frac{1}{(1+G_i)^\alpha} \right) h_i^0 N_i$ , assuming that the elasticity is constant. Using this approximation, one can solve the first order conditions algebraically and thus derive an explicit expression for the solution. The higher the growth level, however, the more imprecise this approximation

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<sup>9</sup> For a more detailed discussion of  $\alpha$ , see Appendix B.

becomes.<sup>10</sup> By framing the optimization problem as one of minimizing poverty rather than maximizing poverty reduction, we avoid the above approximation, and thereby take the convexity of the poverty function into account and obtain more precise estimates. Without the approximation, however, there exists no algebraic solution to the first order conditions, and we must rely on numerical solutions. To our knowledge, this is the first aid effectiveness model to incorporate both diminishing returns to aid and that poverty is a decreasing but convex function of national income.

If we consider, to start with, only interior solutions (in which each country gets some aid), the first order conditions for a minimum are:

$$\frac{\partial h_i}{\partial A_i} N_i = \lambda y_i N_i \quad (7)$$

Drawing on equation (5), we can rewrite the first order conditions as follows:

$$-h_i^0 \alpha \varepsilon_i \left(1 - \frac{A_i}{\beta_i}\right) \left(1 + \varepsilon_i \left(A_i - \frac{A_i^2}{2\beta_i}\right)\right)^{-(\alpha+1)} = \lambda y_i \quad (8)$$

As already mentioned, Equation 8 has no algebraic solution. However, since we know the budget constraint (total aid,  $a_{tot}$ , is \$149.4bn in our data), we can numerically solve for the vector of optimal aid levels  $\{A_i^*\}$  (now allowing for corner solutions).

Next, we assess the poverty reduction that donors could hypothetically achieve by reallocating aid from darling countries (that have received more aid than our allocation rule recommends) to orphan countries (that have received less aid than our allocation rule recommends).

### 3.2 Poverty reduction when reallocating aid from darlings to orphans

Consider the poverty reduction of aid allocated to a particular country. We let  $a_i$  denote aid to country  $i$ .  $a_i$  and  $A_i$  thus have the following relationship:

$$a_i = A_i y_i N_i \quad (9)$$

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<sup>10</sup> Consider the following extreme but illustrative example: if  $G_i = 0.3$  and  $\alpha_i = 4$ , then the poverty reduction according to this expression is 120 percent of the initial poverty, implying that the new poverty level is negative.

We denote the marginal poverty reduction of aid, i.e. the extra poverty reduction achieved by one additional aid dollar,  $\theta_i$ :

$$\theta_i = \frac{\partial(h_i N_i)}{\partial a_i} = \frac{\partial h_i}{\partial a_i} N_i \quad (10)$$

Now consider the aid reallocation that would take place if going from the actual to the optimal aid allocation.  $a_i^0$  and  $A_i^0$  refer to actual aid allocated to country  $i$ , and  $a_i^*$  and  $A_i^*$  refer to the optimal amount of aid country  $i$  should get according to our poverty minimizing allocation rule.  $\theta_i^{Reallocated}$  refers to the average  $\theta_i$  of the aid that would be reallocated to/from country  $i$  when going from the actual to the optimal allocation:

$$\theta_i^{Reallocated} = \frac{h_i(A_i^0)N_i - h_i(A_i^*)N_i}{a_i^* - a_i^0} \quad (11)$$

Using equation (5) and (9) we can re-write this expression as:

$$\theta_i^{Reallocated} = -\frac{h_i^0}{y_i} \frac{\left(1 + \varepsilon_i \left(A_i^* - \frac{A_i^{*2}}{2\beta_i}\right)\right)^{-\alpha} - \left(1 + \varepsilon_i \left(A_i^0 - \frac{A_i^{02}}{2\beta_i}\right)\right)^{-\alpha}}{A_i^* - A_i^0} \quad (12)$$

The gain in poverty reduction achieved by the aid reallocated to orphans is  $\sum_{i \in Orphans} ((a_i^* - a_i^0) \times \theta_i^{Reallocated})$ , and the loss in poverty reduction as a result of the aid reallocated from darlings is  $\sum_{i \in Darlings} ((a_i^0 - a_i^*) \times \theta_i^{Reallocated})$ . The total lost poverty reduction from aid reallocated from the darlings, as percentage of the total gained poverty reduction from the aid reallocated to orphan countries, denoted  $\gamma$ , is thus given by:

$$\gamma = \frac{\sum_{i \in Darlings} ((a_i^0 - a_i^*) \times \theta_i^{Reallocated})}{\sum_{i \in Orphans} ((a_i^* - a_i^0) \times \theta_i^{Reallocated})} \quad (13)$$

### 3.3 Poverty reducing efficiency across donors

Next, we distinguish between donor groups and put a value on the poverty reducing efficiency of each donor. Specifically, we calculate the total poverty reduction of aid from each donor, in relation to the volume of total aid given by that donor. Doing so, we get a measure of the average poverty reduction per aid dollar for each donor.

Consider what the marginal poverty reduction of aid ( $\theta_i$ ) is on average for all aid given to country  $i$ .  $\theta_i^{Average}$  can be expressed as:

$$\theta_i^{Average} = \frac{h_i(A_i^0)N_i - h_i(0)N_i}{a_i^0} \quad (14)$$

Using equation (5) and (9) this can be re-written as:

$$\theta_i^{Average} = -\frac{h_i^0}{y_i} \frac{\left(1 + \varepsilon_i \left(A_i^0 - \frac{(A_i^0)^2}{2\beta_i}\right)\right)^{-\alpha}}{A_i^0} - 1 \quad (15)$$

Now consider the aid given by a specific donor  $j$  to country  $i$ , denoted  $a_i^j$ . The total poverty reduction of all aid given to country  $i$  is  $a_i \times \theta_i^{Average}$ . Dividing this poverty reduction between donors based on the amount of aid given by each donor suggests that the poverty reduction in country  $i$  from aid given by donor  $j$  is  $a_i^j \times \theta_i^{Average}$ .

We can now calculate the poverty-reducing efficiency, which we denote  $\rho$ , of aid from donor  $j$ :

$$\rho_j = \frac{\sum_i (a_i^j \times \theta_i^{Average})}{\sum_i a_i^j} \quad (16)$$

This is the total poverty reduction from aid from donor  $j$ , in relation to the volume of total aid given by that donor. In other words, it is a measure of average poverty reduction per aid dollar. We finally normalize  $\rho_j$  by dividing it by  $\rho_{All\ donors}$  and multiplying the ratio by 100, denoting the normalized poverty-reducing efficiency  $\rho_j^N$ .

$$\rho_j^N = 100 \frac{\rho_j}{\rho_{All\ donors}} \quad (17)$$

This means that, for instance,  $\rho_{Canada}^N = 166.3$  shall be interpreted as Canada's aid being 66.3 percent more effective at reducing poverty than average aid.

#### 4 Data and empirical estimation

In the previous section, we derived a poverty efficient allocation of aid. The next step is to assess the poverty-efficiency of actual aid allocations. As noted, we will first look at aggregate flows, and ask how much poverty could be reduced if aid was allocated according to the specified rule. Next, we break down the analysis by donor groups and flow types and assess the poverty-efficiency of the respective allocations, with a special focus on the comparative impact of new donors and new non-aid flows.



As noted, we find optimal aid using a numerical solution to the first order condition specified in equation (8).<sup>11</sup> For this purpose, we need data on aid flows, poverty and policy, as well as other development outcomes. To begin with, we compile a large amount of aid data, grouping the included donors into two main categories. First, we refer to the traditional donors, that is bilateral DAC donors, the EC, UN, WB, IMF, Regional Development Banks, and other multilateral donors (except Vertical Funds),<sup>12</sup> as well as to non-governmental organizations (NGOs) as ‘old aid’. Second, we classify the bilateral non-DAC donors and New Global Actors (specifically, the Bill and Melinda Gates Fund and Vertical funds) as ‘new donors’.

With respect to the first category, the data on aid from the traditional multilateral and DAC bilateral donors is from the AidData Research Release 3.1 dataset (AidData, 2017a). Part of the data on aid from International NGOs is from Koch et al. (2009). While this data includes only a subset of NGOs, it is to our knowledge the most recent and comprehensive dataset on aid from international NGOs. In addition, we have compiled novel data (covering 2009-2013) on aid from Doctors without borders (MSF) and from the International Red Cross (ICRC), directly from the organizations in question (Médecins Sans Frontières, 2010, 2011, 2012, 2013, 2014; International Committee of the Red Cross, 2010, 2011, 2012, 2013, 2014).

The AidData Research Release 3.1 dataset (AidData, 2017a) also contains data on aid from a great number of non-DAC bilateral donors,<sup>13</sup> and from the New Global Actors, relevant for our second category, ‘new donors’. The data on aid from the non-DAC bilateral donors China, Saudi Arabia and Qatar are from separate datasets, however (AidData 2014a, 2014b, 2017b). Since these countries do not release official, project-level financial information about its foreign aid activities, this data is based on an open-source media based data collection technique that triangulates project information across a range of data sources.<sup>14</sup> Finally, data on aid from the non-DAC bilateral donors Bulgaria, Croatia, Israel, Kazakhstan, Russia and Turkey is from OECD-DAC (2020), since data on these flows is not available from AidData.

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<sup>11</sup> To find the numerical solutions, we use a loop within a loop (based on the Newton-Raphson method) in Stata.

<sup>12</sup> Vertical funds are development financing mechanisms focused on single development domains and drawing on mixed funding sources (Future UN Development System, 2015). The following Vertical Funds are included: The Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM), the Global Alliance for Vaccines and Immunization (GAVI), and the Global Environment Facility (GEF).

<sup>13</sup> Brazil, Bulgaria, Chile, China, Colombia, Croatia, Estonia, India, Israel, Kazakhstan, Kuwait, Latvia, Liechtenstein, Lithuania, Monaco, Qatar, Russia, Saudi Arabia, South Africa, Taiwan, Thailand, Turkey and the United Arab Emirates. We also classify the Czech Republic, Hungary, Iceland, Poland, the Slovak Republic and Slovenia as Non-DAC bilateral donors, since these countries were not DAC-members for most of the period under study (2009-2013).

<sup>14</sup> While information from public media outlets is of course an imperfect substitute for complete statistical data from official sources, Strange et al. (2017) provide a careful description of how they dealt with challenges in the data collection process. See also Muchapondwa et al. (2014), for a validation of the Chinese data using a ‘ground-truthing’ methodology.

When possible, we focus on average (Commitments in Current USD) Official Development Assistance (ODA) 2009-2013. In order to qualify as ODA, an aid flow must be concessional, have a grant element of at least 25 percent, and its main objective should be the promotion of economic development of developing countries (OECD, 2016). For China, Saudi Arabia and Qatar we focus on flows judged as ‘ODA-like’ by AidData coders (see Strange et al., 2017). In other cases, (Brazil, Chile, Colombia, Hungary, India, Latvia, Liechtenstein, Lithuania, Monaco, South Africa, Taiwan and Thailand) ODA-status is not specified. In cases when a donor lacks data on aid flows for some year/s 2009-2013, we use an average of as many, and as recent, years as possible. We include only flows that actually constitute a transfer of money or resources from the donor country to the recipient country, meaning that we exclude e.g. ‘Administrative Costs of Donors’, ‘Action Relating to Debt’, ‘Refugees in Donor Countries’, ‘Scholarships/training in the donor country’ and ‘Promotion of development awareness’.

On the recipient side, we include the countries part of the DAC list of ODA recipients (OECD, 2021) for at least one of the years 2009-2013. We exclude regional aid that cannot be tied to a specific recipient country. Furthermore, we exclude India as an aid recipient since the country, while receiving aid, is simultaneously a major emerging donor. After sample restrictions, we end up with a total sum of 149.4 billion USD that donors could seek to allocate optimally.

Considering the changing aid landscape, where the role of traditional ODA is becoming less dominant (OECD, 2014), we also explore the role of non-aid flows for the poor underfunded countries. In particular, we consider ‘Other Official Flows’ (OOF), transactions by the official sector which do not meet the previously described conditions for eligibility as ODA, obtained from AidData, and personal remittances and foreign direct investment (FDI), obtained from the World Development Indicators (WDI, World Bank, 2019b).

To assess the poverty reducing efficiency of actual aid allocation patterns, we need data on poverty. In our benchmark estimations, we use a poverty index based on GNI (PPP adjusted) per capita, obtained from the WDI (World Bank, 2019b). The rationale for this is partly that richer countries with high poverty should be held accountable for their unequal distribution of income (Sterck et al., 2017; Bigsten and Tengstam, 2015), and partly the relative robustness of the indicator (poverty rates tend to vary considerably based on the specific indicator used). In the sensitivity analysis, we nevertheless use headcount poverty, \$1.90 (PPP) a day as well as \$3.10 (PPP) a day as alternative measures (also from WDI).

To incorporate policy, while taking into account structural economic vulnerability and low human capital (see the discussion in Section 2.1), we use the augmented CPR (ACPR) proposed by Guillaumont et al. (2017a) in our benchmark calibration. As noted, the ACPR is a weighted average of the original CPR of the World Bank and the Economic Vulnerability Index (EVI) and Human Assets Index (HAI) used by the UN to identify LDCs (United Nations, 2019a). In the robustness analysis, however, we also run estimations using the standard country performance rating (CPR) of the World Bank (IDA, 2017b).

We obtain figures on GDP per capita and population from the World Development Indicators (World Bank, 2019b). Finally, we use a group of indicators to find predicted values of variables for which we have missing values. For a summary of variable definitions and data sources, see Table A1, and for descriptive statistics of key variables, see Tables A2-A5.

Among the aid recipient countries, we identify aid darlings and aid orphans, and assess to what extent new donors and non-aid flows contribute to a more or less poverty-efficient allocation. An ‘aid orphan’ here refers to a country that receives less aid than our allocation rule recommends. To reduce poverty more effectively, the donor community should scale up aid to these countries. Correspondingly, an ‘aid darling’ is a country that gets more aid than our allocation rule recommends, implying that the donor community should scale down aid to these countries.

While we present what may seem like exact figures, it is important to remember that optimal aid allocation estimations are sensitive to using different model specifications and measures. To get a sense of the sensitivity of our benchmark findings, we perform a battery of robustness checks. As noted, these entail using different elasticities of poverty with respect to income ( $\alpha$ ) and different aid/GDP saturation points for a nation with average policy ( $\beta_0$ ), as well as incorporating and measuring policy and poverty in several different ways.

Using three different values for  $\alpha$  (1.0 and 2.0, on top of the benchmark value of 1.5) as well as for  $\beta_0$  (20 and 30 percent on top of the 25 percent benchmark) gives nine (3 x 3) different calibrations. With respect to poverty, on top of a poverty index based on GNI/cap (PPP) we also use the headcount ratio at \$1.90 and \$3.10 a day (PPP), respectively. For policy, we use CPR as an alternative to ACPR. Finally, we incorporate policy using three different policy factors.<sup>15</sup> In total, this gives 162 (3x3x3x3x2) different calibrations. For the sake of brevity, we present only the extreme values obtained for each recipient country, which we

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<sup>15</sup> Drawing on Collier and Dollar (2002) we use a benchmark ‘policy factor’ of 0.67, and the alternative policy factors 0.38 and 1.06 in the robustness analysis (see Appendix B for details).

interpret as upper and lower bounds on their estimates. This also allows us to present upper and lower bounds for the estimates in the analysis by donor groups.

Based on these, we modify the above darling/orphan classification. Countries that are orphans (i.e. receive less aid than the allocation rule specifies) in all calibrations we refer to as ‘pure orphans’, and countries that are darlings (i.e. receive more aid than the allocation rule specifies) in all calibrations we refer to as ‘pure darlings’. Countries that are orphans in the benchmark calibration, but darlings in some robustness calibration/s we refer to as ‘borderline orphans’, and correspondingly, countries that are darlings in the benchmark calibration, but orphans in some calibration/s we refer to as ‘borderline darlings’.

## **5 Results**

In this section, we assess the poverty-efficiency of actual aid allocations. First, we consider aggregate flows, and ask how much poverty could be reduced if aid was allocated according to the specified rule. Second, we break down the analysis by donor groups and flow types and assess the poverty-efficiency of the respective allocations, with a special focus on the comparative impact of new donors and new non-aid flows. Finally, we assess to what extent new donors and non-aid flows contribute to a more or less poverty-efficient allocation.

### *5.1 Benchmark results*

Looking at Figure 1, we can note that there is no clear negative relationship between aid per capita and GNI (PPP) per capita among aid receiving countries. Hence, in line with our introductory discussion, there is no indication that the poorest countries in the sample receive most aid and that the richest countries receive least aid. Rather, there is great variation in the amount of aid received among the very poor (compare e.g. Mozambique and the DRC) as well as among the relatively rich (compare e.g. Tunisia and Peru). While Figure 1 is purely descriptive – in particular, it does not incorporate the role of policy – it demonstrates that there are winners and losers in terms of the amount of aid received in relation to country income.

Figure 2 instead shows the optimal amount of aid each country should get according to the allocation rule, again in relation to their GNI (PPP) per capita. Comparing the two graphs again highlights the existence of winners and losers. Figure 3 makes the comparison more explicit, showing both the actual aid received and the optimal aid a country should get according to the

allocation rule for 14 example countries. We can for instance note that the low level of aid the DRC receives in relation to their national income actually corresponds with their specified optimal level of aid, due to their low policy scores and thus low assumed aid/GDP saturation point. Others stand out as clear aid orphans. Consider Tanzania. According to the allocation rule, they should receive 183 USD/capita, but in practice, they only receive 81. At the other end of the spectrum, among the aid darlings, countries like Tunisia, Morocco, Egypt and Turkey receive substantial aid volumes, while according to our allocation rule they should receive none.

Table 1, which shows the actual and optimal aid allocation across orphan and darling countries as defined in Section 4, provides an aggregate picture of our results. The optimal aid allocation (Column 2) and recommended change (Column 5) are based on our benchmark calibration. The upper and lower bounds (Columns 3-4 and 6-7), which will be discussed further in the next section, are derived from the sensitivity analysis. The results suggest a substantial misallocation of aid. Specifically, the benchmark calibration suggests that donors should reallocate 73.5 billion USD from the darling to the orphan countries. Thus, according to our poverty minimizing allocation rule, nearly half of the total aid budget of 149.4 billion USD is misallocated. These figures are clearly alarming.

Our model predicts that the suggested reallocation of aid would come with significant gains in terms of poverty reduction. Based on equation (13), we can conclude that the average poverty reducing effect of the proposed decrease in aid to the darling countries is only 4.4 percent of the equivalent effect in the orphan countries. We can think of the foregone poverty reduction in the darling countries –  $0.044 \times 73.5 = 3.2$  billion USD – as the cost of the proposed reallocation, which in turn implies that the net benefit of the reallocation would be  $73.5 - 3.2 = 70.3$  billion USD.<sup>16</sup> This means that the proposed reallocation of aid could reduce poverty by as much as if the total aid volume would increase by 70.3 billion USD (allocated optimally). The overall picture from our benchmark calibration, based on a comprehensive dataset including a large group of new donors, is thus that today's aid allocation pattern is very inefficient in terms of poverty reduction, and that there are substantial gains to be made by reallocating aid from darling to orphan countries.

A potential objection is that optimal aid allocation estimations are likely to be sensitive to different calibrations, e.g. to using different elasticities of poverty with respect to income,

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<sup>16</sup> In the sensitivity analysis, we find a lower bound of 0.9 percent and an upper bound of 17.6 percent, giving a net benefit in the interval 60.6 – 72.8 billion USD.

different aid/GDP saturation points, and to measuring and incorporating policy and poverty in different ways. In a next step, we take the sensitivity of our findings into account.

## 5.2 *Conservative estimates*

Based on extensive sensitivity analysis, we divide the aid receiving countries in our sample into pure and borderline orphans, and pure and borderline darlings (see Figure 4). For conservative estimates, let us consider only the pure orphans/darlings, i.e. the countries that receive less/more aid than the allocation rule specifies in all 162 calibrations. Tables 2 and 3 present the optimal aid allocation to pure orphans and darlings, broken down by country.

As seen in Table 2, the pure orphans consist of 11 countries. All our estimations suggest that in order to reduce poverty, one should scale up aid to these countries. Today, the total aid to the pure orphan countries amounts to 26 billion USD. According to our benchmark calibration, however, they should receive approximately 65 billion USD, implying a suggested reallocation of nearly 39 billion USD, or 150 percent. In absolute terms, the most seriously underfunded countries in relation to their recommended optimal aid level are (in order) Bangladesh, Tanzania, Ethiopia, Kenya, and Zambia. In Bangladesh, the recommended aid level is more than four times the size of the amount received. In Tanzania, the recommended aid level is more than twice that received. Roughly speaking, the same goes for most countries in the group. Hence, in relative terms, the recommended increases are overall substantial. The highest recommended aid-percent is 33.8 percent of GDP to Burkina Faso. Looking at the upper and lower bounds for optimal aid, we see that the confidence intervals are quite wide. However, at the very least, i.e. considering only the lower bound estimates, the estimations suggest an increase of 14 billion USD going to the pure orphans.

At the other end of the spectrum, 91 of our 152 sample countries receive more aid than the allocation rule specifies in all 162 calibrations and are thus classified as pure darlings (see Table 3). Today, total aid to this group of countries amounts to 60.4 billion USD. According to our benchmark poverty efficient allocation, however, they should receive only 6.9 billion, i.e. less than 12 percent of the actual amount obtained. Indeed, considering the upper and lower bounds for the optimal aid estimates (Columns 9-10), we can note that for most countries in this group, the recommendation is zero aid in all calibrations. We find the largest recommended decrease, in absolute terms, in Egypt (6.1 billion USD). Another notable case is Turkey, which in spite of being an upper middle-income country, receives 4.6 billion USD in aid, rather than as recommended in all calibrations of the poverty efficient allocation: zero.

The pattern illustrates the multiple objectives of donors. The US, for instance, views Egypt as an important ally in the region, helping to counteract military threats from other Arab states against Israel (Al Jazeera, 2017). Egypt's domestic stability, both economic and military, is

thus in the interest of the US. A similar story applies to Turkey, with its strategic position connecting Eastern Europe and West Asia, and bordering several Middle Eastern countries involved in military conflict in the region. Furthermore, some large aid flows, such as those to Haiti after the massive 2010 earthquake, are motivated by humanitarian emergencies. For others, consider e.g. the aid to war-torn Afghanistan, there are likely both strategic and humanitarian motives involved.

While the allocation of aid among countries clearly reflects multiple objectives, the relatively large aid flows to many middle income countries in this group go against the official donor emphasis on poverty reduction. If we again take a cautious approach, and consider only the lower bound estimates, the estimations suggest decreasing the amount of aid going to this group of countries by 46.7 billion USD. According to our lower bound estimate, 31 percent of the total aid budget is thus misallocated.

For the sake of brevity, we present the results for the optimal aid allocation to borderline orphans and darlings, broken down by country, in the appendix (Tables A6-A7). We have 25 borderline orphans in our sample. As noted, these countries receive less aid than the allocation rule specifies in the benchmark calibration, but more aid than our allocation rule specifies in at least one robustness calibration. Considering that we run 162 different calibrations, this is indeed a tough test. The reasons why these countries turn out borderline cases differ.

For some, it is a question of a weak policy environment. Despite widespread poverty and aid levels that under normal circumstances (average policy scores) would be far below the saturation point, calibrations giving high weight to policy scores still suggest reducing aid to these countries (consider e.g. Chad, Eritrea, DRC, Guinea-Bissau, Guinea, Togo, and Madagascar). This group of countries arguably highlights the need to find aid modalities that can help reduce poverty in unstable policy environments (e.g. support through NGOs), or for that matter, the importance of strengthening governance.

For other countries with very low incomes (e.g. Gambia, Malawi, Mozambique, Niger, Rwanda, and Sierra Leone), it is rather a question of being close to the lowest saturation point used in our alternative calibrations. If we choose to trust the most conservative calibrations, one could argue that these countries highlight the importance of increasing the aid absorptive capacity of the poorest countries. Notably, while these countries do not receive very large volumes of aid in per capita terms, their low levels of GDP still imply comparatively high shares of aid in GDP.

Finally, a number of countries are simply borderline cases in terms of poverty. In some countries, the different poverty measures point in different directions (e.g. Nigeria and Nepal),



in other cases, all measures suggest borderline poverty levels (notable Vietnam, Ghana, Nicaragua, and Mauritania).

### *5.3 Donor comparisons*

The donors included in the analysis, ranging from small bilateral actors to large multilaterals organizations and other global players, are by no means homogenous. Indeed, a common argument is that bilateral aid is often tied to the political agenda of the donor country, whereas multilateral donors are often seen as more impartial (see the discussion in Charron, 2011). In this section, we break down the analysis by donor groups and assess the poverty-reducing efficiency of the respective allocations.

We calculate the total poverty reduction of aid from each donor, in relation to the volume of total aid given by that donor, giving a measure of average poverty reduction per aid dollar. We standardize the average poverty reducing efficiency to 100, implying that a country with an estimated poverty reducing efficiency of, say, 120 is 20 percent more effective at reducing poverty than aid on average (see equation (17)). Table 4 presents the results, by donor groups.

The poverty-reducing efficiency in column 2 varies considerably across the specified groups. In line with the above argument, suggesting that bilateral aid is to a greater extent motivated by strategic political considerations, both the DAC and, particularly, the non-DAC bilateral donors perform worse than average in terms of poverty-reducing efficiency. The multilaterals – with the World Bank and the UN at the forefront – as well as the new global actors and the NGOs, are more efficient than average. The exception is aid from the EC, which is significantly below average in terms of poverty-reducing efficiency, possibly reflecting an influence of strategic rather than poverty focused considerations of EC member countries.

There is also considerable variation across donors within groups. In the interest of space, we present the detailed tables, broken down by individual donors, in the appendix (see Table A8). However, we can note some interesting patterns. Among the bilateral DAC-donors the variation is huge. Considering the G7 countries, the allocations of the UK and Canada perform clearly above average, whereas those of Japan, France and Germany perform clearly below (the US and Italy are close to average). Comparing the allocations of the UK and France is particularly striking; the estimations suggest that an aid dollar from the UK is 190 percent more efficient in terms of reducing poverty than an aid dollar from France. The allocations of

Belgium, Ireland, Portugal, the Netherlands and the Nordic countries are all well above average.<sup>17</sup>

China stands for a third of all non-DAC bilateral aid. In terms of the poverty-reducing efficiency of their allocation, they actually perform clearly above average, probably reflecting their relative focus on African countries. Hence, in line with the findings of Dreher et al. (2018), which suggest that Chinas motives are not substantially different from those shaping the allocation of Western aid, these estimates provide no support for worries that China is less poverty oriented than the traditional bilateral DAC donors. The poverty-reducing efficiency of aid flows from the central European nations Hungary, the Slovak Republic, Slovenia, Poland and the Czech Republic (small donors that have become DAC members after the time span considered in this study), are all considerably below average. Finally, Brazil and South Africa (both small donors in terms of volumes) are much more efficient than average, whereas Saudi Arabia, UAE, Kuwait, Qatar and Turkey (together capturing 59 percent of all bilateral non-DAC aid) are much less efficient than average.

Taking into account the sensitivity of estimates does not change this picture very much. The upper and lower bounds of the individual donor estimates tell us that the magnitudes should be interpreted as roughly +/- 20 percent in general. For example, while the benchmark estimate suggests that Canada's poverty-reducing efficiency is 66 percent above average, the lower and upper bounds are 40 and 90 percent respectively. However, since most donors' scores move in the same direction between different calibrations, the relative efficiency across donors is more stable than these intervals would seem to suggest.

In the next section, we have a closer look at the role of the 'new donors' and the new financial flows (NFFs).

#### *5.4 Focusing on the new donors and new financial flows*

Next, we are interested in whether the new actors and sources of development finance on the development arena help counteract the relative neglect of some countries in the distribution of aid. In relative terms, do these new flows help alleviate, or add to, the observed misallocation of aid? In absolute terms, are the flows to aid orphans large enough to compensate for the lack of aid?

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<sup>17</sup> The variation between different NGOs is similarly large. For example, MSF and Welt Hunger Hilfe score about 3 - 6 times higher than Oxfam and World Vision.

With respect to the ‘New Donors’, we have seen that the non-DAC bilateral donors perform clearly below and the new global actors well above average in terms of poverty reduction per aid dollar. While evidently no homogenous group, together the new donors perform below average in terms of relative poverty reducing efficiency. To get a picture of to what extent they contribute to poverty reduction, however, we also need to consider aid volumes. Column 5 in Table 4 gives the proportion of total poverty reduction – defined as poverty reduction efficiency per aid dollar multiplied by the total aid volume – achieved by each donor or donor group.

We can note that even though the estimated poverty reduction per aid dollar among the bilateral non-DAC donors is only 63.5 percent of the average poverty reducing efficiency, they stand for a rather significant share (9.1 percent) of overall poverty reduction.<sup>18</sup> On the other hand, even though the poverty reducing efficiency per aid dollar among the New Global Actors is 44.1 percent higher than average, they stand for a quite modest share (around 5.5 percent) of overall poverty reduction. The reason, of course, lies in the relatively large aid volumes from the non-DAC donors and the relatively modest aid flows from the New Global Actors. Taken together, the new donors contribute to an estimated 14.6 percent of overall poverty reduction. While not a total game changer, this it is clearly not negligible.

Knowing that the part played by traditional official development assistance (ODA) in development cooperation is becoming less dominant (OECD, 2014), we next turn to the role of other international flows. We consider three kinds of new financial flows (NFFs): OOF, FDI and Personal Remittances. Including both state flows, commercial flows, and transfers within families, NFF is clearly a very heterogeneous category including flows that presumably take place for widely different reasons. As such, NFFs are not directly comparable to aid, and we thus cannot apply the same analytical framework as that used to assess the poverty reducing efficiency of aid. For instance, we have no reason to assume the same saturation points, or poverty elasticities with respect to income, for these flows as for aid. Nonetheless, it is interesting to explore whether NFFs help counteract the observed misallocation of aid.

Hence, we compare the distributional profiles of the NFFs to those observed for aid. Column 6 in Table 4 gives the average poverty in the NFF-receiving (and for comparison, aid-receiving) countries, weighed by financial flow volume.<sup>19</sup> Among the NFF-receiving countries,

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<sup>18</sup> For equivalent figures on individual donor countries, see Table A8.

<sup>19</sup> *Average poverty weighed by financial flow volume* =  $\frac{\sum_i (flow_i \times Poverty_i)}{\sum_i flow_i}$  where  $flow_i$  refers to the respective flows of  $OOF_i$ ,  $remittances_i$  and  $FDI_i$  going to country  $i$  (and correspondingly, for comparison, the respective aid flows).

average poverty is in the range of 10-14 percent (lowest for FDI and OOF, highest for remittances). Considering the corresponding figures for aid-receiving countries, which range between 15 (“Other multilateral donors”) and 35 (the World Bank and New Global Actors) percent, it is clear that NFFs have a significantly lower poverty focus than aid.

Another way to assess the distributional profiles of the new donors and new financial flows, is by considering to what extent they go to the most underfunded countries. Table 5 presents the allocation of aid and other flows across orphan and darling countries, in absolute value (USD per capita) as well as a share of the total flow type.<sup>20</sup> For the sake of brevity, we focus primarily on the most under-funded group, i.e. the pure orphans. However, the corresponding figures for the other recipient country groups – borderline orphans, borderline darlings and pure darlings – are included for comparison. As a point of reference, we can note that out of all aid from Traditional donors, about 19 percent goes to pure orphan countries. In terms of volumes, this amounts to around 49 USD per capita.

Among the new donors, in comparison, only 8 percent of the bilateral non-DAC aid goes to the pure orphan countries. In line with our previous discussion, the New Global Actors perform significantly better in relative terms, with 24 percent of their aid going to the most underfunded group. In dollar terms, both the contribution of the non-DAC bilateral donors (4 USD per capita) and that of the New Global Actors (3 USD per capita) are relatively minor, however.

Turning to the new financial flows, we can note that the volume of OOF going to the pure orphan countries is relatively modest. On average, the pure orphans receive about 9 USD per capita in OOF. In USD per capita terms, all aid flows tend to be larger (although, per definition, not large enough according to our allocation rule) among orphan countries than among darling countries, reflecting that the former group of countries tend to be significantly poorer than the latter. Notably, however, this is not true for OOF, which in per capita terms is lowest in the pure orphan group. Indeed, it is more than 50 percent higher in the borderline orphan group, and twice the size in the two darling groups.

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<sup>20</sup> Note that these figures are somewhat difficult to interpret on their own. In general, comparing the allocations of different flow types to a specific group of recipient countries is more informative than comparing the allocation of a specific flow type across groups. For instance, comparing the share of aid vs. the share of OOF going to the most underfunded group (pure orphans), gives a picture of their respective poverty focus. Comparing the shares of a specific flow type, say OOF, going to the orphan and darling groups is, on the other, not very informative, since the orphan and darling groups contain different numbers of countries, with different size populations. Similarly, comparing the USD per capita measures of a specific flow type across the orphan and darling groups is of limited relevance, seeing that the table provides no information about recipient country poverty levels. Again, however, comparing the USD per capita contributions of different flow types to the most underfunded group helps to shed light on to what extent they help alleviate or add to the observed misallocation of funds.

For FDI, this pattern is even more striking; the average FDI per capita in the pure orphan group (17 USD) is only 9 percent of that in the pure darling group (195 USD). Furthermore, the volumes are again relatively modest; considering FDI and OOF together, they amount to less than half of what the most underfunded countries receive in aid per capita. Considering that poverty reduction is no objective of these flows, this is not necessarily surprising. Nonetheless, it is difficult to argue that OOF and FDI substitutes for aid in this vulnerable group. On the contrary, rather than counteracting the relative neglect of the pure orphans in the allocation of aid, these flows add to the inequitable distribution.

Do personal remittances help make up for the allocation problem at hand? Seemingly no. On the one hand, compared to the limited amounts of OOF and FDI to the pure orphan group, these flows are larger in per capita terms. Again, however, the flow type is smallest in the most underfunded group. Furthermore, even if the aggregate picture had been more equitable, personal remittances are unlikely to reach the poorest segments of the population within countries. Once again, then, these flows cannot be said to substitute for aid in the most underfunded countries.

Considering the flow shares going to the pure orphan countries confirms the picture that the NFFs have a comparatively weak poverty focus. Compared to the 17.4 percent of total aid going to the pure orphan countries, the shares of the respective NFFs that go to the same group of countries range from 1.3 percent (FDI) to 6.8 percent (remittances). While hardly surprising (ODA should, by definition, have development intent and thus be more poverty focused), this goes to show that NFFs cannot be said to substitute for aid in the most underfunded countries.

In sum, neither the new donors nor the new financial flows alleviate the observed misallocation of aid. While the new donors stand for a non-negligible share of overall poverty reduction, they perform below average in terms of poverty reduction per aid dollar, and their share in total aid is smaller in the orphan than in the darling countries. Similarly, rather than counteracting the relative neglect of the pure orphans in the allocation of aid, the NFFs considered here add to the inequitable distribution. Furthermore, the size of these alternative flows are not significant enough to substitute for the lack of aid to this group.

## **6 Conclusions**

While poverty reduction takes center stage among official donor objectives, the poorest countries are not necessarily the ones receiving most aid. In this study, we explored whether the changing aid landscape, where new actors and sources of development finance are

becoming increasingly influential, has helped achieve a more poverty efficient allocation of aid. Specifically, we derived a poverty-minimizing allocation of aid, based on which we assessed the poverty-efficiency of actual aid allocations, with a special focus on the comparative impact of new donors and new non-aid flows.

Our poverty-minimizing aid allocation rule has a number of key features. In line with the pioneering work of Collier and Dollar (2001, 2002), it is specified so that holding the level of poverty constant, aid should increase with the quality of policy, and holding the quality of policy constant, it should increase with poverty. However, rather than deriving an allocation rule that maximizes poverty reduction via growth, which can be questioned on both theoretical and empirical grounds, we allow aid to have a direct effect on income. As is standard in the literature, we assume aid to have diminishing returns. Furthermore, we assume that the saturation point for consumption-aid is the same as that for growth-aid. To take account of structural economic vulnerability and low human capital, finally, we use an augmented policy rating rather than the standard CPR. To assess the sensitivity to using different model specifications and measures, we perform a battery of robustness checks.

Considering aggregate flows, our baseline results suggest a substantial misallocation of aid. Specifically, the benchmark calibration suggests that donors should reallocate 73.5 billion USD, i.e. nearly half the total aid budget, from countries receiving more aid than our allocation rule specifies – referred to as aid darlings – to countries receiving less aid than our allocation rule specifies – referred to as aid orphans. Our estimates suggest that this reallocation of aid could reduce poverty by as much as if the total aid volume would increase by 70.3 billion USD (allocated optimally). The overall picture from our benchmark calibration, based on a comprehensive dataset including a large group of new donors, is thus that today's aid allocation pattern is very inefficient in terms of poverty reduction, and that there are substantial gains to be made by reallocating aid from darling to orphan countries.

Acknowledging that optimal aid allocation estimations are likely to be sensitive to different calibrations, we carefully evaluate the sensitivity of these estimates. Using different elasticities of poverty with respect to income, different aid/GDP saturation points, and measuring and incorporating policy and poverty in different ways, we end up with 162 calibrations in total. Based on these, we establish upper and lower bounds on our estimates. Specifically, we divide the aid receiving countries in our sample into pure orphans and darlings, and borderline orphans and darlings, where the former receive less/more aid than the allocation rule specifies in all 162 calibrations whereas the latter change status in some robustness calibration. For conservative estimates, we consider only the pure orphans/darlings.

In our sample of 152 aid-receiving countries, we identify 11 pure orphans and 91 pure darlings. All our estimations suggest that in order to reduce poverty, one should reallocate aid from the latter to the former. Notable pure orphan countries are Bangladesh, Tanzania, Ethiopia, Kenya, and Zambia. In Bangladesh, the recommended aid level is more than four times the size of the amount received. While the allocation of aid among countries clearly reflects multiple objectives, the relatively large aid flows to many middle income countries in the pure darling group go against the official donor emphasis on poverty reduction. If we take a cautious approach, and consider only the lower bound estimates, the results suggest decreasing the amount of aid going to this group of countries by 46.7 billion USD. According to our lower bound estimate, 31 percent of the total aid budget is thus misallocated.

The estimated poverty-reducing efficiency, or the average poverty reduction per aid dollar, varies considerably across donor groups. Whereas the multilaterals – with the World Bank and the UN at the forefront – as well as the new global actors and the NGOs, are more efficient than average, the bilaterals, both DAC and (even more so) non-DAC, as a group perform worse. However, there is equally important variation across donors within groups, with e.g. the World Bank performing significantly better in terms of poverty reducing efficiency than the EC among the multilaterals, and e.g. the UK and Canada performing better than France and Germany among the major bilaterals.

Turning to the new donors and the new financial flows, we should note that both constitute very heterogeneous categories. Regarding the new donors, the new global actors perform well above average and the non-DAC bilateral donors clearly below in terms of poverty reducing efficiency. The NFFs similarly include very diverse flows and actors, guided by very different motivations. Indeed, the NFFs are by no means directly comparable to aid. Nonetheless, we are interested in whether these flows help counteract the observed misallocation of aid.

Overall, neither the new donors nor the new financial flows alleviate the observed misallocation of aid. While it is worth noting that new donors stand for a non-negligible share of overall poverty reduction, together they perform below average in terms of poverty reduction per aid dollar. Similarly, rather than counteracting the relative neglect of the pure orphans in the allocation of aid, the New Financial Flows add to the inequitable distribution. For the countries that we identify as aid orphans, these flows are simply not significant enough to substitute for the lack of aid.

Our findings thus suggest that the traditional donor community cannot rely on the new donors and non-aid flows to compensate for the relative neglect of the most underfunded countries in the distribution of aid. To live up to official donor objectives to ‘end poverty in all

its forms everywhere’ donors should, well, not kill their darlings, but at least reallocate a considerable share of their aid from darling to orphan countries.

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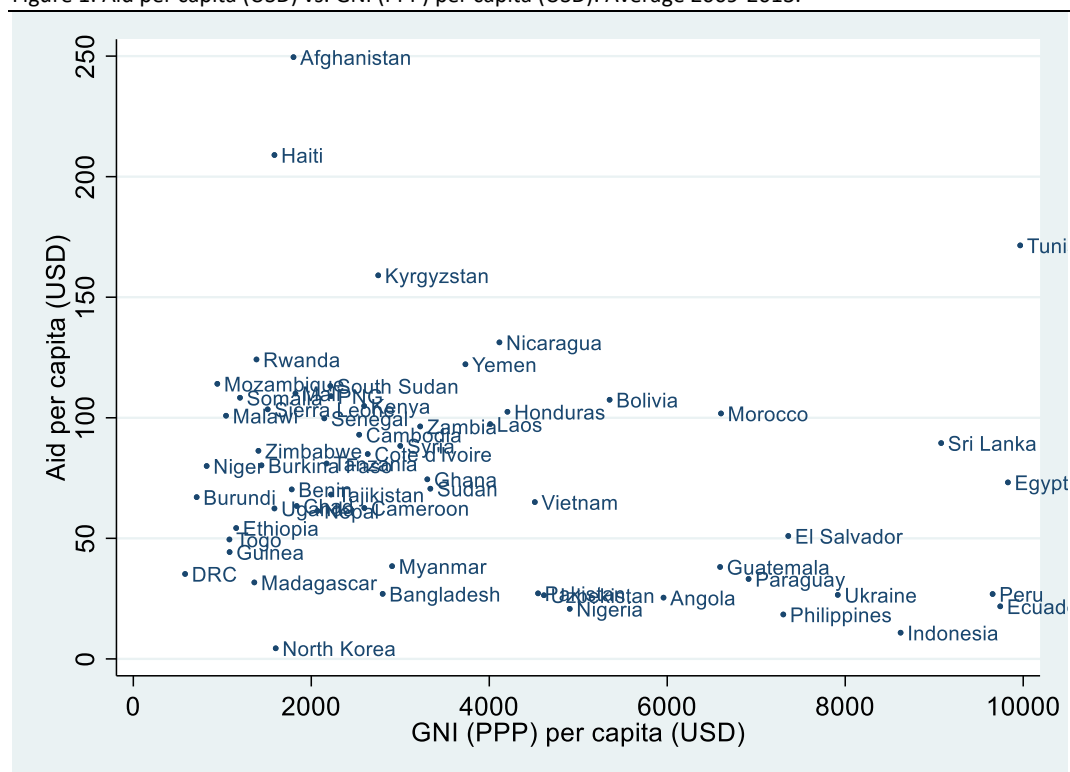
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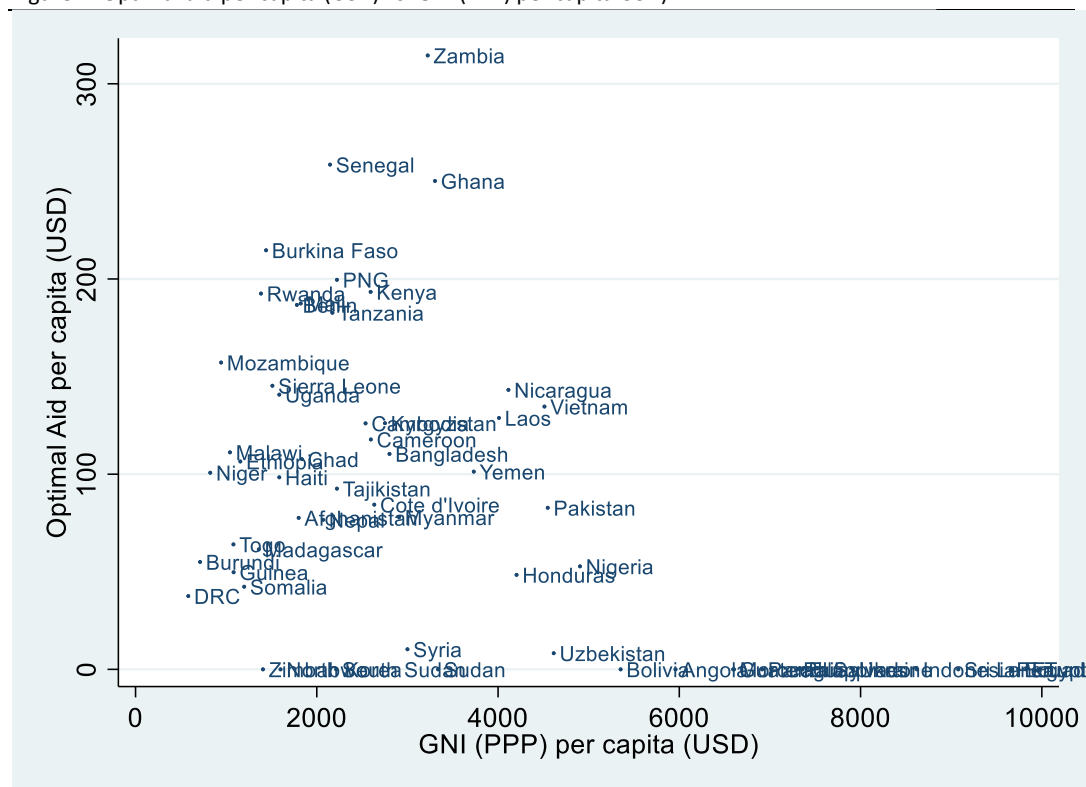
## Figures and Tables

Figure 1: Aid per capita (USD) vs. GNI (PPP) per capita (USD). Average 2009-2013.



Notes: The sample excludes countries with GNI (PPP)/capita over 10,000 USD and countries with a population of less than 5 million

Figure 2: Optimal aid per capita (USD) vs. GNI (PPP) per capita USD



Notes: The sample excludes countries with GNI (PPP)/capita over 10,000 USD and countries with a population of less than 5 million

Figure 3: Optimal and actual aid per capita (USD) vs. GNI (PPP) per capita (USD) for selected countries

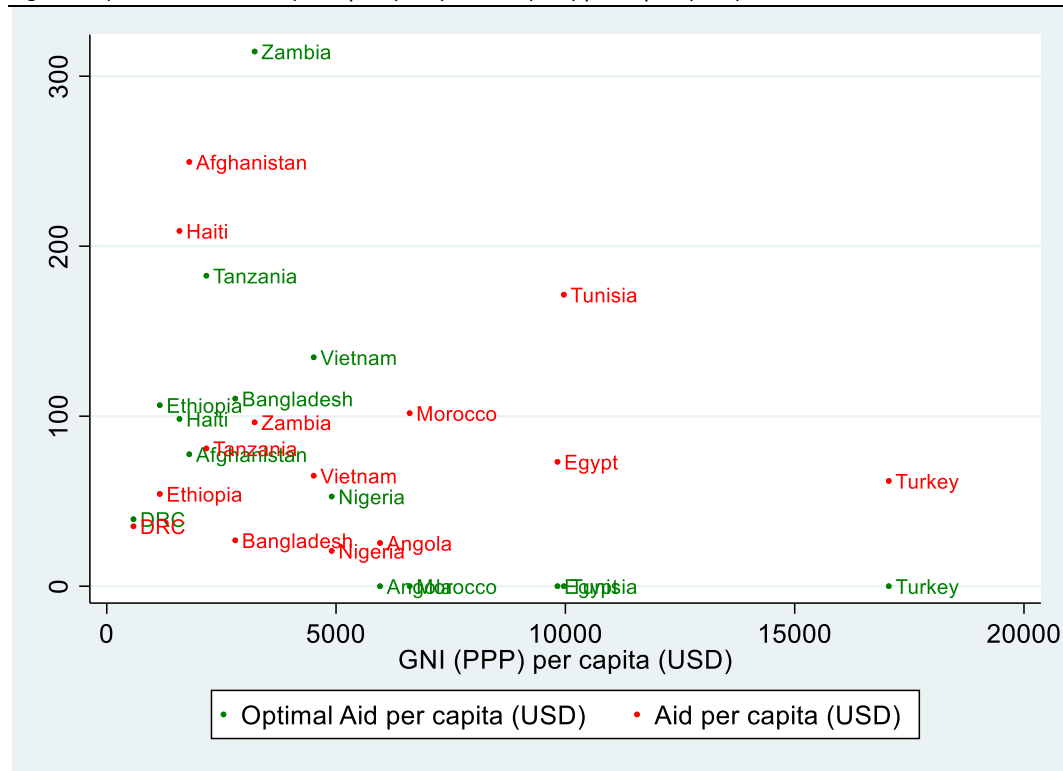


Figure 4: Orphans and darlings

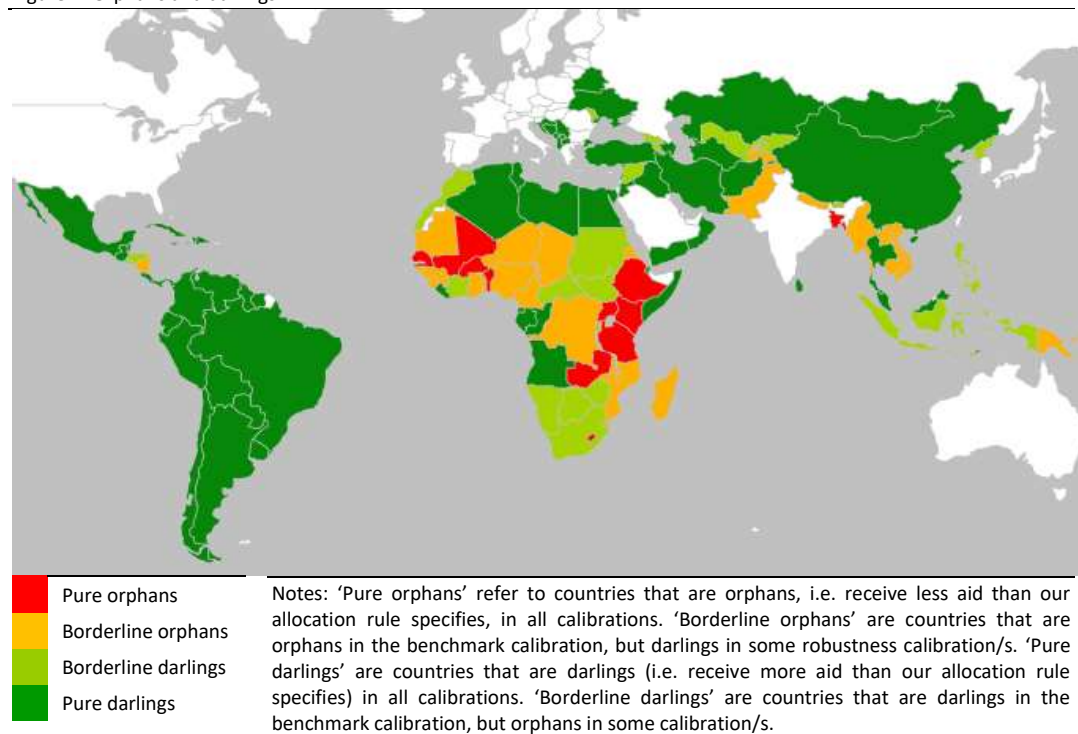


Table 1: Aggregate results, all donors

	1 Actual aid (mil USD)	2 Optimal aid (mil USD)	3 Optimal aid lower bound	4 Optimal aid upper bound	5 Rec. change (mil USD)	6 Rec. Change lower bound	7 Rec. change upper bound
<u>Orphans</u>							
Pure	25985	64595	40017	88124	38610	14032	62139
Borderline	38179	73107	9547	151442	34928	-28632	113263
Total	64164	137702			73538		
<u>Darlings</u>							
Pure	60385	6924	314	13675	-53461	-60071	-46710
Borderline	24840	4763	221	84785	-20077	-24619	59945
Total	85225	11687			-73538		
Grand Total	149389	149389			0		

Notes: 'Pure orphans' refer to countries that are classified as orphans, i.e. countries that receive less aid than our allocation rule specifies, in all calibrations. 'Borderline orphans' are countries that are orphans in the benchmark calibration, but darlings in some robustness calibration/s. 'Pure darlings' are countries that are darlings in all calibrations. 'Borderline darlings' are countries that are darlings in the benchmark calibration, but orphans in some calibration/s. The figures in Columns 2 and 5 are based on the benchmark calibration. Columns 3-4 and 6-7 are min and max values derived from the sensitivity analysis.

Table 2: Actual and optimal aid to pure orphans

	1	2	3	4	5	6	7	8	9	10	11	12	13
Country	population mil.	GDP/capita (USD)	Actual aid/capita (USD)	Actual aid/GDP %	Actual aid total (mil USD)	Optimal aid/capita USD	Optimal aid/GDP %	Optimal aid total (mil USD)	Optimal aid lower bound	Optimal aid upper bound	Rec. increase (mil USD)	Rec. increase lower b.	Rec. increase upper b.
Bangladesh	153	819	27	3.3	4141	110	13.5	16938	9707	24451	12798	5567	20311
Tanzania	47	770	81	10.5	3823	183	23.7	8616	5945	10981	4793	2122	7158
Ethiopia	90	410	54	13.2	4879	106	26.0	9573	6219	11973	4694	1340	7094
Kenya	41	1079	105	9.7	4348	193	17.9	8016	5465	11677	3668	1117	7329
Zambia	14	1558	96	6.2	1384	315	20.2	4517	2005	7008	3132	620	5623
Uganda	34	618	62	10.1	2140	141	22.8	4826	3360	5851	2687	1220	3712
Burkina Faso	16	635	80	12.6	1294	215	33.8	3460	1922	4939	2167	629	3646
Senegal	13	1034	100	9.6	1335	259	25.0	3460	2061	4648	2125	727	3313
Mali	16	759	110	14.5	1722	187	24.7	2932	1806	3745	1210	84	2023
Benin	10	798	70	8.8	687	187	23.4	1826	1207	2270	1139	520	1583
Lesotho	2	1083	115	10.6	234	211	19.5	430	320	581	197	86	347
All	438				25985			64595	40017	88124	38610	14032	62139

Table 3: Actual and optimal aid to pure darlings

	1	2	3	4	5	6	7	8	9	10	11	12	13
Country	Population (millions)	GDP/capita (USD)	Actual aid/capita (USD)	Actual aid / GDP, %	Actual aid (mil USD)	Optimal aid/capita USD	Optimal aid/GDP, %	Optimal aid (mil USD)	Optimal aid lower bound	Optimal aid upper bound	Rec. decrease (mil USD)	Rec. decrease lower b.	Rec. decrease upper b.
Egypt	84	2865	73	2.6	6142	0	0.0	0	0	0	6142	6142	6142
Afghanistan	29	599	250	41.7	7206	78	13.0	2241	0	3531	4965	3675	7206
Turkey	74	10123	62	0.6	4560	0	0.0	0	0	0	4560	4560	4560
Jordan	7	4240	537	12.7	3624	0	0.0	0	0	0	3624	3624	3624
Palestine	4	2549	619	24.3	2432	15	0.6	60	0	748	2371	1683	2432
Iraq	32	5495	67	1.2	2138	0	0.0	0	0	0	2138	2138	2138
China	1344	5429	1	0.0	1857	0	0.0	0	0	0	1857	1857	1857
Tunisia	11	4212	171	4.1	1829	0	0.0	0	0	0	1829	1829	1829
Sri Lanka	20	3022	90	3.0	1815	0	0.0	0	0	0	1815	1815	1815
Serbia	7	5934	228	3.8	1648	0	0.0	0	0	0	1648	1648	1648
Brazil	200	11373	7	0.1	1452	0	0.0	0	0	0	1452	1452	1452
Colombia	46	6909	26	0.4	1219	0	0.0	0	0	0	1219	1219	1219
Ukraine	46	3386	27	0.8	1215	0	0.0	0	0	0	1215	1215	1215
Haiti	10	730	209	28.6	2120	98	13.5	998	157	1545	1122	575	1963
Bolivia	10	2346	107	4.6	1083	0	0.0	0	0	1073	1083	10	1083



Mexico	120	9234	7	0.1	889	0	0.0	0	0	0	889	889	889
Bosnia-H	4	4633	228	4.9	873	0	0.0	0	0	0	873	873	873
Peru	30	5593	27	0.5	801	0	0.0	0	0	0	801	801	801
Lebanon	5	8612	157	1.8	732	0	0.0	0	0	0	732	732	732
Kosovo	2	3544	364	10.3	652	0	0.0	0	0	403	652	249	652
Somalia	10	521	108	20.8	1062	42	8.1	415	0	924	647	138	1062
Guatemala	15	3060	38	1.2	574	0	0.0	0	0	0	574	574	574
Angola	22	4545	25	0.6	558	0	0.0	0	0	475	558	83	558
Thailand	67	5405	8	0.1	540	0	0.0	0	0	0	540	540	540
Macedonia	2	4827	257	5.3	531	0	0.0	0	0	0	531	531	531
Liberia	4	375	209	55.6	848	82	22.0	335	142	425	513	424	706
Yemen	24	1306	122	9.4	2962	101	7.8	2456	0	2958	506	4	2962
Mongolia	3	3384	162	4.8	447	0	0.0	0	0	202	447	245	447
Algeria	37	4974	10	0.2	383	0	0.0	0	0	0	383	383	383
Albania	3	4261	124	2.9	361	0	0.0	0	0	0	361	361	361
Dominican-R	10	5623	35	0.6	348	0	0.0	0	0	0	348	348	348
Mauritius	1	8487	274	3.2	343	0	0.0	0	0	0	343	343	343
Congo-Brazz	4	3046	81	2.7	339	0	0.0	0	0	300	339	39	339
Cabo Verde	0	3560	677	19.0	336	0	0.0	0	0	253	336	83	336
Ecuador	15	5178	22	0.4	331	0	0.0	0	0	0	331	331	331
Azerbaijan	9	6638	34	0.5	312	0	0.0	0	0	0	312	312	312
Timor-Leste	1	983	305	31.0	339	32	3.3	36	0	172	304	167	339
Jamaica	3	5085	89	1.8	242	0	0.0	0	0	0	242	242	242
Mayotte	0	41911	995	2.4	229	0	0.0	0	0	0	229	229	229
Guyana	1	3359	303	9.0	229	0	0.0	0	0	0	229	229	229
Libya	6	10218	36	0.4	226	0	0.0	0	0	0	226	226	226
Kazakhstan	17	11101	13	0.1	220	0	0.0	0	0	0	220	220	220
Solomon-I	1	1569	577	36.8	310	171	10.9	92	0	155	218	156	310
Paraguay	6	3629	33	0.9	209	0	0.0	0	0	0	209	209	209
Fiji	1	4138	237	5.7	206	0	0.0	0	0	0	206	206	206
Montenegro	1	6895	292	4.2	181	0	0.0	0	0	0	181	181	181
Belarus	9	6349	18	0.3	170	0	0.0	0	0	0	170	170	170
Costa Rica	5	8738	37	0.4	170	0	0.0	0	0	0	170	170	170
Argentina	42	12570	4	0.0	162	0	0.0	0	0	0	162	162	162
Chile	17	13721	9	0.1	160	0	0.0	0	0	0	160	160	160
Cuba	11	6103	13	0.2	149	0	0.0	0	0	0	149	149	149
Djibouti	1	1476	361	24.5	304	188	12.7	158	0	179	146	125	304
Gabon	2	10029	89	0.9	141	0	0.0	0	0	0	141	141	141
Micronesia	0	2940	1334	45.4	138	0	0.0	0	0	7	138	131	138

Wallis-F	0	41911	11174	26.7	128	0	0.0	0	0	0	128	128	128
Samoa	0	3841	691	18.0	130	27	0.7	5	0	122	125	8	130
Iran	75	6791	2	0.0	120	0	0.0	0	0	0	120	120	120
Malaysia	29	9723	4	0.0	102	0	0.0	0	0	0	102	102	102
Equatorial-G	1	19923	133	0.7	100	0	0.0	0	0	0	100	100	100
Marshall-I	0	3285	1739	52.9	91	0	0.0	0	0	0	91	91	91
Tonga	0	3875	825	21.3	86	0	0.0	0	0	33	86	53	86
Vanuatu	0	3042	668	22.0	162	314	10.3	76	0	106	86	56	162
Suriname	1	8696	145	1.7	76	0	0.0	0	0	0	76	76	76
Panama	4	9451	20	0.2	75	0	0.0	0	0	0	75	75	75
Maldives	0	6498	191	2.9	72	0	0.0	0	0	0	72	72	72
St. Helena	0	40014	12986	32.5	65	0	0.0	0	0	0	65	65	65
Uruguay	3	13499	18	0.1	60	0	0.0	0	0	0	60	60	60
Montserrat	0	40014	10399	26.0	52	0	0.0	0	0	0	52	52	52
Dominica	0	6931	705	10.2	50	0	0.0	0	0	0	50	50	50
Seychelles	0	12248	560	4.6	50	0	0.0	0	0	0	50	50	50
Belize	0	4503	149	3.3	49	0	0.0	0	0	0	49	49	49
Venezuela	29	12181	2	0.0	48	0	0.0	0	0	0	48	48	48
Turkmenistan	5	5708	9	0.2	47	0	0.0	0	0	0	47	47	47
Kiribati	0	1515	666	44.0	70	229	15.1	24	0	28	46	42	70
Sao Tome-P	0	1366	404	29.6	71	154	11.3	27	15	36	44	35	56
Palau	0	9819	1767	18.0	36	0	0.0	0	0	0	36	36	36
Tuvalu	0	3584	3514	98.1	35	0	0.0	0	0	0	35	35	35
Nauru	0	11332	3235	28.6	33	0	0.0	0	0	0	33	33	33
St. Lucia	0	7116	164	2.3	29	0	0.0	0	0	0	29	29	29
Grenada	0	7542	274	3.6	29	0	0.0	0	0	0	29	29	29
Cook Islands	0	36663	1486	4.1	25	0	0.0	0	0	0	25	25	25
Croatia	4	13804	6	0.0	24	0	0.0	0	0	0	24	24	24
St. Kitts-N	0	13763	449	3.3	24	0	0.0	0	0	0	24	24	24
St. Vincent-G	0	6304	209	3.3	23	0	0.0	0	0	0	23	23	23
Antigua-B	0	13336	228	1.7	20	0	0.0	0	0	0	20	20	20
Niue	0	36663	11944	32.6	19	0	0.0	0	0	0	19	19	19
Tokelau	0	36663	11507	31.4	17	0	0.0	0	0	0	17	17	17
Anguilla	0	40014	518	1.3	8	0	0.0	0	0	0	8	8	8
Oman	3	20030	2	0.0	8	0	0.0	0	0	0	8	8	8
Trinidad-T	1	17435	1	0.0	2	0	0.0	0	0	0	2	2	2
Barbados	0	15686	4	0.0	1	0	0.0	0	0	0	1	1	1
All	2593				60385			6924	314	13675	53461	46710	60071

Table 4 : Aid volumes and poverty reducing efficiency, by donor groups

	1	2	3	4	5	6
	Volume (milj \$)	Poverty reducing efficiency per \$	Lower bound	Upper bound	Proportion of poverty reduction (%)	Average poverty in recipient countries
All Donors Total	149389	100	100	100	100,0	23.8
Old aid (total)	122279	104,3	102,9	105,6	85,4	24.7
Bilateral DAC donors	68090	90,5	89,4	94,9	41,2	24.0
EC	19007	66,9	58,1	69,7	8,5	15.7
UN	2905	139,7	113	161	2,7	30.1
WB	14255	194,1	177,7	203,2	18,5	35.3
IMF	1325	111,2	92,1	173,8	1,0	33.8
Regional development banks	7561	125	115,1	138,7	6,3	27.2
Other multilateral donors (excl. Vertical Funds)	2243	62,2	56,2	67,5	0,9	14.7
NGOs	6893	133,4	102,7	157	6,2	31.2
New aid (total)	27110	80,5	74,7	87	14,6	20.0
Bilateral non-DAC donors	21382	63,5	55	73,8	9,1	15.9
New global actors	5729	144,1	134,6	162,1	5,5	35.2
Vertical funds	5033	140,7	125,6	155	4,7	34.7
Bill and Melinda Gates Fund	696	168,9	134,5	223,7	0,8	38.9
New Financial flows						
OOF	82860					10.2
Personal remittances	264463					14.0
FDI	580858					10.2

Notes: All volumes in the first column, except the new financial flows, refer to ODA; The average poverty reducing efficiency for all donors is set to 100; The upper and lower bounds are derived from the sensitivity analysis; Column 5 gives the proportion of total poverty reduction – defined as poverty reduction efficiency per aid dollar multiplied by the total aid volume – achieved by each donor or donor group. Column 6 gives the average poverty in recipient countries, weighed by financial flow volume.

Table 5: Allocation across orphan and darling countries, in per capita terms as well as the percentage share of the financial flow going to the group in question

		All aid	Old aid		New aid		New Financial Flows		
		Total	Traditional aid (Bi- & Multilateral)	NGOs	Bilateral Non-DAC	New actors	OOF	FDI	Personal remittances
Pure orphans	USD per capita	59,4	49,3	2,9	4,0	3,1	9,2	16,8	41,3
	Share (%)	17,4	18,8	18,7	8,2	23,6	4,9	1,3	6,8
Borderline orphans	USD per capita	47,8	38,5	2,1	4,1	3,1	15,0	40,0	64,4
	Share (%)	25,6	26,8	24,4	15,4	42,6	14,4	5,5	19,4
Borderline darlings	USD per capita	39,4	29,1	2,3	6,4	1,5	21,6	59,0	95,6
	Share (%)	16,6	16,0	21,2	18,9	16,9	16,4	6,4	22,8
Pure darlings	USD per capita	23,3	17,2	0,9	4,7	0,4	20,5	194,6	52,0
	Share (%)	40,5	38,9	35,7	57,5	16,9	64,3	86,8	50,9
Total	USD per capita	33,5	25,9	1,5	4,8	1,3	18,6	130,3	59,3
	Share (%)	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

## Appendix A: Tables referred to in the text

Table A1: Variable descriptions

Variable	Description	Source
<u>Old aid</u>		
DAC bilateral aid	ODA from Bilateral DAC donors, yearly average 2009-2013 in USD.	AidData (2017a)
Multilateral aid	ODA from EC, UN, WB, IMF, Regional Banks, and other multilateral donors (except Vertical funds), yearly average 2009-2013 in USD.	AidData (2017a)
<u>Aid from NGOs</u>		
NGO data from Koch et al.	Aid from NGOs in 2005	Koch et al. (2009)
NGO data from MSF & ICRS	Aid from Doctors without borders (MSF) the International Red Cross (ICRC).	Médecins Sans Frontières (2010, 2011, 2012, 2013, 2014).
	Yearly averages 2009-2013 in USD.	International Committee of the Red Cross (2010, 2011, 2012, 2013, 2014).
<u>New aid</u>		
Non-DAC bilateral aid	ODA from Brazil, Chile, Colombia, Estonia, India, Kuwait, Latvia, Liechtenstein, Lithuania, Monaco, South Africa, Taiwan, Thailand, and United Arab Emirates. We also include Czech Republic, Hungary, Iceland, Poland, Slovak Republic, and Slovenia since they were not DAC-members most of the period 2009-13.	AidData (2014a, 2014b, 2017a, 2017b)
	‘Tracking Under-reported Financial Flows (TUFF) data on ‘ODA-like’ flows from China, Qatar and Saudi Arabia.	
	Yearly average 2009-2013 in USD.	OECD-DAC (2020)
	ODA from Bulgaria, Croatia, Israel, Kazakhstan, Russia, and Turkey	
New global actors	Yearly average 2009-2013 in USD.	AidData (2017a)
	Aid from the Bill and Melinda Gates Foundation (BMGF), the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM), the Global Alliance for Vaccines and Immunization (GAVI), and the Global Environment Facility (GEF).	
	Yearly average 2009-2013 in USD.	
<u>Non-aid flows</u>		
Other Official Flows, OOF	Transactions by the official sector which do not meet (all) the conditions for eligibility as ODA (being concessional, having a grant element of at least 25 percent, and a development objective),	AidData (2014a, 2014b, 2017a, 2017b)
	We use 2013 in USD, since data is missing for the other years.	
	We use Commitments and Current USD (just as in the aid data from the Aiddata 3.1 dataset)	
FDI	Foreign direct investment, net inflows (BoP, current US\$).	World Bank (2019b)
Remittances	Personal remittances, received (current US\$)	World Bank (2019b)
<u>Other variables</u>		
GDP per capita	GDP per capita in current USD	World Bank (2019b)
GNI (PPP) per capita	GNI per capita (current international \$, PPP-adjusted)	World Bank (2019b)
Poverty	Poverty index based on GNI/capita (PPP): $h_i^0 = ky_{PPP,i}^{-\alpha}$ Where $k$ is a constant, $\alpha$ is elasticity of poverty with respect to income, and $y_{PPP,i}$ is GNI/cap (PPP) in country $i$ .	World Bank (2019b)
	Headcount ratio at \$1.90 a day (PPP), % of population	
	Headcount ratio at \$3.10 a day (PPP), % of population	
	Average 2009-2013	
Population, total	Population	World Bank (2019b)

	Average 2009-2013	
Country Performance Rating (CPR)	Country performance rating of the International Development Association, World Bank. $CPR = 0.24CPIA_{A to C} + 0.68CPIA_D + 0.08PPR$ , where the country policy and institutional assessment (CPIA) index is based on indicators focusing on (A) macroeconomic management, (B) structural policies, (C) social policies, and (D) public sector management and institutions, and PPR is the IDA portfolio performance rating.	IDA (2017b)
	We do not do these calculations by hand. CPR is already available, as its own dataset, for all the countries in the CPIA dataset.	
	Average 2009-2013	
Augmented Country Performance Rating (ACPR)	Augmented Country Performance Rating is a weighted average of the World Bank CPR and the Economic Vulnerability Index (EVI) and Human Assets Index (HAI) of the UN.	Weighting as suggested by Guillaumont, Guillaumont-Jenneney and Wagner (2017: 32).
<u>Help variables:</u>		
WGI (Worldwide Governance Indicators)	If CPR is missing, we use predicted CPR from WGI	World Bank (2019c)
Economic Vulnerability Index (EVI) and Human Assets Index (HAI)	Used to construct ACPR. EVI and HAI are from 2012 due to data limitations.	United Nations (2019a)
Human Development Index	If HAI & EVI is missing, then we predict ACPR from HDI. If also HDI is missing, we use ACPR = CPR.	UNDP (2016)
	Average 2010-2013 due to data limitations	
Life expectancy at birth	In years. Used to predict poverty when Poverty 1.90 and/or poverty 3.10 is missing.	World Bank (2019b)
Poverty headcount ratio at national poverty lines (% of population)	Used to predict poverty when Poverty 1.90 and/or poverty 3.10 is missing.	
CPIA (Country Policy and Institutional Assessment)	Used to find calibrations of the interaction of Policy and aid.	IDA (2017a)

Table A2 Descriptive statistics for pure orphan countries

Country	Population (milj)	GDP per capita (USD)	Poverty index	CPR	ACPR	Aid per capita (USD)	Aid / GDP (%)	Aid total (milj. USD)	OOF per capita (USD)	FDI per capita (USD)	Remittances per capita (USD)
Bangladesh	153	819	18.2	3.1	3.1	27	3.3	4141	4.0	9.9	80.1
Benin	10	798	36.0	3.4	3.4	70	8.8	687	6.1	17.1	18.3
Burkina Faso	16	635	49.4	3.7	3.7	80	12.6	1294	7.7	13.1	11.9
Ethiopia	90	410	68.7	3.3	3.4	54	13.2	4879	20.3	5.3	5.3
Kenya	41	1079	20.4	3.5	3.3	105	9.7	4348	7.0	4.7	23.0
Lesotho	2	1083	18.0	3.4	3.3	115	10.6	234	0.0	28.5	277.6
Mali	16	759	34.7	3.3	3.4	110	14.5	1722	9.3	29.2	43.9
Senegal	13	1034	27.2	3.6	3.5	100	9.6	1335	10.1	22.8	114.7
Tanzania	47	770	26.7	3.5	3.4	81	10.5	3823	4.3	33.4	6.6
Uganda	34	618	42.8	3.4	3.3	62	10.1	2140	8.5	26.7	24.6
Zambia	14	1558	14.8	3.3	3.5	96	6.2	1384	25.7	102.6	3.6

Table A3: Descriptive statistics for borderline orphan countries

Country	Population (milj.)	GDP per capita (USD)	Poverty index	CPR	ACPR	Aid per capita (USD)	Aid / GDP (%)	Aid total (milj. USD)	OOF per capita (USD)	FDI per capita (USD)	Remittances per capita (USD)
Cambodia	15	874	21.1	3.0	3.1	93	10.6	1358	53.3	66.1	11.0
Cameroon	21	1225	20.4	3.0	3.0	63	5.1	1323	11.4	28.5	9.2
Chad	12	929	34.3	2.4	3.0	63	6.8	781	1.7	33.6	0.1
DRC	68	350	100.0	2.5	2.9	35	10.1	2400	1.2	-2.4	0.6
Eritrea	5	467	56.3	2.5	3.0	23	4.9	108	0.0	13.1	0.7
Gambia	2	524	43.5	3.2	3.4	128	24.4	224	12.1	21.0	71.4
Ghana	25	1495	14.2	3.7	3.3	74	5.0	1857	13.4	117.7	51.4
Guinea	11	463	75.9	2.7	2.9	44	9.6	502	6.0	19.6	5.7
Guinea-Bissau	2	572	54.8	2.6	3.0	62	10.8	103	0.0	11.5	30.6
Laos	6	1309	10.6	3.2	3.1	97	7.4	620	316.5	50.9	9.7
Madagascar	22	439	53.9	3.0	3.0	32	7.2	688	0.1	38.9	19.4
Malawi	15	431	80.3	3.3	3.4	101	23.4	1538	3.0	24.4	1.7
Mauritania	4	1300	13.9	3.1	3.2	175	13.4	643	19.7	175.2	20.9
Mozambique	25	515	93.1	3.5	3.6	114	22.2	2856	1.7	145.3	5.5
Myanmar	52	1264	17.2	2.8	2.9	38	3.0	2005	0.8	31.0	8.5
Nepal	27	631	28.7	3.1	3.0	61	9.7	1669	0.5	2.8	154.8
Nicaragua	6	1657	10.2	3.4	3.1	131	7.9	762	25.1	118.6	158.6
Niger	17	377	100.0	3.3	3.4	80	21.2	1358	2.8	47.9	8.2
Nigeria	164	2328	7.9	3.1	3.1	21	0.9	3405	6.7	44.0	122.1
Pakistan	174	1165	8.8	3.1	3.0	27	2.3	4724	25.0	9.1	68.3
PNG	7	1746	25.8	3.0	3.0	109	6.2	763	12.3	2.6	1.5
Rwanda	11	607	52.5	3.7	3.7	124	20.4	1311	2.0	13.0	12.9
Sierra Leone	6	568	46.0	3.2	3.4	103	18.2	612	12.7	82.9	9.2
Tajikistan	8	854	25.8	3.1	2.9	68	8.0	529	9.0	5.5	385.6
Togo	7	548	76.1	2.8	2.9	50	9.0	325	6.5	37.0	50.5
Vietnam	88	1554	8.9	3.6	3.2	65	4.2	5715	25.5	91.7	86.8



Table A4: Descriptive statistics for borderline darling countries

Country	Population (milj.)	GDP per capita (USD)	Poverty	CPR	ACPR	Aid per capita (USD)	Aid / GDP (%)	Aid total (milj. USD)	OOF per capita (USD)	FDI per capita (USD)	Remittances per capita (USD)
Armenia	3	3348	4.4	3.9	3.4	158	4.7	469	74.1	189.6	606.3
Bhutan	1	2262	5.4	3.9	3.7	502	22.2	367	0.0	54.4	14.6
Botswana	2	6511	1.7	4.1	3.7	80	1.2	168	78.9	338.1	10.7
Burundi	10	230	100.0	2.9	3.3	67	29.2	657	0.0	0.2	4.2
CAR	5	436	100.0	2.6	3.0	77	17.7	349	0.0	9.4	0.0
Comoros	1	767	54.5	2.6	2.9	145	18.9	104	0.0	16.7	145.6
Cote d'Ivoire	21	1286	20.0	2.8	2.9	85	6.6	1753	15.9	17.4	17.8
El Salvador	6	3744	4.3	3.8	3.3	51	1.4	309	58.6	35.3	606.7
Georgia	4	3563	4.5	4.1	3.5	242	6.8	938	100.8	180.9	390.0
Honduras	8	2232	9.9	3.3	3.0	102	4.6	781	14.5	109.2	365.5
Indonesia	245	3274	3.4	3.5	3.0	11	0.3	2664	14.9	69.6	29.0
Kyrgyzstan	6	1067	18.7	3.2	3.0	159	14.9	880	31.0	81.3	298.7
Moldova	4	1884	9.0	3.6	3.2	165	8.7	587	51.6	71.2	479.7
Morocco	33	2979	5.0	3.6	3.2	102	3.4	3314	84.2	73.3	204.8
Namibia	2	5181	3.5	3.8	3.4	185	3.6	416	130.2	175.4	6.1
North Korea	25	1137	42.2	2.1	2.3	4	0.4	108	0.1	3.7	
Philippines	95	2349	4.3	3.7	3.2	18	0.8	1742	18.8	25.6	245.1
South Africa	52	7172	2.1	4.0	3.4	30	0.4	1527	16.4	109.8	20.0
South Sudan	11	1327	25.9	2.1	2.5	113	8.5	1191	5.5	-30.0	0.2
Sudan	37	1518	14.0	2.3	2.6	71	4.7	2606	15.0	51.6	26.5
Swaziland	1	3473	4.4	3.3	3.2	100	2.9	121	0.0	68.3	40.8
Syria	20	1217	16.4	3.0	2.7	88	7.3	1786	0.1	99.9	77.6
Uzbekistan	29	1540	8.6	3.0	2.9	26	1.7	769	55.9	36.4	148.2
Zimbabwe	14	759	51.2	2.1	2.4	86	11.4	1233	9.4	20.4	119.6

Table A5: Descriptive statistics for pure darling countries

Country	Population (milj.)	GDP per capita (USD)	Poverty	CPR	ACPR	Aid per capita (USD)	Aid / GDP (%)	Aid total (milj. USD)	OOF per capita (USD)	FDI per capita (USD)	Remittances per capita (USD)
Afghanistan	29	599	35.4	2.6	3.0	250	41.7	7206	0.5	2.8	8.6
Albania	3	4261	2.8	3.6	3.2	124	2.9	361	135.1	388.9	393.4
Algeria	37	4974	1.8	3.1	2.8	10	0.2	383	0.0	58.8	5.3
Angola	22	4545	5.9	2.5	3.0	25	0.6	558	48.4	-164.5	0.2
Anguilla	0	40014	0.4	4.8	4.8	518	1.3	8	0.0		
Antigua-B	0	13336	1.0	4.1	3.5	228	1.7	20	113.4	1148.4	234.0
Argentina	42	12570	0.9	3.4	2.9	4	0.0	162	39.3	246.4	14.7
Azerbaijan	9	6638	1.5	3.3	2.9	34	0.5	312	96.6	406.4	180.5
Barbados	0	15686	1.5	4.5	3.7	4	0.0	1	1.2	1385.7	408.5
Belarus	9	6349	1.4	2.9	2.6	18	0.3	170	175.9	231.7	89.4
Belize	0	4503	4.3	3.4	3.2	149	3.3	49	0.0	356.8	232.4
Bolivia	10	2346	6.9	3.3	3.1	107	4.6	1083	20.8	93.5	106.6
Bosnia-H	4	4633	2.9	3.4	3.1	228	4.9	873	99.8	93.1	506.3
Brazil	200	11373	1.6	3.7	3.1	7	0.1	1452	37.0	375.9	14.7
Cabo Verde	0	3560	6.1	4.0	3.5	677	19.0	336	206.4	227.3	321.9
Chile	17	13721	1.1	4.7	3.9	9	0.1	160	42.4	1161.2	6.0
China	1344	5429	2.6	3.7	3.1	1	0.0	1857	4.9	176.6	11.1
Colombia	46	6909	2.3	3.8	3.2	26	0.4	1219	36.3	260.2	89.3
Congo-Brazz	4	3046	9.8	2.7	2.8	81	2.7	339	3.0	452.6	12.9
Cook Islands	0	36663	0.5	2.9	2.9	1486	4.1	25	352.9		
Costa Rica	5	8738	1.9	4.0	3.4	37	0.4	170	135.9	516.3	118.4
Croatia	4	13804	1.0	4.1	3.4	6	0.0	24	0.0	390.0	468.4
Cuba	11	6103	1.1	3.1	2.8	13	0.2	149	0.0		
Djibouti	1	1476	18.2	2.9	3.1	361	24.5	304	148.2	144.5	39.5
Dominica	0	6931	2.8	3.8	3.3	705	10.2	50	195.9	341.6	321.1
Dominican-R	10	5623	2.4	3.4	3.0	35	0.6	348	68.6	206.0	404.8
Ecuador	15	5178	2.8	3.1	2.8	22	0.4	331	143.7	31.8	170.7
Egypt	84	2865	2.8	3.3	2.9	73	2.6	6142	40.0	46.7	169.2
Equatorial-G	1	19923	1.0	2.5	2.8	133	0.7	100	154.4	2145.3	0.2
Fiji	1	4138	4.2	3.1	2.9	237	5.7	206	29.3	309.0	207.6
Gabon	2	10029	1.5	3.1	3.0	89	0.9	141	65.5	427.3	14.3
Grenada	0	7542	2.5	3.6	3.2	274	3.6	29	0.0	593.4	274.1
Guatemala	15	3060	5.0	3.3	3.0	38	1.2	574	13.4	70.4	308.1

Guyana	1	3359	5.6	3.1	2.9	303	9.0	229	0.0	287.7	486.7
Haiti	10	730	42.8	2.7	3.0	209	28.6	2120	1.2	13.2	153.7
Iran	75	6791	1.2	3.0	2.8	2	0.0	120	4.6	49.5	15.9
Iraq	32	5495	1.7	2.8	2.9	67	1.2	2138	19.8	85.2	6.8
Jamaica	3	5085	3.6	3.8	3.3	89	1.8	242	122.2	137.2	767.7
Jordan	7	4240	2.6	3.8	3.2	537	12.7	3624	50.5	263.9	591.4
Kazakhstan	17	11101	1.0	3.4	2.9	13	0.1	220	139.5	713.6	11.9
Kiribati	0	1515	21.0	3.1	3.2	666	44.0	70	5.7	-6.1	150.0
Kosovo	2	3544	3.5	3.4	3.4	364	10.3	652	27.4	232.1	598.2
Lebanon	5	8612	1.4	3.5	3.0	157	1.8	732	32.2	790.4	1527.5
Liberia	4	375	100.0	2.9	3.3	209	55.6	848	4.3	159.3	64.7
Libya	6	10218	0.8	2.7	2.4	36	0.4	226	9.6	210.9	2.6
Macedonia	2	4827	2.1	3.7	3.2	257	5.3	531	0.0	175.2	191.1
Malaysia	29	9723	0.9	4.3	3.6	4	0.0	102	1.1	324.2	43.1
Maldives	0	6498	2.9	3.4	3.2	191	2.9	72	173.6	736.9	9.1
Marshall-I	0	3285	9.7	2.8	2.8	1739	52.9	91	0.0	208.7	440.5
Mauritius	1	8487	1.3	4.4	3.6	274	3.2	343	275.1	319.6	0.5
Mayotte	0	41911	0.4	4.7	4.7	995	2.4	229	0.0		
Mexico	120	9234	1.4	3.9	3.3	7	0.1	889	21.8	223.2	190.4
Micronesia	0	2940	12.9	2.8	2.7	1334	45.4	138	46.5	7.7	188.5
Mongolia	3	3384	3.6	3.4	3.2	162	4.8	447	96.5	987.1	95.7
Montenegro	1	6895	1.6	3.7	3.1	292	4.2	181	218.9	1267.5	549.5
Montserrat	0	40014	0.4	4.9	4.9	10399	26.0	52	0.0		
Nauru	0	11332	1.6	3.1	3.1	3235	28.6	33	0.0	27.6	412.0
Niue	0	36663	0.5	2.9	2.9	11944	32.6	19	0.0		
Oman	3	20030	0.3	4.0	3.4	2	0.0	8	0.0	379.3	11.9
Palau	0	9819	2.0	3.1	2.8	1767	18.0	36	0.0	518.8	96.6
Palestine	4	2549	8.2	3.4	3.1	619	24.3	2432	0.0	49.4	308.3
Panama	4	9451	1.4	3.9	3.3	20	0.2	75	185.6	851.9	107.4
Paraguay	6	3629	4.7	3.2	3.0	33	0.9	209	57.1	52.7	82.1
Peru	30	5593	2.8	3.7	3.2	27	0.5	801	20.4	294.0	88.2
Samoa	0	3841	7.0	4.1	3.6	691	18.0	130	4.5	59.3	810.6
Sao Tome-P	0	1366	18.0	3.2	3.1	404	29.6	71	0.0	144.8	55.1
Serbia	7	5934	2.0	3.6	3.1	228	3.8	1648	105.4	355.9	560.6
Seychelles	0	12248	0.9	3.7	3.3	560	4.6	50	414.9	2579.1	201.7
Solomon-I	1	1569	42.5	2.8	3.0	577	36.8	310	63.9	153.2	31.6
Somalia	10	521	65.1	2.0	2.8	108	20.8	1062	0.0	17.8	2.2

Sri Lanka	20	3022	3.1	3.4	3.0	90	3.0	1815	73.5	36.6	247.0
St. Helena	0	40014	0.4	4.9	4.9	12986	32.5	65	0.0		
St. Kitts-N	0	13763	1.0	4.2	3.7	449	3.3	24	0.0	2112.5	879.7
St. Lucia	0	7116	2.6	3.9	3.3	164	2.3	29	0.0	584.7	163.5
St. Vincent-G	0	6304	2.7	3.8	3.3	209	3.3	23	0.0	979.2	274.5
Suriname	1	8696	1.5	3.5	3.4	145	1.7	76	277.1	61.3	10.6
Thailand	67	5405	1.8	3.9	3.3	8	0.1	540	1.8	156.3	63.7
Timor-Leste	1	983	4.9	2.7	3.0	305	31.0	339	50.8	40.2	97.2
Tokelau	0	36663	0.5	5.1	5.1	11507	31.4	17	0.0		
Tonga	0	3875	7.5	3.6	3.3	825	21.3	86	3.1	41.4	894.6
Trinidad-T	1	17435	0.6	4.0	3.4	1	0.0	2	22.5	1037.1	86.7
Tunisia	11	4212	2.7	3.7	3.1	171	4.1	1829	47.5	110.7	198.6
Turkey	74	10123	1.2	4.0	3.3	62	0.6	4560	53.3	161.7	25.3
Turkmenistan	5	5708	2.5	2.4	2.4	9	0.2	47	319.3	721.9	7.1
Tuvalu	0	3584	7.1	3.0	2.9	3514	98.1	35	0.0	76.2	431.2
Ukraine	46	3386	3.8	3.2	2.8	27	0.8	1215	40.8	136.0	168.0
Uruguay	3	13499	1.2	4.1	3.5	18	0.1	60	218.8	714.4	35.5
Vanuatu	0	3042	18.0	3.4	3.2	668	22.0	162	7.3	228.3	75.0
Venezuela	29	12181	1.2	2.7	2.5	2	0.0	48	65.4	91.3	4.4
Wallis-F	0	41911	0.4	4.7	4.7	11174	26.7	128	0.0		
Yemen	24	1306	11.8	2.9	3.0	122	9.4	2962	16.8	-2.9	89.0

Table A6: Actual and optimal aid to borderline orphans

Country	1 Population (millions)	2 GDP/capita (USD)	3 Actual aid/capita (USD)	4 Actual aid / GDP, %	5 Actual aid (mil USD)	6 Optimal aid/capita USD	7 Optimal aid/GDP, %	8 Optimal aid (mil USD)	9 Optimal aid lower bound	10 Optimal aid upper bound	11 Rec. decrease (mil USD)	12 Rec. decrease lower b.	13 Rec. decrease upper b.
Pakistan	174	1165	27	2.3	4724	83	7.1	14383	0	20577	9659	-4724	15852
Vietnam	88	1554	65	4.2	5715	135	8.7	11831	0	22479	6117	-5715	16764
Nigeria	164	2328	21	0.9	3405	53	2.3	8647	0	49705	5243	-3405	46301
Ghana	25	1495	74	5	1857	250	16.7	6239	0	8917	4382	-1857	7060
Myanmar	52	1264	38	3	2005	78	6.2	4065	0	7590	2060	-2005	5585
Cameroon	21	1225	63	5.1	1323	118	9.6	2489	349	3829	1166	-974	2507
Mozambique	25	515	114	22.2	2856	157	30.5	3936	2316	5308	1079	-540	2451
Rwanda	11	607	124	20.4	1311	193	31.7	2032	1182	2825	721	-129	1514
Madagascar	22	439	32	7.2	688	61	14	1333	591	2263	645	-96	1575
PNG	7	1746	109	6.2	763	200	11.4	1397	547	1838	635	-216	1075
Chad	12	929	63	6.8	781	108	11.6	1326	0	2141	545	-781	1360
Cambodia	15	874	93	10.6	1358	126	14.4	1840	651	2373	483	-707	1015
Nepal	27	631	61	9.7	1669	77	12.2	2084	598	3844	414	-1072	2175
Niger	17	377	80	21.2	1358	101	26.7	1711	1021	2154	352	-338	796
Sierra Leone	6	568	103	18.2	612	145	25.6	859	424	1087	247	-187	475
Laos	6	1309	97	7.4	620	129	9.8	820	464	1237	200	-156	618
Tajikistan	8	854	68	8	529	93	10.8	718	0	1331	190	-529	802
Eritrea	5	467	23	4.9	108	59	12.7	279	0	462	171	-108	354
DRC	68	350	35	10.1	2400	38	10.7	2557	0	4828	157	-2400	2428
Malawi	15	431	101	23.4	1538	111	25.8	1695	1078	2109	157	-459	572
Togo	7	548	50	9	325	64	11.7	421	106	800	95	-220	475
Nicaragua	6	1657	131	7.9	762	143	8.6	831	0	1338	69	-762	576
Guinea	11	463	44	9.6	502	50	10.7	564	93	1133	62	-409	631
Guinea-Bissau	2	572	62	10.8	103	85	14.9	143	8	215	40	-95	111
Mauritania	4	1300	175	13.4	643	184	14.2	679	0	776	35	-643	132
Gambia	2	524	128	24.4	224	129	24.7	227	119	281	3	-105	57
All	798				38179			73107	9547	151442	34928	-28632	113263

Table A7: Actual and optimal aid to Borderline Darlings

Country	1 Population (millions)	2 GDP/capita (USD)	3 Actual aid/capita (USD)	4 Actual aid / GDP, %	5 Actual aid (mil USD)	6 Optimal aid/capita USD	7 Optimal aid/GDP, %	8 Optimal aid (mil USD)	9 Optimal aid lower bound	10 Optimal aid upper bound	11 Rec. decrease (mil USD)	12 Rec. decrease lower b.	13 Rec. decrease upper b.
Morocco	33	2979	102	3.4	3314	0	0	0	0	5044	3314	-1730	3314
Indonesia	245	3274	11	0.3	2664	0	0	0	0	23318	2664	-20654	2664
Sudan	37	1518	71	4.7	2606	0	0	0	0	3036	2606	-430	2606
Philippines	95	2349	18	0.8	1742	0	0	0	0	16482	1742	-14740	1742
Syria	20	1217	88	7.3	1786	10	0.8	208	0	3004	1578	-1218	1786
South Africa	52	7172	30	0.4	1527	0	0	0	0	8760	1527	-7232	1527
Zimbabwe	14	759	86	11.4	1233	0	0	0	0	1519	1233	-287	1233
South Sudan	11	1327	113	8.5	1191	0	0	0	0	1209	1191	-18	1191
Georgia	4	3563	242	6.8	938	0	0	0	0	1807	938	-869	938
Uzbekistan	29	1540	26	1.7	769	8	0.5	241	0	2783	528	-2014	769
Armenia	3	3348	158	4.7	469	0	0	0	0	852	469	-383	469
Namibia	2	5181	185	3.6	416	0	0	0	0	1332	416	-917	416
Honduras	8	2232	102	4.6	781	48	2.2	369	0	1596	412	-815	781
El Salvador	6	3744	51	1.4	309	0	0	0	0	1212	309	-903	309
Bhutan	1	2262	502	22.2	367	178	7.9	130	0	408	237	-41	367
Kyrgyzstan	6	1067	159	14.9	880	126	11.8	698	0	1100	182	-220	880
Botswana	2	6511	80	1.2	168	0	0	0	0	1846	168	-1679	168
Swaziland	1	3473	100	2.9	121	0	0	0	0	465	121	-344	121
Burundi	10	230	67	29.2	657	55	23.9	539	198	657	118	0	459
North Korea	25	1137	4	0.4	108	0	0	0	0	3464	108	-3355	108
CAR	5	436	77	17.7	349	55	12.6	249	24	423	101	-73	326
Moldova	4	1884	165	8.7	587	150	7.9	533	0	923	54	-336	587
Comoros	1	767	145	18.9	104	77	10.1	55	0	104	48	-1	104
Cote d'Ivoire	21	1286	85	6.6	1753	84	6.6	1741	0	3442	12	-1689	1753
All	631				24840			4763	221	84785	20077	-59945	24619

Table A8: Aid volumes and poverty reducing efficiency for individual donors

	1	2	3	4	5
	Volume (milj \$)	Poverty reducing efficiency per \$	Lower bound	Upper bound	Proportion of poverty reduction (%)
<u>All Donors Total</u>	149389	100.0	100.0	100.0	100.00
<u>Old aid</u>	122279	104.3	102.9	105.6	85.38
<u>DAC bilateral donors</u>	68090	90.5	89.4	94.9	41.23
Australia	2706	29.1	22.3	66.3	0.53
Austria	281	85.5	65.8	106.3	0.16
Belgium	872	351.5	128.2	512.1	2.05
Canada	2046	166.3	140.4	189.5	2.28
Denmark	1209	142.4	112.9	190.1	1.15
Finland	528	135.6	124.2	155.7	0.48
France	6331	53.1	49.0	67.9	2.25
Germany	6876	69.1	64.2	72.9	3.18
Greece	64	20.9	10.1	31.5	0.01
Ireland	430	281.3	204.9	334.5	0.81
Italy	543	111.6	85.9	123.7	0.41
Japan	12445	50.0	42.1	84.0	4.17
Korea	1625	89.6	81.0	117.6	0.98
Luxembourg	198	148.2	127.7	189.6	0.20
Netherlands	1309	191.8	150.8	225.2	1.68
New Zealand	243	10.7	6.3	30.7	0.02
Norway	1841	128.9	105.2	141.7	1.59
Portugal	358	223.4	108.4	329.4	0.54
Spain	1469	77.8	61.6	83.8	0.76
Sweden	1455	141.3	122.1	164.1	1.38
Switzerland	1063	108.4	95.5	120.8	0.77
United Kingdom	3186	154.1	139.3	174.5	3.29
United States	21012	89.3	87.2	93.1	12.57
<u>European Commission</u>	19007	66.9	58.1	69.7	8.51
<u>United Nations</u>	2905	139.7	113.0	161.0	2.72
International Fund for Agric.	735	180.3	153.7	203.6	0.89
Joint United Nations Program	60	123.0	101.8	135.1	0.05
United Nations Childrens Fun	563	221.3	142.2	282.0	0.83
United Nations Development P	384	182.9	129.6	207.3	0.47
United Nations Economic Comm	0.008	2.4	0.6	14.5	0.00
United Nations High Commissi	203	78.2	63.1	113.2	0.11
United Nations Peacebuilding	60	111.6	41.6	165.8	0.04
United Nations Population Fund	267	125.0	102.8	142.0	0.22
United Nations Relief and Wo	508	2.6	0.1	18.5	0.01
World Health Organization	124	112.1	94.4	125.9	0.09
<u>World Bank</u>	14255	194.1	177.7	203.2	18.52
<u>International Monetary Fund</u>	1325	111.2	92.1	173.8	0.99
<u>Regional development banks</u>	7561	125.0	115.1	138.7	6.33
African Development Bank	20	78.6	50.6	128.1	0.01
African Development Fund	2536	300.3	235.3	317.3	5.10
Asian Development Bank	3293	30.7	9.5	100.6	0.68
Inter-American Development Bank	1284	8.2	2.8	35.0	0.07
Islamic Development Bank	428	164.6	141.5	186.4	0.47
<u>Other Multilaterals (excl. Vertical Funds)</u>	2243	62.2	56.2	67.5	0.93
Arab Bank for Economic Devel	194	270.7	198.1	293.3	0.35
Arab Fund for Economic Soci	1318	7.2	2.3	27.5	0.06
Global Green Growth Institute	5	177.3	102.9	228.6	0.01
Nordic Development Fund	30	271.6	161.5	387.5	0.06
OPEC Fund for International	637	106.4	95.2	118.6	0.45
Organization for Security an	57	8.5	0.6	26.5	0.00
<u>Non-governmental organizations (NGOs)</u>	6893	133.4	102.7	157.0	6.15
Action Aid	119	168.8	125.0	204.4	0.13
Adra	560	181.6	131.5	198.0	0.68

Broederlijkdelen	8	140.6	61.3	213.9	0.01
Brot für die Welt	40	94.9	82.9	107.8	0.03
Cafod	42	91.7	81.8	114.7	0.03
Care	779	161.0	143.8	174.7	0.84
Caritas Switzerland	48	121.5	90.9	169.4	0.04
CCF	184	124.6	97.1	146.9	0.15
Christian Aid	22	105.9	81.5	193.3	0.02
Church of Sweden	39	70.8	61.6	95.6	0.02
Concern	116	194.9	128.4	227.2	0.15
Cord Aid	153	97.9	64.0	122.1	0.10
Devp Canada	21	76.2	4.0	118.8	0.01
Diakona	15	77.1	63.7	105.0	0.01
EED	93	99.9	74.3	142.0	0.06
FES	53	41.6	31.2	68.3	0.01
Ford Foundation	120	82.3	59.2	108.5	0.07
Goal	77	279.5	149.3	309.4	0.14
Handicap International	68	151.3	100.0	204.2	0.07
Helvetas	8	154.6	110.5	169.4	0.01
Hivos	48	74.9	57.9	106.2	0.02
ICCO	97	100.1	81.9	112.7	0.07
ICRC	743	92.2	24.7	184.9	0.46
IPPF	27	139.1	107.4	171.9	0.02
Kellog	124	24.7	16.5	59.9	0.02
Kinder not Hilfe	52	115.1	86.6	145.3	0.04
Konrad Adenauer Stiftung	44	23.6	10.3	40.7	0.01
KOO	72	97.2	85.6	110.8	0.05
Marie Stopes International	14	215.2	157.3	361.5	0.02
Mcarthur	32	30.8	25.1	44.1	0.01
Mercy Corps	23	23.0	10.5	112.8	0.00
Misereor	142	62.2	53.6	82.7	0.06
MSF	729	204.2	76.5	325.7	1.00
Norwegian Church Aid	80	124.9	76.1	134.5	0.07
Norwegian Peoples Aid	87	77.4	62.2	102.5	0.05
Novib	54	165.2	114.1	219.4	0.06
Oxfam	140	37.3	28.3	48.4	0.04
Plan International	43	81.3	58.3	121.5	0.02
PSI	10	108.0	82.6	129.6	0.01
Rockefeller	229	168.8	141.6	207.0	0.26
SNV	80	160.2	120.0	209.3	0.09
Soros	146	205.0	135.8	254.0	0.20
STC	115	137.2	105.9	176.9	0.11
Swiss Aid	26	48.1	31.8	113.8	0.01
Swiss Contact	22	98.4	68.2	119.0	0.01
TDHCH	43	60.0	50.0	72.5	0.02
TDHNL	14	37.8	23.1	113.1	0.00
Trocaire	59	154.0	112.2	182.6	0.06
Vredeseilanden	10	150.6	59.6	260.6	0.01
VSO UK	364	114.7	92.3	145.6	0.28
Water Aid	53	118.5	94.8	128.4	0.04
Welt Hunger Hilfe	127	271.6	93.1	430.6	0.23
Woordendaad	22	81.3	61.5	131.4	0.01
World Vision	456	78.9	65.8	91.9	0.24
<b>New aid</b>	<b>27110</b>	<b>80.5</b>	<b>74.7</b>	<b>87.0</b>	<b>14.62</b>
<hr/>					
<i><u>Non-DAC bilateral donors</u></i>	21382	63.5	55.0	73.8	9.09
Brazil	146	285.7	138.7	415.2	0.28
Bulgaria	0.2	3.0	0.3	48.6	0.00
Chile	2	20.5	14.8	37.2	0.00
China	7006	153.0	128.3	183.3	7.17
Colombia	9	2.2	0.0	99.2	0.00
Croatia	1	0.009	0.0005	16.2	0.00
Czech Republic	43	59.9	39.8	71.1	0.02
Estonia	13	14.0	7.4	29.8	0.00
Hungary	8	5.1	1.9	16.1	0.00
Iceland	14	347.8	207.2	450.0	0.03
India	981	46.9	33.1	63.8	0.31
Israel	108	52.0	26.9	59.3	0.04
Kazakhstan	1	0.9	0.2	12.6	0.00
Kuwait	1389	44.5	35.9	51.2	0.41



Latvia	1	9.9	3.4	36.5	0.00
Liechtenstein	3	59.9	31.2	81.1	0.00
Lithuania	2	1.7	0.7	12.6	0.00
Monaco	5	272.1	198.0	334.5	0.01
Poland	128	8.4	6.2	23.4	0.01
Qatar	1741	2.2	0.4	19.7	0.03
Russia	220	42.4	34.9	74.3	0.06
Saudi Arabia	5109	10.4	4.2	30.1	0.36
Slovak Republic	9	17.9	11.8	45.7	0.00
Slovenia	11	18.1	9.1	23.6	0.00
South Africa	36	209.4	76.3	367.0	0.05
Taiwan	31	41.4	26.0	68.8	0.01
Thailand	4	44.9	22.3	111.7	0.00
Turkey	1559	11.1	6.6	44.0	0.12
United Arab Emirates	2800	9.8	5.4	21.6	0.18
<i><u>New global actors</u></i>	5729	144.1	134.6	162.1	5.53
Global Alliance for Vaccines and Immunization	1140	195.9	171.2	207.8	1.50
Global Fund to fight AIDS, Tuberculosis and Malaria	2934	141.3	126.5	171.6	2.78
Global Environment Facility	959	73.2	61.4	80.8	0.47
Bill and Melinda Gates Foundation	696	168.9	134.5	223.7	0.79

Notes: All volumes in the first column, except the new financial flows, refer to aid; The average poverty reducing efficiency for all donors is set to 100; The upper and lower bounds are derived from the sensitivity analysis; Column 5 gives the proportion of total poverty reduction – defined as poverty reduction efficiency per aid dollar multiplied by the total aid volume – achieved by each donor or donor group.

## Appendix B: Calibration of the model

This section elaborates on the calibration of the theoretical model. Specifically, we discuss the elasticity of poverty with respect to realized per-capita-income ( $\alpha$ ), the relationship between a country's policy and its saturation point ( $\beta_i$ ) and the fraction of the first aid-dollar that is not lost due to transaction costs ( $\varepsilon_i$ ). We establish the benchmark values (as well as values to use in the sensitivity analysis) of the parameters that are a part of the concerned functions and that will be used in the calibrations of our model, and describe necessary transformations of key indicators.

### *B1. The elasticity of poverty with respect to realized per-capita-income, $\alpha$*

In the benchmark setup we assume and that the elasticity of poverty with respect to realized per capita income, denoted  $\alpha$ , is 1.5. We base this figure on previous empirical literature in the area. In particular, Alvaredo and Gasparini (2015) estimate the average total growth elasticity of poverty (as measured by the proportion of individuals below \$1.25 a day) over the period 1981-2010 to be around 1.5. Based on a careful review of the literature, they note that most estimates of  $\alpha$  lie in the range of 1-2 (See e.g. World Bank, 2000; Bourguignon, 2003; Ferreira and Ravallion, 2009; Ravallion, 2012). Collier and Dollar (2002), finally, use  $\alpha=2.0$ . Against this background, we use  $\alpha = 1.5$  as benchmark, and 1.0 respective 2.0 in the robustness analysis.

### *B2. The saturation point for a country with average policy, $\beta_0$*

Just as the standard assumption of diminishing returns in the aid-growth literature, we assume a quadratic relationship between aid and realized income, i.e. that recipient country governments have limited absorptive capacity when it comes to delivering consumption just as in delivering economic growth. With large aid volumes, a recipient country will reach a point where they can no longer absorb or spend aid efficiently.

In our benchmark calibration, we assume that the saturation point for a country with average policy score, which we denote  $\beta_0$ , occurs when aid constitutes 25 percent of GDP. As noted in Section 3, we base this figure on the estimates in Clemens et al (2012), who find inflection points for the aid-growth relationship when aid exceeds about 20-25 percent of GDP. This would suggest a reasonable benchmark estimate of  $\beta_0$  is 22.5 percent. Since we do not

use the same aid measure as Clemens et al (2002), however, we need to transform their estimates to a saturation point that is relevant in our setup. To begin with, we use aid commitments rather than actual disbursements. Furthermore, unlike Clemens et al., we include aid from NGOs, non-DAC bilateral donors and ‘New global actors’. While the latter two posts were negligible during their period under study (1970-2005), we need to adjust for the fact that they omitted aid from NGOs. Finally, we drop the part of reported aid that does not involve an actual transfer of money (e.g. administrative costs, see Section 4). Based on aid commitments being 20.8 percent higher than net aid disbursements, aid from NGOs being 5.9 percent of ‘traditional aid’, and the aid posts that we drop being 10.4 percent of (reported) aid, we conclude that a saturation point of 22.5 percent in Clemens et al. (2012) correspond to a saturation point of approximately 25 percent with our measure.<sup>21</sup> To evaluate the sensitivity of results to using alternative saturation points, we use  $\beta_0=20$  and  $\beta_0=30$  percent in alternative calibrations.

*B3 The saturation point  $\beta_i$  and the fraction of the first aid-dollar that is not lost due to transaction costs,  $\varepsilon_i$*

As noted, we set the saturation point for a country with average policy,  $\beta_0$ , to 25 percent in our benchmark estimations. Like Collier and Dollar (2002), however, we also let country  $i$ ’s saturation point  $\beta_i$  and the fraction of its first aid-dollar that is not lost to transaction costs,  $\varepsilon_i$ , vary with policy. Based on their theoretical model, we derive the functional form for this relationship, and based on their empirical results, we arrive at the parameter estimates to use in the benchmark and sensitivity analysis.

The saturation point,  $\beta_i$ , and the fraction of the first aid-dollar that is not lost due to transaction costs,  $\varepsilon_i$ , enter our theoretical model in equation (3). Below, we show how we derive this equation from Collier and Dollar (2002). In their setup:

$$\frac{\partial G_i}{\partial A_i} = b_3 + b_5 P_i + 2b_4 A_i \quad (B1)$$

where  $P_i$  denotes Policy (below, we return to how this is measured) in country  $i$ . Based on average Policy,  $\bar{P}$ , and the standard deviation of Policy,  $P_{sd}$ , we construct the following variable transformation to define Normalized Policy in country  $i$ ,  $P_{N,i}$ :

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<sup>21</sup>  $22.5 \times 1.208 \times 1.059 \times 0.896 = 25.8$ .

$$P_{N,i} = \frac{P_i - \bar{P}}{P_{sd}} \quad (B2)$$

Combining equation (B1) and (B2) we get:

$$\frac{\partial G_i}{\partial A_i} = (b_3 + b_5 \bar{P}) \left( \left( 1 + \frac{b_5 P_{sd}}{b_3 + b_5 \bar{P}} P_{N,i} \right) + \frac{2b_4}{b_3 + b_5 \bar{P}} A_i \right) \quad (B3)$$

We now define the following variable transformations:

$$P_f = \frac{b_5 P_{sd}}{b_3 + b_5 \bar{P}} \quad (B4)$$

$$\eta = -\frac{b_3 + b_5 \bar{P}}{2b_4} \quad (B5)$$

$P_f$  refers to a ‘Policy Factor’. Based on equations (B3) – (B5) we can write:

$$\frac{\partial G_i}{\partial A_i} = (b_3 + b_5 \bar{P}) \left( 1 + P_f P_{N,i} \right) \left( 1 - \frac{A_i}{(1 + P_f P_{N,i}) \eta} \right) \quad (B6)$$

From equation (B6) we see that the saturation point is  $(1 + P_f P_{N,i}) \eta$ . This implies that for a country with average policy ( $P_{N,i} = 0$ ), the saturation point is given by  $\eta$ . We already have a value for the saturation point for a country with average policy – that is,  $\beta_0$  – and can thus replace  $\eta$  with  $\beta_0$  in equation (B6).

We assume that policy has the same effect on  $q_i$  (the relationship between aid and realized per capita income) as on growth. The magnitude of  $\frac{\partial q_i}{\partial A_i}$  will, however, not be the same as the magnitude of  $\frac{\partial G_i}{\partial A_i}$ , since  $q_i$  and  $G_i$  are measured in different units. In terms of magnitude, we must ensure that  $\frac{\partial q_i}{\partial A_i} \leq 1$ , so that one aid dollar never adds to realized income by more than one dollar. We therefore let  $\frac{\partial q_i}{\partial A_i}$  have the form as  $\frac{\partial G_i}{\partial A_i}$ , but multiply it with a factor so that  $\frac{\partial q_i}{\partial A_i} = 1$  when aid is zero and  $P_{N,i} = P_{N,max}$ . This gives us:

$$\frac{\partial q_i}{\partial A_i} = \frac{1}{(b_3 + b_5 \bar{P})(1 + P_f P_{N,max})} \frac{dG_i}{dA_i} \quad (B7)$$

Combining equations (B6) and (B7), and replacing  $\eta$  by  $\beta_0$ , we get:

$$\frac{\partial q_i}{\partial A_i} = \frac{1 + P_f P_{N,i}}{1 + P_f P_{N,max}} \left( 1 - \frac{A_i}{(1 + P_f P_{N,i}) \beta_0} \right) \quad (B8)$$

Letting:

$$\epsilon_i = \frac{1 + P_f P_{N,i}}{1 + P_f P_{N,max}} \quad (B9)$$

and:

$$\beta_i = (1 + P_f P_{N,i}) \beta_0 \quad (\text{B10})$$

we arrive at:

$$\frac{\partial q_i}{\partial A_i} = \epsilon_i \left(1 - \frac{A_i}{\beta_i}\right) \quad (\text{B11})$$

Equation (B11) together with  $q_i = 1$  when  $A_i = 0$  implies that  $q_i = 1 + \epsilon_i \left(A_i - \frac{A_i^2}{2\beta_i}\right)$ , which is Equation (3) in our theoretical model. So far, we have shown how to calibrate  $\epsilon_i$  and  $\beta_i$  based on Collier and Dollar (2002). We use equations (B2), (B4), (B9) and (B10) for the calibration.

Our benchmark estimate of  $P_f$  is based on the empirical results of Collier and Dollar (2002). Specifically, we used their coefficient estimates for  $b_3$  and  $b_5$ , as well as their measures of average Policy,  $\bar{P}$ , and the standard deviation of Policy,  $P_{sd}$ .<sup>22</sup> Plugging in  $b_3 = -0.54$ ,  $b_5 = 0.31$ ,  $\bar{P} = 3.04$  and  $P_{sd} = 0.875$  in equation (B4) we get our benchmark  $P_f = 0.67$ .

To get estimates of  $P_f$  for the sensitivity analysis, we follow the approach in Collier and Dollar (2002, p. 1481), changing their estimated coefficients of  $b_3$  and  $b_5$  by one standard deviation:

Lower bound:  $b_3 + s.d. (0.39)$ ;  $b_5 - s.d. (0.11)$

Higher bound:  $b_3 - s.d. (0.39)$ ;  $b_5 + s.d. (0.11)$

Doing so, we get  $P_f = 0.38$  as lower bound and  $P_f = 1.06$  as higher bound for the sensitivity analysis.

We calculate  $P_{N,i}$  and  $P_{N,max}$  using equation (B2), where  $P_i$  and  $P_{max}$  refer to actual values in the policy index we are using (ACPR in the benchmark setup, CPR in the sensitivity analysis).  $\bar{P}$  and  $P_{sd}$  are transformations of the values used in the Collier and Dollar (2002) study, ( $\bar{P} = 3.04$  and  $P_{sd} = 0.875$ ) into the index we are using. We elaborate on these transformations in the next section. Finally, given  $P_{N,i}$ ,  $P_{N,max}$ , and  $P_f$  (and  $\beta_0$  from Clemens et al., 2012), we calculate  $\epsilon_i$  and  $\beta_i$  using equations (B9) and (B10).

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<sup>22</sup>  $b_3 = -0.54$  and  $b_5 = 0.31$  are found in Column 1 in their Table 1 on page 1479,  $\bar{P} = 3.04$  is found on page 1482, and  $P_{sd} = 0.875$  is from Table 2 on page 1481.

#### B4 Adjusting for the use of different policy indicators

To calculate Normalized Policy,  $P_{N,i}$ , we compare the policy score for each country in our dataset to the average and the standard deviation of the policy score in the dataset of Collier and Dollar (2002). Doing so, however, we need to adjust for the fact that we use different policy indicators. In particular, to integrate structural economic vulnerability and low human capital into the allocation rule, we use the ACPR in our benchmark calibration (and CPR in the sensitivity analysis). Collier and Dollar (2002), on the other hand, used the unweighted average of the components in the World Bank's Country Policy and Institutional Assessment (CPIA) measure. This contrasts with both the CPR, which is a weighted average of the components in CPIA, and the ACPR, which is an index made up of CPR together with measures of vulnerability. We thus need to transform the average and standard deviation ( $\bar{P} = 3.04$  and  $P_{sd} = 0.875$ ) from the Collier and Dollar (2002) policy index into the scale of the ACPR and CPR, respectively.<sup>23</sup> We carry out this transformation in two steps:

In a first step, we account for the fact that before 1998 the CPIA was measured on a scale from 1-5 and after that on a scale from 1-6 (Gonzalez and Nishiuchi, 2018). With the new scale, both average and median CPIA scores increased from 3.0 in the 1977-1997 period to 3.5 in the 1998-2016 period (Gonzalez and Nishiuchi, 2018). Against this background, we make a linear transformation:

$$\frac{(P_i^{New}-1)}{6-1} = \frac{(P_i^{Old}-1)}{5-1} \Rightarrow P_i^{New} = 1.25P_i^{Old} - 0.25 \quad (B12)$$

where  $P_i^{Old}$  refers the policy measure used by Collier and Dollar (2002), and  $P_i^{New}$  refers to  $P_i^{Old}$  transformed into the 1-6 points scale. From this, we find that:

$$\bar{P}^{New} = 1.25\bar{P}^{Old} - 0.25 = 3.5500 \quad (B13)$$

$$P_{sd}^{New} = 1.25P_{sd}^{Old} = 1.0938 \quad (B14)$$

In a second step, we transform  $\bar{P}^{New}$  and  $P_{sd}^{New}$  into the scale of the ACPR and the CPR, respectively. Here we need to introduce some new notations.  $ACPR_i$  and  $CPR_i$  refer to our respective policy measures.  $P_i^{New,09-13}$  refers to a policy measure constructed as the one used in Collier and Dollar (2002), but for our 2009-2013 dataset. Finally,  $P_i^{ACPR}$  and  $P_i^{CPR}$  refer to

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<sup>23</sup> Please note that the result of this transformation will not be the same as the average and standard deviation of ACPR (respective CPR) in our 2009-2013 dataset.

the transformed versions of the Collier and Dollar (2002) Policy Index. All these indicators –  $ACPR_i$ ,  $CPR_i$ ,  $P_i^{New,09-13}$ ,  $P_i^{ACPR}$  and  $P_i^{CPR}$  – are measured on a 1-6 points scale.

In order to transform  $\bar{P}^{New}$  into  $\bar{P}^{ACPR}$  (and correspondingly,  $P_{sd}^{New}$  into  $P_{sd}^{ACPR}$ ) we multiply  $\bar{P}^{New}$  by the scaling factor  $\frac{\overline{ACPR}}{\bar{P}^{New,09-13}}$ . Doing the same for the average and standard deviation of  $CPR$  we thus calculate:

$$\bar{P}^{ACPR} = \frac{\overline{ACPR}}{\bar{P}^{New,09-13}} \bar{P}^{New} = \frac{3.1438}{3.3062} 3.5500 = 3.38 \quad (B15)$$

$$P_{sd}^{ACPR} = \frac{ACPR_{sd}}{P_{sd}^{New,09-13}} P_{sd}^{New} = \frac{0.2605}{0.4852} 1.0938 = 0.59 \quad (B16)$$

$$\bar{P}^{CPR} = \frac{\overline{CPR}}{\bar{P}^{New,09-13}} \bar{P}^{New} = \frac{3.1662}{3.3062} 3.5500 = 3.40 \quad (B17)$$

$$P_{sd}^{CPR} = \frac{CPR_{sd}}{P_{sd}^{New,09-13}} P_{sd}^{New} = \frac{0.4512}{0.4852} 1.0938 = 1.02 \quad (B18)$$

Based on these, we calculate the maximum policy values in our dataset (note that it is pure coincidence that  $ACPR_{N,max}$  and  $CPR_{N,max}$  happen to get the same numerical value):

$$ACPR_{Max} = 5.10 \quad (B19)$$

$$CPR_{Max} = 5.10 \quad (B20)$$

Finally, we combine equation (B2) with equations (B15) – (B20) to get the normalized policy indicators we are using in our calibrations:

$$ACPR_{N,i} = \frac{ACPR_i - \bar{P}^{ACPR}}{P_{sd}^{ACPR}} = \frac{ACPR_i - 3.38}{0.59} \quad (B21)$$

$$CPR_{N,i} = \frac{CPR_i - \bar{P}^{CPR}}{P_{sd}^{CPR}} = \frac{CPR_i - 3.40}{1.02} \quad (B22)$$

$$ACPR_{N,max} = \frac{ACPR_{max} - \bar{P}^{ACPR}}{P_{sd}^{ACPR}} = \frac{5.10 - 3.38}{0.59} = 2.92 \quad (B23)$$

$$CPR_{N,max} = \frac{CPR_{max} - \bar{P}^{CPR}}{P_{sd}^{CPR}} = \frac{5.10 - 3.40}{1.02} = 1.67 \quad (B24)$$

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