Development Aid and Economic Growth:

A Positive Long-Run Relation

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Abstract. We analyze the growth impact of official development assistance to developing countries. Our approach is different from that of previous studies in two major ways. First, we disentangle the effects of two kinds of aid: developmental and non-developmental. Second, our specifications allow for the effect of aid on economic growth to occur over long periods. Our results indicate that developmental aid promotes long-run growth. The effect is significant, large and robust to different specifications and estimation techniques.

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1. Introduction

Does aid promote economic growth? Interest in this question has grown as large infusions of aid to developing countries have been recommended in recent years as a means of escaping poverty traps and promoting development (Sachs et al., 2004; Sachs 2005a, 2005b). Major efforts have been underway to mobilize resources for increases in aid (e.g., through an International Financing Facility). In contrast, some have argued that aid has historically been ineffective in promoting growth (Easterly, 2007a, 2007b; Rajan and Subramanian, 2008) and large increases in aid are therefore undesirable. An intermediate position has been that more aid spurs growth under specific conditions (such as when countries have good macroeconomic policies, on which see Burnside and Dollar, 2000).

Despite the large literature on aid and growth, "the debate about aid effectiveness is one where little is settled" (Rajan, 2005, p. 54). Empirical evidence has been provided in favor of the argument that aid spurs economic growth unconditionally or in certain macroeconomic environments (Burnside and Dollar, 2000; Guillaumont and Chauvet, 2001; Hansen and Tarp, 2001; Collier and Dollar, 2002; Gomanee, Girma, and Morrissey, 2002; Dalgaard, Hansen and Tarp, 2004; Clemens, Radelet and Bhavnani, 2004), that it is growth-neutral (Boone 1964, 1996; Easterly, Levine, and Roodman, 2004; Easterly, 2005) or even growth-depresssing (Bobba and Powell, 2007).[2]

In this paper, we provide new cross-country evidence on the positive effect of aid on growth.[3] We distinguish between developmental and non-developmental aid as distinct types of aid with distinct effects on per capita GDP growth. Our specifications allow aid flows to translate into economic growth after long time periods. We find that developmental aid has a positive, large, and robust effect on growth, while non-developmental aid is mostly growth neutral and occasionally negatively associated with economic growth.

[2] It has been argued that aid may inhibit development by creating a dependency mentality and overwhelming the management capacity of governments (Kanbur, 2000), crowding out private sector development (Bauer, 1976; Krauss, 1983), worsening bureaucratic quality (Knack and Rahman, 2007), weakening governance (Knack, 2000; Rajan and Subramanian, 2007), and lowering competitiveness through Dutch Disease effects (Rajan and Subramanian, 2005).

[3] In testing whether developmental aid has an impact on economic growth, we assume that aid can either relax the budget constraint of the country or influence the composition of expenditures. It seems uncontroversial to argue the former, unless it is thought that aid can generate perverse consequences, possibly of sufficient magnitude to reduce recipient country welfare (Brecher and Bhagati, 1982; Easterly, 2006). In contrast, the influence of aid transfers on the composition of government expenditures has been vigorously debated. In the area of public finance, there is a substantial and ambiguous literature on the "flypaper effect" and related topics (Hines and Thaler, 1995; Inman, 2008). A more specific literature on whether aid is fungible has also emerged and has also come to ambiguous conclusions (Howard and Rothenberg, 1993; Khilji and Zampelli, 1994; Feyzioglu, Swaroop, and Zhu, 1998; Van de Walle and Cratty, 2005; Van de Walle and Mu, 2007; Pettersson, 2007).

We conclude that aid of the right kind is good for growth and that it translates into growth outcomes after long periods of time. Our results carry potentially significant policy implications,as they entail that shifting the composition of aid in favour of developmental aid or increasing its quantity can lead to sizable long-term benefits. They also call into question arguments that aid is inherently ineffective and that donor budgts should be reduced. The findings shed light on the so-called "macro-micro paradox" wherein aid is found to have zero average effects in macroeconomic studies but positive effects in microeconomic studies such as project assessments (Boone, 1994; Clemens, Radelet and Bhavnani, 2004). A possible resolution is that whereas macroeconomic studies have been concerned with identifying the impact of total aid, which encompasses non-developmental aid, microeconomic studies have focused on assessing projects with plausible developmental impact.

The remainder of the paper is structured as follows: in the next section, we describe key findings of the aid effectiveness literature. Section 3 highlights econometric challenges specific to growth-aid regressions. Section 4 presents our definition and measures of developmental aid. Empirical evidence is discussed in Sections 5 and 6. Section 7 presents our conclusions. Some results are not included here for brevity, but are available in the supplementary appendix of Minoiu and Reddy (2008).

2. Literature Review

The aid effectiveness literature has generally relied on two key assumptions: (i) that aid has a solely *contemporaneous* effect on growth (assumed by most of the papers on the topic), and (ii) that different kinds of aid have the *same* effect on growth. While a comprehensive literature review is beyond the scope of the paper, we review several key contributions.

A central issue in those contributions to the aid effectiveness literature which make the assumption that aid has a *contemporanous* effect on growth, is that of endogeneity caused by reverse causality. Under the exclusion assumption, lagged aid has often served as a useful source of exogenous variation (Dalgaard, Hansen and Tarp, 2004). Other prominent instruments include "friends of the donors" variables which exploit the idea that aid may be given for geopolitical reasons that are extraneous to a country's economic performance (Alesina and Dollar, 2000; Easterly, 2003, 2005; Rajan and Subramanian, 2008). Examples include UN voting patterns, whether the recipient country is a member of or a signatory to a strategic alliance, whether it has been a colony of the donor, and whether the donor and the recipient share a common language.

Several studies have identified the pitfalls of using geostrategic variables as instruments for total aid. For example, Fleck and Kilby (2006a) noted that these are more likely to capture aid flows motivated by donors' geostrategic considerations, which may not be extended to recipient countries for developmental purposes but rather to build and sustain political allegiances. Similarly, some geostrategic variables may fail the exogeneity and exclusion restrictions. For example, membership in geostrategic alliances may be correlated with expectations of aid flows from certain members of such alliances (Headey, 2005, 2007). In addition, colonial heritage variables may have a direct causal effect on growth, for example, by determining initial levels of technological advancement (Bagchi, 1982; Bertochhi and Canova, 1996; Grier, 1999; Price, 2003).

A growing literature has underlined the possibility that aid of different types may have different effects. For example, Clemens, Radelet, and Bhavnani (2004) assess the impact of aid allocated to support the budget and balance of payments commitments, investments in infrastructure, agriculture, and industry.[4] The authors take the view that aid allocated to these sectors is likely to have a discernable impact on growth in the short-run. They find that aid is effective, with estimates suggesting that a $1 increase in short-impact aid raises income, on average, by $1.64 (in present value). The authors state that aid which is aimed at supporting democracy, the environment, health, and education is likely to have a long-term impact on growth, but do not statistically identify its effect.[5]

More recently, Rajan and Subramanian (2008) provide evidence that total aid is ineffective at promoting growth, and attempt to distinguish between multilateral and bilateral aid; aid from Scandinavian and non-Scandinavian donors; and social, economic, and food aid. Throughout, aid is allowed to affect growth only contemporaneously and is instrumented for with "friends of the donors" variables. As suggested above, since variation in aid explained by geopolitical factors does not adequately predict variation in developmental aid, the authors' finding that aid predicted by geopolitical factors does not have an effect on growth is not surprising, since "[…] political variables may instrument, in part, for the purpose of aid. And the purpose of aid will likely influence the effects of aid on development." (Fleck and Kilby, 2006a, p. 220).

Our study reflects this insight and shares the approach of Headey (2007) and Bobba and Powell (2007) who argue that the failure to distinguish between growth-neutral geostrategic and growth-enhancing non-geostrategic aid accounts for the finding of a zero effect of total aid on growth in cross-country studies. Heady argues that bilateral aid (amounting to 70 percent of total aid) did not have an impact on growth during the Cold War mainly because it served donors' global geopolitical interests.[6] Using a dataset for 56 countries spanning 1970–2001, the author finds that multilateral aid flows were more effective than geostrategically-driven bilateral aid flows during the pre-Cold War period. In contrast, bilateral aid has a positive and large effect on growth in the post-Cold War

[4] Other examples include Gomanee, Girma, and Morrissey (2002), who focus on the effect of an aid aggregate without food aid and technical assistance; Miquel-Florensa (2007) who compares the efficacy of tied vs. untied aid; Mishra and Newhouse (2007), who isolate the effect of health aid on infant mortality; and Asiedu and Nandwa (2006) who analyze whether aid spent in the education sector is growth-enhancing.

[5] Identifying the growth effect of long-term impact aid is made difficult by the short span of sector-level disbursement data in the DAC (2006) database.

[6] This argument is supported by Berthélemy and Tichit (2004), who reported that the end of the Cold War brought about reduced bias in aid allocation on the basis of colonial ties in favor of a fresh bias in favor of trade partners.

sample. In a similar vein, Bobba and Powell (2007) compare aid allocated to political allies with aid extended to non-allies. This distinction is motivated by evidence that political factors (past colonial ties, or membership in political alliances) explain a large share of the variation in aid flows across OECD donor countries. Using instrumental variables, the authors uncover strong and robust evidence that aid extended to non-allies has a positive contemporaneous effect on recipient countries' average growth, whereas aid extended to political allies has the opposite effect.

Unlike many of the previous studies, we simultaneously (i) focus on the distinction between developmental aid and non-developmental aid and (ii) allow aid to have discernible effects on growth over long time periods.We provide new and robust evidence that aid of the right kind can have a sizable positive impact on long-run economic growth. Before defining and operationalizing our concept of development aid, we assess the misspecification bias in a standard specification of the aid-growth relationship which assumes that different kinds of aid have the same effect on growth.

3. The Pitfalls of Misspecification[7]

A key premise in previous studies is that the effects of aid on growth are uniform. We challenge this premise by questioning whether aid offered for one purpose (e.g., general budgetary support to an authoritarian regime which enables it to sustain political support or military spending) will have the same effect on growth as aid spent on another (e.g., irrigation projects, rural roads, bridges and ports which help to bring goods to market, immunization campaigns, health clinics, and schools). If aid of different kinds indeed has different effects on growth, then using total aid as an explanatory variable for growth may lead to erroneous conclusions. The aggregative nature of the total aid variable—different components of which may have a positive, zero, or negative effect on growth—can explain the finding in the literature that aid is ineffective.

To illustrate, we derive the bias of the Ordinary Least Squares (OLS) and Two-Stage-Least-Squares (2SLS) estimators in the standard aid-growth model where different kinds of aid are assumed to have the same effect on growth. Suppose that the true model is given by:

$$\gamma = DA\beta_1 + NDA\beta_2 + C\delta_T + \varepsilon_T \qquad (1)$$

where γ denotes per capita GDP growth, *DA* stands for developmental aid (and may be lagged to allow aid to operate on growth over a longer time-period), *NDA* represents non-developmental aid (and may be lagged), and C is a matrix of suitable control variables. (Country subscripts are omitted.) Suppose also that the estimated model is given by:

$$\gamma = TA\beta + C\delta_R + \varepsilon_R \qquad (2)$$

[7] Analytical derivations are available in Minoiu and Reddy (2008, supplementary appendix section I).

where *TA* represents total aid (*TA=DA+NDA*). Then the OLS estimator of the coefficient on *TA* is a weighted function of the true coefficients on *DA* and *NDA*:

$$\hat{\beta}^{OLS} \xrightarrow{P} \left[\beta_1 \frac{Cov(\widetilde{TA}, \widetilde{DA})}{Var(\widetilde{TA})} + \beta_2 \frac{Cov(\widetilde{TA}, \widetilde{NDA})}{Var(\widetilde{TA})} \right] \quad (3)$$

The weights are functions of variances and covariances of *DA*, *NDA*, and *TA* conditional on the covariates (with this conditionality signified by the tildes over the variables). If the two aid categories have opposite effects on growth, then the estimated coefficient on *TA* can be zero. Similarly, if *DA* is effective and *NDA* is ineffective, then the OLS estimator will suffer from attenuation bias.[8]

As noted, if aid affects growth contemporaneously and model (2) is estimated instead of model (1), an instrumentation strategy is necessary. Then, the 2SLS estimator of the effect of *TA* on growth is given by:

$$\hat{\beta}^{2SLS} \xrightarrow{P} \left[\beta_1 \frac{Cov(\widetilde{DA}, \widetilde{NDA})}{Cov(\widetilde{NDA}, \widetilde{TA})} + \beta_2 \frac{Var(\widetilde{NDA})}{Cov(\widetilde{NDA}, \widetilde{TA})} \right] \quad (4)$$

Equations (3) and (4) suggest that the standard aid-growth regression may lead to erroneous conclusions because of a "strategic bias" problem (Headey, 2005) or because the instrument (geopolitical variables) only picks up a component of the instrumented variable (*TA*) as conjectured in Murray's (2006) heterogeneous response and instrumental variables framework.

4. Defining Developmental Aid

We define developmental aid (*DA*) as aid expended in a manner that is anticipated to promote development, whether achieved through economic growth or other means. Non-developmental aid (*NDA*) is defined as aid of all other kinds. One way to think about this definition of *DA* is that it is possible to rank-order aid expenditures based on the extent to which they are expected to promote development. Subsequently, one can identify a threshold of effectiveness in promoting development that will determine developmental and non-developmental expenditures.[9]

[8] The problem can also be cast as a standard omitted variables problem. To see this, note that the true model can be re-written as $\gamma = \beta_1 TA + (\beta_2 - \beta_1) NDA + C\delta_T + \varepsilon_T$ while the estimated model omits the *NDA* term. The bias on the total aid coefficient depends on the relative sizes of β_1 and β_2 and the (conditional) variance-covariance matrix of the data.

[9] Note that neither the motive for aid provision, nor the effects of aid expenditure, are employed to define *DA*. For example, aid underpinned by geostrategic interests, which is actually spent in a manner that could promote development, as well as aid extended for developmental purposes and spent accordingly but which eventually fails to promote economic growth, are part of *DA* according to our definition.

Data limitations prevent us from directly identifying development-promoting aid expenditures—the ideal proxy for *DA*. For example, sector-level aid disbursement data (e.g., aid spent on social infrastructure and services, health and education, employment, and housing and social services) are unavailable for the period considered (1960–2000).[10] We employ a second-best solution based on the assumption that *DA* is likely undergirded by the developmental motive. Accordingly, we draw on the findings of the aid allocation literature and use established aid-quality donor rankings to identify development-friendly donor countries. *DA* measures are then constructed by pooling bilateral aid flows from these donors.[11]

Throughout the analysis, multilateral aid (*MA*) is treated as a separate component of aid, possibly developmental in nature. Our conjecture is that aid channeled through and spent by multilateral organizations is more likely to be expended in a developmental manner. The definition of multilateral aid provided in the OECD-DAC database reflects this idea: "Multilateral transactions are those made to a recipient institution which conducts all or part of its activities in favor of development" (DAC, 2006). The evidence on the nature of multilateral aid flows is mixed: Headey (2007) finds that multilateral aid is much less determined by strategic factors than is bilateral aid, but Fleck and Kilby (2006b) argue that multilateral aid responds to influential members' interests. Taking an agnostic stance, we allow *MA* to have an independent effect on growth.

The aid allocation literature has documented various motives underlying bilateral aid flows to developing countries (Dollar and Levin, 2004; Berthélemy and Tichit, 2004; and Berthélemy, 2006). Alesina and Dollar (2000) show that the largest donors are more likely to be motivated by political and strategic considerations, a result which seems robust to the end of the Cold War. Such motives can explain more of aid allocations over 1970–1994 than do poverty, regime type (e.g., the presence of democracy), or the economic policy of the recipient. In particular, the US pattern of aid is heavily influenced by its interests in the Middle East, with one third of it having been allocated to Egypt and Israel during the period.[12] In addition, large donors such as the UK and France directed most of their bilateral aid to former colonies; in fact, non-democratic former colonies

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[10] To circumvent this problem, Clemens, Radelet, and Bhavnani (2004) use sector-level aid commitment data (1973–2000) to obtain dibursements of three types of aid: short-term aid (with a developmental impact within 4 years), long-term aid, and humanitarian aid. Sector-level disbursements are estimated assuming that the fraction of disbursements equals that of commiments for each aid type and year.

[11] We also experimented with other proxies for *DA*, such as the share of total aid predicted by variations in the quality of the agricultural season, and total bilateral aid from donors chosen according to statistical criteria (Minoiu and Reddy, 2008, supplementary appendix sections V–VI).

[12] Concerning the structure of US aid, Brainard (2006, p. 8) argues that "a look at the US foreign assistance budget in any given year makes it clear that only a small fraction of funds is allocated strictly according to economic and poverty criteria—less than 15 percent". Moreover, Fleck and Kilby (2006a) show that domestic politics play an important role in US aid allocations. A conservative Congress directs aid based on commercial concerns (e.g., trade relations). In contrast, a liberal president and Congress give more weight to development concerns in aid allocation.

received on average twice more aid than democratic non-colonies. French and Japanese aid is found to have had the lowest elasticity to the income of recipients, and both countries sent unusually large amounts of aid to Egypt. They also tended to either favor old colonies (France) or allied countries as measured by the correlation of UN General Assembly voting patterns (Japan). UN votes cast by recipient countries are able to explain aid allocations from Germany, France, the UK and the US even after controlling for income, institutional quality, and macroeconomic policies.

In contrast, Nordic countries' aid "seems remarkably free from self-interest and, indeed more oriented towards their stated objective of poverty alleviation, the promotion of democracy, and human rights" (Gates and Hoeffler, 2004, p. 16). Alesina and Dollar (2000) report that small donor aid has the highest elasticity to recipient income, while Gates and Hoeffler (2004) show that Nordic countries (Denmark, Finland, Norway, and Sweden) lend to poorer countries, many of which are in sub-Saharan Africa (SSA). "Norway and Denmark are lauded for their singular focus on development." (Brainard, 2006, p. 8) Some donors tend to lend little money to former colonies (Netherlands, 17 percent) or not have little scope for fostering global strategic interests due to a lack of colonial past. Alesina and Dollar (2000) conclude that "Certain donors (notably, the Nordic countries) respond more to the *correct* incentives, namely income levels, good institutions of the receiving countries, and openness" (p. 33; italics in original text). Similarly, Gates and Hoeffler (2004) argue that Nordic donors as an aggregate differ markedly from other donors in their allocation of aid: their recipients are more likely to be democracies and have a better human rights record. At odds with the findings of Alesina and Dollar (2000) that countries open to international trade are favored by Nordic donors, Gates and Hoeffler (2004) report that the same countries still direct significant amounts of aid to recipients with "poor" trade policies.[13]

Based on this evidence, we assume that Scandinavian donors and selected additional donors have aid programs that are more likely to target developmental aims (especially economic infrastructure, poverty allevation, and social services), and that their aid is more likely to be spent in a growth-enchancing manner. We consider the following two distinct proxies for *DA*: total bilateral aid from Denmark, Finland, Norway, Sweden, and Netherlands (henceforth, 'G1'), and total bilateral aid from a larger group of countries comprised of: Denmark, Finland, Norway, Sweden, Ireland, Austria, Canada, Luxembourg, Netherlands, and Switzerland (henceforth, 'G2'). There is some contention in the aid allocation literature that the Netherlands and Canada are similar to Nordic countries, although there is no definite evidence on the matter (Gates and Hoeffler, 2004).

Scandinavian donors in G1 fared well according to the 2007 ranking produced of the Commitment to Development Index (CDI). The CDI assesses the performance of rich nations along various dimensions of policy, including aid trade, investment, migration, security, environment, and technology. One of its components, the Aid CDI ranks donor

[13] Although there is evidence of heterogeneity in terms of aid allocation patterns among Nordic donors themselves (Gates and Hoeffler, 2004), they have been labeled "like-minded" by Neumeyer (2003) and the literature usually treats them as one uniform group.

nations after adjusting their aid figures for the type of aid extended to recipient countries (Roodman, 2005, 2006, 2007a). In particular, the index penalizes donor countries which offer tied rather than untied aid, loans rather than grants, and too many small aid projects which are likely to burden the recipient government with administrative responsibilities.[14] Four of our G1 donor countries (Denmark, Norway, Sweden, and the Netherlands) were the highest-ranking according to the 2005 Aid CDI. This is not surprising since a small share of Nordic aid is tied (with the exception of Denmark) and it is concentrated on social infrastructure, especially in the health sector (Gates and Hoeffler, 2004).

Assuming that the highest-ranking nations on the quality-adjusted aid ladder are more likely to provide *DA*, we choose one more group of development-friendly countries which rank in the top 10 according to the 2005 Aid CDI. The third proxy for *DA* is pooled bilateral aid from the following ten donors: Denmark, Norway, Sweden, Netherlands, Switzerland, Ireland, United Kingdom, Belgium, Finland, and France (henceforth, 'G3'). Notably, this group includes donor countries that have been shown to allocate aid in a geostrategic manner, so we expect a lower effectiveness of its aid.

Once *DA* is extracted from *TA*, the remainder is viewed as *NDA* (*NDA = TA–MA–DA*) and is also allowed to have a distinct impact on growth.

5. Empirical Evidence

We estimate a standard cross-country growth-aid model in a sample of developing countries over 1960–2000 (DAC, 2006). The aid variable is defined as grants plus net loans with a grant element higher than 25 percent. Lagged values of *DA* and *NDA* are included to explain variations in the recipients' average growth rate of per capita GDP. In our baseline specifications (similar to Rajan and Subramanian, 2008), the control variables are initial per capita income, initial level of life expectancy, institutional quality (World Bank Country Policy and Institutional Assessment, CPIA index averaged over 1960–1999), geography (average number of frost days and tropical land area), initial level of government consumption, an indicator of social unrest (revolutions), the growth rate of terms of trade and their standard deviation, initial economic policy (updated Sachs-Warner openness dummy), and continent dummies (for SSA and East Asia). For variable list, data sources, and summary statistics, see Tables 1–2.

Figure 1 shows the shares of bilateral and multilateral aid in total aid by decade. In the 1960s, almost 90 percent of aid was channelled to recipient countries through bilateral arragements. However, the share of bilateral aid decreased in later decades to roughly

[14] In constructing the Aid CDI, tied aid is penalized 20 percent and partially tied aid is discounted 10 percent. The donors' selection rules for recipients of their aid are assessed using a selectivity weight which aims to capture the recipients' *need* for aid along the following dimensions: governance, poverty level, and income level. Greater project proliferation has the effect of discounting aid from a donor, while donor policies aimed at encouraging charitable giving to development organizations have the opposite effect. Final donor rankings are based on the ensuing quality-adjusted aid variable (Roodman, 2005, 2007a).

two thirds. Figure 2 depicts the relative weight of *DA* measured by our first proxy—cumulative bilateral aid from groups G1–G3. Bilateral contributions of the G1 and G2 donors only account for at most 18 percent of total bilateral aid, given that certain major donors are excluded. The inclusion of the UK and France in G3 raises the share of bilateral aid to around 30 percent. Tables 3–4 report the average share of different kinds of aid to receipients' GDP in every decade. On the one hand, bilateral aid accounts on average for 6–7 pecent of recipients' GDP, while the average ratio of *MA* to GDP ranges between 1 and 3.9 percent. *DA* from G3 countries, on the other hand, contributed 5–9 percent of recipient countries' GDP over 1960–1990, while *DA* from G1 countries only accounted for at most 3 percent of recipients' GDP over the same period. These summary statistics suggest that our development-friendly countries are relatively small donors.

5.1 Cross-Sectional Regressions[15]

To estimate the long-term effect of aid on growth and allow for deep lags on the aid variable, our dependent variable is the average per capita GDP growth rate over 1990–2000, while the explanatory variables—*DA*, *MA*, and *NDA*—are averaged over 1960–90.[16]

We begin by replicating the standard growth-aid model presented by Rajan and Subramanian (2008). We obtain the same results as the authors (Table 5), reflecting aid's persistent lack of power in explaining subsequent growth. In contrast, when we include deeper lags of *TA* (Table 6), the effect of aid turns positive: average growth in the 1990s is well explained by *TA* lagged over 1960–80, 1960–90, and 1970–90. The coefficients range between 6.8 and 8.5, suggesting that an increase of total aid during these periods by 1 percentage point of GDP is associated with an average per capita GDP growth rate that is higher by approximately 0.068 to 0.085 percentage points in the 1990s.

Table 7 presents several novel specifications in which we examine the possibility that the most growth-enhancing form of aid is *DA*—pooled bilateral aid from the donors belonging to groups G1 to G3.[17] The results reveal some remarkable regularities. First, we identify a positive effect of bilateral aid from G1 and G2 donors on growth, with coefficients that are large in magnitude: average growth in the 1990s was higher by as much as 1.2–1.3 percentage points for countries which had received 1 additional percentage point of GDP as aid transfers from these donor countries over the previous three decades. The effects are large, rendering the coefficients both statistically and

[15] All robustness checks to the cross-sectional results are available in Minoiu and Reddy (2008, supplementary appendix section IV). These include estimating a model where *DA*, *MA*, and *NDA* are included in the regressions one at a time to investigate whether the results are driven by multicollinearity (Minoiu and Reddy, 2008, supplementary appendix section IV, Table 8C).

[16] Regressions with the dependent variable representing average growth over 1970–00 and 1980–00 did not prove robust across specifications since the feasible aid lags were shorter, restricting our ability to test whether aid acts on growth with deep lags for these earlier time periods.

[17] The results are robust to weighing the observations to reduce the influence of outliers according to the Huber (1981) procedure (Minoiu and Reddy, 2008, supplementary appendix section IV, Table 6).

economically meaningful. A weaker effect is identified for bilateral aid from G3 donors: a 1 percentage point increase the ratio (to GDP) of aid received between 1960–1990 is associated with subsequent growth rates that are higher by 0.14 percentage points. The reduced coefficient on bilateral aid from G3 donors is not surprising due to the presence in this group of large geostrategic donors such as the UK, Belgium, and France (Alesina and Dollar, 2000). In all three specifications, *MA* has a positive, yet insignificant effect on subsequent growth. *NDA* appears to have a small, ambiguous effect on growth.

To illustrate the strength of the association between different aid categories and average growth (conditional on the covariates), we present a set of partial scatterplots (Figures 3–6). Figure 3 reveals that total lagged bilateral aid is only weakly correlated with subsequent growth (the t-statistic on the coefficient of bilateral aid is 1.11). In contrast, once bilateral aid is sliced into its *DA* and *NDA* components, we are able to identify an upward sloping, strong relationship between lagged *DA* and later growth (Figures 4–6).

The analysis of the outliers in these partial scatterplots is also informative. Two of the outliers are Botswana and the Democratic Republic of Congo (DRC)—landlocked, primary commodity exporting countries with markedly different growth trajectories. Botswana is often perceived to have had an exemplary institutional framework (characterized by unbroken democratic governance and institutional probity) and sound macroeconomic policies (e.g., prudent fiscal and debt policies), whereas the DRC remains plagued by weak institutions, competition for mineral rents, and deep civil conflict. These factors are only partially captured by our explanatory variables (such as geography, terms of trade volatility, and institutional quality), suggesting that although *DA* appears to be an important growth-promoting factor, it is not the only one.

Several key concerns emerge regarding the cross-sectional regressions presented here. For instance, lagged aid may act as a proxy for country-specific unobservables (an idea explored, for example, by Dalgaard, Hansen and Tarp, 2004). This possibility is dealt with using panel data analysis in the following section. Furthermore, lagged aid may capture the impact of initial conditions which are not well proxied by the covariates (initial income, life expectancy, and literacy), and the results may be sensitive to the choice of information set. We try to address the latter concern by estimating the same model with alternative explanatory variables. First, we replace the World Bank CPIA index with another institutional variable in lagged form in order to minimize possible endogeneity bias. We use the International Country Risk Guide (ICRG) index from the IRIS III dataset (Knack and Keefer, 1995) averaged over 1984–89. Second, we add initial literacy as a proxy for the human capital. The results[18] show that when changing the set of control variables, the coefficients on *DA* remain significant and are even larger for all groups of development-friendly donor countries.

[18] See Minoiu and Reddy (2008, supplementary appendix section IV, Tables 7A–7B).

5.2 Panel Regressions

We re-estimate our model using panel data comprised of eight five-year averages between 1960 and 2000 and the system GMM estimator (Blundell and Bond, 1998). This estimation strategy appears to be appropriate in our setting because the unobserved country-specific fixed effects are eliminated through first-differencing, endogenous variables are instrumented out, and our panel is short. The system GMM estimator uses a system of equations in first differences and levels (of GDP), where the instruments employed in the levels equations are lagged first differences of the endogenous series, while those used in the differenced equation are lagged levels of the endogenous series. We check the overall validity of the instruments with the Hansen test of overidentifying restrictions. Furthermore, we assess the validity of subsets of instruments using the Arellano-Bond *m1* and *m2* test statistics for AR(1) and AR(2)-type serial correlation in the differenced residuals. To conclude that the instruments are valid, we need to find evidence of first-, but not second-order serial correlation in the differenced residuals.[19]

The following covariates are treated as endogenous: beginning-of-period income level, inflation, policy (openness), government consumption, and one period lagged aid. Since the choice of lags used in constructing the GMM instruments is unrestricted by the estimator, yet limited by the time dimension of our panel, we use all possible lags (of levels and differences dated *t–2* and earlier) in building the set of instruments. The three components of aid—*DA*, *MA*, and *NDA*—are assumed to be uncorrelated with future shocks to the growth model except when lagged one period. Institutional quality and revolutions are taken to be contemporaneously uncorrelated with growth.[20] Finally, the geography variable and the time dummies are strictly exogenous and used as instruments.

To test the hypothesis that aid operates on growth with a time lag, while maintaining a parsimonious model, we include distinct aid lags in distinct specifications (Table 8). The formulations include the aid categories lagged 1, 3, and 5 periods (corresponding to 5, 15, and 25 years). Once again, *DA* is found to have a positive and significant impact on growth decades later: for the G1 and G2 donor groups, a 1 percentage point increase in the *DA*/GDP ratio is associated with average growth that is higher by 0.2 percentage points 5 years later, and higher by 0.7 to 1.1 percentage points 25 years later. Not surprisingly, the effect of bilateral aid from G3 donors is much smaller and not robust across specifications. *MA* and *NDA* have no statistically discernable impact on growth. Their coefficients alternate between positive and negative and are imprecise.

[19] This does not preclude the possibility that the estimator may be biased because of country-level heterogeneity in slope coefficients (Lee, Pesaran and Smith, 1997).

[20] Treating these regressors as endogenous does not alter the results.

In all regressions, the p-values of the Hansen over-identifying restriction test indicate that the GMM instruments are valid.[21] Furthermore, the *m1* and *m2* statistics for most specifications suggest that there is first-order serial correlation in the differenced residuals, but there is no second-order serial correlation. However, as the sample size shrinks (in specifications with deep lags of aid), the validity and relevance of a subset of instruments from the differenced equation becomes questionable according to the Arellano-Bond test of second-order serial correlation since fewer lags (observations) are available to construct the instruments. This increases the possibility of a downward bias in the system GMM estimator (Bond, Hoeffler, and Temple, 2001) and demands caution in interpreting the results.

A key concern about our empirical approach is that some donors found to have provided effective aid might have simply been either (i) lucky in their choice of recipients, which had stellar growth performances for reasons other than aid flows or (b) "cherry-picked" them in anticipation of high-growth trajectories. In both cases, bilateral aid from such donors would spuriously appear to be positively correlated with growth. Although these concerns cannot be fully dismissed, we argue that they cannot entirely account for our results either. First, could certain donor countries have been fortunate enough to have chosen the "right" recipients and then specialized in providing aid to them? There is extensive empirical evidence that donors do not specialize in providing aid to certain recipients or regions. For example, Easterly (2007a) documents high donor fragmentation both at the country and sector level and concludes that donors tend to "plant their flag" everywhere. Similarly, Alesina and Dollar (2000) find that Nordic countries tend to be involved everywhere, even if only to a small extent. We sought to determine whether this is the case in our data, and found that 90 percent of the recipients in our sample received aid from each development-friendly donor group considered.[22] Secondly, could the donor countries have chosen their recipients in anticipation of high-growth trajectories? We view this to be unlikely, too, since few star performers in the 1960s managed to sustain high growth rates decades later. To illustrate, of the 51 countries which were growing in the 1960s in a sample twice larger, 21 countries experienced negligible or negative growth four decades later (Reddy and Minoiu, 2009). Furthermore, casual evidence from the development discourse prevailing in the 1960s and 1970s suggests that few, if any, countries which later did well (e.g., South Korea) were successfully forecast as such and many of the countries which later did poorly (e.g., those in SSA) were also rarely predicted to do so.

[21] A cautionary note is in order, as a relatively high number of instruments may lead to overfitting of the endogenous variables and could weaken the Hansen test of instruments' joint validity (Roodman, 2007b). We tested for robustness of our Table 8 results by aggressively lowering the numbers of instruments (either by limiting lag depth or by collapsing the instruments), and found that the results held up primarily for *DA* proxied G1 and G2 aid, and to a lesser extent for G3 aid (Minoiu and Reddy, 2008, supplementary appendix, section VII) as we might expect given the hypothesis that some G3 donors have historically been more often guided by strategic interests in supplying aid than those belonging to G1 and G2.

[22] Minoiu and Reddy (2008, supplementary appendix section II).

6. Further Results

We also estimated richer specifications aimed at testing (1) whether low and lower middle income countries are more effective at translating aid into economic growth, and (2) whether *DA* is more effective in specific policy environments.

6.1 Income Threshold Effects

It has been suggested that the presence of income threshold effects may influence countries' ability to render capital productive and generate economic growth. For example, according to the poverty trap model outlined in Sachs et al. (2004), thresholds for the productivity of capital may exist in less developed countries, making it difficult for them to embark on a path of sustained economic growth, especially when combined with low savings rates and high population growth. Sachs et al. (2004) argue that a poverty trap induced by low productivity of capital, low savings rates, or high population growth can be the result of underlying structural causes (poor infrastructure and resulting high transportation costs, small market size, low agricultural productivity, high disease burden, inadequate skilled personnel, low availability of new technology, etc.).

To test whether aid is more effective in low or lower-middle income countries than elsewhere, we include interaction terms of *DA* with income-group dummies in the baseline specifications. The data do not favour this hypothesis.[23] However, since a large proportion of our 107-country sample are low and lower-middle income countries, we face a variance-inflating problem due to high collinearity between the *DA* variable and the interaction variable. Nevertheless, while the interaction term is mostly insignificant, the aid-effectiveness coefficient remains positive, large, and statistically significant.

6.2 Aid and the Policy Environment

We also tested the conjecture that aid is more effective when specific macroeconomic policies are in place (Burnside and Dollar, 2000; Collier and Dollar 2001, 2002) To capture the policy environment, we experimented with the following measures: the original and updated Sachs-Warner policy variables (Sachs and Warner, 1995; Wacziarg and Welch, 2003), and a policy index representing the weighted average of budget surplus, inflation, and trade openness (Burnside and Dollar, 2000). In the baseline specifications, the evidence in favor of aid raising growth only in good policy environments remains inconclusive. The interaction term coefficient is only significant in 4 out of 9 cases, and the level of statistical significance never reaches 1 percent.

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[23] See Minoiu and Reddy (2008, supplementary appendix section IV, Table 8).

7. Discussion and conclusions

In this paper, we re-estimated the causal relationship between aid and growth in a large cross-section of aid recipients, allowing for different kinds of aid to have distinct effects on growth. We attempted to disentangle the effects of two components of aid: a developmental component consisting of expenditures that could reasonably be anticipated to promote growth (*DA*), and a non-developmental component consisting of other expenditures (*NDA*). While we cannot directly measure *DA* due to data limitations, we construct proxies for it representing total bilateral aid from donor countries which are reputed to have development-oriented programs or rank high according to formal aid quality indices. Our specifications allow for the effect of aid on economic growth to appear after long time-lags (possibly involving several decades).

We find that *DA*—as opposed to *NDA*—has a positive and robust effect on subsequent growth. The coefficient estimates show a sizable marginal impact: in cross-country regressions, an increase in average bilateral aid from Scandinavian countries by 1 percentage point of GDP over 1960–90 is associated with average per capita GDP growth rates in the 1990s that are higher by 1.2–1.3 percentage points. The effect is slightly smaller when bilateral aid from a larger number of donor countries is used as a proxy for *DA*. Panel regressions confirm the cross-sectional results: an increase in average bilateral aid from countries ranking highest according to the Aid Commitment to Development Index (CDI) of 1 percentage point of GDP is associated with average per capita GDP growth 15 years later that is higher by 0.2 percentage points. The deep lags considered in our specifications suggest that *DA*'s causal impact operates over several decades. This result is consistent with the view that *DA* may support investments in physical infrastructure, organizational development, and human capabilities (child health, nutrition, and schooling), which bear fruit only over long periods.

The study gives rise to important policy implications. First, by uncovering robust patterns in the data, our results counter claims that aid is inherently ineffective and aid budgets should be reduced. On the contrary, our findings imply that an increase in aid and change in its composition in favor of *DA* are likely to create sizable returns in the long run. Second, by putting forth the proposition that donor characteristics could matter for aid effectiveness, the study calls into question the trend towards greater aid selectivity based on an exclusive focus on recipient countries' characteristics (such as institutional characteristics and macroeconomic policies). At a minimum, the quality of the match between donor and recipient may matter for aid effectieveness. More substantially, donor characteristics may have an effect on aid effectiveness which is independent of recipient characteristics.

Our finding that aid from specific donors promotes subsequent economic growth while aid from other donors does not raises an important question: What is it that makes aid from certain donors work? Data on sectoral allocations of aid at the donor-recipient level is incomplete and cannot serve as a basis for a conclusive analysis. For this reason, we remain agnostic as to the mechanisms which make aid from certain donors more growth-promoting than aid from others. For example, it could be speculated that effective donors have more efficient administrations, face lower overhead costs, or are less bureaucratic so that more of each dollar of aid reaches the intended recipients (see Easterly and Pfutze, 2008). Another possibility that has been noted is that aid from donors free of strategic preoccupations is more likely to facilitate politically costly, but growth-enhancing economic reforms (Bearce and Tirone, 2008). According to this argument, the aid-growth causal mechanism breaks down when the strategic benefits associated with providing aid are large for the donor government, as it cannot credibly enforce its conditions for desirable economic reforms in the recipient countries. A third possibility is that certain donors spend their resources better, by choosing priorities well and developing productive relationships with partners in the receipient country which ensure that official development assistance functions as it is intended to do.

Despite a sizable and mature aid effectiveness literature, we know little about what makes some types of aid more development-effective than others. Our analysis points to the need for further research aimed at identifying the growth effects of distinct categories of aid over relevant time periods and better understanding the strategies of the most effective donors, so as to isolate the channels through which development aid works.

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APPENDIX

Table 1. Variables and sources

VARIABLE	SOURCE
Multilateral aid, in 2003 million US$ Net bilateral aid (grants and concessional loans) broken down by donor, in 2003 million US$	DAC database (2006)
GDP in 2000 million US$ Initial literacy level Income group classification	World Development Indicators online database (2006)
Real per capita GDP growth rate Initial per capita GDP Initial life expectancy Institutional quality (World Bank CPIA, 1960–1999) Geography variable Initial level of government consumption, Indicator of social unrest (# revolutions) Terms of trade (average and standard deviation)	Rajan and Subramanian (2008)
Original Sachs-Warner policy variable	Sachs and Warner (1995)
Updated Sachs-Warner variable	Wacziarg and Welch (2003)
Institutional quality (annual ICRG index, 1984–89)	Stephen Knack and Keefer, Philip (1995) IRIS-3: File of ICRG data. College Park, Maryland: IRIS (producer). East Syracuse, New York: The PRS Group, Inc. (distributor)
Burnside and Dollar (2000) policy variable	Easterly, Levine and Roodman (2004)

Table 2. Summary statistics of selected variables

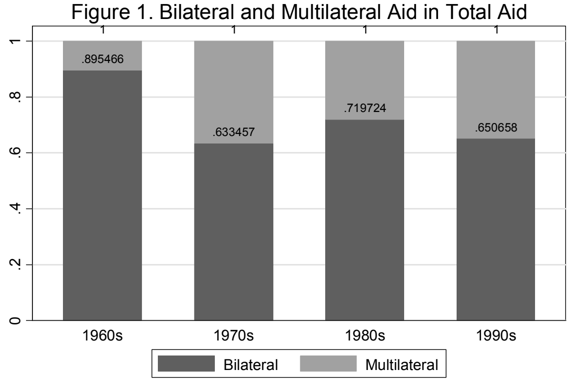
Cross-sectional regressions

Variable	# countries	Mean	Std. Dev.	Min	Max
Per capita GDP Growth	86	1.3825	1.7510	-3.3734	6.7943
Initial Per Capita GDP	82	7.3858	0.6859	5.9442	8.9671
Initial Level of Life Expectancy	97	48.8192	10.9880	31.6100	71.6800
Institutional Quality (CPIA)	88	0.5271	0.1234	0.2250	0.8590
Geography	89	-0.4722	0.8306	-1.0400	1.7839
Initial Government Consumption	107	17.0369	12.3362	1.3766	65.0415
Revolutions	107	0.2243	0.2354	0.0000	1.4444
Terms of trade (Average)	107	112.0005	21.7761	66.6658	176.2134
Terms of trade (St. Dev.)	107	23.8871	18.1735	0.0058	94.3235
Initial policy	107	0.0187	0.1361	0.0000	1.0000

Panel regressions (five-year average panel)

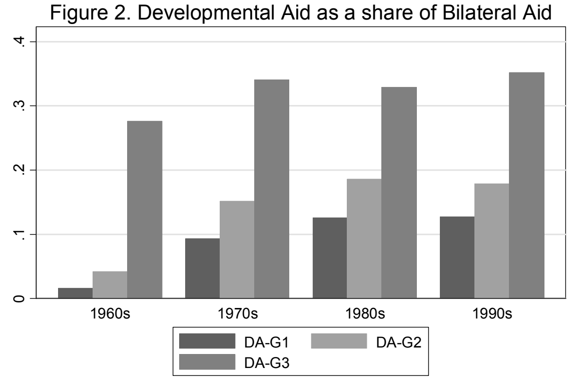
Variable	# obs	Mean	Std. Dev.	Min	Max
Per capita GDP growth	743	1.4407	3.7023	-14.2798	22.9337
Log(inflation)	631	0.2181	0.4681	-0.0436	4.1922
Institutional Quality (CPIA)	728	0.5309	0.1272	0.2250	0.8590
Geography	736	-0.4691	0.8190	-1.0400	1.7839
Initial Per Capita GDP	754	7.7613	0.8277	5.7739	10.0276
Revolutions	762	0.2126	0.3534	0.0000	2.6000
Initial policy	880	0.1864	0.3896	0.0000	1.0000
Government Consumption	766	20.7881	11.0700	2.1432	73.4520
DA from G1 donors /GDP	700	0.0076	0.0254	-0.0005	0.3448
DA from G2 donors /GDP	700	0.0110	0.0292	-0.0025	0.3630
DA from G3 donors /GDP	700	0.0353	0.0644	-0.0004	0.5828
Multilateral aid/GDP	700	0.0296	0.0499	-0.0013	0.3918
NDA from non-G1 donors/GDP	700	0.0574	0.0792	-0.0009	0.6123
NDA from non-G2 donors/GDP	700	0.0539	0.0758	-0.0013	0.6067
NDA from non-G3 donors/GDP	700	0.0297	0.0465	-0.0019	0.4814

Figure 1. Bilateral and Multilateral Aid in Total Aid



Source: OECD-DAC

Figure 2. Developmental Aid as a share of Bilateral Aid



Source: OECD-DAC | Bilateral aid is the sum total of bilateral flows from the largest 22 donors

Table 3. Total aid, multilateral aid, and bilateral aid (% of recipients' GDP)

Variable	Time period	# countries	Mean	Std. Dev.	Min	Max
$\frac{Total\ Aid}{GDP}$	1960-1970	67	0.0729	0.0935	0.0000	0.4364
	1970-1980	76	0.0938	0.1128	0.0000	0.5701
	1980-1990	87	0.1147	0.1598	0.0000	0.8916
	1960-1990	67	0.0881	0.0993	0.0000	0.4441
$\frac{Multilateral\ Aid}{GDP}$	1960-1970	67	0.0096	0.0141	-0.0001	0.0677
	1970-1980	76	0.0293	0.0395	0.0000	0.1715
	1980-1990	87	0.0390	0.0647	-0.0001	0.3813
	1960-1990	67	0.0235	0.0321	0.0000	0.1469
$\frac{Bilateral\ Aid}{GDP}$	1960-1970	67	0.0634	0.0876	0.0000	0.4101
	1970-1980	76	0.0645	0.0790	0.0000	0.3986
	1980-1990	87	0.0757	0.0995	0.0000	0.5104
	1960-1990	67	0.0646	0.0716	0.0000	0.2972

Table 4. Bilateral aid from G1-G3 donor groups (% recipients' GDP)

Variable	Time period	# countries	Mean	Std. Dev.	Min	Max
$\frac{DA-G1}{GDP}$	1960-1970	67	0.0017	0.0078	-0.0001	0.0007
	1970-1980	76	0.0228	0.1872	0.0000	0.0067
	1980-1990	87	0.0328	0.2648	-0.0001	0.0112
	1960-1990	67	0.0072	0.0319	0.0000	0.0040
$\frac{DA-G2}{GDP}$	1960-1970	67	0.0028	0.0111	0.0000	0.0018
	1970-1980	76	0.0247	0.1896	0.0000	0.0106
	1980-1990	87	0.0370	0.2878	0.0000	0.0156
	1960-1990	67	0.0103	0.0459	0.0000	0.0072
$\frac{DA-G3}{GDP}$	1960-1970	67	0.0935	0.4401	-0.0003	0.0466
	1970-1980	76	0.0483	0.2128	0.0000	0.0339
	1980-1990	87	0.0587	0.3462	0.0000	0.0364
	1960-1990	67	0.0550	0.2464	-0.0001	0.0365

Note: In Tables 2–4, the number of observations represents the number of countries for which data is available for both the aid and the GDP variables.

Table 5. OLS regressions à la Rajan and Subramanian (2008)
Dependent variable: Average Annual Growth Rate of Per Capita GDP

Growth is averaged over:	1960–00	1960–80	1970–00	1980–00	1990–00
TA/GDP is averaged over:	1960–70	1960–70	1960–80	1970–80	1980–90
TA/GDP (lagged)	-0.16	-2.97	0.99	2.98	5.21**
	[2.76]	[2.95]	[2.00]	[2.79]	[2.09]
Observations	61	58	64	64	77
R-squared	0.73	0.51	0.72	0.68	0.56

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%
Intercept and all controls as in Rajan and Subramanian (2008) are included, but coefficients not shown. Controls: initial income, initial life expectancy, institutional quality, geography, initial government consumption, revolutions, average and standard deviation of terms of trade, initial policy, and continent dummies.

Table 6. OLS regressions with deeper lags than Rajan and Subramanian (2008)
Dependent variable: Average Annual Growth Rate of Per Capita GDP 1990–00

TA/GDP is averaged over:	1960–80	1960–90	1970–90
TA/GDP (lagged)	8.45**	8.22**	6.77**
	[3.31]	[3.57]	[2.71]
Observations	64	64	70
R-squared	0.65	0.64	0.61

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%
Intercept and all controls as in RS (2005) are included, but coefficients not shown. The control variables included in the regressions above are: initial income, initial life expectancy, institutional quality, geography, initial government consumption, revolutions, average and standard deviation of terms of trade, initial policy, and continent dummies.

Table 7. OLS regressions of the effect of *DA* on growth
Dependent variable: Average Annual Growth Rate of Per Capita GDP (1990–00)

DA-G1/GDP (lagged)	**131.97*** **		
	[43.66]		
DA-G2/GDP (lagged)		**120.25*** **	
		[34.15]	
DA-G3/GDP (lagged)			**14.75** **
			[7.31]
MA/GDP (lagged)	26.71	21.83	6.73
	[17.22]	[15.16]	[17.80]
NDA/GDP (lagged)	-3.67	-5.03	1.32
	[6.54]	[6.50]	[5.39]
Initial Income	-0.24	-0.04	-0.54
	[0.70]	[0.70]	[0.66]
Initial Life Expectancy	0.01	0.01	0.04
	[0.09]	[0.08]	[0.09]
Institutional Quality	3.85	3.26	3.89
	[3.61]	[3.52]	[4.45]
Geography	0.48	0.43	0.39
	[0.37]	[0.39]	[0.38]
Initial Government Consumption	-0.05*	-0.05**	-0.04
	[0.03]	[0.02]	[0.03]
Revolutions	-1.53**	-1.57**	-1.85**
	[0.67]	[0.64]	[0.83]
Terms of trade average	0.04	0.03	0.02
	[0.04]	[0.03]	[0.04]
Terms of trade standard deviation	-0.16***	-0.16***	-0.15***
	[0.04]	[0.03]	[0.04]
Initial Policy	-0.03	-0.18	0.11
	[0.60]	[0.57]	[0.64]
SSA Dummy	-3.62**	-3.75**	-3.20*
	[1.63]	[1.55]	[1.63]
East Asia Dummy	1.09	1.26*	0.88
	[0.72]	[0.73]	[0.86]
Constant	-0.23	-0.88	2.65
	[4.76]	[4.78]	[4.65]
Observations	64	64	64
R-squared	0.69	0.72	0.66

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%
Note: *DA*, *MA*, and *NDA* are averaged over 1960–90.

Figure 3

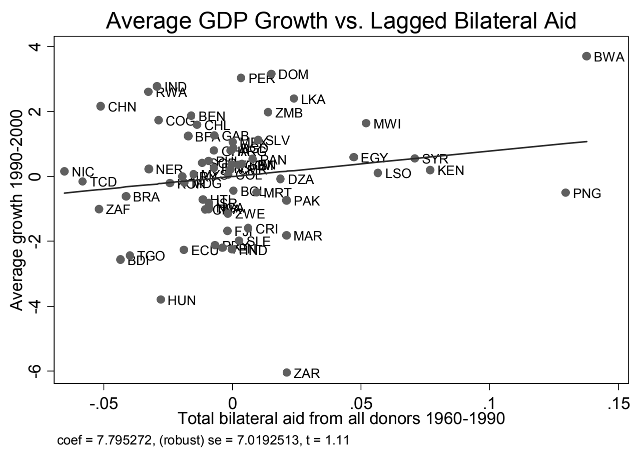


Figure 4

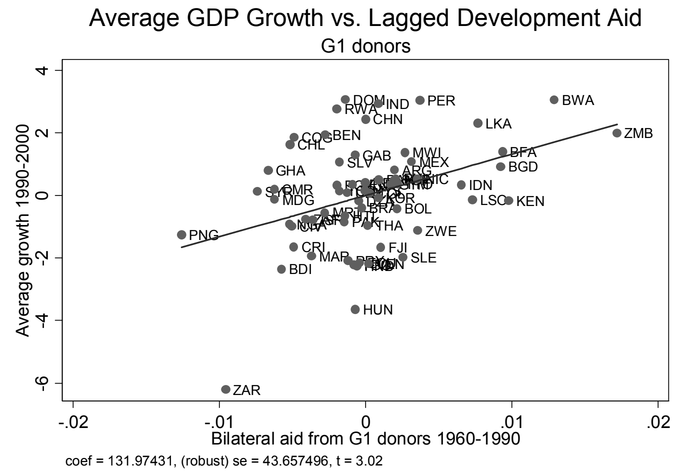


Figure 5

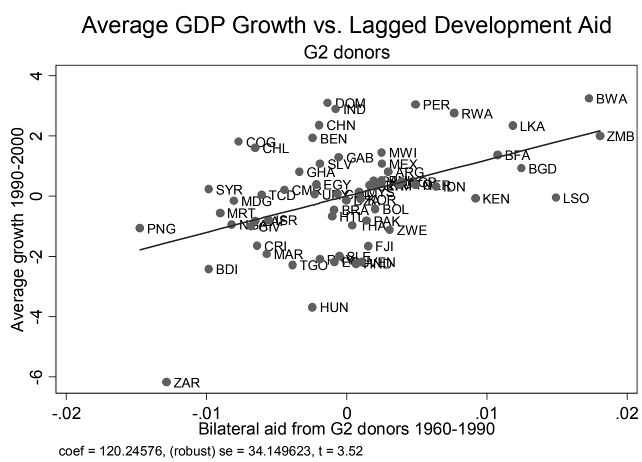


Figure 6

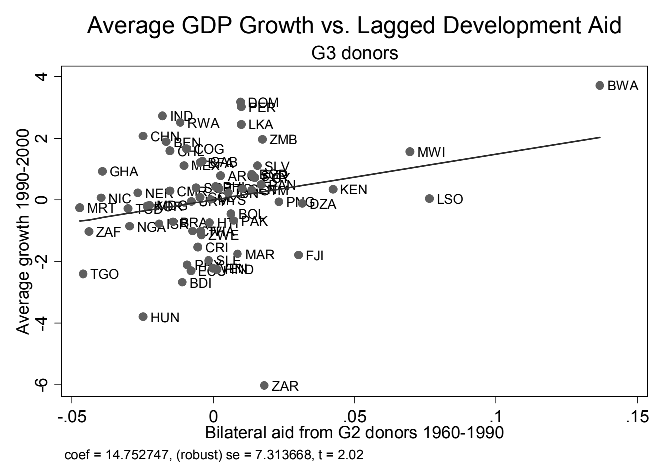


Table 8. System GMM regressions of the effect of *DA* on growth

Dependent variable: Average Annual Growth Rate of Per Capita GDP

Aid is lagged	5 years			15 years			25 years		
DA from donor group	G1	G2	G3	G1	G2	G3	G1	G2	G3
DA/GDP Lagged	**19.57***	**18.41***	**11.19**	**14.22**	**16.69***	**4.77**	**111.27**	**74.62***	**0.52***
	[6.40]	**[6.22]**	**[4.74]**	**[6.22]**	**[6.32]**	**[3.02]**	**[44.14]**	**[17.27]**	**[0.31]**
MA/GDP Lagged	-5.38	-4.46	4.51	-14.14	-16.45*	-6.55	8.24	5.79	22.02**
	[7.18]	[6.89]	[5.98]	[8.77]	[9.44]	[5.22]	[12.23]	[11.50]	[11.17]
NDA/GDP Lagged	2.34	1.87	-8.04*	6.14	5.30	1.82	1.54	1.55	-0.13
	[5.45]	[5.48]	[4.79]	[4.25]	[4.23]	[5.94]	[2.47]	[2.47]	[4.12]
Log Inflation (1+(inf/100))	-1.64***	-1.55***	-1.64***	-1.48***	-1.48***	-1.49***	-1.63***	-1.60***	-1.54***
	[0.30]	[0.31]	[0.28]	[0.31]	[0.30]	[0.29]	[0.30]	[0.30]	[0.28]
Institutional Quality	7.08***	6.39***	5.28*	7.20**	6.95**	6.93**	3.33	3.28	4.15
	[2.60]	[2.43]	[2.72]	[3.17]	[3.20]	[3.09]	[5.06]	[4.70]	[2.61]
Geography	0.38*	0.43**	0.33*	0.27	0.29	0.29	0.52*	0.51*	1.92
	[0.20]	[0.20]	[0.20]	[0.28]	[0.26]	[0.27]	[0.30]	[0.30]	[4.32]
Initial Income	-1.11**	-0.90*	-0.73	-1.15**	-1.13*	-1.25**	-0.78	-0.77	-0.77
	[0.48]	[0.49]	[0.49]	[0.58]	[0.62]	[0.58]	[0.69]	[0.67]	[0.71]
Revolutions	-1.51***	-1.63***	-1.59***	-1.46*	-1.47*	-1.62*	-2.20*	-2.42*	-2.66**
	[0.54]	[0.60]	[0.60]	[0.82]	[0.87]	[0.90]	[1.17]	[1.29]	[1.29]
Initial Policy	0.70	0.71	0.60	0.60	0.57	0.64	0.61	0.59	0.67
	[0.52]	[0.52]	[0.53]	[0.58]	[0.55]	[0.55]	[0.60]	[0.59]	[0.63]
Initial Government Consumption	-0.05**	-0.07***	-0.04*	-0.00	-0.01	-0.01	-0.02	-0.02	-0.02
	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.03]	[0.03]	[0.03]
SSA dummy	-2.33**	-2.03**	-2.79***	-2.92***	-2.80***	-3.34***	-3.74***	-3.75***	-3.72***
	[0.93]	[0.91]	[0.87]	[1.02]	[1.03]	[0.92]	[0.92]	[0.98]	[1.12]
East Asia dummy	1.17	1.31*	1.80***	1.37*	1.38*	1.20*	1.22	1.37*	1.44*
	[0.75]	[0.70]	[0.63]	[0.74]	[0.73]	[0.71]	[0.84]	[0.76]	[0.76]
Hansen test p-value	1.000	1.000	1.000	1.000	1.000	1.000	0.974	0.956	0.978
AR(1) test p-value (*m1*)	0.000	0.000	0.000	0.000	0.000	0.000	0.028	0.037	0.027
AR(2) test p-value (*m2*)	0.372	0.409	0.509	0.053	0.050	0.071	…	…	…
Observations	468	468	468	336	336	336	202	202	202

Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. Intercept not shown.

SUPPLEMENTARY APPENDIX

Contents

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Misspecification Bias

a) Bias of the OLS estimator of the marginal effect coefficient on total aid (*TA*) in a standard growth-aid model.

The hypothesized *true* model is: $\gamma = DA\beta_1 + NDA\beta_2 + C\delta_T + \varepsilon_T$ (1) where γ represents average real per capita GDP growth; *DA* is developmental aid and has coefficient β_1; *NDA* is non-developmental aid with coefficient β_2, and *C* is a matrix of covariates, with δ_T the vector of corresponding coefficients. The *estimated* model is: $\gamma = TA\beta + C\delta_R + \varepsilon_R$ (2) where *TA*= *DA* + *NDA* and $E(TA \mid \varepsilon_R) = 0$.

The OLS estimator of β is given by $[TA'M_C TA]^{-1} TA'M_C\gamma$ where M_C is the residual-maker matrix and therefore $M_C TA$ and $M_C\gamma$ are the residuals from the partialled-out regressions of *TA* and γ on the set of controls. Given (1), the OLS estimator can be written as:

$$\begin{aligned}\tilde{\beta}^{OLS} &= \left[TA'M_C TA\right]^{-1} TA'M_C\left[\beta_1 DA + \beta_2 NDA + C\delta_T + \varepsilon_T\right] \\ &= \beta_1\left[TA'M_C TA\right]^{-1} TA'M_C DA + \beta_2\left[TA'M_C TA\right]^{-1} TA'M_C NDA + \\ &+ \delta_T\left[TA'M_C TA\right]^{-1} TA'M_C C + \left[TA'M_C TA\right]^{-1} TA'M_C\varepsilon_T\end{aligned}$$

The last two terms are zero since $M_C C = 0$ and $M_C\varepsilon_T = 0$ (given exogeneity of C). Using the fact that the residual-maker matrix is symmetric and idempotent, we can write:

$TA'M_C TA = TA'M_C{}'M_C TA = (M_C TA)'M_C TA$. The same relationship holds for *DA* and *NDA*:
$TA'M_C DA = TA'M_C{}'M_C DA = (M_C TA)'M_C DA$ and
$TA'M_C NDA = TA'M_C{}'M_C NDA = (M_C TA)'M_C NDA$.

Denote $M_C TA = \widetilde{TA}$, $M_C DA = \widetilde{DA}$ and $M_C NDA = \widetilde{NDA}$ to obtain
$\tilde{\beta}^{OLS} = \beta_1\left[\widetilde{TA}'\widetilde{TA}\right]^{-1}\widetilde{TA}'\widetilde{DA} + \beta_2\left[\widetilde{TA}'\widetilde{TA}\right]^{-1}\widetilde{TA}'\widetilde{NDA}$.

This can be re-written as: $\hat{\beta}^{\text{OLS}} = \left[\beta_1\frac{\widehat{Cov}(\widetilde{TA},\widetilde{DA})}{\widehat{Var}(\widetilde{TA})} + \beta_2\frac{\widehat{Cov}(\widetilde{TA},\widetilde{NDA})}{\widehat{Var}(\widetilde{TA})}\right]$ (3).

Furthermore, by the Law of Large Numbers,

$$\hat{\beta}^{\text{OLS}} \xrightarrow{P} \left[\beta_1\frac{Cov(\widetilde{TA},\widetilde{DA})}{Var(\widetilde{TA})} + \beta_2\frac{Cov(\widetilde{TA},\widetilde{NDA})}{Var(\widetilde{TA})}\right] \quad (4)$$

Thus, the OLS estimator converges to a weighted average of the true coefficients identifying the effect of *DA* and *NDA*, respectively, and the weights are functions of the variances and covariances involving the two components of aid.

b) Bias of the 2SLS estimator of the marginal effect coefficient on Total Aid (TA) in a standard growth-aid model.

Assume that the true and estimated models are as in (1) and (2). Assume in (2) that *TA* is endogenous to growth (i.e., $E(TA \mid \varepsilon_R) \neq 0$) due to reversed causality. An instrumentation strategy is employed whereby *NDA* serves as an instrument for *TA* (assuming that there is no measurement error in *NDA*). Further, assume that *NDA* fulfills the relevance and exogeneity requirements for an instrument, but is not excludable from the model.

In the first stage, exogenous variation in the instrumented variable is obtained through the OLS regression $TA = NDA\pi + C\delta_1 + \zeta$, yielding $\hat{\pi} = \left[NDA' M_C NDA\right]^{-1} NDA' M_C TA$ and residuals $\widetilde{TA}$. In the second stage, the original equation is estimated replacing TA with $\widetilde{TA}$ to obtain:

$$\hat{\beta}^{2SLS} = \left[\widetilde{TA}' M_C \widetilde{TA}\right]^{-1} \widetilde{TA}' M_C \gamma$$

By symmetry and idempotency of the residual-maker matrix, the first multiplicative term in the formula of $\hat{\beta}^{2SLS}$ is given by $\widetilde{TA}' M_C \widetilde{TA} = \widetilde{TA}' M_C' M_C \widetilde{TA} = (M_C \widetilde{TA}')' M_C \widetilde{TA}$. Given the first stage, we have: $M_C \widetilde{TA} = M_C\left[NDA\hat{\pi} + C\delta_1\right] = \hat{\pi} M_C NDA + M_C C\delta_1 = \hat{\pi} M_C NDA$ since $M_c C = 0$. Therefore, $\widetilde{TA}' M_C \widetilde{TA} = \left[\hat{\pi} M_C NDA\right]' \hat{\pi} M_C NDA = \hat{\pi}^2 NDA' M_C NDA$. The second multiplicative term is given by $\widetilde{TA}' M_C \gamma = \left[M_C \widetilde{TA}\right]' M_C \gamma = \left[\hat{\pi} M_C NDA\right]' M_C \gamma = \hat{\pi} NDA' M_C \gamma$

The 2SLS estimator becomes:

$$\hat{\beta}^{2SLS} = \left[\hat{\pi}^2 NDA' M_C NDA\right]^{-1} \hat{\pi} NDA' M_C \gamma = \hat{\pi}^{-1}\left[NDA' M_C NDA\right]^{-1} NDA' M_C \gamma \quad (5)$$

First, note that:

$$\hat{\pi}^{-1} = \left[\left[NDA' M_C NDA\right]^{-1} NDA' M_C TA\right]^{-1} = \left[NDA' M_C TA\right]^{-1} NDA' M_C NDA \quad (6)$$

Replace $\hat{\pi}$ given by (6) in (5) to obtain:

$$\hat{\beta}^{2SLS} = \left[NDA' M_C TA\right]^{-1} NDA' M_C NDA\left[NDA' M_C NDA\right]^{-1} NDA' M_C \gamma = \left[NDA' M_C TA\right]^{-1} NDA' M_C \gamma$$

Using (1), we have:

$$\hat{\beta}^{2SLS} = \left[NDA' M_C TA\right]^{-1} NDA' M_C\left[\beta_1 DA + \beta_2 NDA + C\delta_T + \varepsilon_T\right] =$$
$$\beta_1\left[NDA' M_C TA\right]^{-1} NDA' M_C DA +$$
$$+ \beta_2\left[NDA' M_C TA\right]^{-1} NDA' M_C NDA\left[NDA' M_C TA\right]^{-1} NDA' M_C \varepsilon_T$$

The last term is equal to 0 since *NDA* is exogenous. Thus,

$$\hat{\beta}^{2SLS} = \beta_1 [NDA' M_C TA]^{-1} NDA' M_C DA + \beta_2 [NDA' M_C TA]^{-1} NDA' M_C NDA$$

Factor out $[NDA' M_C TA]^{-1}$ to obtain: $\hat{\beta}^{2SLS} = \hat{Cov}(N\widetilde{DA}, \widetilde{TA})^{-1} \left[\beta_1 \hat{Cov}(\widetilde{DA}, N\widetilde{DA}) + \beta_2 \hat{Var}(N\widetilde{DA})\right]$

The 2SLS estimator converges to a weighted average of the coefficients of *DA* and *NDA*, with weights given by function of the conditional variances and covariances involving the two variables:

$$\hat{\beta}^{2\mathrm{SLS}} \xrightarrow{P} \left[\beta_1 \frac{Cov(\widetilde{DA}, N\widetilde{DA})}{Cov(N\widetilde{DA}, \widetilde{TA})} + \beta_2 \frac{Var(N\widetilde{DA})}{Cov(N\widetilde{DA}, \widetilde{TA})} \right] \quad (7)$$

Do Donors 'Plant their Flag' Everywhere?

Here we provide evidence that donor countries in general, including our development-friendly donor groups (G1, G2, and G3) extended aid to a large pool recipient countries over 1960–90. The data suggests high donor fragmentation: donors tend to be present, albeit to a small extent, in many recipient countries.

Table 1. Do donors "plant their flag" everywhere? (N=97)

Donor country	**1960–90**	**1960–70**	**1970–80**	**1980–90**
Australia	**78**	31	57	76
Austria	**85**	61	80	85
Belgium	**87**	66	84	87
Canada	**87**	63	76	87
Denmark	**82**	49	76	74
Finland	**84**	0	72	84
France	**87**	38	84	87
Germany	**88**	79	86	88
Ireland	**52**	0	26	52
Italy	**87**	66	82	86
Japan	**88**	63	84	88
Luxembourg	**46**	0	0	46
Netherlands	**87**	51	85	87
New Zealand	**47**	0	34	44
Norway	**83**	45	74	82
Portugal	**5**	5	0	4
Spain	**73**	0	0	73
Sweden	**82**	45	67	76
Switzerland	**87**	75	84	86
UK	**87**	79	83	87
US	**85**	78	79	85

	1960–70	**1970–80**	**1980–90**
Donor group	# of recipient countries		
G1	70	86	88
G2	81	87	88
G3	82	86	88
	% of recipient countries		
G1	73%	90%	92%
G2	84%	91%	92%
G3	85%	90%	92%

Aid Features: Sectoral Allocations, Tiedness, and Grant element

The ideal proxy for *DA* as defined in our study is a variable which cumulates aid spent in areas that can reasonably be anticipated to promote growth (e.g., social infrastructure and services, health, education, employment, housing, social services, gender empowerment). Unfortunately, sector-level *aid disbursement* data are not available over 1960–00 in the DAC (2006) database—the sole provider of comprehensive aid data. Here we use data on *aid commitments* for the period 1967–00 (DAC, 2006, Table 5) to illustrate several difficulties encountered in constructing *DA* and *NDA* proxies,[24] and provide some justification for the alternative route we took in the paper to estimate *DA*.[25]

We seek to identify development-friendly donors. Specifically, we calculate the share of *DA* in total bilateral aid (*DA/BA*) for various donors and donor groups.

We classify as *DA* those flows spent on:

- social infrastructure and services (100s)
- economic infrastructure and services (200s)
- production sectors (300s)
- multisectoral crosscutting (400s)
- food aid excluding emergency food aid (520s)
- emergency assistance (700)
- donation to NGOs (920)

NDA are those flows spent on:[26]

- business and other services (250)
- structural adjustment with IBRD/WB/IMF (510)
- other general aid and commodity assistance (530)
- action related to debt (600s)[27]

[24] Donor-level commitments (DAC, 2006, Table 5) and disbursements of aid (DAC, 2006, Table 2a) are highly correlated over time: simple correlation coefficients range between 0.73 and 0.99 (see also Neumeyer, 2003). At the same time, there are important discrepancies between commitments and disbursements (the average gap between the two over the period 1990–00 is US$ 350 million, and it ranges between US$ 0 and US$ 12.1 billion). These facts should be borne in mind when interpreting the results.
[25] A major hurdle is that aid flows are often classified as "unspecified/unallocated" in the database. Further, unallocated aid can represent a large share of a specific donor's aid outlays (49 percent of Belgium; 20 percent for Sweden). There is no basis for deciding how to classify this type of aid (e.g., Clemens, Radelet and Bhavnani, 2004, treat it as long-term impact aid). For simplicity, we eliminated unallocated aid from our examination of the composition of bilateral flows.
[26] Even if it may be controversial that certain aid categories—notably, donations to NGOs, multisectoral crosscutting, and emergency assistance—be treated as *NDA*, these aid flows are small and their classification does not materially affect our conclusions.
[27] It is unclear whether "debt forgiveness" should be taken to be developmental or non-developmental in nature as it releases resources which may be used for diverse purposes. Further, the entire principal forgiven in a given year is counted as aid provided in that year in the DAC (2006) database. This way of recording debt forgiveness makes it almost useless for our purpose since the bulk of the aid recorded as having been provided in a given year is notional in that year and its benefits will be distributed over many subsequent years. Nevertheless, it

- administrative costs of donors (910)

Table 2. DA by donor (1967–00)

Donor	1967–90		1970–79	1980–89	1990–99
	DA/BA	Rank	DA/BA		
Australia	60%	18	45%	60%	81%
Austria	85%	12	95%	93%	70%
Belgium	93%	2	94%	93%	78%
Canada	93%	1	95%	88%	82%
Switzerland	91%	4	91%	93%	82%
Germany	88%	8	86%	90%	82%
Denmark	92%	3	91%	93%	85%
Finland	91%	5	88%	93%	86%
France	87%	10	91%	87%	69%
UK	83%	13	89%	84%	74%
Ireland	87%	9	-	87%	88%
Italy	72%	17	63%	89%	62%
Japan	86%	11	88%	87%	81%
Netherlands	76%	15	84%	88%	83%
Norway	91%	6	95%	92%	86%
New Zealand	80%	14	84%	76%	79%
Sweden	90%	7	93%	89%	85%
US	73%	16	76%	62%	71%

The average DA/BA is 84 percent over 1967–90.[28] Furthermore, the highest ranking donors based on this crude measure are: Canada, Belgium, Denmark, Switzerland, and Finland. These are all members of either the G2 or G3 donor groups employed to estimate *DA* in our study.

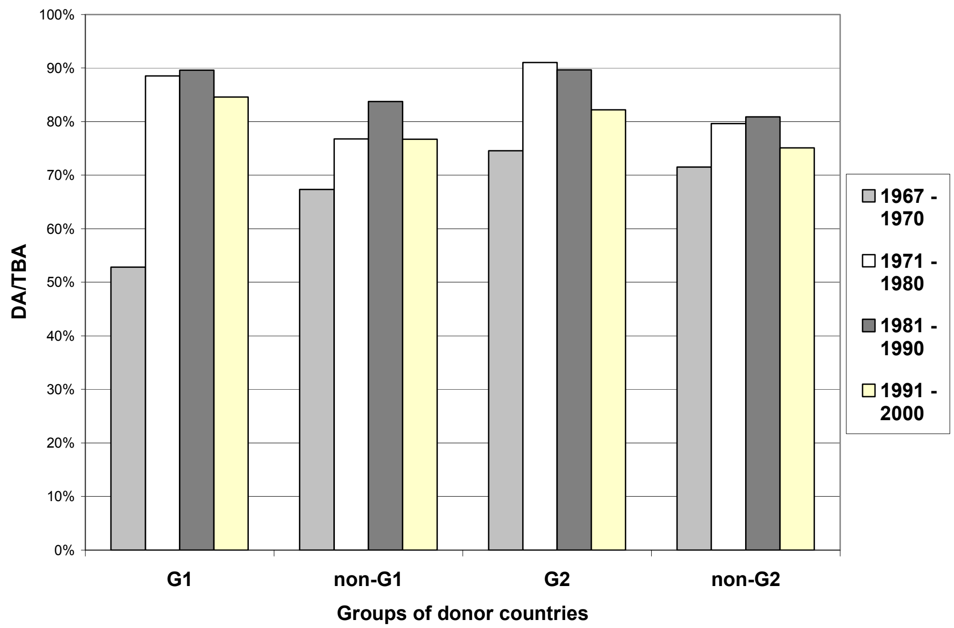
To determine if there are systematic differences in the sectoral allocation of aid budgets between our chosen donor groups and others, we plot DA/BA from G1 (Sweden, Norway, Denmark, Netherlands, and Finland), G2 (Sweden, Norway, Denmark, Netherlands, Finland, Austria, Ireland, Canada, Luxembourg, and Switzerland), and donor countries outside these groups (Figure 1). We observe slightly lower shares of DA/BA for non-G1 and non-G2 donors compared to their "development-friendly"

should be noted that the total aid variable in the database includes substantial debt relief extended to countries under the HIPC Initiative over the last decade.

[28] According to Table 2, all donor countries seem to direct aid primarily to the growth-enhancing sectors; however, marked differences in the spending profile of donors have been documented from more disaggregated analyses. For example, using actual disbursements for 2002–04, Thiele, Nunnenkamp, and Dreher (2006) find that the share of aid going to the social infrastructure and services sector ranges from 22 percent in Japan to 50 percent in Norway. Similarly, France and Germany spend little on primary education, as opposed to the Netherlands, Norway, and the UK. Moreover, Denmark and Germany are the only donors that allocate an important share of aid to basic water and sanitation. Thiele, Nunnenkamp, and Dreher (2006) document substantial heterogeneity in sectoral aid allocations across donors.

counterparts. In light of our definition of *DA* which focuses on the nature of expenditures, the evidence put forth here demonstrates that our selection of donors into the G1-G3 groups is broadly consistent with donors' portraits derived from sector-level aid data.

Figure 1. Share of DA/BA by donor group



We also analyze (i) the share of untied aid (based on aid commitment data, 1971–90), and the share of grants (based on actual aid disbursements, 1960–90) (Table 3). We find no evidence that G1-G3 donors countries systematically give more untied aid, or that they prefer grants to loans.

Table 3. Tied vs untied aid; Grants vs loans

Donor group	% untied aid (1971–90)	% grant aid (1960–90)
G1	74	89
Non-G1	56	77
p-value	*0.3302*	*0.5321*
G2	62	85
Non-G2	57	77
p-value	*0.4450*	*0.4855*

G3	52	82
Non-G3	60	76
p-value	*0.5800*	*0.5078*

Note: The p-values are for tests of equality of means. The alternative hypothesis in these tests is that G1, G2, and G3 give *more* grant and untied aid on average than non-G1, non-G2, and non-G3 donors. The % of untied aid refers to both completely and partially untied aid.

We conclude that aid from any given donor—whether motivated by strategic or development considerations—is likely to be largely allocated to growth-promoting sectors. The lack of clearer patterns concerning donor behavior may be driven by the too aggregative nature of the classifications, mismeasurement, or misclassification (Headey, 2005). This analysis also reflects the difficulties encountered by the applied researcher who wishes to use sector-level or any other type of aid information to construct proxies for the productive and less productive components of aid.

Cross-sectional Evidence: Robustness Checks

Table 4. OLS regressions: Bilateral vs. multilateral aid

Dependent variable: Average Per Capita GDP Growth (1990–00), N=64

Lagged aid is averaged over →	**1960–90**	**1960–85**	**1960–80**
BA/GDP (lagged)	**7.80**	**6.59**	**7.03**
	[7.02]	**[4.97]**	**[6.04]**
MA/GDP (lagged)	9.46	18.04	11.65
	[18.92]	[18.61]	[19.18]
Initial Income	-0.70	-0.73	-0.74
	[0.65]	[0.62]	[0.63]
Initial Life Expectancy	0.05	0.06	0.05
	[0.09]	[0.09]	[0.09]
Institutional quality	4.97	4.90	5.03
	[4.29]	[4.50]	[4.40]
Geography	0.41	0.38	0.39
	[0.39]	[0.39]	[0.39]
Initial government consumption	-0.05*	-0.05*	-0.05*
	[0.03]	[0.03]	[0.03]
Revolutions	-1.73**	-1.73**	-1.75**
	[0.82]	[0.81]	[0.82]
Terms of trade average	0.02	0.01	0.02
	[0.04]	[0.04]	[0.04]
Terms of trade standard deviation	-0.13***	-0.13***	-0.13***
	[0.04]	[0.04]	[0.04]
Initial Policy	0.23	0.21	0.24
	[0.63]	[0.61]	[0.62]
SSA Dummy	-2.70	-2.74	-2.71
	[1.65]	[1.66]	[1.66]
East Asia Dummy	0.72	0.76	0.72
	[0.83]	[0.82]	[0.82]
Constant	1.73	2.11	2.13
	[4.81]	[4.63]	[4.70]
R-squared	0.64	0.65	0.64

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5. OLS regressions: Using different lags of aid

Dependent variable: Average Per Capita GDP Growth (1990–00), N=64

Lagged aid is averaged over →	1960–80[29]			1960–85		
	G1	**G2**	**G3**	**G1**	**G2**	**G3**
DA/GDP (lagged)	**188.19*** **	**170.62*** **	**9.31***	**147.26*** **	**133.09*** **	**11.80***
	[58.36]	**[41.38]**	**[4.79]**	**[47.45]**	**[36.21]**	**[6.17]**
MA/GDP (lagged)	36.77*	32.83*	17.71	28.92	24.28	10.18
	[19.11]	[16.44]	[18.04]	[18.46]	[16.18]	[18.36]
NDA/GDP (lagged)	-6.07	-9.19	0.95	-4.25	-6.28	1.34
	[6.17]	[6.36]	[4.82]	[6.21]	[6.28]	[4.94]
Initial Income	-0.32	-0.08	-0.60	-0.30	-0.08	-0.59
	[0.65]	[0.62]	[0.63]	[0.69]	[0.67]	[0.64]
Initial Life Expectancy	0.02	0.02	0.04	0.01	0.01	0.04
	[0.09]	[0.07]	[0.09]	[0.09]	[0.08]	[0.09]
Institutional quality	3.99	3.40	4.19	4.02	3.49	4.07
	[3.84]	[3.58]	[4.59]	[3.73]	[3.58]	[4.56]
Geography	0.44	0.39	0.38	0.43	0.38	0.37
	[0.37]	[0.37]	[0.39]	[0.38]	[0.39]	[0.39]
Initial Govt. Cons.	-0.03	-0.04	-0.04	-0.04*	-0.05*	-0.04
	[0.02]	[0.02]	[0.03]	[0.02]	[0.02]	[0.03]
Revolutions	-1.48**	-1.48**	-1.81**	-1.57**	-1.60**	-1.85**
	[0.68]	[0.61]	[0.82]	[0.69]	[0.64]	[0.83]
Terms of trade average	0.02	0.01	0.01	0.03	0.02	0.02
	[0.04]	[0.03]	[0.04]	[0.04]	[0.03]	[0.04]
Terms of trade standard deviation	-0.15***	-0.15***	-0.14***	-0.15***	-0.15***	-0.15***
	[0.04]	[0.03]	[0.04]	[0.04]	[0.03]	[0.04]
Initial Policy	-0.18	-0.42	0.12	-0.03	-0.20	0.14
	[0.63]	[0.57]	[0.64]	[0.61]	[0.57]	[0.64]
SSA Dummy	-3.62**	-3.74**	-3.13*	-3.62**	-3.75**	-3.13*
	[1.63]	[1.50]	[1.67]	[1.65]	[1.55]	[1.65]
East Asia Dummy	1.15	1.42**	0.90	1.07	1.27*	0.87
	[0.72]	[0.70]	[0.85]	[0.73]	[0.73]	[0.85]
Constant	1.60	0.96	2.80	0.76	0.36	2.81
	[4.40]	[4.29]	[4.54]	[4.60]	[4.58]	[4.56]
R-squared	0.70	0.73	0.66	0.69	0.72	0.66

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

[29] The large coefficient estimates on DA/GDP averaged over 1960–80 and 1960–85 may be a result of the fact that we are omitting from the specification *DA* that was expended in other years (1980–90 and 1985–90) but may have had an impact on growth in the 1990s. For this reason, coupled with a preference for parsimony as well as the relatively small samples available, we neither pursue specifications in which *DA* is lagged over other time periods, nor do we include separate aid terms for distinct lags.

Table 6. OLS regressions: The effect of influential observations

Dependent variable: Average Per Capita GDP Growth (1990–00), N=64

	G1	G2	G3
DA/GDP (lagged)	**91.78****	**95.05*****	**18.44****
	[43.96]	**[31.10]**	**[7.68]**
MA/GDP (lagged)	10.68	10.74	-3.36
	[16.10]	[14.14]	[14.87]
NDA/GDP (lagged)	3.14	3.60	2.67
	[7.35]	[6.66]	[7.48]
Initial Income	-0.41	0.43	-0.59
	[0.65]	[0.60]	[0.63]
Initial Life Expectancy	0.11*	0.08	0.12**
	[0.06]	[0.06]	[0.06]
Institutional quality	-0.25	-2.03	-1.28
	[3.12]	[2.89]	[3.15]
Geography	0.56	0.29	0.54
	[0.37]	[0.34]	[0.36]
Initial government consumption	-0.05*	-0.06**	-0.04
	[0.03]	[0.03]	[0.03]
Revolutions	-1.25*	-1.35**	-1.33**
	[0.64]	[0.58]	[0.63]
Terms of trade average	0.00	-0.00	-0.02
	[0.04]	[0.03]	[0.04]
Terms of trade standard deviation	-0.15***	-0.13***	-0.15***
	[0.05]	[0.05]	[0.05]
Initial Policy	0.00	0.15	-0.03
	[0.60]	[0.56]	[0.59]
SSA Dummy	-1.46	-1.59	-1.23
	[1.04]	[0.96]	[1.04]
East Asia Dummy	1.44*	1.30*	1.57*
	[0.80]	[0.74]	[0.79]
Constant	0.15	-4.01	2.86
	[5.18]	[4.78]	[5.12]
R-squared	0.65	0.67	0.64

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%
Note: All components of aid are averaged over 1960–90. To weaken the effect of influential observations, these are weighted according to the Huber (1981) procedure.

Table 7A. OLS regressions: Variation in the set of control variables

Dependent variable: Average Per Capita GDP Growth (1990–00), N=58

	G1	G2	G3
DA/GDP (lagged)	**154.60***** **[40.59]**	**142.22***** **[31.86]**	**17.69***** **[6.36]**
MA/GDP (lagged)	28.32 [19.67]	22.39 [17.03]	9.38 [20.91]
NDA/GDP (lagged)	-1.53 [6.82]	-1.80 [6.65]	2.17 [6.86]
Initial Income	0.52 [0.79]	0.66 [0.74]	0.25 [0.90]
Initial Life Expectancy	-0.01 [0.11]	0.02 [0.08]	-0.01 [0.12]
Initial Literacy	-0.41 [1.75]	-0.64 [1.57]	-0.18 [1.67]
Institutional quality	0.01 [0.01]	0.01 [0.01]	0.01 [0.01]
Geography	0.56* [0.30]	0.51 [0.31]	0.51* [0.29]
Initial Govt. Cons.	-0.07** [0.02]	-0.07*** [0.02]	-0.04 [0.03]
Revolutions	-1.25* [0.72]	-1.25* [0.67]	-1.62* [0.90]
Terms of trade average	0.03 [0.04]	0.03 [0.04]	0.01 [0.04]
Terms of trade standard deviation	-0.13*** [0.03]	-0.13*** [0.03]	-0.13*** [0.04]
Initial Policy	0.19 [0.61]	0.00 [0.56]	0.37 [0.67]
SSA Dummy	-3.60** [1.48]	-3.55** [1.35]	-3.42** [1.62]
East Asia Dummy	0.77* [0.42]	0.92** [0.39]	0.52 [0.51]
Constant	-3.19 [5.29]	-5.46 [5.33]	0.65 [4.77]
R-squared	0.71	0.74	0.66

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: All components of aid are averaged over 1960–90. The regressions differ from those shown previously in that we have added one more proxy for the quality of human capital (initial literacy rate) and have replaced the institutional variable representing the World Bank CPIA index averaged over 1960–99 with International Country Risk Guide (ICRG) index averaged over 1984–89 to reduce the potential for endogeneity.

Table 7B. OLS regressions: Variation in the set of control variables

Dependent variable: Average Per Capita GDP Growth (1990–00), N=66

	G1	G2	G3
DA/GDP (lagged)	**138.38*** **	**121.03*** **	**10.70* **
	[47.16]	**[37.29]**	**[6.40]**
MA/GDP (lagged)	29.56	25.33	12.72
	[18.44]	[16.80]	[19.30]
NDA/GDP (lagged)	-4.27	-6.35	0.44
	[6.10]	[6.91]	[5.48]
Initial Income	0.27	0.41	-0.06
	[0.81]	[0.79]	[0.84]
Initial Life Expectancy	0.03	0.03	0.05
	[0.08]	[0.07]	[0.08]
Geography	0.58*	0.54	0.62*
	[0.34]	[0.36]	[0.35]
Initial Government Consumption	-0.05*	-0.05**	-0.04
	[0.03]	[0.02]	[0.03]
Revolutions	-1.50**	-1.50**	-1.78**
	[0.67]	[0.65]	[0.88]
Terms of Trade average	0.03	0.02	0.01
	[0.04]	[0.03]	[0.04]
Terms of Trade standard deviation	-0.15***	-0.14***	-0.13***
	[0.04]	[0.03]	[0.04]
Initial Policy	-0.10	-0.18	0.16
	[0.57]	[0.54]	[0.58]
SSA Dummy	-2.96**	-3.08**	-2.40*
	[1.31]	[1.26]	[1.28]
East Asia Dummy	1.57**	1.75***	1.44**
	[0.61]	[0.64]	[0.64]
Constant	-2.94	-3.21	0.49
	[4.75]	[4.63]	[4.59]
R-squared	0.68	0.70	0.63

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%
Note: All components of aid are averaged over 1960–90. The regressions differ from those shown previously in that we have eliminated the institutional quality variable.

Table 7C. OLS regressions: Multicollinearity

Dependent variable: Average Per Capita GDP Growth (1990–00), N=64

	G1	G2	G3	G1	G2	G3	
DA/GDP (lagged)	**123.69*****	**118.36*****	**16.64*****				
	[38.77]	**[31.44]**	**[5.18]**				
MA/GDP (lagged)							21.55
							[13.23]
NDA/GDP (lagged)				9.37*	8.68*	1.99	
				[4.76]	[4.86]	[5.14]	
Initial Income	-0.62	-0.33	-0.59	-0.84	-0.88	-0.97	-0.63
	[0.63]	[0.64]	[0.61]	[0.61]	[0.61]	[0.61]	[0.63]
Initial Life Expectancy	0.00	0.01	0.03	0.05	0.05	0.03	0.04
	[0.09]	[0.08]	[0.09]	[0.09]	[0.09]	[0.09]	[0.08]
Institutional Quality	4.60	3.74	3.82	5.27	5.39	6.01	5.18
	[3.97]	[3.75]	[4.46]	[4.47]	[4.49]	[4.62]	[4.13]
Geography	0.44	0.38	0.38	0.40	0.41	0.48	0.49
	[0.36]	[0.38]	[0.38]	[0.39]	[0.39]	[0.38]	[0.36]
Initial Government Consumption	-0.04	-0.05**	-0.03	-0.04*	-0.04	-0.02	-0.03
	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.03]
Revolutions	-1.52**	-1.57**	-1.87**	-1.74**	-1.73**	-1.67**	-1.71**
	[0.68]	[0.64]	[0.83]	[0.82]	[0.82]	[0.82]	[0.83]
Terms of trade average	0.03	0.03	0.01	0.02	0.02	0.01	0.02
	[0.03]	[0.03]	[0.04]	[0.04]	[0.04]	[0.04]	[0.04]
Terms of trade standard deviation	-0.18***	-0.17***	-0.16***	-0.14***	-0.14***	-0.15***	-0.13***
	[0.04]	[0.03]	[0.03]	[0.04]	[0.04]	[0.04]	[0.04]
Initial Policy	0.09	-0.09	0.11	0.28	0.30	0.33	0.22
	[0.59]	[0.56]	[0.62]	[0.63]	[0.63]	[0.66]	[0.65]
SSA Dummy	-3.19**	-3.44**	-3.23**	-2.52	-2.49	-2.31	-2.72*
	[1.56]	[1.51]	[1.57]	[1.58]	[1.59]	[1.58]	[1.61]
East Asia Dummy	0.82	1.02	0.86	0.62	0.61	0.66	0.88
	[0.76]	[0.75]	[0.86]	[0.88]	[0.88]	[0.85]	[0.78]
R-squared	0.67	0.70	0.65	0.63	0.63	0.61	0.63

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%
Note: All components of aid are averaged over 1960–90. The regressions include the various aid components one at a time to investigate the possibility that our results are driven by multicollinearity.

Matrix of correlation coefficients between aid components

	DA-G1/GDP	DA-G2/GDP	DA-G3/GDP	MA/GDP
NDA-G1/GDP	0.5173*			0.8079*
NDA-G2/GDP		0.6170*		0.7984*
NDA-G3/GDP			0.1018	0.4261*
MA/GDP	0.4016*	0.5622*	0.7313*	1

Note: * indicates statistical significance at the 1 percent level.

Table 8. OLS regressions: Aid and income-threshold effects

Dependent variable: Average Per Capita GDP Growth (1990–00), N=64

Panel 1 (Low income countries)			
	G1	**G2**	**G3**
DA/GDP (lagged)	**164.18*** [30.30]**	**132.81*** [22.81]**	**24.06*** [4.73]**
1=Low income country	0.29 [0.86]	0.15 [0.87]	1.02 [0.87]
Aid/GDP (lagged) x 1=Low income country	-63.62 [46.92]	-32.11 [38.79]	-17.10** [8.42]
Constant	-0.74 [5.78]	-0.80 [5.48]	-0.19 [6.14]
R-squared	0.70	0.71	0.67
Panel 2 (Lower middle income countries)			
DA/GDP (lagged)	**103.71** [47.90]**	**102.94** [40.37]**	**7.69 [7.78]**
1=Lower middle income country	-0.00 [0.63]	0.04 [0.65]	-0.32 [0.67]
DA/GDP (lagged) x 1=Lower middle income country	56.44 [60.64]	25.64 [49.13]	14.53* [7.92]
Constant	0.49 [4.84]	-0.21 [4.94]	3.52 [4.70]
R-squared	0.70	0.71	0.67

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%
All covariates included, but coefficient estimates are omitted for simplicity.

Table 9. OLS regressions: Aid and the policy environment

Dependent variable: Average Per Capita GDP Growth (1990–00), N=64

Panel 1 (N=64)	Policy variable: Updated Sachs-Warner openness dummy, Wacziarg and Welch (2003)		
	G1	**G2**	**G3**
DA/GDP (lagged)	**101.11****	**104.08*****	**12.15****
	[46.69]	**[36.65]**	**[5.43]**
Initial Policy	-0.12	-0.32	-0.15
	[0.63]	[0.62]	[0.64]
DA/GDP (lagged) x Initial Policy	69.81	47.78	13.92**
	[48.36]	[36.02]	[6.64]
Constant	4.33	2.35	4.58
	[4.24]	[4.26]	[4.32]
R-squared	0.68	0.71	0.67
Panel 2 (N=64)	Policy variable: Original Sachs-Warner openness dummy, Sachs and Warner (1995)		
DA/GDP (lagged)	**93.51****	**99.29*****	**11.73****
	[44.43]	**[35.80]**	**[5.35]**
Initial Policy	-0.12	-0.31	-0.15
	[0.60]	[0.57]	[0.63]
DA/GDP (lagged) x Initial Policy	83.10*	53.22*	15.07**
	[42.18]	[30.58]	[6.73]
Constant	4.64	2.65	4.70
	[4.21]	[4.24]	[4.31]
R-squared	0.68	0.71	0.67
Panel 3 (N=48)	Policy variable: Burnside and Collier (2000) policy index		
DA/GDP (lagged)	**108.56***	**132.23*****	**1.78**
	[60.46]	**[46.07]**	**[15.73]**
Initial Policy	0.13	-0.03	-0.05
	[0.42]	[0.38]	[0.40]
DA/GDP (lagged) x Initial Policy	10.38	4.42	7.19
	[18.15]	[12.84]	[4.68]
Constant	1.90	0.52	0.18
	[6.94]	[6.20]	[7.79]
R-squared	0.72	0.75	0.72

Robust standard errors in brackets.
significant at 10%; ** significant at 5%; *** significant at 1%
All covariates are included, but coefficient estimates are omitted for simplicity.

Using National Rainfall to Predict *DA*[30]

An alternative measure of *DA* can be obtained by exploting (exogenous) growth-enhancing sources of variation in *TA*. We posit that the amount of *DA* extended to recipient countries—where agriculture is often the predominant sector—is related to the quality of their agricultural season. This approach is motivated by the idea that the volume of *DA* (as distinguished from *NDA*) is likely to depend on judgments concerning a country's needs and is likely to be spent for developmental purposes. An indicator of the quality of the agricultural season, which is highly correlated with crop yields, is the National Rainfall Index (NRI) developed by FAO-SDRN. The index is defined for areas where water is limiting for agricultural production. It represents the national average of the total annual precipitation weighted by its long-term average.

Using the within- and between-country variation in the NRI, we predict the share of *TA* in GDP received by developing countries with one-period lagged NRI and using an OLS estimation procedure with country-specific intercepts. A quadratic term is included to allow for both very low (drought) and very high (flood) level of precipitations to attract more aid. The *DA* variable is then constructed by averaging the fitted TA/GDP over relevant time periods (e.g., 1960–90). It is implicitly assumed in the second-step specifications that the NRI does not have an independent effect on growth other than via its effect on aid. This assumption is consistent with the empirical growth literature, in which the sole geographical determinants of growth considered are latitude, area, and continent dummies (Sala-i-Martin, 1997). Furthermore, the introduction of the NRI index as a self-standing explanatory variable in the growth equation yields a statistically insignificant coefficient, which suggests that the exclusion restriction holds.

As shown by the small R-squared in the first-step regressions (Table 10), the NRI explains little of the yearly variation in aid flows. Nevertheless, the second-step regressions—when *DA/GDP* $(=\widehat{TA}/GDP)$ is averaged over 1960–90 (Table 10) or different periods (Table 11)––reveal that aid flows predicted by the NRI raise subsequent growth. Although the coefficient magnitudes are lower than in earlier specifications, they are significant at the 10 percent level (regular standard errors) and at the 12 percent level (bootstrapped standard errors). An increase in *DA* by 1 percentage point of GDP over the period 1960–90 leads to an increase in later average per capita income growth by 0.09–0.2 percentage points. While the coefficient magnitudes may be too small to be economically significant, the results are consistent with those based on alternative *DA* proxies.

[30] We are grateful to the Food and Agriculture Organization, Environment and Natural Resources Services (FAO-SDRN) for providing the NRI data.

Table 10. OLS regressions: Using national rainfall to predict DA

STAGE 1. Fixed Effects Regression of TA/GDP on the NRI (1960–00), N=107

	$\frac{TA}{GDP_{it}} = \beta_1 NRI_{i,t-1} + \varepsilon_{it}$	$\frac{TA}{GDP_{it}} = \beta_1 NRI_{i,t-1} + \beta_2 N$
$NRI_{i,t-1}$	-0.000022	-0.000125
	(2.73)**	(5.79)**
$NRI^2_{i,t-1}$		2.74e-08
		(5.14)**
Constant	0.123907	0.193483
	(11.92)**	(11.34)**
Observations	3438	3438
R-squared	0.01	0.01

Absolute value of t statistics in parentheses
* significant at 5%; ** significant at 1%

STAGE 2. OLS regression of growth on *DA*
Dependent variable: Average Per Capita GDP Growth (1990–00), N=84

DA is estimated based on the model →	$\frac{TA}{GDP_{it}} = \hat{\beta}_1 NRI_{i,t-1}$	$\frac{TA}{GDP_{it}} = \hat{\beta}_1 NRI_{i,t-1} + \hat{\beta}_2 NRI$
DA/GDP (lagged)	**23.20***	**9.84***
p-value (robust st. error)	[0.053]	[0.051]
p-value (bootstrapped st. error)	[0.1096]	[0.1118]
R-squared	0.50	0.50

Robust standard errors in brackets
significant at 10%; ** significant at 5%; *** significant at 1%
Note: *DA/GDP* is averaged over 1960–90. All control variables are the same as before, but the coefficient estimates are omitted for simplicity. The table shows p-values associated with a test that the coefficient on *DA/GDP* is zero, using both regular and bootstrapped standard errors. The bootstrapped standard errors are calculated since the second-stage regression contains a generated regressor.

Table 11. OLS regressions: Using national rainfall to predict DA (alternative aid lags)

Dependent variable: Average Per Capita GDP Growth (1990–00), N=84

DA is estimated based on the model →	$\frac{\hat{TA}}{GDP_{it}} = \hat{\beta}_1 NRI_{i,t-1}$		$\frac{\hat{TA}}{GDP_{it}} = \hat{\beta}_1 NRI_{i,t-1} + \hat{\beta}_2 NRI^2_{i,t-1}$	
DA/GDP is averaged over →	1960–80	1960–85	196–80	1960–85
DA/GDP (lagged)	**22.35***	**23.18***	**9.60***	**9.77***
[Robust standard errors]	[11.81]	[11.86]	[4.97]	[4.97]
[Bootstrapped standard errors]	[14.46]	[14.63]	[5.61]	[6.20]
Initial Income	-0.76	-0.76	-0.86	-0.86
	[0.59]	[0.59]	[0.59]	[0.59]
Initial Life Expectancy	0.04	0.04	0.05	0.05
	[0.08]	[0.08]	[0.08]	[0.08]
Institutional quality	3.37	3.36	3.37	3.36
	[3.71]	[3.71]	[3.69]	[3.69]
Geography	0.21	0.20	0.27	0.27
	[0.39]	[0.39]	[0.36]	[0.36]
Initial Government Consumption	-0.03	-0.03	-0.04	-0.04
	[0.02]	[0.02]	[0.02]	[0.02]
Revolutions	-1.59**	-1.59**	-1.60**	-1.60**
	[0.78]	[0.78]	[0.78]	[0.78]
Terms of trade average	-0.02	-0.02	-0.02	-0.02
	[0.03]	[0.03]	[0.03]	[0.03]
Terms of trade standard deviation	-0.09**	-0.09**	-0.08**	-0.08**
	[0.04]	[0.04]	[0.04]	[0.04]
Initial Policy	0.74	0.73	0.73	0.73
	[0.47]	[0.47]	[0.47]	[0.47]
SSA Dummy	-1.36	-1.39	-1.24	-1.26
	[1.28]	[1.28]	[1.25]	[1.25]
East Asia Dummy	1.52**	1.51**	1.34*	1.34*
	[0.74]	[0.74]	[0.75]	[0.74]
Constant	4.30	4.28	6.09	6.11
	[4.33]	[4.32]	[4.19]	[4.19]
R-squared	0.50	0.50	0.50	0.50

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: *DA/GDP* is generated from the first-stage regression (shown in Table 10).

Choosing Development-Friendly Donors Based on Statistical Criteria

The results presented here seek to validate our choice of development-friendly donor countries using a statistical ranking methodology. Furthmore, we construct a coefficient gradient of donor effectiveness to show how the aid-growth marginal effects evolve depending on the selection of donors into the development-friendly pool. The analysis usxes 21 DAC countries' bilateral aid (*BA*) flows (i.e., all 22 DAC donors except Portugal) over the period 1960–90 and their growth effect in the 1990s.

We rank donors in terms of their aid-effectiveness as follows. We specify a standard cross-sectional aid-growth regression in which *BA* from each donor country, *MA*, and *BA* from all other donors, are explanatory variables. The model is estimated for each of the 21 donors and the *BA* coefficients are compared across regressions (donors). The donor whose aid has the marginal effect with the highest (positive) t-statistic is deemed to "win" that round of regressions: its *BA* is labeled as *DA* and becomes a covariate in the subsequent round of regressions. The new model is estimated for the 20 remaining donors, and another winner is identified in the same way. Its *BA* is labeled as *DA*, is cumulated with that of the previous winner, and the new *DA* aggregate is maintained as a separate explanatory variable. The process continues until all donors are exhausted.[31] The end result of this procedure is a ranking of donor countries in terms of the effectiveness of their *BA* at raising growth.

The top 7 donors ranked by the size and precision of the marginal effects of own-*BA* on growth are: Canada, Norway, Switzerland, Netherlands, France, Denmark, and Sweden (Table 12). It is reassuring to observe that the top ranking countries from our donor contest are those identified as development-friendly based on own judgements informed by the findings of the aid allocation literature. All "development-friendly" donors listed below are in G3.

Table 12. Ranking of "development-friendly" donors based on statistical methods

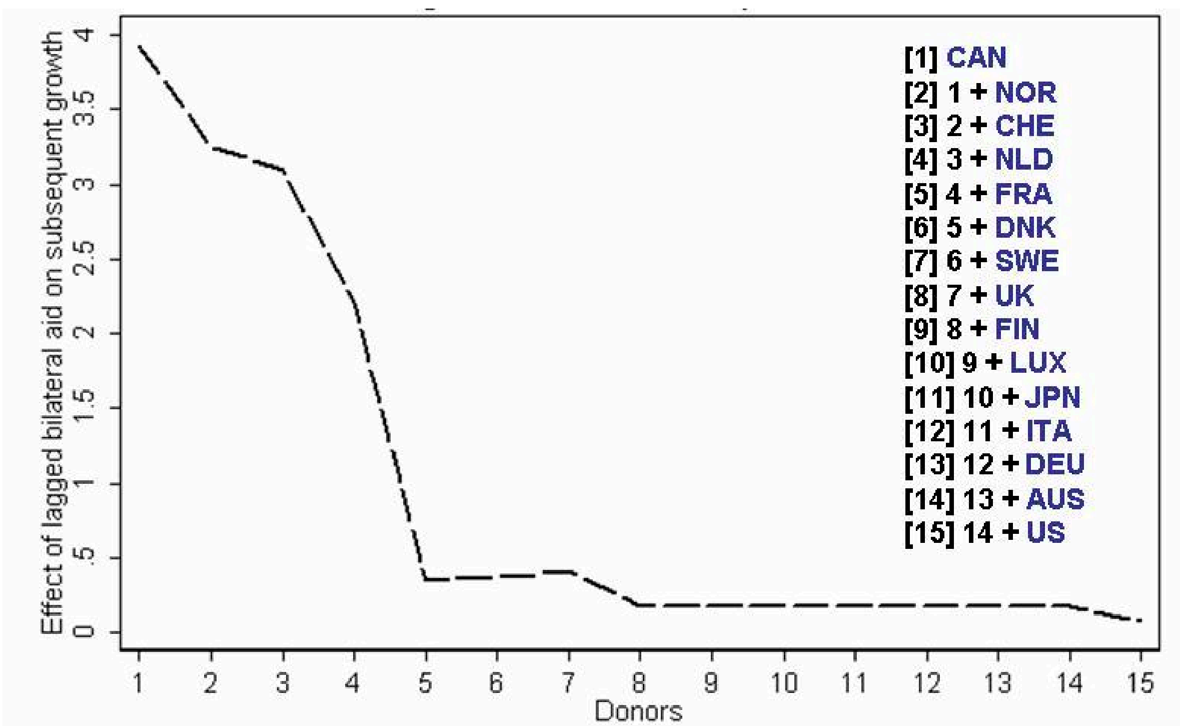
Rank	Donor	t-statistic	Rank	Donor	t-statistic
1	Canada	3.60	11	Luxembourg	2.87
2	Norway	4.10	12	Japan	2.84
3	Switzerland	4.14	13	Italy	2.85
4	Netherlands	4.13	14	Germany	-2.75
5	France	1.99	15	Australia	-1.03
6	Denmark	2.15	16	US	-0.92

[31] The contest therefore has 21 rounds, each of which identifies one donor whose *BA* has the most statistically significant marginal effect on growth. The contest picks a winner in each round even if no coefficient on *BA* is statistically significant. In such rounds, the winner is that donor the coefficient estimate of which has the highest (even if negative) t-statistic. Throughout, the threshold adopted for determining statistical significance is the conventional one.

7	Sweden	2.30	17	Belgium	-1.10
8	UK	2.87	18	Ireland	-1.10
9	Finland	2.87	19	Spain	-1.10
10	Austria	2.87	20	New Zealand	-1.97

The second step is to investigate how the coefficient on *BA*—our proxy for *DA*—changes when *BA* is cumulated over donors identified as winners in consecutive rounds. We obtain a coefficient gradient of development-friendliness by plotting the marginal effects on *DA* from each round against that round's number of donors (Figure 2). As expected, the gradient is positive in the initial rounds where *DA* corresponds to the most effective donors, hovering at around 2–3.5 percentage points. It falls to around 0.5 until round 8, and continues to fall as decreasingly "development-friendly" donors are added. The coefficient curve suggests that increases in the average *DA/GDP* ratio from the first 5 contest winners by 1 percentage point over 1960–90 raised average growth in the 1990s by 1–3 percentage points.

Figure 2. Coefficient gradient of donor effectiveness



Note: The marginal effect estimates are obtained from cross-sectional OLS regressions in which the dependent variable is average growth in the 1990s; the main regressor is *BA* from 1, 2, 3, … up to 15 donors ranked in order of aid-effectiveness (expressed as a share of recipient countries' GDP, and averaged over 1960–90). The control variables are the same as in previous cross-sectional regressions.

Panel Evidence: Robustness Checks

Table 13. System GMM regressions: Robustness to Collapsing the Instrument Set

Dependent variable: Average Growth Rate of Per Capita GDP

	Collapsed instruments (lags 1–5)			Collapsed and reduced instruments (lag depth 15)		
Aid is lagged →	5 years	15 years	25 years	5 years	15 years	25 years
DA-G1/GDP Lagged	19.36	27.53**	238.24	23.86*	27.87*	255.37
	[14.31]	[13.76]	[157.13]	[14.17]	[16.49]	[174.62]
Hansen test p-value	0.423	0.453	0.371	0.396	0.161	0.213
AR(1) test p-value (*m1*)	0.000	0.000	…	0.000	0.012	…
AR(2) test p-value (*m2*)	0.270	…	…	0.243	…	…
Ratio: instruments/countries	0.72	0.66	0.63	0.59	0.56	0.51
DA-G2/GDP Lagged	21.00	26.58*	146.80**	27.07	29.22*	176.24**
	[14.92]	[13.65]	[69.82]	[16.77]	[15.79]	[83.74]
Hansen test p-value	0.325	0.211	0.399	0.382	0.062	0.185
AR(1) test p-value (*m1*)	0.000	0.001	…	0.000	0.010	…
AR(2) test p-value (*m2*)	0.264	…	…	0.233	…	…
Ratio: instruments/countries	0.72	0.66	0.63	0.59	0.56	0.51
DA-G3/GDP Lagged	6.61	6.40	-1.32	8.08	6.03	1.07
	[4.82]	[4.43]	[9.39]	[5.57]	[4.63]	[8.84]
Hansen test p-value	0.367	0.346	0.382	0.428	0.200	0.256
AR(1) test p-value (*m1*)	0.000	0.000	…	0.000	0.002	…
AR(2) test p-value (*m2*)	0.459	…	…	0.447	…	…
Ratio: instruments/countries	0.72	0.66	0.63	0.59	0.56	0.51

Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. The control variables are the same as in previous panel regressions, but the coefficient estimates are omitted for simplicity.

Table 14. System GMM regressions: Robustness to Specification Changes

Dependent variable: Average Growth Rate of Per Capita GDP

Aid is cumulated over →	1, 2 and 3 periods			1, 2, 3 and 4 periods		
	G1	**G2**	**G3**	**G1**	**G2**	**G3**
DA/GDP Lagged	**6.81*****	**7.22*****	**4.45*****	**5.93****	**7.48****	**2.59**
	[2.40]	**[0.25]**	**[2.98]**	**[2.92]**	**[0.26]**	**[0.25]**
MA/GDP Lagged	-2.57	-3.02	0.50	-2.11	-3.05	0.37
	[2.70]	[2.64]	[2.01]	[2.10]	[2.05]	[1.69]
NDA/GDP Lagged	-0.71	-0.93	-4.38***	-0.21	-0.06	-1.90**
	[2.08]	[1.95]	[1.06]	[1.20]	[1.16]	[0.93]
Log Inflation (1+(inf/100))	-1.53***	-1.54***	-1.59***	-1.50***	-1.51***	-1.49***
	[0.29]	[0.29]	[0.28]	[0.31]	[0.31]	[0.29]
Institutional Quality	8.97***	0.39	6.25**	7.27**	6.90**	5.80*
	[3.08]	[2.38]	[1.72]	[3.41]	[3.47]	[3.32]
Geography	0.38	8.54***	0.24	0.63**	0.61**	0.48*
	[0.25]	[3.13]	[0.24]	[0.26]	[3.22]	[1.58]
Initial income	-1.82***	-1.79***	-1.21**	-1.88***	-1.82***	-1.27**
	[0.59]	[0.58]	[0.52]	[0.65]	[0.66]	[0.61]
Revolutions	-1.79**	-1.98**	-1.52**	-2.11**	-2.13**	-2.17**
	[0.74]	[0.77]	[0.76]	[1.02]	[1.05]	[1.01]
Initial Policy	0.63	0.63	0.46	0.66	0.58	0.51
	[0.51]	[0.50]	[0.54]	[0.52]	[0.51]	[0.54]
Initial govt. consumption	-0.03*	-0.04**	-0.01	-0.05**	-0.06**	-0.03
	[0.02]	[0.02]	[0.02]	[0.03]	[0.03]	[0.02]
SSA dummy	-3.16***	-3.14***	-4.16***	-3.60***	-3.70***	-4.00***
	[0.97]	[0.93]	[0.89]	[1.07]	[1.05]	[0.99]
East Asia dummy	0.82	0.88	1.64**	0.73	0.76	1.36**
	[0.80]	[0.79]	[0.73]	[0.76]	[0.73]	[0.64]
Hansen test p-value	1.000	1.000	1.000	1.000	1.000	1.000
AR(1) test p-value (*m1*)	0.000	0.000	0.000	0.004	0.004	0.003
AR(2) test p-value (*m2*)	0.053	0.050	0.098	0.010	0.009	0.013
Observations	336	336	336	268	268	268

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%. Intercept estimate not shown

Table 15. System GMM regressions: Multicollinearity

Dependent variable: Average Growth Rate of Per Capita GDP

Aid is lagged → No. of observations	**5 years** N=468			**15 years** N=336			**25 years** N=202		
	G1	**G2**	**G3**	**G1**	**G2**	**G3**	**G1**	**G2**	**G3**
DA/GDP Lagged	**15.65*** [3.85]**	**14.06*** [3.78]**	**13.59*** [3.68]**	**6.83** [3.22]**	**8.03** [4.07]**	**6.92** [3.30]**	**134.03*** [44.75]**	**91.58*** [18.32]**	**124.21*** [46.82]**
MA/GDP Lagged		0.95 [6.72]			0.53 [3.64]			13.73 [11.11]	
NDA/GDP Lagged	2.55 [4.93]	2.04 [5.16]	2.30 [5.01]	3.49 [3.51]	3.72 [3.51]	3.34 [3.55]	3.41 [2.36]	2.94 [2.29]	3.18 [2.41]

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%.
Note: Each coefficient in the table above corresponds to a distinct regression in which each DA, MA, and NDA are included in the set of covariates independently to determine if our results are driven by collinearity concerns. The control variables are the same as in previous panel regressions, but the coefficient estimates and specification tests are omitted for simplicity. Intercept estimates not shown.

Matrix of correlation coefficients between aid components (lagged)

	DA-G1, t-1	DA-G1, t-3	DA-G1, t-5	NDA-G1, t-1	NDA-G2, t-3	NDA-G3, t-5	MA, t-1	MA, t-3	MA, t-5
DA-G1, t-1	1								
DA-G1, t-3	0.5795*	1							
DA-G1, t-5	0.2017*	0.2114*	1						
NDA-G1, t-1	0.3385*	0.3735*	0.0627	1					
NDA-G2, t-3	0.2449*	0.1977*	0.1674	0.6817*	1				
NDA-G3, t-5	0.3060*	0.1904*	0.2818*	0.4479*	0.6418*	1			
MA, t-1	0.6020*	0.4589*	0.1688	0.6077*	0.4745*	0.4292*	1		
MA, t-3	0.3917*	0.5788*	0.1433	0.6908*	0.4551*	0.3765*	0.7839*	1	
MA, t-5	0.2632*	0.1423	0.2683*	0.5978*	0.5789*	0.3250*	0.6430*	0.7133*	

Note: * indicates statistical significance at the 1 percent level. All the variables are expressed as % of GDP.

Table 16. System GMM regressions: Replicating Rajan and Subramanian (2008)

Dependent variable: Average Growth Rate of Per Capita GDP

Panel 1 – Specifications with contemporaneous TA/GDP (as in Rajan and Subramanian, 2008, Table 10)

	[1]	[2]	[3]	[4]
TA/GDP	4.65	0.66	4.87	8.05*
	[3.03]	[6.78]	[10.93]	[4.26]
TA/GDP ^ 2		6.75		
		[9.44]		
TA/GDP x Policy			-0.46	
			[22.28]	
TA/GDP x Geography				5.11
				[3.80]
Observations	507	507	507	507

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%
Note: The regressions above replicate Table 10 with system GMM regressions shown in Rajan and Subramanian (2008). The control variables are the same as in previous panel regressions and the instruments as discussed in the text, but the coefficient estimates and specification tests are omitted for simplicity.

Panel 2 – Specifications with lagged TA/GDP

	5 years	10 years	15 years	20 years	25 years
TA/GDP Lagged	-0.84	2.09	1.84	3.39	3.60
	[2.96]	[1.93]	[1.49]	[2.21]	[3.01]
Observations	455	389	322	256	190

Robust standard errors in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%
Note: The regressions above replicate Table 10 with system GMM regressions shown in Rajan and Subramanian (2008). The control variables are the same as in previous panel regressions and the instruments as discussed in the text, but the coefficient estimates and specification tests are omitted for simplicity.