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Business Cycle Fluctuations, Large Macroeconomic Shocks, and Development Aid

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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 experience large adverse shocks. Our findings suggest that development aid may play an important cushioning role in developing countries, but only during times of severe macroeconomic stress. Our results are robust to alternate definitions of aid flows, specifications, and estimation techniques.

Key words — foreign aid, bilateral donors, business cycle, macroeconomic shocks

1. INTRODUCTION

In the run-up to the global financial crisis, development aid increased markedly, reaching a peak around the Gleneagles summit in 2005 (Figure 1).[1] However, the strains caused by the 2008–09 downturn on public finances in donor countries raised concerns that the supply of aid would decline. Although the immediate impact of the crisis on aid flows was not as deleterious as expected, the risk that development aid will fall is still looming. Given the prolonged recession and uncertain economic prospects facing a number of leading donor countries, it is natural to ask whether aid flows are at risk of being cut in the near future. To answer this question, we must examine the link between aid flows on the one hand, and macroeconomic fluctuations in donor and recipient countries on the other.

We empirically assess how donor- and recipient-country macroeconomic conditions affect foreign aid flows, focusing on both "normal" business cycle fluctuations and "unusually large" adverse shocks. Specifically, we provide answers to 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 countries influence their aid receipts? What happens to aid flows 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 to which we add a wide range of business cycle variables and measures of large macroeconomic shocks. Our dataset represents bilateral (country-pair) aid flows from 22 OECD donors to 113 aid recipients over 1970–2005.

We find that foreign aid is on average procyclical with respect to the donor and recipient output cycles, rising during expansions and falling during recessions.[2] In particular, donors reduce aid outlays significantly during periods of severe economic stress. But bilateral aid becomes countercyclical when aid recipients are hit by large adverse shocks, increasing significantly during sustained episodes of negative growth and terms-of-trade (TOT) collapses. These effects tend to be persistent. When both the donor and recipient country experience large negative macroeconomic fluctuations, there is no additional impact on aid flows. Our results are robust to alternative definitions of aid flows and across specifications and estimation techniques.

We estimate an empirical aid allocation model using a rich panel dataset with information on country-pair aid flows and country characteristics. The three-way nature of the panel affords us a number of advantages over standard donor- or recipient-level models employed in the literature. First, bilateral data provide a rich amount of variation, allowing us to estimate the model on sample sizes of almost 90,000 observations and increasing the precision of our estimates. Second, we can

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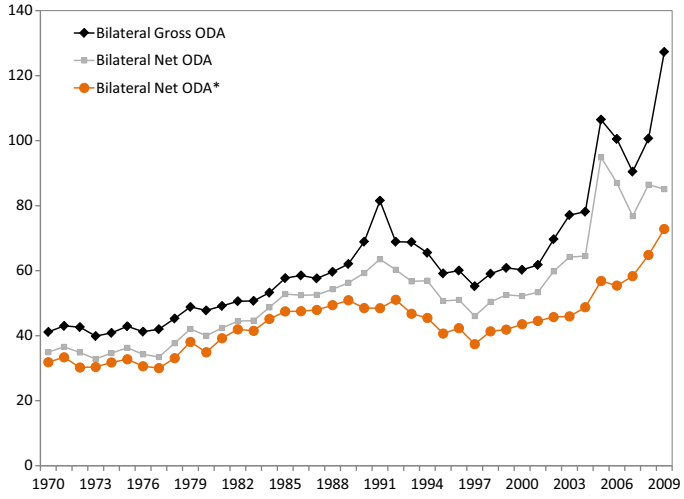

Figure 1. *Bilateral ODA, 1970–2009. Notes: Figures are expressed in 2008 US$ billion. Sample comprises 22 OECD donors. Bilateral Net ODA* excludes humanitarian aid, development food aid, and debt relief grants.*

estimate the business cycle effects on aid disbursements while controlling for time-invariant unobserved heterogeneity in the donor-recipient relationships (which is subsumed into country-pair fixed effects). Third, the data enable us to assess the impact of country-level variables such as negative economic shocks that *simultaneously* affect the donor and the recipient. Fourth, bilateral data help reduce concerns regarding reversed causation that plague traditional country-level panel regressions because the dependent variable captures pair-level information while many regressors vary at the country level.

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) find inconclusive evidence on the relationship between business cycles in donor countries and aid disbursements to Africa over 1969–92, but present some evidence of procyclicality of aid commitments. Mold, Olcer, and Prizzon (2008) argue that the relationship between economic growth in donor countries and their aid outlays is ambiguous. They show that aid flows and GDP tend to co-move over long periods, but aid often "decouples" from economic growth in OECD countries. Faini (2006) finds no statistical relationship between the output gap as a measure of the cyclical position of donor countries and aid flows over 1980–2004. By contrast, Bertoli, Cornia, and Manaresi (2008) document a robust positive relationship between the same 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 interpret as a more than proportional impact of the cycle on aid allocations.

The recent crisis has spurred new work on the link between conditions in donor countries and aid flows. Using donor-level regressions, Dang *et al.* (2009) show that aid falls substantially after systemic banking crises after controlling for their impact on output. Frot (2009) estimates that banking crises in donor countries cause reductions in aid by 13% on average (level effect) and by 5% yearly after the onset of a crisis (trend effect). Mendoza, Jones, and Vergara (2009) find that stock market volatility in the United States of America—a proxy for financial stress and economic uncertainty—is associated with lower aid disbursements. We expand this line of research by showing that there is a robust and systematic average relationship between donor country conditions and aid disbursements. We also document interesting heterogeneity in donor behavior by showing that donors' tendency to disburse procyclically relative to their own cycle is inversely related to the quality of their aid-related activities.

With respect to the recipient-country cycle, most of the existing evidence, including ours, suggests that foreign aid is procyclical with respect to output and revenues. For instance, Pallage and Robe (2001) show that in half of developing countries and in most African economies there is a high positive correlation between the cyclical component of aid receipts and that of domestic output.[3] As Svensson (2000) shows analytically, this procyclical result can be explained by moral hazard arguments: in the second-best equilibrium with unverifiable government actions, the donor ties aid disbursements to the recipient country's macroeconomic performance because they cannot distinguish whether downturns are caused by exogenous shocks or by macroeconomic mismanagement.

Pallage, Robe, and Beroube (2006) argue that foreign aid can act as insurance against macroeconomic shocks in developing countries, reducing macroeconomic volatility, and benefitting long-run growth. Our results support this idea but also provide some nuance: not only donors' aid policy becomes countercyclical when developing countries experience unusually severe economic stress (caused, e.g., by TOT collapses or climatic disasters), this effect is stronger in countries with more transparent institutions. Our results then suggest that higher-quality institutions can help resolve the aid monitoring problem (see Banerjee, 2010).

The remainder of the paper is organized as follows. In Section 2 we describe the data and introduce our key variables. We discuss the baseline empirical model, the estimation method, and report the main findings in Section 3. Section 4 presents robustness checks and Section 5 concludes. Detailed information on the data sources, the list of countries, summary statistics, and additional results are available in an online appendix.[4]

2. DATA, DEFINITIONS, AND DESCRIPTIVE STATISTICS

(a) *Data and definitions of aid and business cycle variables*

We construct our dataset starting with OECD-DAC information on bilateral aid flows from 22 donors to 113 recipients over the period 1970–2005, giving us about 90,000 observations.[5] Our dependent variable is real bilateral foreign aid, defined as bilateral official development assistance (ODA) net of principal repayments. From this aggregate we subtract humanitarian emergency aid, emergency food aid, and debt forgiveness grants, since these may be primarily driven by shocks in recipient countries and hence not have the same cyclical properties as regular development flows.

A potential problem with using bilateral flows is that the data contain many zero entries. Dropping these observations may bias our results if such entries were nonrandom, for instance by reflecting unobserved characteristics of the donor-recipient pair. Following Arndt, Jones, and Tarp (2010), we retain these zeros since they mainly represent *unreported null values* rather than absent data. In addition, we adopt a semi-log transformation of the form[6]:

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

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 both zero entries as well as negative observations.[7] The estimated coefficients in the ordinary least squares (OLS) regressions can be interpreted as (semi-) elasticities for large values of aid (Eichengreen & Irwin, 1998).

We consider a range of variables to measure 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 methodology for estimating the output gap. While the former approach is purely statistical, the latter is based on estimation of a production function (for details, see Beffy, Ollivaud, Richardson, & Sedillot, 2006). The two output gap estimates have a correlation coefficient of 0.56 (statistically significant at the 99% level). Our third proxy for the donor cycle is a dummy for years of above- (below) trend real growth, capturing economic expansions (recessions).

Quantifying economic fluctuations is more difficult in aid-receiving countries, particularly in low-income countries that are undergoing structural transformation and are subject to more frequent and severe shocks. Rand and Tarp (2002) argue 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.[8] Our first proxy for the cycle in recipient countries is the output gap calculated using the Hodrick–Prescott (HP) filter, adjusting the smoothing parameter λ to allow for shorter cycles ($\lambda = 1$ as opposed to 10 or 100 as is customary for yearly data) and dropping endpoints. We add to the output gap two additional measures of recessions, namely two 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 during times of extreme macroeconomic stress. For donors, large shocks are captured with 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[9]; (ii) climatic shocks referring to years in which the recipient economy experienced floods, drought, extreme temperature variations, and windstorms; and (iii) growth collapse episodes of at least 3 years when the country experiences a sustained deceleration to negative growth (Hausmann *et al.*, 2008).

Our first two proxies for the recipient cycle—TOT and climatic shocks—are external shocks associated with short-term fluctuations in international commodity prices or agricultural output, and 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 internal factors such as civil strife and political instability (Minoiu & Reddy, 2009).

(b) *Data exploration: descriptive statistics*

We start the empirical analysis by looking at simple descriptive statistics of the cycle variables, including their correlations with bilateral aid flows. Summary statistics for the full sample are presented in Table 1.

The 22 OECD donors in our sample have experienced relatively small fluctuations in economic activity since the 1970s. The box-plots in Figure 2 show that most of the donor output gap observations are between −2 and +2 percentage points of GDP (Panel A), with few extreme observations. The number of extreme output gap estimates is noticeably larger for aid-receiving countries (Panel B). Both output gap distributions have become narrower over time, reflecting a general fall in aggregate volatility toward the end of the sample period.

Simple correlation coefficients between different 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 (Panels A and B). It is less clear how they disburse relative to the recipient economy as the correlation coefficients are more heterogeneous and their distribution is centered on zero (Panels C and D).

3. 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 econometric specification:

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

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; γ_t represents time effects that control for global shocks and partly capture pre-existing trends (Plümper & Neumayer, 2010); and ε_{ijt} is a well-behaved error term. The country-pair fixed effects α_{ij} allow us to control for time-invariant country-pair features (such as past colonial ties, sharing a common language, other forms of cultural proximity, and geographical distance) that may influence the likelihood of a bilateral relationship.

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 attenuates endogeneity concerns associated with causality running from aid flows to the output cycle variables, especially in the case of recipient countries. We estimate this parsimonious model both for the full sample and the sub-samples of low- and middle-income countries using the OLS estimator with a full set of country-pair and time fixed effects. We cluster the standard errors on country-pair to exploit residual within-country-pair correlation.[10]

(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 2. We find that expansions in donor countries, captured by a higher output gap or above-trend real growth, are accompanied by higher aid flows (Panel A). A one percentage point increase in the donor output gap (as a share of potential GDP) raises real aid disbursements on average by between 8.3% and 11.6% depending on the output gap estimate (columns 1 and 2).[11] On average, expansions raise aid outlays by one fifth

Table 1. *Summary statistics*

	No. Obs.	Mean	St. Dev.	Min	Max
Donors (N = 22)					
Output gap (% potential GDP)	89,496	0.14	5.31	−19.14	21.81
Output gap (OECD) (% potential GDP)	78,987	−0.41	2.32	−9.20	6.70
1 = Above-trend GDP growth	87,010	0.53	0.50	0.00	1.00
Log-GDP trend	89,496	26.47	1.44	22.68	30.15
Log-population	89,496	16.47	1.43	12.79	19.51
Recipients – Full sample (N = 113)					
Output gap (% potential GDP)	81,290	0.00	2.99	−40.91	19.19
1 = Below-trend GDP growth	78,804	0.49	0.50	0.00	1.00
1 = Below-trend consumption growth	71,896	0.50	0.50	0.00	1.00
1 = TOT growth rate in bottom decile	84,744	0.08	0.27	0.00	1.00
1 = Climatic disaster	89,496	0.18	0.39	0.00	1.00
1 = Growth collapse	89,496	0.45	0.50	0.00	1.00
Log-GDP trend	81,290	23.65	2.01	18.26	29.76
Log-population	82,786	15.68	1.87	10.82	20.99
War index	74,008	1.08	2.11	0.00	13.00
Institutional quality (Polity IV)	73,964	−0.89	6.83	−10.00	10.00
Country-pairs (N = 2,486)					
Log-real aid* (net flows)	89,496	7.57	8.31	−20.77	21.82
Log-real aid* (gross flows)	89,496	8.27	7.64	−18.33	22.81
Log-real net aid transfers	89,496	0.92	1.52	−7.15	8.10

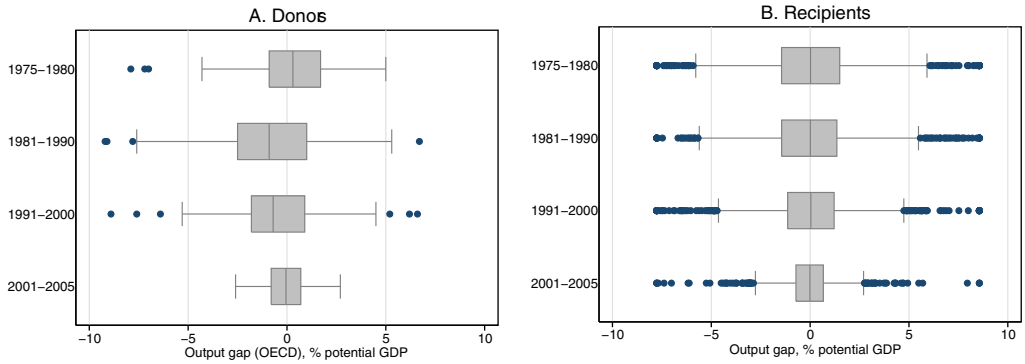

Figure 2. *Distribution of output gap estimates. Notes: The chart depicts horizontal box-plots of output gap estimates for donor and recipient countries, by decade. The left and right edges of each box are the first and third quartiles, and the band inside the box is the median. In Panel B, output gap observations have been winsorized at the 1st and 99th percentile.*

(column 3). These findings underscore the procyclicality of aid flows with respect to the donor cycle documented in earlier aid allocation studies, albeit with different measures of the donor cycle (e.g., Bertoli *et al.*, 2008; Frot, 2009). In addition, we find no systematic difference across income groups, as the estimated semi-elasticities have similar magnitudes across subsamples (columns 4–9).

When donors experience severe economic stress, they reduce aid outlays substantially (Table 2, Panel B). In these specifications, unusually harsh conditions 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% in the full sample, depending on the gap measure (columns 1–2). Growth recessions reduce aid disbursements by 11.3% on average (column 3). Interestingly, aid flows to middle-income countries appear less sensitive to the donor cycle, as the estimated coefficients are 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 downturns, donors become more concerned over how aid is being managed by the recipient government and whether aid ultimately spurs development. Since institutional quality—a rough indicator of how transparently aid is spent—tends to be poorer in low-income countries, donors may be more prone to reducing disbursements to these countries relative to those with a better institutional environment.

Are these results symmetric? Taking the same approach to constructing proxies for the donor's cyclical positions, we check whether the patterns identified so far hold up for unusually *favorable* economic conditions. Our measures of economic boom 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 Table 2 (Panel C), the estimated semi-elasticities are close in

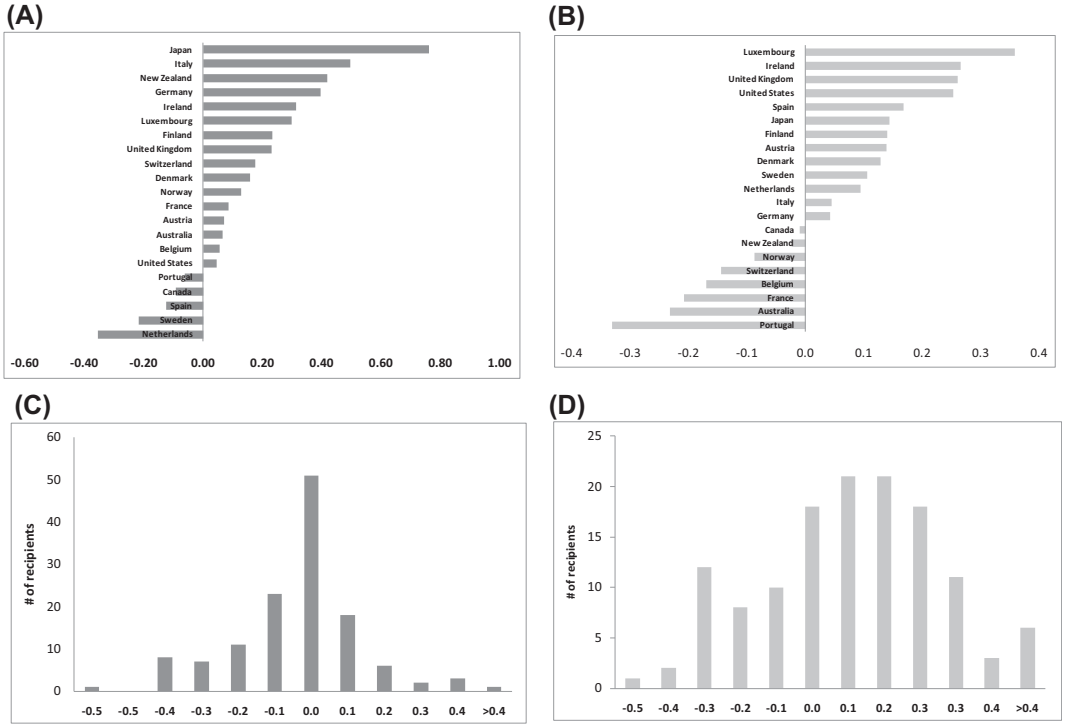

Figure 3. *Unconditional correlations between aid and the business cycle. (A) Correlation between aid and the donor output gap. (B) Correlation between aid and the donor expansion (above-trend GDP growth) dummy. (C) Histogram of correlations between aid and the recipient output gap. (D) Histogram of correlations between aid and the recipient recession (below-trend GDP growth) dummy. Notes: The chart depicts unconditional contemporaneous correlations between aid and the output gap (panels A and B) and the histogram of correlations (panels C and D). Aid is expressed in ratio to GDP. Greece is omitted from the charts.*

magnitude (and of opposite sign) to those for large negative shocks. Big economic booms in donor countries have historically caused aid to increase by 20–100%, depending on the measure used (columns 1–3).

It is important to determine whether the average effects documented above conceal heterogeneity in donor behavior. Panel A in Figure 4 depicts donor-specific marginal effects of a rise by one percentage point in the donor output gap on that donor's bilateral aid flows.[12] The estimates range between large and positive for the United States and the United Kingdom—the most "procyclical" donors—and negative for Australia, Austria, and Belgium—the most "countercyclical" donors. By contrast, countries such as Ireland, Greece, and Germany display acyclical behavior.

Could donor inclination toward 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 (Roodman, 2005; Roodman & Walz, 2010). 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 nontied aid, as well as donors who target poor noncorrupt countries and encourage charitable giving. Interestingly, the degree of donor procyclicality is negatively correlated with this aid-quality index (Figure 4, Panel B), which suggests that more development-oriented donors-those who rank higher according to this index-tend to disburse acyclically or even countercyclically. This finding provides a new nuance to the definition of a "development-friendly" donor—that is, a donor who disburses aid in a way relatively insensitive to their 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 3. These are similar 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 because donors tend to limit their engagement in development activities and postpone new projects during periods of social unrest or civil war, which tend to coincide with economic downturns. Including the recipient war index 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% in recession years (Panel A, columns 2 and 3). The coefficient on our measure of the recipient output gap is 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% during years of below-trend output or consumption growth (columns 8 and 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 (Bulir & Hamann, 2008; Pallage & Robe, 2001), they reveal that the procyclicality is present for middle- rather than low-income countries.

Table 2. *Impact of the donor cycle on aid*

	Full sample			Low-income			Middle-income		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Panel A – "Regular" cycle									
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)
Observations	81,290	72,344	79,178	26,708	23,730	26,004	54,582	48,614	53,174
Within *R*-squared	0.09	0.07	0.08	0.14	0.10	0.12	0.08	0.06	0.07
Number of country-pairs	2,486	2,486	2,486	814	814	814	1,672	1,672	1,672
Panel B – Large negative shocks									
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)
Observations	81,290	81,290	81,290	26,708	26,708	26,708	54,582	54,582	54,582
Within *R*-squared	0.09	0.08	0.08	0.13	0.13	0.13	0.07	0.07	0.07
Number of country-pairs	2,486	2,486	2,486	814	814	814	1,672	1,672	1,672
Panel C – Large positive shocks									
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)
Observations	81,290	81,290	81,290	26,708	26,708	26,708	54,582	54,582	54,582
Within *R*-squared	0.08	0.08	0.08	0.13	0.13	0.13	0.07	0.07	0.07
Number of country-pairs	2,486	2,486	2,486	814	814	814	1,672	1,672	1,672

Notes: The dependent variable is given by semi-log transformed real aid flows. All specifications include country-pair and year fixed effects. Standard errors are clustered on country-pair.

* Statistical significance at the 10% significance level.

** Statistical significance at the 5% significance level.

*** Statistical significance at the 1% significance level.

Table 3. *Impact of the recipient cycle on aid*

	Full sample			Low-income			Middle-income		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Panel A – "Regular" cycle									
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)
Observations	72,248	70,246	63,844	25,102	24,442	21,296	47,146	45,804	42,548
Within *R*-squared	0.09	0.08	0.08	0.14	0.13	0.12	0.08	0.07	0.07
Number of country-pairs	2,288	2,288	2,134	792	792	682	1,496	1,496	1,452
Panel B – Large negative shocks									
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)
Observations	69,696	72,248	72,248	23,144	25,102	25,102	46,552	47,146	47,146
Within *R*-squared	0.09	0.09	0.09	0.14	0.14	0.14	0.08	0.08	0.08
Number of country-pairs	2,156	2,288	2,288	704	792	792	1,452	1,496	1,496

Notes: Same as Table 2.
* Statistical significance at the 10% significance level.
** Statistical significance at the 5% significance level.
*** Statistical significance at the 1% significance level.

We next explore whether aid flows behave similarly when aid-receiving countries experience *large* macroeconomic shocks. We add to the specifications three binary variables, representing, respectively, years when TOT growth rates fall into the bottom decile of each recipient's TOT growth distribution; the country experiences a climatic disaster such as floods, drought, extreme temperatures, or windstorms; and there is a sustained deceleration to negative income growth. Compared to filter-based estimates of output/growth gap, these variables are less likely to suffer from measurement error. Furthermore, they are likely to be exogenous with respect to pair-wise aid flows. Growth collapses are arguably exogenous since a shock to aid disbursements from any particular donor is unlikely to trigger a multi-year growth collapse in a recipient country. Hausmann *et al.* (2008) show 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 relative to pair-wise aid flows. TOT shocks are exogenous insofar as commodity export prices are not driven by individual country actions that may also affect bilateral aid flows (Deaton & Miller, 1996).

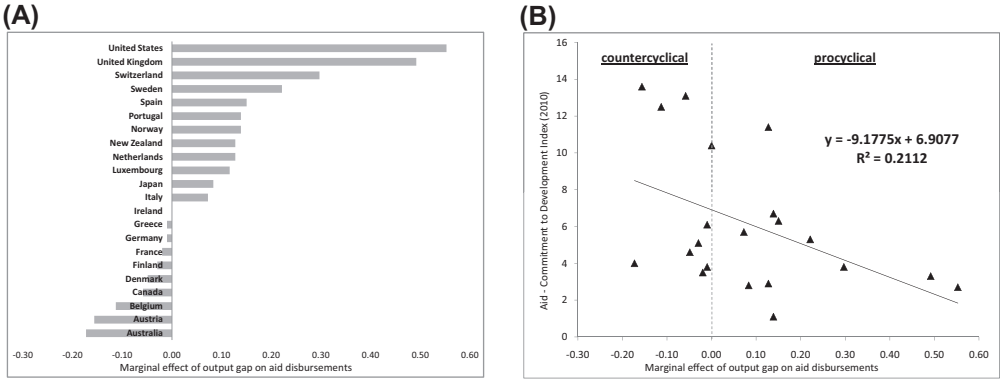

Figure 4. *Donor heterogeneity in development aid cyclicality. (A) Donor-specific marginal effects of output gap on aid flows. (B) Marginal effects and the 2010 Aid Commitment-to-Development index. Notes: Panel A depicts marginal effects of an increase by one percentage point (of potential GDP) of the output gap by donor. These are the semi-elasticity coefficient estimates on donor output gap (% of potential GDP) from individual donor-level OLS regressions of bilateral aid 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.*

The results, shown in Table 3 (Panel B), indicate that aid recipients attract higher aid disbursements in the wake of these large negative shocks. Bilateral aid to countries afflicted by large TOT shocks increases on average by one-fifth for the full-sample. When countries experience a climatic disaster, aid disbursements are higher by almost 30% on a yearly basis—which is notable given that humanitarian and emergency food aid are not captured in our dependent variable. Similarly, growth collapses attract significantly higher bilateral aid flows—68.2% in the full sample—some 44% 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 food 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 foreign aid. Banerjee (2010) argues 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 use 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 implementing her policy.

Estimated coefficients from the baseline specification that includes the Polity IV measure and interactions with developing country business cycle measures are reported in Table 4. First, we find that aid-receiving countries with better institutions attract higher aid flows on average, even after controlling for income (through recipient log-GDP trend). This level effect largely reflects aid selectivity (as documented, for instance, in Dollar & Levin, 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 aid may have a stronger average 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. Our estimates support these recommendations and suggest that bilateral donors have historically increased financing to developing countries after adverse macroeconomic fluctuations. Good institutions have strengthened this effect for middle-income countries. More research is needed, however, to determine whether this higher financing has cushioned the impact of the shocks on real output.

(d) *Results: dynamic effects and simultaneous shocks*

After exploring the contemporaneous cyclical properties of foreign aid, we turn to specifications that allow for the cycle to have a lagged effect on aid. These allow for the fact that aid disbursements are typically locked into multi-year budgets and cannot be easily adjusted when recipients needs suddenly change. In Table 5 we report the results of our baseline regressions with large shocks in which we 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 and 2), the growth deviation from trend falling in the bottom quartile (column 3); and for recipients, negative TOT shocks (column 4), climatic disasters (column 5), and growth collapses (column 6).

Large fluctuations in donor countries have a persistent effect on aid outlays, reducing them for up to 2 years after recessions (columns 1–3). The result is robust across various measures for the donor cycle. When it comes to the recipient cycle, negative

Table 4. *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 × 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 × 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 × institutional quality			0.03**			0.02			0.04**
			(0.01)			(0.02)			(0.02)
Observations	69,366	71,588	71,588	22,836	24,706	24,706	46,530	46,882	46,882
Within *R*-squared	0.09	0.09	0.09	0.14	0.14	0.14	0.08	0.08	0.08
Number of country-pairs	2,156	2,266	2,266	704	770	770	1,452	1,496	1,496

Notes: Same as Table 2.
* Statistical significance at the 10% significance level.
** Statistical significance at the 5% significance level.
*** Statistical significance at the 1% significance level.

shocks trigger higher bilateral aid flows, with aid flows rising almost 50% by the third year following a TOT collapse and by one fifth after a climatic disaster (columns 4–6). Estimated magnitudes are comparable for negative growth spells through the first three years. It appears that while aid budgets may display some rigidity due to medium-term planning, aid recipients do receive more aid in the wake of large exogenous shocks for a few years after the shock.

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:

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

On the donor side, the cycle is captured 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 shock variable in turn ($CYCLE_{it}{}^{donor} \times CYCLE_{jt}{}^{rec}$). The results are depicted in Table 5 (columns 7–9). We notice that the patterns identified so far are robust to including interaction terms for the cyclical position of donors and recipients. However, the coefficients on the interaction terms themselves are statistically insignificant. We conclude that when both the donor and the recipient country simultaneously experience a large negative shock, 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. [13]

4. ROBUSTNESS ANALYSIS

In this section we consider a series of sensitivity tests for our baseline results, which include 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*

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 from which we further subtracted humanitarian aid, emergency food aid, and debt forgiveness grants. Here we construct three alternative proxies of bilateral aid—all aimed at better capturing actual donor

Table 5. *Dynamic effects and the impact of simultaneous shocks on aid*

	Donor cycle			Recipient cycle			Donor × 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 × Recipient large shock							−0.12	0.01	−0.01
							(0.21)	(0.15)	(0.15)
Observations	77,066	77,066	77,066	64,966	67,298	67,298	68,332	70,752	70,752
Within R-squared	0.08	0.07	0.07	0.08	0.08	0.08	0.08	0.09	0.09
Number of country-pairs	2,486	2,486	2,486	2,178	2,310	2,310	2,178	2,310	2,310

Notes: Same as Table 2. Estimates are based on the full sample. Donors shocks are dummies for the output gap falling in the bottom quartile of the donor-specific distribution of output gaps (log-linear and OECD 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). 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).
* Statistical significance at the 10% significance level.
** Statistical significance at the 5% significance level.
*** Statistical significance at the 1% significance level.

effort—as follows. First, we consider gross (rather than net) ODA in the definition above, thus eliminating principal repayments made by the recipient. However, this measure is not perfect since interest repayments, which are sometimes large, are not captured in the OECD-DAC database. Our second measure corresponds to Net Aid Transfers (NAT)—disbursements net of *both* principal and interest repayments (Roodman, 2005). Our third measure is the original dependent variable from which we also subtract imputed multilateral aid, which captures aid disbursements by multilateral agencies attributable to individual donors. [14] Excluding these flows from our aid aggregate addresses the possibility that net ODA increases when recipients suffer large shocks because donor increase their contributions to multilateral rather than bilateral development agencies.

Notwithstanding some variation in the size of the coefficients, the estimates produced by alternate dependent variables (Table 6) are consistent with our baseline results. Regardless of the definition of donor effort employed—gross ODA, Net Aid Transfers, or net ODA excluding multilateral contributions—the estimates suggest that aid is procyclical with respect to the business cycle in both donor and recipient countries. Furthermore, aid becomes countercyclical when developing countries experience large adverse macroeconomic shocks.

(b) *Alternative specifications*

If past aid levels have a causal impact on current aid allocations, our model specification should reflect this. 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 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. The lagged dependent variable causes a dynamic panel bias problem that affects the estimated coefficients for all regressors. In particular, the coefficient on

Table 6. *Robustness to alternative definitions of the dependent variable*

	Donor cycle						Recipient cycle					
	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]
A. Gross ODA (excl. humanitarian aid, emergency food aid, debt relief grants)												
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)
Observations	81,290	72,344	79,178	81,290	81,290	81,290	72,248	70,246	63,844	69,696	72,248	72,248
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 country-pairs	2,486	2,486	2,486	2,486	2,486	2,486	2,288	2,288	2,134	2,156	2,288	2,288
B. Net Aid Transfers (i.e., ODA net of principal and interest payments on ODA loans)												
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)

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Table 6—(*continued*)

	Donor cycle						Recipient cycle					
	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]
Observations	81,290	72,344	79,178	81,290	81,290	81,290	72,248	70,246	63,844	69,696	72,248	72,248
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 country-pairs	2,486	2,486	2,486	2,486	2,486	2,486	2,288	2,288	2,134	2,156	2,288	2,288
C. Further exclude imputed multilateral aid from benchmark dependent variable												
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)
Observations	81,290	72,344	79,178	81,290	81,290	81,290	72,248	70,246	63,844	69,696	72,248	72,248
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 country-pairs	2,486	2,486	2,486	2,486	2,486	2,486	2,288	2,288	2,134	2,156	2,288	2,288

Notes: Same as Table 2 except for change in the definition of the dependent variable as indicated in the title of each panel. Estimates are based on the full sample.
* Statistical significance at the 10% significance level.
** Statistical significance at the 5% significance level.
*** Statistical significance at the 1% significance level.

Table 7. *Robustness across specifications*

	Donor cycle						Recipient cycle					
	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]
Panel A. Control for lagged aid												
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)
Observations	79,178	71,480	79,178	79,178	79,178	79,178	70,554	70,246	63,844	68,046	70,554	70,554
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 country-pairs	2,486	2,486	2,486	2,486	2,486	2,486	2,288	2,288	2,134	2,156	2,288	2,288
Panel B. Drop "no relationship" pairs												
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)

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Table 7—(*continued*)

	Donor cycle						Recipient cycle						
	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]
Observations	76,285	68,234	74,301	76,285	76,285	76,285	68,995	67,080	60,884	66,469	68,995	68,995
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 country-pairs	2,333	2,333	2,333	2,333	2,333	2,333	2,179	2,179	2,030	2,049	2,179	2,179

Notes: Same as Table 2. Estimates are based on the full sample.
* Statistical significance at the 10% significance level.
** Statistical significance at the 5% significance level.
*** Statistical significance at the 1% significance level.

the lagged dependent variable is biased upward while the coefficients on other regressors are biased downward (Maddala & Rao, 1973). We proceed under the assumption 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.[15] The results are reported in Table 7 (Panel A). Accounting for the persistence of development aid flows does not appear to materially affect our main results. Foreign aid increases during donor upturns for all proxies of the cycle. The results hold up for all proxies of the recipient cycle in all-but-two specifications (namely, columns 8 and 10).

Another concern that is typical in studies of bilateral flows are the numerous zero-aid observations (see, e.g., Dutt & Traca, 2010, on this problem for bilateral trade flows). So far we have kept these observations in the sample by adding \$1 to the aid flows before the logarithmic transformation, on the assumption that there is an aid relationship even if we do not observe one. We check the sensitivity of our results to the inclusion of zero-aid observations by re-estimating the model conditional on observing at least one nonzero aid flow in the country-pair during the sample period. This leads us to drop some 5,500 observations or 6.15% of country-pairs. The coefficient estimates (Table 7, Panel B) are similar to those for the full sample and confirm that our baseline results are not driven by no-relationship country pairs.

(c) *Regressions by sub-period*

It is often argued that the end of the Cold War changed the nature of bilateral aid. In particular, geopolitical concerns now play a more muted role (Ball & Johnson, 1996; Meernik, Krueger, & Poe, 1998; Fleck & Kilby, 2010) while aid selectivity criteria such as growth performance or the quality of institutions have a more prominent impact on aid allocations (Bandyopadhyay & Wall, 2007; Berthelemy & Tichit, 2004; McGillivray, 2005). 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 interactions with measures of the business cycle. Small or 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 8 shows that the interactions terms on the donor cycle variables are all statistically insignificant, suggesting that bilateral aid disbursements have been 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 only two interaction coefficients turning out statistically significant (columns 4–6). There is some evidence that the cyclical properties of foreign aid we have identified in the baseline results are present mainly in the post-Cold War sample (columns 7–12). This is consistent with the view that economic concerns have become more important in the post-Cold War era.

(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 may determine the likelihood of a pair-wise relationship. We consider four alternative estimators: (a) pooled OLS, which treats

Table 8. *Robustness across sub-periods (pre/post Cold War)*

	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 × (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 × (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)
Observations	81,290	72,344	79,178	81,290	81,290	81,290	72,248	70,246	63,844	69,696	72,248	72,248
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 country-pairs	2,486	2,486	2,486	2,486	2,486	2,486	2,288	2,288	2,134	2,156	2,288	2,288

Notes: Same as Table 2. Estimates are based on the full sample.
* Statistical significance at the 10% significance level.
** Statistical significance at the 5% significance level.
*** Statistical significance at the 1% significance level.

Table 9. *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: The dependent variable is given by semi-log transformed real aid flows. Estimates are based on the full sample. All specifications include year fixed effects. Standard errors are clustered on country-pair in all models except the Tobit with random effects. The table includes only the coefficient estimates on the donor and recipient cycle variables along with the level of statistical significance. For the Tobit model, we drop negative observations and report marginal effects estimated using the Delta method.
* Statistical significance at the 10% significance level.
** Statistical significance at the 5% significance level.
*** Statistical significance at the 1% significance level.

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 allow for time-varying unobserved heterogeneity at the country (but not country-pair) level; and (d) donor-year, recipient-year, and country-pair fixed effects. We also consider the Tobit estimator with random effects to account for the censored nature of the dependent variable. In all specifications we include time effects to control for global shocks.

For brevity, in Table 9 we report only the main coefficient estimates corresponding to each estimator. We note that the benchmark results carry through when we change the estimation technique (columns 1–9), in particular when we saturate the model with dummies that capture country and country-pair features that may both affect aid disbursements and be correlated with the output cycle, but are difficult to measure or observe. Negative growth episodes in aid-receiving countries are robustly associated with higher aid flows (column 12). When it comes to negative TOT shocks or climatic disasters, the coefficients lose statistical significance for some estimators (columns 10 and 11).

5. CONCLUSIONS

The severity of the recent financial crisis and its swift transmission worldwide have prompted new interest in studying the behavior of foreign aid during economic downturns—both in donor and recipient countries. The issue is particularly relevant for policymakers, as many donors currently face the looming specter of a protracted recession. In this paper, we have empirically analyzed the link between the business cycles in donor and recipient countries and development aid flows, paying particular attention to periods of acute macroeconomic stress.

Using a large dataset on bilateral aid disbursements, we have 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 have also presented novel evidence regarding the link between large macroeconomic shocks and aid flows. While aid contracts sharply during severe downturns in donor countries, it turns countercyclical when developing countries experience unusually large shocks. Our findings are robust to changes in specification, the definition of aid, and estimation technique.

A question that naturally arises from our analysis is how aid disbursements will evolve in the near future given stressed economic conditions in some donor countries. In the aftermath of the 2008–09 crisis, development aid continued to rise in 2010 but it has declined since 2011 (OECD-DAC., 2013). The evidence presented here may not be the best basis for projections given the severity of the global financial crisis and the ongoing debt-related concerns in advanced economies. Nonetheless, our key finding that deep recessions in donor countries have historically triggered persistent declines in foreign aid suggests that there are significant downside risks to the outlook for aid. The upside is that large negative shocks in developing countries have historically been met with higher aid flows than previously thought.

NOTES

1. Sub-Saharan African countries have been the main beneficiary of the increased aid flows since the late 1990s.

2. Similar results were obtained in earlier studies, see, e.g., Dang, Knack, and Rogers (2009), Frot (2009), Bulir and Hamann (2008), and Pallage and Robe (2001).

3. By contrast, Rand and Tarp (2002) do not find any evidence that aid is procyclical in developing countries.

4. Available for download on http://www.camelia-minoiu.com/aid-onlineappendix.pdf.

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

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

7. The latter represent 2.8% of all observations.

8. See also Male (2011) and Hausmann, Rodriguez, and Wagner (2008) for a comparison of the output cycle in advanced *vs.* developing countries.

9. The effects of negative TOT shocks on aid flows are not statistically significant when we use a higher cutoff, e.g., the bottom quartile (as opposed to decile) of the distribution.

10. 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, and IMF program dummy), and pair-wise variables (political allegiance, bilateral trade). The main results remained virtually unchanged. 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).

11. The marginal effects are obtained by exponentiation of the coefficient estimates. For instance, $e^{0.08} - 1 = 0.083$ (or 8.3%) for the first coefficient cited.

12. These are the semi-elasticity coefficient estimates on donor output gap (% of potential GDP) from individual donor-level 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.

13. In results not reported, we also found that when donors experience a sharp upturn, they do not increase aid *more* to recipients who simultaneously experience a deep recession.

14. 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 imputed multilateral aid accounts for about 90% of total donor 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.

15. 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% 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.

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