Business Cycle Fluctuations, Large Macroeconomic Shocks, and Development Aid[1]

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First version: October 1, 2010
This version: August 18, 2011

Abstract. We examine the cyclical properties of development aid using bilateral data for 22 donors and 113 recipients during 1970–2005. We find that bilateral aid flows are on average procyclical with respect to the business cycle in both donor and recipient countries. While aid outlays contract sharply during severe downturns in donor countries, they rise steeply when aid-receiving countries are hit by large adverse shocks. Our findings suggest that development aid plays an important cushioning role in developing countries—regardless of their income level—but only during times of severe macroeconomic stress. Our results are robust to alternate definitions of aid flows, across specifications and estimation techniques.

Keywords: foreign aid, bilateral donors, business cycle, macroeconomic shocks
JEL classification codes: E22, E32, O11, O19

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[1] We are grateful for useful comments from Andrew Berg, Hugh Bredenkamp, Dongchul Cho, Rune Hagen, Christopher Kilby, Catherine Pattillo, Andrea Presbitero, Mahvash S. Qureshi, Laura Valderrama, and seminar participants at the IMF Institute, School of Economics at the Georgia Institute of Technology, Research Department Seminar at the African Development Bank, 2010 Nordic Conference in Development Economics (Helsinki), 2010 Korea Development Institute Conference on Economic Development and Impact Evaluation (Seoul), and 2011 CSAE Conference on Economic Development in Africa (Oxford). We would especially like to thank Giovanni Andrea Cornia, Mahvash S. Qureshi, and Francisco Rodriguez for generously sharing their data. All remaining errors are our own.

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I. INTRODUCTION

In the decade prior to the global financial crisis, bilateral aid flows to developing countries had increased markedly, reaching a peak around the Gleneagles summit in 2005 (Figure 1).[3] The strains caused by the 2008–09 crisis on public finances in donor countries, however, raised concerns that the supply of aid would decline. At the same time, the demand for development aid was expected to rise as aid-receiving countries experienced the aftershocks of the crisis. Although the immediate impact of the crisis on aid flows was not as deleterious as expected, the risk that development aid will fall is looming. Given the prolonged downturn and the uncertain economic prospects facing leading donor countries, a natural question that arises is whether aid flows are at risk of being cut in the near future. More generally, we ask whether there is a systematic link between macroeconomic fluctuations donor and recipient countries on the one hand, and aid flows on the other.

This paper is an empirical assessment of how donor and recipient-country macroeconomic conditions affect development aid flows, focusing both on regular business cycle fluctuations and large adverse shocks. We wish to address the following questions: To what extent does the business cycle in donor countries influence their aid outlays? Has this impact been large and persistent during past recessions? Similarly, how do macroeconomic conditions in aid-dependent nations influence their aid receipts? Finally, what happens to aid disbursements during synchronized recessions in which both the donor and the recipient experience large negative shocks? We tackle these questions using an empirical aid allocation model enriched with a range of measures of the business cycle and estimated over 1970–2005 using a three-way panel. Our dataset comprises 22 OECD donors and 113 aid-receiving countries.

We find that aid flows are on average procyclical with respect to the donor and recipient output cycles, rising during expansions and falling during recessions. Previous studies have focused on the independent effect of the business cycle in donor and recipient countries on aid flows, finding similar results.[4] However, our paper is the first to analyze jointly the impact of the donor and recipient business cycles on aid using bilateral (dyadic) data. This unveils new patterns in the data and affords us a number of advantages over standard panel models employed in the literature. First, dyadic data provide a rich amount of variation, with sample sizes of almost 90,000 observations, thus increasing the precision of our estimates. Second, they allow us to estimate the business cycle effects on aid disbursements while controlling for time-invariant heterogeneity in donor-recipient relationships (which is subsumed into a large set of country-pair dummies). Third, they enable us to assess the impact of pair-wise time-varying variables such as negative economic shocks that *simultaneously* afflict the donor and the recipient. Finally, the use of dyadic data reduces endogeneity concerns that plague standard donor- or recipient-level panel regressions because the dependent variable here captures pair-level information while many covariates are country-level variables.

More importantly, we also find that bilateral aid is countercyclical when aid recipients are hit by *large* adverse shocks, substantially increasing during spells of negative growth and adverse

[3] Sub-Saharan African countries are the main beneficiary of the increased aid flows since the late 1990s.
[4] See, e.g., Dang et al. (2009), Frot (2009), Bulir and Hamann (2007), and Pallage and Robe (2001).

terms-of-trade (TOT) movements. These effects tend to be persistent. Furthermore, aid outlays are substantially reduced when donors experience unusually adverse economic conditions. However, when both the donor and recipient country experience large negative macroeconomic fluctuations, we find no additional impact on aid flows. All our results are robust to alternative definitions of aid flows, across specifications and estimation techniques.

Our work closely relates to the handful of studies that have singled out the role of business cycles and crises in donor countries in determining aid allocations. Pallage and Robe (2001) found inconclusive evidence on the relationship between business cycles in donor countries and aid disbursements to Africa over 1969–1992, but presented some evidence of procyclicality of aid commitments. Mold et al. (2008) argued that the relationship between economic growth in donor countries and their aid outlays is ambiguous. They found that aid flows and GDP tend to co-move over long periods, but aid often becomes 'decoupled' from economic growth in OECD countries. Faini (2006) documents that no statistical relationship between the output gap as a measure of the cyclical position of selected donors and aid flows over 1980–2004. In contrast, Bertoli et al. (2008) uncovered a robust positive relationship between this measure of the cycle and aggregate aid flows over 1970–2004. Allen and Giovannetti (2009) argued that the output gap does not explain aid flows, but its cube has a negative and statistically significant coefficient, which they interpreted as a more than proportional impact of cycles on aid allocations.

The global financial crisis has spurred new work on the link between donor crises and aid flows. Using donor-level panel regressions, Dang et al. (2009) showed that aid flows fall substantially after systemic banking crises in donor countries after controlling for their impact on output. Frot (2009) estimated that banking crises in donor countries caused decreased in aid by 13 percent on average (level effect) and by 5 percent yearly after the onset of a crisis (trend effect). Mendoza et al. (2009) find that stock market volatility—a proxy for financial stress and economic uncertainty—is also associated with lower aid disbursements by the US.

The evidence on the cyclicality of development aid flows relative to recipient economies is more mixed. Pallage et al. (2006) theoretically documented the potential of foreign aid to act as insurance against macroeconomic shocks in developing countries, reducing macroeconomic volatility, hence benefitting long-run growth (Ramey and Ramey, 1995). Nevertheless, development aid appears procyclical with respect to output and revenues in many recipient countries. Pallage and Robe (2001) found that in two thirds of African economies and half of non-African developing countries there is a high correlation between the cyclical component of aid receipts and that of domestic output.[5] The procyclicality of aid receipts can be explained by a standard moral hazard model in which the donor country ties aid disbursements to the recipient's macroeconomic performance because of her inability to distinguish whether downturns are caused by exogenous shocks or macroeconomic mismanagement (Svensson, 2000). The donor's inability to perfectly monitor the use of aid can be mitigated, for example, by higher quality macroeconomic management institutions in the aid-receiving country (Banerjee, 2010).

The remainder of this paper is organized as follows. Section II describes the data and provides definitions of our key variables. Section III describes the baseline empirical model, discusses the

[5] In contrast, Rand and Tarp (2002) found no evidence that aid is procyclical in developing countries.

estimation method, and reports the main findings. Section IV presents a series of robustness checks. Conclusions are deferred to Section V.

II. Data, Definitions, and Descriptive Statistics

A. Data and Definitions of Aid and Business Cycle Variables

We use the OECD-DAC bilateral dataset of aid flows from 22 donors to 113 recipients over the period 1970–2005, giving us about 90,000 observations.[6] (Tables 1 and 2 define the variables used in the analysis and list the countries in our sample, respectively.) Our dependent variable is real bilateral foreign aid, defined as bilateral ODA net of principal repayments, from which we subtract humanitarian emergency aid, development food aid, and debt forgiveness grants.[7]

A potential problem with using bilateral flows is that the data contain many zero entries. Dropping these observations may bias our results if, for example, such entries were non-random, reflecting unobserved characteristics of the donor-recipient pair. Following Arndt et al. (2010), we retain these zeros given that a majority of these flows represent *unreported null values* rather than absent data. In addition, we adopt a semi-log transformation of the form:[8]

$$aid_{ijt}^{*} = sign(aid_{ijt}) \log(1+ | aid_{ijt} |),$$

where aid_{ijt} denotes real bilateral aid from donor *i* to recipient *j* at time *t*. With this transformation of the dependent variable, we retain information related to zero entries (representing an absent donor-recipient relationship)[9] and negative observations (net repayments, accounting for 2.8 percent of all observations). Furthermore, the estimated coefficients in the ordinary least squares (OLS) regressions can be interpreted as (semi-) elasticities for large values of aid (Eichengreen and Irwin, 1998).

We construct several variables that capture fluctuations in the business cycle of donors and recipients. For donor countries, proxies for the output cycle are constructed by separating the permanent from the transitory component of GDP to obtain the output gap. We do this alternately through a log-linear regression of real output against time or using the OECD dating methodology for identifying the output gap. While the former approach is purely statistical, the latter is based on estimation of a production function to examine differences between actual and potential output (see Beffy et al., 2006). The two output gap estimates for the sample of 22 donors have a correlation coefficient of 0.56. Our third proxy for the donor cycle is a dummy for years of above- (below) trend real growth, capturing economic expansions (recessions).

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[6] There are 134 recipients in the database, from which we eliminate 21 economies that are currently wealthy and/or have fully transitioned to donor status.

[7] These aid components were eliminated because they are less likely to be sensitive to regular business cycle fluctuations, especially those in donor countries.

[8] This semi-log transformation was also employed, for instance, by Yeyati et al. (2007) to examine the impact of the output cycle in source and destination economies on foreign direct investment.

[9] While zero observations can cause selection bias, only 6.2 percent of all possible bilateral aid flows are zeros in our dataset, which is about four times less than typically observed in bilateral trade flows (see, e.g., Dutt and Traca, 2010). Furthermore, there is ample evidence that donors do not systematically target a subset of recipients—instead, they tend to "plant their flag everywhere" (Easterly, 2007).

Quantifying economic fluctuations is more difficult in recipient countries, particularly low-income countries that are undergoing structural transformation and are subject to more frequent and severe shocks. Rand and Tarp (2002) show that short-run macroeconomic fluctuations in developing countries differ markedly from those in advanced countries. The business cycle is shorter because of frequent and large shocks, and recessions are typically deeper and longer.[10] Our first proxy for the cycle in recipient countries is the output gap calculated using the Hodrick-Prescott (HP) filter, adjusting the smoothing parameter to allow for shorter cycles (λ=1 as opposed to 10 or 100 as is customary for yearly data) and dropping endpoints (as suggested by Rand and Tarp, 2002).[11] We add to the output gap two additional measures of recession periods, which are dummy variables for years of below-trend GDP and consumption growth, respectively.

For all countries, we also construct measures of *large* macroeconomic shocks to determine whether aid flows behave differently in times of extreme economic fluctuations. For donors, large shocks are captured using dummies for those years when the output gap or growth deviations from trend fall into the bottom quartile of the donor-specific distribution. For recipients, we focus on (i) unusually large adverse TOT movements—measured as year-on-year growth rates that fall in the bottom decile of the recipient-specific distribution; (ii) climatic shocks referring to years in which the recipient economy experienced floods, drought, extreme temperature variations, and windstorms; and (iii) episodes of growth collapse representing sustained decelerations to negative growth lasting at least three years (Hausmann et al., 2008).[12] Our first two proxies for the recipient cycle—TOT and climatic shocks—are external shocks associated with fleeting fluctuations in international commodity prices or agricultural output, and have been shown to account for a relatively small share of output instability in low-income countries (Raddatz, 2007). In contrast, growth collapses are protracted downturns and may be caused not only by external shocks, but also by other internal factors such as civil strife and political instability (Minoiu and Reddy, 2009).

B. Data Exploration: Descriptive Statistics

We start our empirical analysis by looking at some simple descriptive statistics of the cycle variables, including their correlation with bilateral aid flows. Summary statistics for all variables used in the analysis are presented in Table 3.

The 22 OECD donors in our sample have experienced relatively small fluctuations in economic activity since the 1970s. Box-plots show that the large majority of donor output gap observations are between –2 and +2 percentage points, with few extreme observations (Figure 2, left hand-side panel). There is much more variation in the range of estimated output gaps for aid recipients (Figure 2, right hand-side panel), but both cross-sectional distributions become narrower over time, reflecting a general fall in aggregate volatility towards the end of the sample period. Simple

[10] See also Male (2011) and Hausmann et al. (2008) for empirical evidence on the differences between the output cycle in advanced and developing countries.

[11] Note that we do not estimate the output trend for developing countries using the log-linear approach, as we have done for donors.

[12] As a robustness check, we considered an alternative definition of shocks defined over the full-sample distribution rather than donor-specific distributions. The main thrust of our results remained unchanged.

correlation coefficients between two measures of the business cycle in donor and recipient countries and aggregate aid flows (scaled by GDP) are depicted in Figure 3. The plots suggest that most donors disburse aid procyclically relative to their economy (left hand-side panels). It is far less clear how they disburse relative to the recipient economy, as the correlation coefficients are more heterogeneous and their distribution is centered on zero for both measures (right hand-side panels).

III. The Baseline Model and Main Empirical Results

A. The Baseline Model and Estimation Method

To investigate the impact of business cycle fluctuations and large macroeconomic shocks on bilateral aid flows, we use the following specification:

$$aid_{ijt}^{*} = \alpha_{ij} + \beta CONTROLS_{ijt} + \gamma CYCLE_{it}^{donor} + \delta CYCLE_{jt}^{rec} + \lambda_t + \varepsilon_{ijt},$$

where aid_{ijt}^{*} represents real (semi-log transformed) bilateral aid flows, α_{ij} denotes country-pair fixed effects, β is a vector of coefficients on time-varying control variables that capture scale effects (such as population and GDP trend); $CYCLE^{donor}$ and $CYCLE^{rec}$ refer to variables that capture the business cycle in the donor and recipient country, respectively; λ_t represents time effects that control for shocks common to all country-pairs such as increases in aid flows for all countries and partly capture pre-existing trends (Plümper and Neumayer, 2010). ε_{ijt} is a well-behaved error term. The country-pair fixed effects model time-invariant dyadic features that determine the likelihood of a bilateral relationship (for instance past colonial ties, sharing a common language, other forms of cultural proximity, and geographical distance).[13]

Note that our key covariates $CYCLE^{donor}$ and $CYCLE^{rec}$ vary only at the donor- and recipient level, respectively, while the dependent variable varies at the country-pair level. This implies that endogeneity concerns, caused by causality running from aid flows to the output cycle variables, especially in the case of recipient countries, are attenuated. We estimate this parsimonious specification both for the full sample and the sub-samples of low- and middle-income countries, using the OLS estimator with country-pair and time fixed effects; the standard errors are clustered at the country-pair level to exploit within-panel serial correlation.[14]

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[13] Since we are not interested in the effects of these variables on bilateral aid disbursements, we do not include them explicitly in the model.

[14] While our baseline specification is purposefully parsimonious, we have experimented with more comprehensive specifications that include other donor-level determinants (e.g., debt level, government revenue, trade balance, remittances outflows, and Gini coefficient of inequality), recipient-level determinants (e.g., life expectancy, institutional quality, IMF program dummy), and pair-wise variables (political allegiance, bilateral trade). The results remained virtually unchanged (and are reported in Dabla-Norris et al., 2010). For more comprehensive empirical specifications regarding the determinants of aid allocations, see, among others, Barthel (2011), Harrigan and Wang (2011), Hoeffler and Outram (2011), Ball (2010), Tingley (2009), Chong and Gradstein (2008), and Round and Odedokun (2004).

B. Results: Aid and the Donor Cycle

The empirical results on the link between aid disbursements and the donor output cycle are summarized in Table 4. Expansions in donor countries, captured both by a higher output gap and above-trend real growth, are accompanied by higher aid flows (Panel A). A one percentage point increase in the donor output gap (in percentage of potential GDP) raises real aid outlays on average by between 8.3 and 11.6 percent depending on the output gap estimate (columns 1–2).[15] Expansions raise aid disbursements by one fifth in the full sample (column 3). These findings underscore the procyclicality of aid flows with respect to the donor cycle that has been empirically established in the literature. We find no systematic difference across income groups, with estimated semi-elasticities having similar magnitudes across sub-samples (columns 4–9).

When donors experience unusually adverse economic conditions, aid outlays are substantially reduced (Table 4, Panel B). In these specifications, unusually harsh conditions in donor countries are captured by dummies for the output gap or a deviation of growth from trend falling in the bottom quartile of the donor-specific distribution. In years with large negative output gap, aid outlays fall by between 27.4 and 58.9 percent in the full sample, depending on the gap measure (columns 1–2). Growth recessions reduce aid disbursements by 11.3 percent on average (column 3). Interestingly, aid flows to middle-income countries appear less sensitive to the donor cycle, with the estimated coefficients being systematically lower than for low-income countries (columns 4-9). This suggests that in the face of large economic downturns, donors have historically reduced aid outlays to low-income countries by *more* than to middle-income countries. A possible explanation is that during sharp economic downturns, concerns over how aid is being managed by the recipient government and whether aid ultimately spurs development, become more prominent for donors. Since institutional quality—a rough indicator of how transparently aid is spent—tends to be poorer in low-income countries, donors seem more prone to reduce disbursements to these countries relative to those with a better institutional environment.

We also checked whether the patterns identified so far hold up for unusually *favorable* economic conditions in donor countries—that is, whether aid flows respond symmetrically to positive shocks. Our proxies for economic booms in donor countries are dummy variables for deviations of output and output growth from their respective trends falling in the *top* quartile of the donor-specific distribution. As depicted in Panel C of Table 4, the estimated semi-elasticities are close in magnitude (and of opposite sign) to those for large negative shocks (shown in Panel B). Large positive output gap years have historically caused aid to increase by 50 to 100 percent (depending on the gap measure), while economic expansions in donor countries have raised it by almost one fifth.

Finally, we ask whether the average effects discussed above conceal any heterogeneity in the impact of donor recessions on aid outlays. The left hand-side panel in Figure 4 depicts donor-specific marginal effects of a rise by one percentage point in the donor output gap on that

[15] The marginal effects are obtained by exponentiation of the coefficient estimates in the tables. For instance, $e^{0.08} - 1 = 0.083$ (8.3 percent) for the first coefficient cited.

donor's bilateral aid flows.[16] The estimates range between large and positive for the US and the UK—the most 'procyclical' donors—and negative for Australia, Austria, and Belgium—the most 'countercyclical' donors. In contrast, countries such as Ireland, Greece, and Germany display acyclical behavior.

Could donor inclination towards pro- or countercyclical aid disbursements be correlated with other donor characteristics? To tackle this question, we consider donor features summarized in the CGD Aid Commitment to Development Index for 2010 developed by Roodman (2010, 2005). The index aims to capture the 'quality' of donor foreign aid-related policies. It rewards donors that give more aid (in absolute terms and relative to GDP) and relatively more grants and non-tied aid, as well as donors who target poor non-corrupt countries and encourage charitable giving. Interestingly, the degree of donor procyclicality is negatively correlated with this aid-quality index (Figure 4, right hand-side panel), which suggests that more development-oriented donors—that is, donors that rank higher according to this index—tend to disburse acyclically or even countercylically relative to the others. This pattern gives a new nuance to what it means for a donor to be development-friendly—specifically, to disburse aid in a way that is less sensitive to its own output cycle.

C. Results: Aid and the Recipient Cycle

Results for the baseline specification that includes measures of the output cycle in recipient countries are shown in Table 5A (Panel A). These are akin to our previous regressions, except that now we control for the donor output trend and gap, and add proxies for the recipient cycle. In addition, we add a recipient war index as a control variable. Donors tend to limit their engagement in development activities and postpone new projects during episodes of social unrest or civil war, which also tend to coincide with economic downturns. Including the recipient war index thus allows us to discern whether economic downturns in recipient countries are associated with lower aid disbursements above and beyond the direct impact of war on donor behavior.

We find that bilateral aid disbursements are on average procyclical vis-à-vis the recipient cycle, with decreases by 10.4–19.7 percent in recession years (columns 2–3). The coefficient on our measure of the recipient output gap turns out statistically insignificant—a possible indication of attenuation bias caused by measurement error (column 1). Furthermore, aid flows respond mostly to the output cycle in middle-income countries, with aid falling by 19.7–26.7 percent during years of below-trend output or consumption growth (columns 8–9). The sub-sample of middle-income countries drives the results for the full sample. While our results are consistent with other studies that have documented foreign aid to be on average procyclical with respect to the recipient cycle, they reveal that the procyclicality is present for middle- rather than low-income countries. However, given the difficulties in measuring output fluctuations in developing nations, we cannot exclude the possibility that the coefficients for the low-income sub-sample are simply estimated too imprecisely.

[16] These are the semi-elasticity coefficient estimates on donor output gap (% of potential GDP) from donor-by-donor OLS regressions of bilateral aid disbursements on the following set of covariates: recipient log-GDP, recipient log-population, donor log-population, donor log-GDP trend, donor output gap, and recipient fixed effects.

Does this pattern hold up when we focus on the effect on aid of *large* macroeconomic shocks in aid-receiving countries? To answer this question, we use our three binary variables, which capture respectively, TOT growth rates falling into the bottom decile of each recipient's distribution (of TOT growth rates); climatic disasters such as floods, drought, extreme temperatures, and windstorms; and episodes of sustained deceleration to negative income growth. These variables have the advantage that they alleviate measurement concerns that plague filter-based estimates. Furthermore, they arguably are exogenous vis-à-vis pair-wise aid flows. Growth collapses are likely exogenous since it is difficult to imagine that a shock to aid disbursements from any particular donor could trigger a multi-year growth collapse. Hausmann et al. (2008) have shown that the onset of growth collapses is typically associated with wars, dramatic falls in exports, sudden stops, and political transitions—variables that can also be treated as exogenous with respect to pair-wise aid flows. As for TOT shocks, they are exogenous insofar as commodity export prices are not driven by individual country actions that may also affect bilateral aid flows (Deaton and Miller, 1996).

We find that aid recipients attract higher aid disbursements in the wake of these large negative shocks (Table 5A, Panel B). Bilateral aid to countries afflicted by large TOT shocks increases on average by one-fifth for the full-sample. When countries experience a climatic shock, aid disbursements are higher by almost 30 percent on a yearly basis—which is notable given that humanitarian and emergency aid are not included in our dependent variable.[17] Similarly, growth collapses attract significantly higher bilateral aid flows—68.2 percent in the full sample—some 44 percent for low-income countries and twice as much for middle-income countries. The results are once again stronger in the sample of middle-income countries.

The fact that bilateral aid to low-income countries rises less than to middle-income countries during growth collapses may be explained by many of these episodes being caused by conflict or political strife, which may be only partially captured by our war index variable. Any omitted variables positively correlated with periods of downturn but negatively correlated with aid would lead to a negative bias on the growth collapse coefficient. Furthermore, it is possible that for low-income countries with severe financial constraints, a bigger share of bilateral aid is disbursed as humanitarian and emergency aid during such periods. Finally, insofar as growth disasters in low-income countries are seen as the result of domestic causes (such as economic mismanagement), bilateral donors may be hesitant to disburse countercyclically because of concerns over the quality of macroeconomic policies and the effectiveness of aid.

We also checked whether the quality of institutions in aid-receiving economies influences the cyclical properties of bilateral aid, as suggested in the literature. For instance, Banerjee (2010) found that conditional on a good institutional environment, aid acts as insurance in the wake of large adverse shocks. This may be because better macroeconomic management, enabled by better institutions, partly resolves the aid monitoring problem. As a proxy for institutions, we used the Polity IV measure of democracy, which varies between –10 (autocracy) and +10 (democracy) and captures the extent to which the executive faces political constraints to

[17] In results not reported, we found, as expected, that humanitarian aid rises markedly in the aftermath of climate and geological shocks.

implementing her policy.[18] Estimated coefficients from the baseline specification that includes the Polity IV measure and interaction terms with business cycle proxies for developing countries are reported in Table 5B. First, we find that aid-receiving countries with better institutions attract higher aid flows on average, even after controlling for income level (through recipient log-GDP trend). This level effect largely reflects aid selectivity (as documented, for instance, in Dollar and Levine, 2006). Second, the estimated coefficients on the interactions between institutions on the one hand, and large negative shocks, on the other, are positive and statistically significant in the full sample, suggesting that on average aid has a stronger cushioning effect in countries with better institutions. However, these results are driven by middle- rather than low-income countries.

To sum up, our finding that bilateral aid increases markedly in the face of large TOT shocks, climatic disasters, and growth collapses, are novel in the aid allocation literature and underscore the potential of development aid to mitigate the effects of adverse shocks. Collier and Dehn (2001) and Collier and Goderis (2009) have shown that negative commodity export price shocks reduce short-term growth but aid can substantially reduce that effect, and have called for aid to be better targeted at shock-prone countries. In line with these policy recommendations, our estimates suggest that bilateral donors have historically increased financing to developing countries in the wake of unusually adverse fluctuations, enabling aid to play an important cushioning role. Good institutions appear to enforce this effect among middle-income countries.

D. Results: Dynamic Effects and Simultaneous Shocks

So far we have explored the *contemporaneous* cyclical properties of bilateral aid. We turn to specifications that allow for the cycle to have a *lagged* effect on foreign aid outlays. In doing so, we wish to reflect the fact that aid disbursements are typically locked into multi-year budgets and may not be easily adjustable when recipients needs change suddenly due to unexpected shocks. In Table 6 we report the results of our baseline regressions with large shocks, in which we now allow for lagged effects. The shocks considered are, for donors, dummies for the log-linear and OECD output gap falling in the bottom quartile (columns 1–2), the growth deviation from trend falling in the bottom quartile (column 3); and for recipients, TOT collapses (column 4), climatic disasters (column 5), and growth collapses (column 6).

We find that large fluctuations in donor countries have a persistent effect on aid outlays, reducing them for up to two years after recessions (columns 1–3). The result is robust across different measures for the donor cycle. When it comes to the recipient cycle, negative shocks trigger higher bilateral aid flows, with aid flows rising almost 50 percent by the third year following a TOT collapse and by one fifth after a climatic disaster (columns 4–6). Magnitudes are comparable for negative growth spells through the first three years. It appears that while aid budgets may display some in-built rigidity due to medium-term planning, recipient countries do receive more aid in the wake of large exogenous shocks for a few years after the occurrence of the shock.

[18] While the Polity IV score is not strictly an institutional quality indicator, we report results based on it, as our preferred measure—the International Country Risk Guide (ICRG) composite index—is only available since 1984.

Lastly, we focus on the impact on aid flows of macroeconomic shocks *simultaneously* afflicting the donor and the recipient. We modify the baseline specification to include interaction terms between the donor and the recipient measures for economic fluctuations, as follows:

$$aid_{ijt}^{*} = \alpha_{ij} + \beta CONTROLS_{ijt} + \gamma CYCLE_{it}^{donor} + \delta CYCLE_{jt}^{rec} + \eta\left(CYCLE_{it}^{donor} \times CYCLE_{jt}^{rec}\right) + \lambda_t + \varepsilon_{ijt},$$

On the donor side the cycle is proxied by a dummy variable for the output gap falling into the bottom quartile ($CYCLE_{it}^{donor}$). On the recipient side we consider all three measures of large shocks—TOT shock, climatic disaster and growth collapse ($CYCLE_{jt}^{rec}$)—and interact the donor output with each large shock variable in turn ($CYCLE_{it}^{donor} \times CYCLE_{jt}^{rec}$). The results are depicted in Table 6 (columns 7–9). The patterns identified so far appear robust to including interaction terms for the position of donors and recipients in their respective cycle. However, the estimated coefficients on the interaction terms themselves are statistically insignificant. Thus, when the donor and aid-receiving country simultaneously experience large negative shocks, aid flows are not affected above and beyond the independent impact of the two cycles. In other words, when donors experience a deep recession, they do not decrease aid disbursements less if their aid recipients also experience a deep recession.[19]

IV. Robustness Analysis

In this section we consider a series of robustness checks to our baseline results, including estimating the model (i) with alternate definitions of aid flows; (ii) with different specifications; (iii) across sub-periods; and (iv) with alternate estimation techniques.

A. Alternative Definitions of Aid

First we check if our results are sensitive to the definition of our dependent variable. So far we have used bilateral ODA net of principal repayments (net ODA) after subtracting humanitarian emergency aid, development food aid, and debt forgiveness grants. Here we construct three alternative proxies of bilateral aid—all aimed at better capturing actual donor effort—as follows. First, we consider gross (rather than net) ODA in the definition above, thus eliminating principal repayments made by the recipient. Nevertheless, this measure is not perfect since interest repayments, which are sometimes of large magnitude, are not captured in the OECD-DAC database. Thus, our second measure are Net Aid Transfers (NAT)—disbursements net of both principal and interest repayments (Roodman, 2005). Our third robustness measure is the baseline dependent variable from which we also subtract imputed multilateral aid. Imputed multilateral aid is an approximation of aid disbursements by multilateral agencies attributable to individual donors.[20] Excluding these flows from our aid aggregate addresses the possibility that net ODA

[19] Alternatively, in results not reported for brevity, we found that when donors experience a sharp upturn, they do not increase aid *more* to recipients who simultaneously experience a deep recession.

[20] For details on the OECD-DAC methodology of calculating this aggregate, see http://www.oecd.org/document/54/0,3746,en_2649_34447_41037110_1_1_1_1,00.html (accessed on June 16, 2011). Note that the imputed multilateral aid variable we use accounts for about 90 percent of total donor

(continued…)

increases when recipients suffer large shocks because donor increase their contributions to multilateral rather than bilateral development agencies.

The estimates corresponding to alternate dependent variables—reported in Table 7 (Panels A to C)— are qualitatively similar, with some variation in the size of coefficients. Gross ODA, Net Aid Transfers, and net ODA excluding multilateral contributions, suggest procyclicality with respect to the business cycle in both donor and recipient countries. In contrast and in line with our baseline results, aid flows become countercyclical when developing countries experience large adverse macroeconomic shocks.

B. Alternative Specifications

If past aid levels have a causal impact on current aid allocations, it is important to account for this in our model specification. Aggregate aid figures show a high degree of persistence induced, among others, by the multi-year planning process. In addition, donors look at past figures in deciding their present and future aid budgets, and could find it difficult to alter the trend in disbursements when aid-receiving countries experience unexpected shocks. To allow for the possibility that past aid flows affect current disbursements, we re-estimate the baseline model with lagged aid as an explanatory variable. Naturally, the lagged dependent variable causes a dynamic panel bias problem that affects the estimated coefficients for all regressors. In particular, the coefficient on the lagged dependent variable is biased upwards while the coefficients on other regressors are biased downwards (Maddala and Rao, 1973). To proceed, we assume that the time period (T=36) is long enough for the dynamic panel bias to be small and estimate the model with OLS and country-pair fixed effects.[21] The results are reported in Table 8 (Panel A). Accounting for the persistence of development aid flows does not appear to materially affect our main results. Bilateral aid on average increase during donor upturns for all proxies of the cycle. The results are also robust across all proxies of the recipient cycle in all-but-two specifications (columns 8, 10).

The second concern we address is the presence of zero-aid observations. These account for 6.2 percent of the dataset, which is about four times less than typically observed in bilateral trade flows (see, e.g., Dutt and Traca, 2010), and mainly represent unreported null values, as documented in Arndt et al. (2010). So far these observations have been retained in the sample by adding $1 to the aid flows before the logarithmic transformation (Equation 1) on the assumption that there is an aid relationship even if we do not observe one (e.g., because of mismeasurement). In order to check the sensitivity of our results to the inclusion of zero-aid observations, we re-estimate the model conditionally on observing at least one non-zero aid flow in the dyad during the sample period. This leads us to drop some 5,500 observations or 6.25 percent of the sample.

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multilateral ODA, as it only refers to about 20 multilateral agencies which have sufficiently rich outflow data to enable the calculation of multilateral contributions by donor.

[21] Kiviet (1995) shows that the bias is of order $O(N^{-1}T^{-3/2})$. Judson and Owen (1999) use simulations in samples of 30 observations and show that the bias of the auto-regression coefficient estimate ranges between 3 and 20 percent of the true value; however, that on the remaining regressors is small and similar across OLS and GMM-type estimators. In our case, re-estimating the model with the Anderson-Hsiao bias correction and bootstrapped standard errors (Bruno, 2005) yields virtually the same results for the coefficients of interest.

The coefficient estimates (Table 8, Panel B) are similar to those on the full sample, confirming that our baseline results are not driven by the presence of no-relationship country pairs.

C. Regressions by Sub-period

It has been argued that the end of the Cold War changed the nature of bilateral aid. After 1990, geopolitical concerns played a diminished role (Ball and Johnson, 1996; Meernik et al., 1998; Fleck and Kilby, 2010) and aid selectivity criteria such as growth performance or the quality of institutions acquired a more prominent role (Berthelemy and Tichit, 2004; McGillivray, 2005; Bandyopadhyay and Wall, 2007). We check whether our core results hold up in the pre- and post-Cold War period by adding a post-1989 indicator variable together with interaction terms with the donor and recipient measures of the output cycle. Small and statistically insignificant coefficients on the interaction terms would suggest that there is no difference in the cyclical behavior of bilateral aid flows pre- and post-1990.

Table 9 shows that the interactions terms on the donor cycle variables are all statistically insignificant, suggesting that bilateral aid disbursements were on average equally procyclical relative to the donor cycle before and after 1990 (columns 1–3). However, the results are more mixed for the large shock variables, with two out of the interaction coefficients statistically different from zero (columns 4–6). Furthermore, there is evidence that the procyclicality of aid with respect to the recipient output cycle and its countercyclicality in face of large negative shocks are present mainly in the post-Cold War sample (columns 7–12). This is consistent with the view that economic concerns became more important in the post-Cold War era, as discussed in the literature.

D. Alternative Estimation Techniques

Lastly, we check for the sensitivity of our results to alternative estimators. The baseline model has been estimated with country-pair fixed effects which model unobserved time-invariant characteristics that determine the likelihood of a pair-wise relationship. Here we consider four alternative estimators: (a) pooled OLS, which treats donor-recipient-year cells as independent observations, ignoring the two-way cross-sectional and time series dimensions of the data; (b) donor and recipient (or country) fixed effects, which control for time-invariant unobserved heterogeneity at the country (but not country-pair) level; (c) donor and recipient fixed effects interacted with time, which allows for time-varying unobserved heterogeneity at the country (but not country-pair) level; and (d) donor-year, recipient-year, and country-pair fixed effects. Finally, we consider the Tobit estimator with random effects to account for the censored nature of the dependent variable. In all specifications we include a full set of time effects to control for global shocks.

Table 10 summarizes our findings by reporting solely the estimated coefficients on output cycle variables corresponding to each estimator. The benchmark results are resilient to changing the estimation technique, and in particular to saturating the model with dummies which capture country and country-pair features that may affect aid disbursements and be correlated with the output cycle, but are otherwise difficult to measure or observe. The least robust results concern the large shock dummies for recipients, where in two-three cases the coefficients lose statistical significance (columns 6, 10, 11). Nevertheless, growth collapses in aid-receiving countries are

associated with higher bilateral disbursements in five out of the six cases considered (that is, except in column 12).

V. CONCLUSIONS

The severity of the global financial crisis in advanced economies and its swift transmission worldwide prompted new interest in how foreign aid is affected by economic downturns. The issue is becoming more relevant as many advanced economies are currently facing the looming specter of a double-dip recession. In this paper, we documented the relevance of business cycles in donor and recipient countries in driving development aid flows, paying particular attention to large negative shocks.

Using a dyadic dataset on bilateral aid disbursements from 22 OECD donors to 113 developing countries over 1975–2005, we estimated a parsimonious aid allocation model and found that aid flows are on average procyclical with respect to the donor and recipient output cycles. We also presented novel evidence regarding the link between large shocks and aid flows. We found that while aid contracts sharply during severe downturns in donor countries, it also has a countercyclical role for developing countries when these experience large adverse shocks. These results suggest that that aid plays an important cushioning role for developing countries afflicted by TOT shocks, climatic disasters, or growth collapses. Our findings appear robust to changes in specification and across aid definitions and estimation techniques.

A question that naturally arises from our analysis is how aid disbursements will evolve in the near future given the current economic downturn in donor countries. It is possible that the evidence presented here is not the best basis for projections given the unprecedented severity of the global financial crisis and ongoing debt-related concerns in advanced economies. Nonetheless, our key finding that severe economic downturns in donor countries have historically triggered persistent declines in foreign aid supports the view that there are downside risks to the outlook for development aid. The upside is that large negative shocks in developing countries have historically been met with higher aid flows than previously thought.

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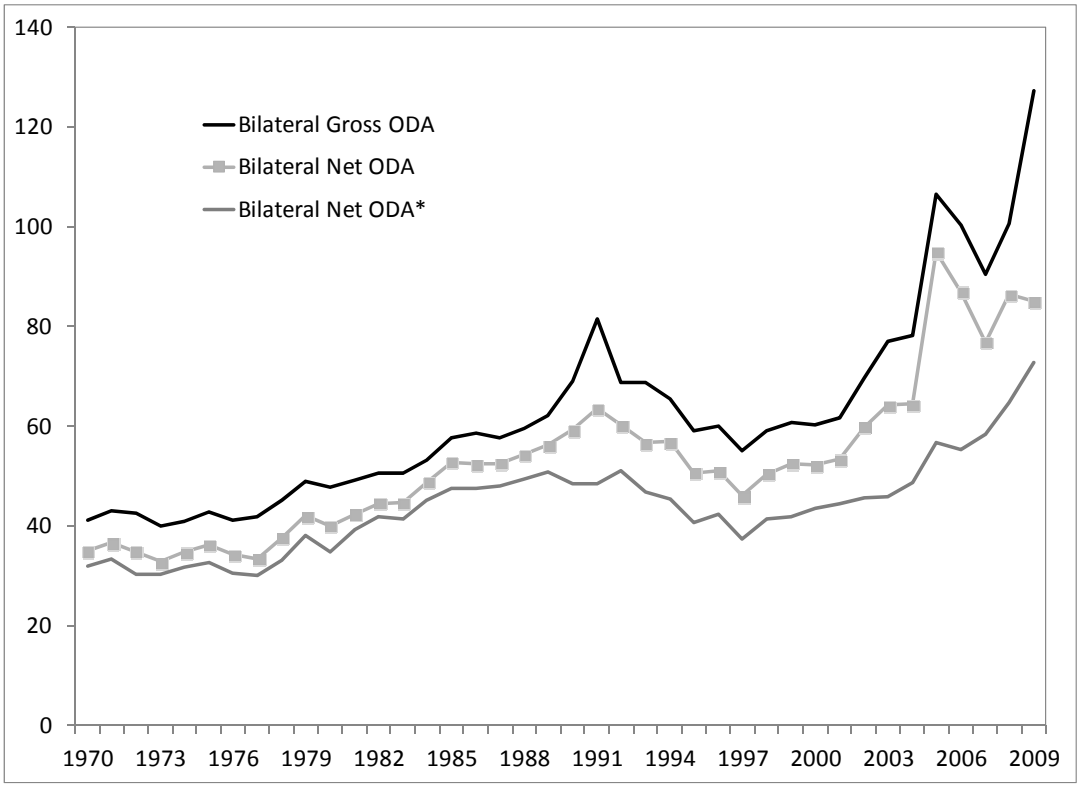
APPENDIX

Figure 1. Bilateral ODA, 1970–2009



Note: All figures are in 2008 US$ billion for 22 OECD donors. Bilateral Net ODA* excludes humanitarian aid, development food aid, and debt relief grants. Source: OECD-DAC.

Table 1. Variable definitions and sources

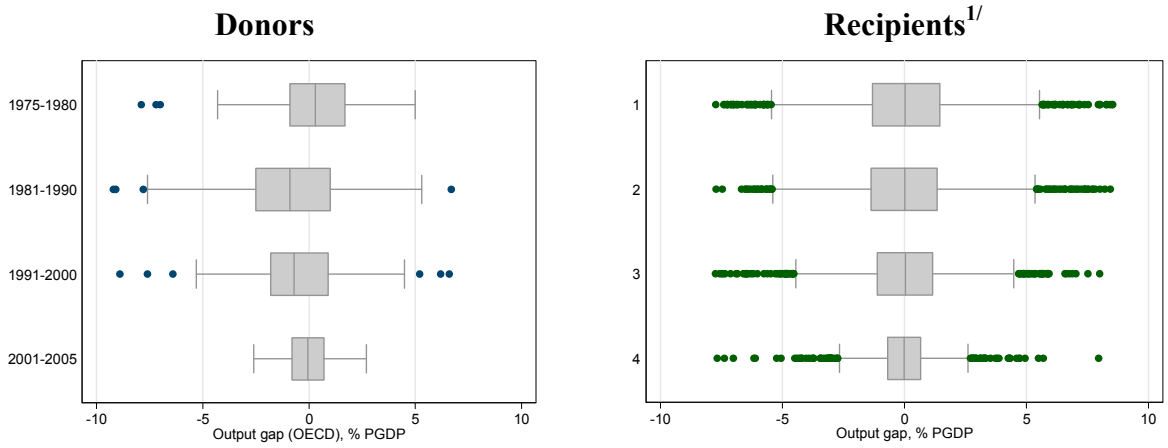
Variable	Definition	Source
Dyadic variables		
Real bilateral aid (dyadic)	Bilateral net ODA (Net ODA minus humanitarian aid, emergency food aid, and debt relief grants; in 2007 USD)	OECD-DAC
Real net aid transfers (dyadic)	Bilateral net aid transfers (i.e. Gross ODA net of principle and interest payments received on ODA loans; in 2007 USD)	Net Aid Transfers dataset 1960-2009 (updated January 28, 2011)
Donor and recipient-level variables		
Donor and recipient-level real GDP per capita	Real GDP per capita (constant prices: chain series, 2005 international US$)	PWT Mark 6.3 (Heston et al., 2009)
Donor and recipient-level population		PWT Mark 6.3 (Heston et al., 2009)
Donor output gap & trend	Output trend: Obtained through log-linear regression of real GDP on time. The output gap is the difference between the actual output and trend.	Authors' calculations.
Donor output gap (OECD)	See Beffy et al. (2006) for details on the OECD methodology to estimating the output gap	OECD Economic Outlook: Sources and Methods.
*Donor above/below trend growth	Growth trend: Obtained through linear regression of real GDP growth rate on time. The variable takes value 1 when actual growth rate is larger than trend value.	Authors' calculations.
Commitment-to-Development Index (Aid component)	The Commitment-to-Development Index ranks foreign aid donors based on their "dedication" to policies regarding the quantity and quality of foreign aid that benefit developing countries.	Center for Global Development, Roodman and Walz (2010).
Recipient output gap & trend	Output trend: obtained through HP filter with λ=1 (Rand and Tarp, 2002) applied to real GDP. The output gap is the difference between the actual output and trend.	Authors' calculations.
*Recipient above/below trend (output or consumption) growth	Same definition as for "Donor above/below trend growth."	Authors' calculations.
*'Recipient terms of trade shocks	Terms of trade growth rates in the bottom decile of the recipient-specific distribution. The terms of trade variable has been smoothed using two-year moving average.	Authors' calculations using terms of trade data from the World Economic Outlook (2009).
*Recipient growth collapse	Episodes of deceleration to negative per capita GDP growth rates as defined in Hausmann, Rodriguez and Wagner (2008). We retain collapses that lasted at least three years.	Hausmann, Rodriguez and Wagner (2008)
Recipient war index	Major Episodes of Political Violence (MEPV) index which captures episodes of "systematic and sustained use of lethal force by organized groups that result in at least 500 directly-related deaths." (Codebook: MEVP, available on: http://www.systemicpeace.org/inscr/MEPVcodebook2008.pdf)	Integrated Network for Social Conflict Research, Center for Systemic Peace, Armed Conflict and Intervention (ACI) datasets
Recipient institutional quality	Polity IV score on a scale from -10 (autocracy) to +10 (democracy).	Polity IV project: Political Regime Characteristics and Transitions, 1800-2008.

* dummy variable.

Table 2. List of countries used in the analysis

Low-income countries		Middle-income countries			
N=37		N=76			
Afghanistan, I.R. of	Mali	Albania	Costa Rica	Macedonia, FYR	Seychelles
Bangladesh	Mauritania	Algeria	Côte d'Ivoire	Malaysia	Solomon Islands
Benin	Mozambique	Angola	Djibouti	Maldives	South Africa
Burkina Faso	Nepal	Argentina	Dominica	Mauritius	Sri Lanka
Burundi	Niger	Armenia	Dominican Republic	Mexico	Sudan
Cambodia	Rwanda	Azerbaijan, Rep. of	Ecuador	Moldova	Suriname
Central African Rep.	Senegal	Belarus	Egypt	Mongolia	Swaziland
Chad	Sierra Leone	Belize	El Salvador	Morocco	Syrian Arab Republic
Comoros	Tajikistan	Bhutan	Gabon	Namibia	Thailand
Congo, Dem. Rep. of	Tanzania	Bolivia	Georgia	Nicaragua	Tunisia
Eritrea	Togo	Bosnia & Herzegovina	Guatemala	Nigeria	Turkey
Ethiopia	Uganda	Botswana	Guyana	Pakistan	Turkmenistan
Gambia, The	Uzbekistan	Brazil	Honduras	Panama	Ukraine
Ghana	Vietnam	Bulgaria	India	Papua New Guinea	Uruguay
Guinea	Yemen, Republic	Cameroon	Indonesia	Paraguay	Vanuatu
Guinea-Bissau	Zambia	Cape Verde	Iran, I.R. of	Peru	Venezuela, Rep. Bol.
Haiti	Zimbabwe	Chile	Jamaica	Philippines	
Kenya		China	Jordan	Poland	
Madagascar		Colombia	Kazakhstan	Romania	
Malawi		Congo, Republic of	Kiribati	Russia	

Figure 2. Distribution of output gap estimates



1/ Excluding extreme output gap observations (in the top and bottom ten percent). N=111 recipients.

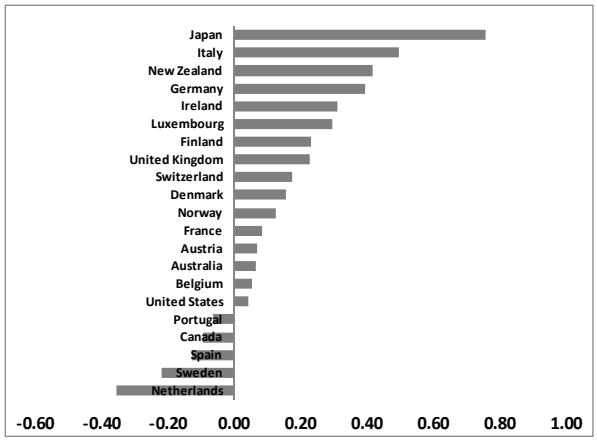
Table 3. Summary statistics

	# obs.	Mean	St. Dev.	Min	Max
Donor variables					
Output gap (% potential GDP)	89,496	0.1	5.3	-19.1	21.8
Output gap (OECD) (% potential GDP)	78,987	-0.4	2.3	-9.2	6.7
1= Above-trend GDP growth	87,010	0.5	0.5	0.0	1.0
Log-GDP trend	89,496	26.5	1.4	22.7	30.2
Log-population	89,496	16.5	1.4	12.8	19.5
Recipient variables - All countries					
Output gap (% potential GDP) 1/	81,290	0.0	3.0	-40.9	19.2
1=Below-trend GDP growth	78,804	0.5	0.5	0.0	1.0
1=Below-trend consumption growth	71,896	0.5	0.5	0.0	1.0
1=TOT growth rate in bottom decile	84,744	0.1	0.3	0.0	1.0
1=Climatic disaster	89,496	0.2	0.4	0.0	1.0
1=Growth collapse	89,496	0.5	0.5	0.0	1.0
Log-GDP trend	81,290	23.7	2.0	18.3	29.8
Log-population	82,786	15.7	1.9	10.8	21.0
War index	74,008	1.1	2.1	0.0	13.0
Institutional quality (Polity IV score)	73,964	-0.9	6.8	-10.0	10.0
Recipient variables - Low-income					
Output gap (% potential GDP) 1/	26,708	0.0	3.3	-40.9	19.2
1=Below-trend GDP growth	25,894	0.5	0.5	0.0	1.0
1=Below-trend consumption growth	22,594	0.5	0.5	0.0	1.0
1=TOT growth rate in bottom decile	26,136	0.1	0.3	0.0	1.0
1=Climatic disaster	29,304	0.2	0.4	0.0	1.0
1=Growth collapse	29,304	0.4	0.5	0.0	1.0
Log-GDP trend	26,708	23.0	1.2	19.0	26.5
Log-population	27,148	15.9	1.2	12.5	18.8
Institutional quality (Polity IV score)	26,488	-3.3	5.2	-10.0	9.0
Recipient variables - Middle-income					
Output gap (% potential GDP)	54,582	0.0	2.8	-25.9	15.9
1=Below-trend GDP growth	52,910	0.5	0.5	0.0	1.0
1=Below-trend consumption growth	49,302	0.5	0.5	0.0	1.0
1=TOT growth rate in bottom decile	58,608	0.1	0.3	0.0	1.0
1=Climatic disaster	60,192	0.2	0.4	0.0	1.0
1=Growth collapse	60,192	0.5	0.5	0.0	1.0
Log-GDP trend	54,582	24.0	2.2	18.3	29.8
Log-population	55,638	15.6	2.1	10.8	21.0
Institutional quality (Polity IV score)	47,476	0.4	7.2	-10.0	10.0
Donor-recipient variables					
Log-real aid* (net flows)	89,496	7.6	8.3	-20.8	21.8
Log-real aid* (gross flows)	89,496	8.3	7.6	-18.3	22.8
Log-real net aid transfers	89,496	0.9	1.5	-7.1	8.1

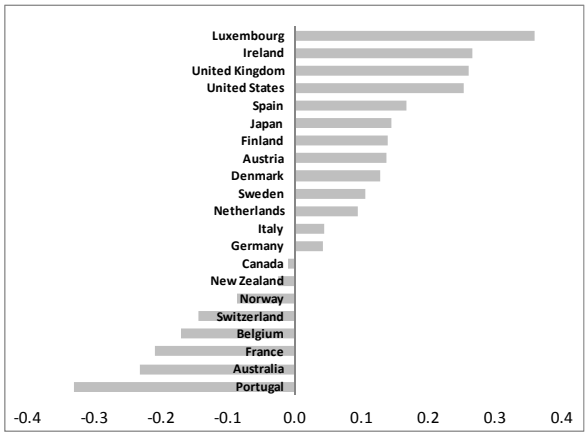
1/ The minimum value for the output gap of aid recipients of –40.9 is for Rwanda, 1994.

Figure 3. Unconditional correlations between aid and the business cycle[1/]

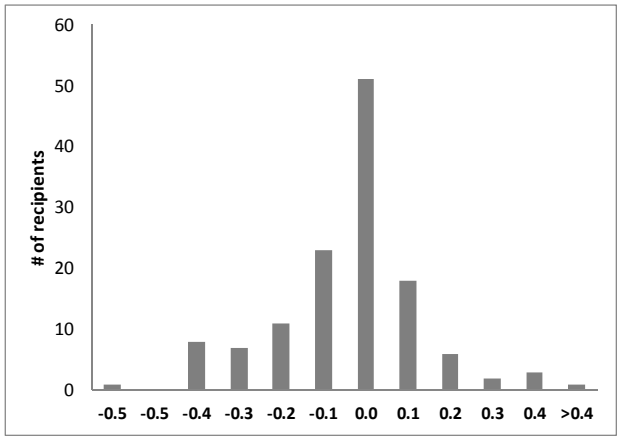
Correlation between aid and the donor output gap[3/]



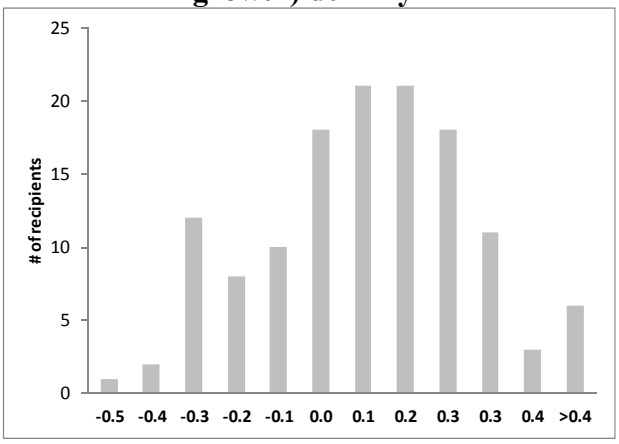
Correlation between aid and the donor expansion (above-trend GDP growth) dummy[3/]



Histogram of correlations between aid and the recipient output gap[2/]



Histogram of correlations between aid and the recipient recession (below-trend GDP growth) dummy



1/ Correlation coefficients are contemporaneous and aid is expressed in ratio to GDP.
2/ Extreme output gap observations (below the 10th percentile and above the 90th percentile) have been dropped.
3/ Excluding Greece.

Table 4. Impact of the donor cycle on aid

PANEL A - "Regular" cycle	**Full sample**			**Low-income**			**Middle-income**		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Log-Recipient GDP	-0.76***	-0.88***	-0.76***	1.29***	1.21**	1.20***	-1.37***	-1.67***	-1.40***
	(0.26)	(0.30)	(0.26)	(0.42)	(0.48)	(0.43)	(0.34)	(0.39)	(0.35)
Log-Recipient population	-3.14***	-3.79***	-3.38***	-1.59	-1.36	-1.51	-3.95***	-4.73***	-4.19***
	(0.64)	(0.73)	(0.65)	(1.45)	(1.70)	(1.48)	(0.73)	(0.84)	(0.76)
Log-Donor population	-0.60	1.10	1.92	-5.85***	-4.27	-2.99	2.01	3.75	4.35*
	(1.70)	(1.93)	(1.77)	(2.20)	(2.60)	(2.32)	(2.30)	(2.58)	(2.39)
Log-Donor GDP trend	5.30***	3.99***	5.27***	8.90***	8.17***	9.04***	3.52***	1.92	3.40***
	(0.74)	(1.00)	(0.77)	(1.10)	(1.56)	(1.14)	(0.94)	(1.26)	(0.97)
Donor output gap	0.11***			0.13***			0.10***		
	(0.01)			(0.01)			(0.01)		
Donor output gap (OECD)		0.08***			0.07**			0.08***	
		(0.02)			(0.03)			(0.02)	
1=Donor above-trend (GDP) growth			0.21***			0.16**			0.24***
			(0.05)			(0.08)			(0.07)
Country-pair fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	81290	72344	79178	26708	23730	26004	54582	48614	53174
Within R-squared	0.09	0.07	0.08	0.14	0.10	0.12	0.08	0.06	0.07
Number of pairid	2486	2486	2486	814	814	814	1672	1672	1672

PANEL B - Large negative shocks	**Full sample**			**Low-income**			**Middle-income**		
Log-Recipient GDP	-0.76***	-0.76***	-0.76***	1.29***	1.29***	1.29***	-1.37***	-1.37***	-1.37***
	(0.26)	(0.26)	(0.26)	(0.42)	(0.43)	(0.43)	(0.34)	(0.34)	(0.34)
Log-Recipient population	-3.14***	-3.14***	-3.14***	-1.59	-1.59	-1.59	-3.95***	-3.95***	-3.95***
	(0.64)	(0.64)	(0.64)	(1.46)	(1.46)	(1.46)	(0.74)	(0.74)	(0.74)
Log-Donor population	0.65	1.58	1.51	-4.43**	-3.30	-3.39	3.17	4.00*	3.94*
	(1.70)	(1.71)	(1.71)	(2.21)	(2.25)	(2.25)	(2.29)	(2.30)	(2.30)
Log-Donor GDP trend	5.23***	4.90***	4.92***	8.81***	8.41***	8.43***	3.45***	3.16***	3.17***
	(0.74)	(0.74)	(0.74)	(1.11)	(1.10)	(1.10)	(0.94)	(0.94)	(0.94)
1=Output gap in bottom quartile	-0.89***			-1.10***			-0.79***		
	(0.09)			(0.13)			(0.11)		
1=Output gap in bottom quartile (OECD)		-0.32***			-0.42***			-0.27**	
		(0.08)			(0.12)			(0.11)	
1=Growth deviation in bottom quartile			-0.12*			-0.20**			-0.08
			(0.07)			(0.09)			(0.09)
Country-pair fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	81290	81290	81290	26708	26708	26708	54582	54582	54582
Within R-squared	0.09	0.08	0.08	0.13	0.13	0.13	0.07	0.07	0.07
Number of pairid	2486	2486	2486	814	814	814	1672	1672	1672

Notes: The dependent variable is given by semi-log transformed real aid flows (see Section III.A). Levels of statistical significance are indicated by: *** p<0.01, ** p<0.05, * p<0.1.

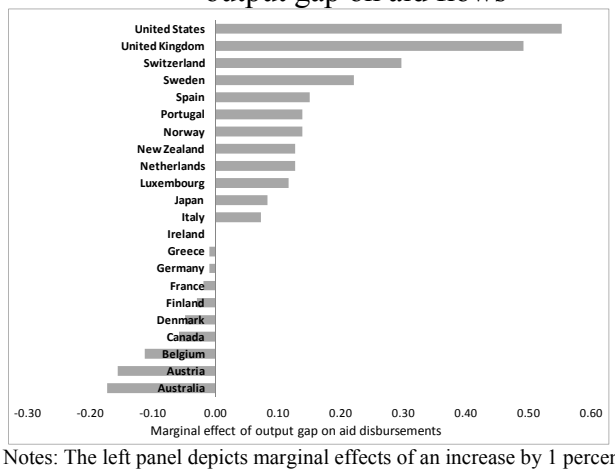
Table 4. Impact of the donor cycle on aid (continued)

PANEL C - Large positive shocks	Full sample			Low-income			Middle-income		
Log-Recipient GDP	-0.76***	-0.76***	-0.76***	1.29***	1.29***	1.29***	-1.37***	-1.37***	-1.37***
	(0.26)	(0.26)	(0.26)	(0.42)	(0.43)	(0.43)	(0.34)	(0.34)	(0.34)
Log-Recipient population	-3.14***	-3.14***	-3.14***	-1.59	-1.59	-1.59	-3.95***	-3.95***	-3.95***
	(0.64)	(0.64)	(0.64)	(1.45)	(1.46)	(1.45)	(0.74)	(0.73)	(0.74)
Log-Donor population	0.82	1.35	1.55	-4.23*	-3.52	-3.34	3.33	3.78*	3.97*
	(1.71)	(1.70)	(1.71)	(2.23)	(2.25)	(2.25)	(2.31)	(2.29)	(2.30)
Log-Donor GDP trend	4.82***	4.99***	4.88***	8.31***	8.49***	8.38***	3.08***	3.25***	3.14***
	(0.74)	(0.74)	(0.74)	(1.09)	(1.10)	(1.10)	(0.94)	(0.94)	(0.94)
1=Output gap in top quartile	0.73***			0.90***			0.64***		
	(0.07)			(0.10)			(0.09)		
1=Output gap in top quartile (OECD)		0.38***			0.31***			0.41***	
		(0.08)			(0.10)			(0.10)	
1=Growth deviation in top quartile			0.18***			0.25**			0.15*
			(0.06)			(0.10)			(0.08)
Country-pair fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	81290	81290	81290	26708	26708	26708	54582	54582	54582
Within R-squared	0.08	0.08	0.08	0.13	0.13	0.13	0.07	0.07	0.07
Number of pairid	2486	2486	2486	814	814	814	1672	1672	1672

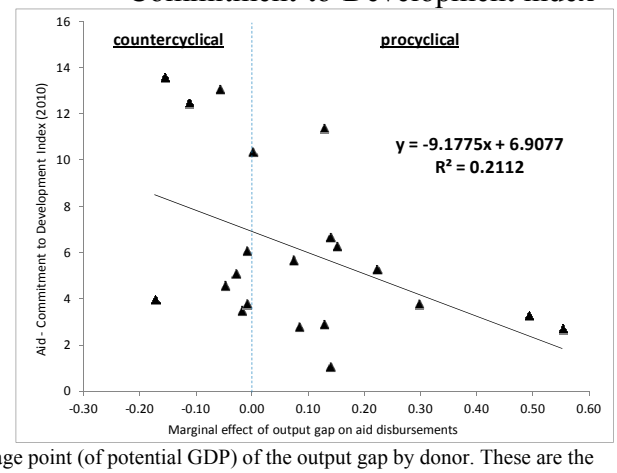
Notes: The dependent variable is given by semi-log transformed real aid flows (see Section III.A). Levels of statistical significance are indicated by: *** p<0.01, ** p<0.05, * p<0.1.

Figure 4. Donor heterogeneity in development aid cyclicality

A. Donor-specific marginal effects of output gap on aid flows



B. Marginal effects and the 2010 Aid Commitment-to-Development index



Notes: The left panel depicts marginal effects of an increase by 1 percentage point (of potential GDP) of the output gap by donor. These are the semi-elasticity coefficient estimates on donor output gap (% of potential GDP) from donor-by-donor OLS regressions of bilateral aid disbursements on the following set of covariates: recipient log-GDP, recipient log-population, donor log-population, donor log-GDP trend, donor output gap, and recipient fixed effects.

Table 5A. Impact of the recipient cycle on aid

PANEL A - "Regular" cycle	Full sample			Low-income			Middle-income		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Log-Recipient population	-4.75***	-4.83***	-5.18***	-1.97	-1.85	-2.09	-6.17***	-6.30***	-6.70***
	(0.73)	(0.75)	(0.84)	(1.49)	(1.51)	(1.56)	(0.86)	(0.89)	(0.98)
Log-Donor population	-0.82	-0.19	0.21	-5.19**	-4.75**	-4.71*	1.58	2.32	2.75
	(1.84)	(1.91)	(2.05)	(2.25)	(2.31)	(2.50)	(2.57)	(2.67)	(2.81)
Log-Donor GDP trend	5.98***	6.06***	6.15***	9.41***	9.66***	9.87***	4.10***	4.08***	4.23***
	(0.78)	(0.81)	(0.87)	(1.13)	(1.16)	(1.27)	(1.02)	(1.05)	(1.11)
Donor output gap, log-linear	0.11***	0.11***	0.11***	0.13***	0.14***	0.13***	0.10***	0.10***	0.10***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Log-Rec GDP trend	-1.35***	-1.34***	-1.78***	0.82*	0.76	0.96*	-2.07***	-2.10***	-2.59***
	(0.32)	(0.33)	(0.37)	(0.46)	(0.47)	(0.52)	(0.44)	(0.45)	(0.48)
Recipient war index	-0.27***	-0.26***	-0.22***	-0.24***	-0.24***	-0.20***	-0.24***	-0.22***	-0.18***
	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Recipient output gap	-0.00			-0.02**			0.01		
	(0.01)			(0.01)			(0.01)		
1=Recipient below-trend (GDP) growth		-0.11**			0.08			-0.22***	
		(0.05)			(0.07)			(0.07)	
1=Recipient below-trend (cons.) growth			-0.22***			-0.04			-0.31***
			(0.06)			(0.08)			(0.08)
Country-pair fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	72248	70246	63844	25102	24442	21296	47146	45804	42548
Within R-squared	0.09	0.08	0.08	0.14	0.13	0.12	0.08	0.07	0.07
Number of pairid	2288	2288	2134	792	792	682	1496	1496	1452

PANEL B - Large negative shocks	Full sample			Low-income			Middle-income		
Log-Recipient population	-4.36***	-4.77***	-4.90***	-2.39	-2.06	-2.12	-5.61***	-6.15***	-6.57***
	(0.75)	(0.73)	(0.73)	(1.52)	(1.49)	(1.49)	(0.88)	(0.86)	(0.86)
Log-Donor population	-0.75	-0.82	-0.82	-5.51**	-5.19**	-5.19**	1.69	1.58	1.58
	(1.87)	(1.84)	(1.84)	(2.29)	(2.25)	(2.25)	(2.57)	(2.57)	(2.56)
Log-Donor GDP trend	5.87***	5.98***	5.98***	9.32***	9.41***	9.41***	4.11***	4.10***	4.10***
	(0.80)	(0.78)	(0.78)	(1.18)	(1.13)	(1.13)	(1.02)	(1.02)	(1.02)
Donor output gap	0.12***	0.11***	0.11***	0.14***	0.13***	0.13***	0.11***	0.10***	0.10***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Log-Recipient GDP trend	-1.60***	-1.36***	-1.21***	1.06**	0.81*	0.83*	-2.29***	-2.07***	-1.74***
	(0.34)	(0.32)	(0.32)	(0.50)	(0.46)	(0.46)	(0.45)	(0.44)	(0.44)
Recipient war	-0.23***	-0.27***	-0.28***	-0.21***	-0.23***	-0.25***	-0.20***	-0.24***	-0.23***
	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
1=Recipient large TOT shock	0.20**			0.14			0.21		
	(0.10)			(0.14)			(0.13)		
1=Recipient climatic disaster		0.25***			0.01			0.37***	
		(0.07)			(0.09)			(0.09)	
1=Recipient growth collapse			0.52***			0.37**			0.65***
			(0.13)			(0.17)			(0.18)
Country-pair fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	69696	72248	72248	23144	25102	25102	46552	47146	47146
Within R-squared	0.09	0.09	0.09	0.14	0.14	0.14	0.08	0.08	0.08
Number of pairid	2156	2288	2288	704	792	792	1452	1496	1496

Notes: The dependent variable is given by semi-log transformed real aid flows (see Section III.A). Levels of statistical significance are indicated by: *** p<0.01, ** p<0.05, * p<0.1.

Table 5B. Impact of institutions on the link between the recipient cycle and aid

	Full sample			Low-income			Middle-income		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Log-Recipient population	-4.06***	-4.07***	-4.25***	-3.02**	-2.87**	-2.90**	-4.68***	-4.59***	-5.04***
	(0.74)	(0.72)	(0.73)	(1.46)	(1.42)	(1.42)	(0.87)	(0.85)	(0.87)
Log-Donor population	-0.84	-0.87	-0.87	-5.77**	-5.43**	-5.43**	1.66	1.61	1.61
	(1.87)	(1.84)	(1.84)	(2.28)	(2.24)	(2.24)	(2.55)	(2.53)	(2.55)
Log-Donor GDP trend	5.84***	5.95***	5.95***	9.25***	9.35***	9.35***	4.11***	4.10***	4.10***
	(0.79)	(0.78)	(0.78)	(1.18)	(1.14)	(1.14)	(1.01)	(1.00)	(1.00)
Donor output gap	0.12***	0.11***	0.11***	0.14***	0.13***	0.13***	0.10***	0.10***	0.10***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Log-Recipient GDP trend	-1.34***	-1.29***	-1.16***	0.81*	0.60	0.64	-1.61***	-1.60***	-1.42***
	(0.34)	(0.32)	(0.32)	(0.49)	(0.46)	(0.46)	(0.45)	(0.44)	(0.45)
Recipient war	-0.20***	-0.23***	-0.23***	-0.18***	-0.21***	-0.23***	-0.16***	-0.17***	-0.17***
	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Recipient institutional quality	0.10***	0.10***	0.07***	0.01	-0.02	-0.03	0.14***	0.16***	0.12***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
1=Recipient large TOT shock	0.14			-0.00			0.03		
	(0.09)			(0.16)			(0.13)		
TOT shock x institutional quality	0.03**			-0.04			0.05***		
	(0.01)			(0.02)			(0.02)		
1=Recipient climatic disaster		0.20***			-0.07			0.46***	
		(0.07)			(0.11)			(0.10)	
Climatic disaster x institutional quality		0.05***			-0.01			0.08***	
		(0.02)			(0.02)			(0.02)	
1=Recipient growth collapse			0.45***			0.38*			0.38**
			(0.13)			(0.19)			(0.18)
Growth collapse x institutional quality			0.03**			0.02			0.04**
			(0.01)			(0.02)			(0.02)
Country-pair fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	69366	71588	71588	22836	24706	24706	46530	46882	46882
Within R-squared	0.09	0.09	0.09	0.14	0.14	0.14	0.08	0.08	0.08
Number of pairid	2156	2266	2266	704	770	770	1452	1496	1496

Notes: The dependent variable is given by semi-log transformed real aid flows (see Section III.A). Levels of statistical significance are indicated by: *** p<0.01, ** p<0.05, * p<0.1.

Table 6. Dynamic effects and the impact of simultaneous shocks on aid

Full sample	**Donor cycle**			**Recipient cycle**			**Donor x Recipient cycle**		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Log-Recipient GDP	-0.78***	-0.78***	-0.78***						
	(0.27)	(0.27)	(0.27)						
Log-Recipient population	-3.59***	-3.59***	-3.59***	-5.47***	-5.99***	-6.16***	-5.04***	-5.46***	-5.62***
	(0.67)	(0.67)	(0.67)	(0.82)	(0.80)	(0.80)	(0.79)	(0.77)	(0.76)
Log-Donor population	1.37	2.86	2.68	0.09	-0.04	-0.04	-0.40	-0.43	-0.43
	(1.83)	(1.84)	(1.84)	(2.02)	(1.98)	(1.98)	(1.87)	(1.84)	(1.84)
Log-Donor GDP trend	6.07***	5.58***	5.61***	6.08***	6.24***	6.24***	5.85***	5.98***	5.98***
	(0.81)	(0.80)	(0.80)	(0.86)	(0.84)	(0.84)	(0.80)	(0.79)	(0.79)
Donor output gap				0.11***	0.11***	0.11***			
				(0.01)	(0.01)	(0.01)			
Log-Recipient GDP trend				-1.69***	-1.51***	-1.18***	-1.64***	-1.40***	-1.21***
				(0.36)	(0.33)	(0.34)	(0.34)	(0.32)	(0.32)
Recipient war index				-0.22***	-0.26***	-0.27***	-0.23***	-0.27***	-0.27***
				(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
1=Donor large shock	-0.46***	-0.30***	-0.09				-0.90***	-0.89***	-0.87***
	(0.08)	(0.07)	(0.07)				(0.09)	(0.10)	(0.12)
1=Donor large shock, t-1	-0.31***	-0.11*	-0.16***						
	(0.06)	(0.06)	(0.06)						
1=Donor large shock, t-2	-0.46***	-0.31***	-0.28***						
	(0.07)	(0.07)	(0.07)						
1=Recipient large shock				0.15*	0.21***	0.26**	0.23**	0.26***	0.53***
				(0.09)	(0.07)	(0.12)	(0.11)	(0.07)	(0.14)
1=Recipient large shock, t-1				0.21***	0.23***	0.19*			
				(0.08)	(0.07)	(0.10)			
1=Recipient large shock, t-2				0.42***	0.19***	0.23*			
				(0.08)	(0.07)	(0.12)			
1=Donor x Recipient large shock							-0.12	0.01	-0.01
							(0.21)	(0.15)	(0.15)
Country-pair fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	77066	77066	77066	64966	67298	67298	68332	70752	70752
Within R-squared	0.08	0.07	0.07	0.08	0.08	0.08	0.08	0.09	0.09
Number of pairid	2486	2486	2486	2178	2310	2310	2178	2310	2310

Notes: The dependent variable is given by semi-log transformed real aid flows (see Section III.A). The large shocks to donor economies are dummies for the output gap falling in the bottom quartile of the donor-specific distribution of output gaps (log-linear and OECD respectively in columns [1] and [2]; and deviations of GDP growth from trend falling in the bottom quartile of the donor-specific distribution of GDP growth rates in column [3]. The recipient shocks are TOT collapse (column [4]), climatic disaster (column [5]); and growth collapse (column [6]). The interaction between donor and recipient large shocks refers to the donor's output gap falling into the bottom quartile and the recipient experiencing a TOT shock (column [7]), climatic disaster (column [8]) and growth collapse (column [9]). The standard errors are clustered at the country-pair level. Levels of statistical significance are indicated by: *** p<0.01, ** p<0.05, * p<0.1.

Table 7. Robustness to alternative definitions of the dependent variable

	Donor cycle						Recipient cycle					
A. Gross ODA (excl. humanitarian aid, emergency food aid, debt relief grants)	Output gap	Output gap (OECD)	1 = Above-trend (GDP) growth	1=Output gap bottom quartile	1=Output gap bottom quartile (OECD)	1=Growth deviation in bottom quartile	Output gap	1=Below-trend (GDP) growth	1=Below-trend (cons.) growth	1=TOT collapse	1=Climatic disaster	1=Growth collapse
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Log-Recipient GDP	-0.16	-0.21	-0.16	-0.16	-0.16	-0.16						
	(0.22)	(0.25)	(0.22)	(0.22)	(0.22)	(0.22)						
Log-Rec GDP trend							-0.55**	-0.55**	-0.86***	-0.73***	-0.56**	-0.45*
							(0.26)	(0.27)	(0.30)	(0.28)	(0.26)	(0.26)
Log-Recipient population	-3.78***	-4.54***	-4.07***	-3.78***	-3.78***	-3.78***	-5.43***	-5.58***	-6.26***	-5.19***	-5.44***	-5.54***
	(0.56)	(0.63)	(0.57)	(0.56)	(0.56)	(0.56)	(0.62)	(0.64)	(0.72)	(0.63)	(0.62)	(0.62)
Log-Donor population	-2.46*	-1.70	-0.90	-1.50	-0.90	-0.96	-3.07**	-2.83*	-2.77*	-2.96**	-3.07**	-3.07**
	(1.41)	(1.57)	(1.45)	(1.40)	(1.40)	(1.40)	(1.48)	(1.53)	(1.64)	(1.50)	(1.48)	(1.48)
Log-Donor GDP trend	4.99***	4.48***	5.10***	4.91***	4.70***	4.72***	5.71***	5.90***	6.08***	5.63***	5.71***	5.71***
	(0.71)	(0.91)	(0.73)	(0.72)	(0.71)	(0.71)	(0.74)	(0.76)	(0.82)	(0.75)	(0.74)	(0.74)
Recipient war index							-0.23***	-0.23***	-0.18***	-0.19***	-0.23***	-0.23***
							(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Donor cycle proxy	0.08***	0.06***	0.29***	-0.56***	-0.28***	-0.13***	0.08***	0.08***	0.07***	0.08***	0.08***	0.08***
	(0.01)	(0.01)	(0.04)	(0.06)	(0.06)	(0.05)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Recipient cycle proxy							-0.01	-0.08**	-0.13***	0.22***	0.20***	0.36***
							(0.00)	(0.03)	(0.04)	(0.07)	(0.05)	(0.09)
Country-pair fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	81290	72344	79178	81290	81290	81290	72248	70246	63844	69696	72248	72248
Within R-squared	0.18	0.15	0.17	0.18	0.18	0.18	0.19	0.18	0.18	0.19	0.19	0.19
Number of pairid	2486	2486	2486	2486	2486	2486	2288	2288	2134	2156	2288	2288
B. Net Aid Transfers (i.e. ODA net of principal and interest payments on ODA	Donor cycle						Recipient cycle					
Log-Recipient GDP	-0.21***	-0.23***	-0.21***	-0.21***	-0.21***	-0.21***						
	(0.05)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)						
Log-Rec GDP trend							-0.31***	-0.32***	-0.42***	-0.38***	-0.32***	-0.30***
							(0.06)	(0.07)	(0.08)	(0.07)	(0.06)	(0.06)
Log-Recipient population	-0.05	-0.10	-0.09	-0.05	-0.05	-0.05	-0.19	-0.24*	-0.27*	-0.14	-0.20	-0.21
	(0.11)	(0.12)	(0.11)	(0.11)	(0.11)	(0.11)	(0.13)	(0.13)	(0.15)	(0.13)	(0.13)	(0.13)
Log-Donor population	-0.71**	-0.12	-0.35	-0.46	-0.29	-0.31	-0.86***	-0.89***	-1.03***	-0.88***	-0.86***	-0.86***
	(0.30)	(0.34)	(0.31)	(0.30)	(0.30)	(0.30)	(0.33)	(0.34)	(0.36)	(0.33)	(0.33)	(0.33)
Log-Donor GDP trend	0.17	0.17	0.16	0.15	0.09	0.09	0.18	0.20	0.19	0.17	0.18	0.18
	(0.11)	(0.15)	(0.12)	(0.11)	(0.11)	(0.11)	(0.12)	(0.13)	(0.13)	(0.12)	(0.12)	(0.12)
Recipient war index							-0.05***	-0.06***	-0.05***	-0.05***	-0.05***	-0.05***
							(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Donor cycle proxy	0.02***	0.02***	0.02***	-0.16***	-0.05***	0.01	0.02***	0.02***	0.02***	0.02***	0.02***	0.02***
	(0.00)	(0.00)	(0.01)	(0.02)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Recipient cycle proxy							-0.05***	-0.06***	-0.05***	-0.05***	-0.05***	-0.05***
							(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Country-pair fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	81290	72344	79178	81290	81290	81290	72248	70246	63844	69696	72248	72248
Within R-squared	0.06	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06
Number of pairid	2486	2486	2486	2486	2486	2486	2288	2288	2134	2156	2288	2288

Notes: The dependent variable is given by semi-log transformed real aid flows (see Section III.A) and the models are run on the full sample. The standard errors are clustered at the country-pair level. Levels of statistical significance are indicated by: *** p<0.01, ** p<0.05, * p<0.1.

Table 7. Robustness to alternative definitions of the dependent variable (continued)

	Donor cycle						Recipient cycle					
C. Further exclude imputed multilateral aid from benchmark dependent variable	Output gap	Output gap (OECD)	1 = Above-trend (GDP) growth	1=Output gap bottom quartile	1=Output gap bottom quartile (OECD)	1=Growth deviation in bottom quartile	Output gap	1=Below-trend (GDP) growth	1=Below-trend (cons.) growth	1=TOT collapse	1=Climatic disaster	1=Growth collapse
Log-Recipient GDP	0.15***	0.16**	0.15***	0.15***	0.15***	0.15***						
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)						
Log-Rec GDP trend							0.18**	0.18**	0.12	0.12	0.17**	0.21***
							(0.07)	(0.07)	(0.08)	(0.07)	(0.07)	(0.07)
Log-Recipient population	-0.37***	-0.39***	-0.37***	-0.37***	-0.37***	-0.37***	-0.43***	-0.43***	-0.30*	-0.39***	-0.44***	-0.48***
	(0.12)	(0.14)	(0.12)	(0.12)	(0.12)	(0.12)	(0.14)	(0.15)	(0.16)	(0.15)	(0.14)	(0.14)
Log-Donor population	1.61***	1.99***	2.09***	1.73***	1.91***	1.89***	1.70***	1.89***	1.79***	1.68***	1.70***	1.70***
	(0.34)	(0.38)	(0.35)	(0.34)	(0.34)	(0.34)	(0.38)	(0.39)	(0.41)	(0.39)	(0.38)	(0.38)
Log-Donor GDP trend	0.27**	-0.10	0.21	0.28**	0.22	0.22	0.28*	0.23	0.15	0.26*	0.28*	0.28*
	(0.14)	(0.17)	(0.14)	(0.14)	(0.14)	(0.14)	(0.15)	(0.15)	(0.16)	(0.15)	(0.15)	(0.15)
Recipient war index							-0.05***	-0.05***	-0.05***	-0.04***	-0.05***	-0.05***
							(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Donor cycle proxy	0.02***	0.02***	0.01	-0.17***	-0.08***	-0.07***	0.02***	0.02***	0.02***	0.02***	0.02***	0.02***
	(0.00)	(0.00)	(0.01)	(0.02)	(0.02)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Recipient cycle proxy							0.01***	-0.04***	-0.03**	0.06***	-0.01	0.13***
							(0.00)	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)
Country-pair fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	81290	72344	79178	81290	81290	81290	72248	70246	63844	69696	72248	72248
Within R-squared	0.05	0.05	0.04	0.05	0.05	0.05	0.06	0.06	0.05	0.06	0.06	0.06
Number of pairid	2486	2486	2486	2486	2486	2486	2288	2288	2134	2156	2288	2288

Notes: The dependent variable is given by semi-log transformed real aid flows (see Section III.A) and the models are run on the full sample. The standard errors are clustered at the country-pair level. Levels of statistical significance are indicated by: *** p<0.01, ** p<0.05, * p<0.1.

Table 8. Robustness across specifications

	Donor cycle						Recipient cycle					
Panel A. Control for lagged aid	Output gap	Output gap (OECD)	1 = Above-trend (GDP) growth	1=Output gap bottom quartile	1=Output gap bottom quartile (OECD)	1=Growth deviation in bottom quartile	Output gap	1=Below-trend (GDP) growth	1=Below-trend (cons.) growth	1=TOT collapse	1=Climatic disaster	1=Growth collapse
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Log(real aid flows), t-1	0.52***	0.51***	0.52***	0.52***	0.52***	0.52***	0.50***	0.50***	0.50***	0.50***	0.50***	0.50***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Log-Recipient GDP	-0.41***	-0.45***	-0.41***	-0.41***	-0.41***	-0.41***						
	(0.13)	(0.15)	(0.13)	(0.13)	(0.13)	(0.13)						
Log-Rec GDP trend							-0.69***	-0.69***	-0.97***	-0.81***	-0.71***	-0.62***
							(0.17)	(0.17)	(0.19)	(0.18)	(0.16)	(0.17)
Log-Recipient population	-1.34***	-1.63***	-1.33***	-1.33***	-1.33***	-1.32***	-2.16***	-2.13***	-2.73***	-1.97***	-2.17***	-2.24***
	(0.32)	(0.37)	(0.32)	(0.32)	(0.32)	(0.32)	(0.38)	(0.38)	(0.45)	(0.39)	(0.38)	(0.38)
Log-Donor population	0.57	1.91*	1.60*	1.03	1.65*	1.60*	0.57	0.63	1.17	0.62	0.57	0.57
	(0.88)	(1.01)	(0.87)	(0.87)	(0.87)	(0.87)	(0.98)	(0.98)	(1.07)	(1.00)	(0.98)	(0.98)
Log-Donor GDP trend	2.84***	2.07***	2.73***	2.92***	2.72***	2.74***	3.15***	3.17***	3.21***	3.09***	3.16***	3.16***
	(0.39)	(0.52)	(0.38)	(0.39)	(0.38)	(0.38)	(0.42)	(0.42)	(0.46)	(0.43)	(0.42)	(0.42)
Recipient war index							-0.13***	-0.13***	-0.11***	-0.11***	-0.13***	-0.14***
							(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Donor cycle proxy	0.06***	0.05***	0.14***	-0.50***	-0.20***	-0.13**	0.06***	0.06***	0.06***	0.06***	0.06***	0.06***
	(0.00)	(0.01)	(0.04)	(0.05)	(0.05)	(0.05)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Recipient cycle proxy							-0.00	-0.04	-0.14***	0.10	0.14***	0.27***
							(0.01)	(0.04)	(0.04)	(0.07)	(0.05)	(0.07)
Country-pair fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	79178	71480	79178	79178	79178	79178	70554	70246	63844	68046	70554	70554
Within R-squared	0.33	0.30	0.33	0.33	0.33	0.33	0.32	0.32	0.31	0.31	0.32	0.32
Number of pairid	2486	2486	2486	2486	2486	2486	2288	2288	2134	2156	2288	2288
Panel B. Drop "no relationship" pairs	Donor cycle						Recipient cycle					
Log-Recipient GDP	-0.25	-0.29	-0.25	-0.25	-0.25	-0.25						
	(0.23)	(0.26)	(0.23)	(0.23)	(0.23)	(0.23)						
Log-Rec GDP trend							-0.55**	-0.55**	-0.89***	-0.76***	-0.57**	-0.45*
							(0.27)	(0.27)	(0.31)	(0.29)	(0.26)	(0.27)
Log-Recipient population	-4.30***	-4.90***	-4.60***	-4.31***	-4.31***	-4.31***	-5.60***	-5.76***	-6.45***	-5.34***	-5.62***	-5.71***
	(0.58)	(0.65)	(0.60)	(0.58)	(0.58)	(0.58)	(0.64)	(0.65)	(0.74)	(0.65)	(0.64)	(0.63)
Log-Donor population	-2.40	-1.87	-0.71	-1.40	-0.74	-0.77	-2.70*	-2.49	-2.47	-2.59	-2.71*	-2.69*
	(1.51)	(1.68)	(1.56)	(1.50)	(1.50)	(1.50)	(1.56)	(1.62)	(1.74)	(1.59)	(1.56)	(1.56)
Log-Donor GDP trend	5.98***	5.25***	6.06***	5.90***	5.64***	5.65***	6.09***	6.30***	6.54***	6.02***	6.09***	6.08***
	(0.73)	(0.97)	(0.75)	(0.73)	(0.72)	(0.72)	(0.76)	(0.78)	(0.84)	(0.77)	(0.76)	(0.76)
Recipient war index							-0.23***	-0.23***	-0.18***	-0.20***	-0.23***	-0.24***
							(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Donor cycle proxy	0.09***	0.07***	0.32***	-0.60***	-0.29***	-0.17***	0.08***	0.08***	0.07***	0.08***	0.08***	0.08***
	(0.01)	(0.02)	(0.04)	(0.06)	(0.06)	(0.05)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Recipient cycle proxy							-0.01	-0.09**	-0.14***	0.24***	0.20***	0.39***
							(0.00)	(0.04)	(0.04)	(0.08)	(0.05)	(0.10)
Country-pair fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	76285	68234	74301	76285	76285	76285	68995	67080	60884	66469	68995	68995
Within R-squared	0.20	0.16	0.18	0.19	0.19	0.19	0.20	0.19	0.18	0.19	0.20	0.20
Number of pairid	2333	2333	2333	2333	2333	2333	2179	2179	2030	2049	2179	2179

Notes: The dependent variable is given by semi-log transformed real aid flows (see Section III.A) and the models are run on the full sample. The standard errors are clustered at the country-pair level. Levels of statistical significance are indicated by: *** p<0.01, ** p<0.05, * p<0.1.

Table 9. Robustness in pre- and post-Cold War sub-samples

	Donor cycle						Recipient cycle					
	Output gap	Output gap (OECD)	1 = Above-trend growth	1=Output gap bottom quartile	1=Output gap bottom quartile (OECD)	1=Growth deviation in bottom quartile	Output gap	1=Below-trend GDP growth	1=Below-trend consumption growth	1=TOT growth rate in bottom decile	1=Climatic disaster	1=Growth collapse
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Log-Recipient GDP	-0.76***	-0.88***	-0.76***	-0.76***	-0.76***	-0.76***						
	(0.26)	(0.30)	(0.26)	(0.26)	(0.26)	(0.26)						
Log-Rec GDP trend							-1.35***	-1.32***	-1.77***	-1.60***	-1.32***	-1.29***
							(0.32)	(0.33)	(0.37)	(0.34)	(0.32)	(0.31)
Log-Recipient population	-3.14***	-3.79***	-3.38***	-3.14***	-3.14***	-3.14***	-4.76***	-4.79***	-5.18***	-4.36***	-4.74***	-4.83***
	(0.64)	(0.73)	(0.65)	(0.64)	(0.64)	(0.64)	(0.73)	(0.75)	(0.84)	(0.75)	(0.73)	(0.73)
Log-Donor population	-0.59	1.09	1.96	0.67	1.63	1.48	-0.82	-0.19	0.21	-0.75	-0.82	-0.82
	(1.70)	(1.93)	(1.77)	(1.70)	(1.71)	(1.71)	(1.84)	(1.91)	(2.05)	(1.87)	(1.84)	(1.84)
Log-Donor GDP trend	5.33***	3.99***	5.26***	5.26***	4.86***	4.92***	5.98***	6.06***	6.15***	5.87***	5.98***	5.98***
	(0.76)	(1.00)	(0.77)	(0.75)	(0.74)	(0.74)	(0.78)	(0.80)	(0.87)	(0.80)	(0.78)	(0.78)
Recipient war index							-0.27***	-0.27***	-0.22***	-0.23***	-0.27***	-0.28***
							(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Donor cycle proxy	0.11***	0.08***	0.25***	-0.98***	-0.14	-0.01	0.11***	0.11***	0.11***	0.12***	0.11***	0.11***
	(0.01)	(0.02)	(0.07)	(0.10)	(0.10)	(0.07)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Donor cycle proxy x (1=Post-Cold War)	-0.00	0.00	-0.07	0.19	-0.37**	-0.22*						
	(0.01)	(0.03)	(0.11)	(0.16)	(0.16)	(0.12)						
Recipient cycle proxy							-0.01	0.08	-0.11	0.10	0.59***	0.67***
							(0.01)	(0.07)	(0.08)	(0.12)	(0.11)	(0.16)
Recipient cycle proxy x (1=Post-Cold War)							0.01	-0.38***	-0.23*	0.26	-0.62***	-0.35*
							(0.01)	(0.10)	(0.12)	(0.18)	(0.17)	(0.21)
1=Post-Cold War	2.98***	5.22***	1.59***	3.04***	0.70	2.79***	3.91***	0.83***	0.81***	3.88***	3.97***	3.91***
	(0.95)	(0.69)	(0.31)	(0.95)	(0.62)	(0.79)	(1.06)	(0.17)	(0.17)	(1.08)	(1.06)	(1.05)
Country-pair fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	81290	72344	79178	81290	81290	81290	72248	70246	63844	69696	72248	72248
Within R-squared	0.09	0.07	0.08	0.09	0.08	0.08	0.09	0.08	0.08	0.09	0.09	0.09
Number of pairid	2486	2486	2486	2486	2486	2486	2288	2288	2134	2156	2288	2288

Notes: The dependent variable is given by semi-log transformed real aid flows (see Section III.A) and the models are run on the full sample. The standard errors are clustered at the country-pair level. Levels of statistical significance are indicated by: *** p<0.01, ** p<0.05, * p<0.1.

Table 10. Robustness across estimation techniques

	Donor cycle						Recipient cycle					
	Output gap	Output gap (OECD)	1 = Above-trend growth	1=Output gap bottom quartile	1=Output gap bottom quartile (OECD)	1=Growth deviation in bottom quartile	Output gap	1=Below-trend GDP growth	1=Below-trend consumption growth	1=TOT growth rate in bottom decile	1=Climatic disaster	1=Growth collapse
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Benchmark estimator:												
Country-pair fixed effects	0.11***	0.08***	0.21***	-0.89***	-0.32***	-0.12*	-0.00	-0.11**	-0.22***	0.20**	0.25***	0.52***
Alternative estimators:												
Pooled OLS	0.11***	0.07***	0.08	-0.92***	-0.28***	-0.10	-0.01	-0.13**	-0.24***	0.12	0.75***	0.21
Country fixed effects	0.11***	0.07***	0.22***	-0.86***	-0.34***	-0.13*	-0.00	-0.11**	-0.22***	0.20**	0.25***	0.52***
Country-year fixed effects	0.11***	0.04**	0.06	-0.95***	-0.30***	-0.02	-0.01	-0.17***	-0.29***	0.04	0.01	0.29**
Country-year and country-pair fixed effects	0.11***	0.04**	0.07	-0.95***	-0.30***	-0.02	-0.01	-0.17***	-0.29***	0.04	0.01	0.29**
Tobit with random effects	0.06***	0.04***	0.03***	-0.46***	-0.19***	-0.20***	-0.01**	-0.07***	-0.12***	0.22***	0.13***	0.28***

Notes: We report only the coefficient estimates on the donor and recipient cycle variables along with the level of statistical significance (*** p<0.01, ** p<0.05, * p<0.1). The dependent variable is given by semi-log transformed real aid flows (see Section III.A) for all specifications. (For the Tobit model, we drop negative observations). The models are run on the full sample. For the Tobit estimator we report marginal effects estimated using the Delta method. All specifications include time effects. The standard errors are clustered at the country-pair level for all estimators except Tobit with random effects.