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AID AND GROWTH: ASYMMETRIC EFFECTS?

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HAMBURG CONTEMPORARY ECONOMIC DISCUSSIONS

NO. 76

Hamburg Contemporary Economic Discussions
University of Hamburg
Faculty of Business, Economics and Social Sciences
Chair for Economic Policy
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https://www.wiso.uni-hamburg.de/en/fachbereich-vwl/professuren/maennig/home.html
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Photo Cover: Riccardo Meyer/Shutterstock.com
Font: TheSans UHH by LucasFonts

ISSN 1865 - 2441 (Print)
ISSN 1865 - 7133 (Online)

ISBN 978-3-942820-64-66-0 (Print)
ISBN 978-3-942820-67-7 (Online)

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Aid and growth: Asymmetric effects?

Abstract: This paper provides new empirical findings on the aid–growth relation. We find evidence for considerable asymmetry in the aid–growth relation; i.e., aid cuts have a large negative impact on economic activity, while increasing aid may be ineffective in promoting growth. Development aid thus largely replaces rather than complements domestic resources. We innovate by combining dynamic generalized method of moments techniques with asymmetric effect analysis. Unlike previous studies in this area, our empirical design allows us to account for potential weak instrument problems and endogeneity concerns when estimating the effects of aid upturns and downturns separately.

***Keywords**: Aid effectiveness, economic growth, asymmetric effect analysis*
***JEL**: O11, O40, C33*

***Version:** March 2024*

1 Introduction

The effectiveness of development aid is a highly debated topic in development and growth economics. However, research on the aid–growth relation remained mostly qualitative with fewer evidence-based studies until the 1970s. Griffin and Enos (1970) were the first to examine this topic by means of (rudimentary) econometric methods. Subsequent studies by Weisskopf (1972), Papanek (1973), Gulati (1978), Mosely (1980), Levy (1988), and Mosely et al. (1990) revealed effects in different directions, but these findings should be treated with caution due to methodological shortcomings and small sample sizes (Clemens et al., 2012). Boone's (1996) study is generally regarded as the beginning of modern research on the subject (Burnside and Dollar, 2000; Hansen and Dalgaard, 2001; Easterly et al., 2004; Rajan and Subramanian (2008) (RS); Clemens et al., 2004, 2012). Boone was one of the first to estimate the macroeconomic impact of aid using a modern neoclassical growth model and advanced instrumental variable approaches, which formed the basis for today's analysis of the aid–growth nexus (Hansen and Dalgaard, 2001). However, the author finds no significant effect of aid on growth, confirming the basic consensus of previous research.

Development assistance works via different channels, and its effectiveness is widely believed to be influenced by other factors. Research since the early 2000s has shown that there is evidence of conditional (positive) growth effects of aid when, for example, accompanying policies, the timing of aid or the target sector are taken into account. Burnside and Dollar (2000) were among the first to link the effectiveness of aid to the quality of accompanying economic policy measures and found a small but robust positive effect on growth in developing countries with good fiscal, monetary, and trade policies. Clemens et al. (2004) divide aid grants into short-term and long-term aid and show that aid flows are systematically linked to modest, positive subsequent growth in cross-country panel data. Mosely and Suleiman (2007) showed that aid effectiveness is high when aid targets agriculture, education and infrastructure[1].

To this end, all studies have implicitly assumed that the impact of aid is symmetric, i.e., that an increase in aid has exactly the same magnitude of effect as a decrease. However, there is no compelling reason to assume that the economies of recipient countries will respond to increases in aid in the same way as they will to reductions in aid. There is extensive literature on asymmetric effects in the context of growth models. For example, authors have found evidence of an asymmetric impact of oil prices (Mork, 1989; Mork et al., 1994; Zhang, 2008; Markwardt, 2009) and monetary policy shocks (Cover, 1992; Weise, 1999; Garcia and Schaller, 2002) on economic activity. To the best of our knowledge, Asaleye et al., 2023 is the only study that looks at the possible asymmetric effects of development aid. The authors find some evidence that growth rates may respond differently to increases and decreases in aid, but their results are limited to Nigeria. We contribute to the discussion by analyzing possible asymmetries in aid

[1] It is important to note that all of these results are subject to ongoing debate and that all of them were challenged by later studies (Hansen and Tarp, 2001; Hansen and Dalgaard, 2001, Easterly et al., 2004, Rajan and Subramanian, 2008).

effectiveness on a broader, multinational level. Our estimates show that neglecting asymmetric effects leads to a small but significant positive effect of development aid, which corroborates the findings of previous studies. In contrast, our estimated asymmetric effects suggest that these effects are driven by a substantial negative effect of aid cuts, while an increase in aid does not affect economic growth. Various model specifications substantiate our findings.

From an econometric perspective, researchers acknowledged endogeneity concerns early on when analyzing aid's effect on growth. For example, a shock to growth, such as a natural disaster, also affects the donating behavior of the international community. Possible solutions to this caveat include dynamic panel data analyses that control for potential exogeneity concerns by using internal instruments. These models have been successfully used by a growing number of authors to estimate the impact of aggregate aid at the global level, with ambiguous results (Clemens et al., 2004; RS, 2008; Clemens et al., 2012).[2] We innovate by combining dynamic GMM techniques with asymmetric effect analysis following Allison (2019) using an updated panel database with broad coverage.

Our results may be explained by the theoretical discussion initiated by Boone (1996) on the lack of robust evidence for a positive impact of development aid on economic activity. He suggested that the inefficiency of aid is because aid money is consumed rather than invested, a finding that has been echoed by subsequent studies (Burnside and Dollar, 2000; Hansen and Dalgaard, 2001; RS; Clemens et al., 2012). A suspected reason for the limited growth effects of consumed aid is that it substitutes for, rather than

[2] Internal instrumentation has serious limitations, prompting more recent publications to look for more conventional instruments for aid. For example, Brückner (2013) uses rainfall growth to adjust aid for the part driven by economic growth (Brückner, 2013) while Galiani et al. (2017) employ the International Development Association's (IDA) threshold for receiving concessional aid as an instrument (Galiani et al., 2017). Other studies rely on an interaction term of donor government fractionalization with a recipient country's probability of receiving aid (Dreher and Langlotz, 2020). However, limited data coverage of conventional instruments frequently results in fewer observations, and endogeneity resulting from persistent growth series remains a problem in these settings.

complements, domestic resources (Boone, 1996; Easterly, 2003)[3]. However, this channel has not been conclusively proven. Our results may provide first evidence that aid flows may replace domestic resources rather than boost economic performance.

The remainder of this paper is structured as follows. Section 2 presents our data. Section 3 introduces the empirical model and derives the econometric estimation framework used. Section 4 replicates selected previous findings from the literature, updates the model, and estimates the potential asymmetric effects of aid on growth. Section 5 presents conclusions.

2 Data

We use an updated version of the dataset used in RS, covering the time period from 1970–2010[4]. In line with RS and the previous literature, we define economic growth (*Growth*) as the annual average growth rate (%) of real GDP (PPP) per capita from the Penn World Table and development aid (*Aid/GDP*) as the ratio of total official development assistance (ODA) to GDP. Aid is measured in USD at current prices and adjusted for the effect of economic growth from the OECD. ODA is granted from the OECD Development Assistance Committee to a list of developing countries and contains multilateral aid (granted by NGOs and international organizations) and bilateral aid (granted by OECD member countries directly).

Furthermore, we control for a fixed set of economic, sociocultural and geographical covariates, using data from the World Bank, Easterly et al. (2004), Bossworth and Collins (2003), and Banks (2008). The log of the average annual growth rate of CPI-based inflation (*Log Inflation*), initial life expectancy at birth (*Initial Life Expectancy*), the initial Sachs-Warner trade policy index updated by Wacziarg and Welch (2008) (*Initial Policy*) and the ICRGE index of institutional quality (*Institutional Quality*) are included to

[3] Another possible reason for the limited growth effects of consumed development aid is that it encourages a larger, bloated and inefficient government, as shown in Boone (1996).

[4] This paper does not use the updated RS panel database by Clemens et al.(2012), which only contains data up to 2005, but an external updated database.

capture economic effects. To control for financial stability, we add the general government budget balance (*Budget Balance/GDP*) and money and quasi money (*M2/GDP*), both in % of GDP. To cover sociocultural influences, we rely on the Historical Index of Ethnic Fractionalization (*Ethnic Fractionalization*) and a political stability indicator defined as the average number of revolutions (*Revolution*). Geographical aspects include a composite geographical index of average frost days/year, area covered by tropical forest, and average frost days per month in winter from Rodrik, Subramanian, and Trebbi (2004) (*Geography*).

Table 1 shows the summary statistics for our updated dataset, which are very similar to those of the shorter version used in RS[5]. The countries in our database have an average growth rate of 1.8 percent and an average share of development aid payments in GDP of 5.5 percent, of which approximately 3.5 percent is accounted for by bilateral aid and the rest by multilateral aid.

Table 1: Summary statistics of the updated RS database

	count	mean	sd	min	max
Growth	562	1.790	3.200	-12.299	13.118
Aid/GDP	533	5.517	7.794	0.008	56.059
Bilaid/GDP	527	3.481	4.720	0.007	35.555
Multilaid/GDP	527	2.022	3.653	0.000	26.095
Initial Log of per cap. GDP	562	8.069	0.930	5.335	10.645
Initial Life Expectancy	572	60.940	10.706	35.386	85.115
Initial Policy	566	0.438	0.497	0.000	1.000
Institutional Quality	567	0.452	0.171	0.040	0.950
Log Inflation	526	0.442	0.736	-0.005	4.192
M2/GDP	544	33.006	24.236	0.231	246.219
Budget Balance/GDP	483	-10.096	63.888	-882.844	235.169
Revolutions	570	0.217	0.376	0.000	2.600
SSA	574	0.334	0.472	0.000	1.000
EA	574	0.098	0.297	0.000	1.000
Geography	575	-0.404	0.859	-1.040	1.784
Ethnic Fractionalization	546	0.448	0.298	0.000	0.900

[5] The summary statistics correspond to Table 1 (column 'Panel') in the original paper.

3 Model and identification

Our analysis relies on the neoclassical growth model used by RS, which explains economic growth as a function of aid plus a set of covariates drawing on the modeling approaches and covariates provided by the relevant literature on growth modeling and aid effectiveness.

$$\Delta Growth_{i,t} = \gamma_1 \Delta lgdppc_{i,t} + \beta_1 \Delta Aid/GDP_{i,t} + \beta_2 \Delta Aid/GDP^2{}_{i,t} + \beta_3 \Delta Z_{i,t} + \varphi_t + \Delta u_{i,t} \tag{1}$$

In addition to the main variables *Aid/GDP* and *Growth*, $lgdppc_{i,t}$ is the initial log of per capita GDP (PPP) and controls for dynamic and convergence effects, whereas a squared aid term is included to capture diminishing returns to aid. The vector $Z_{i,t}$ contains the covariates described in the last section, all of which are treated as endogenous, with the exception of the geographical and ethnolinguistic indices. Period dummies φ_t are included in the equation to control for trends and structural breaks in the data. We further transform the underlying data. First, the equation is first differenced to remove country-specific effects and to hedge the results against the effects of time series properties. Second, all variables are in 5-year averages to ensure that the coefficients are not driven by short-term fluctuations and to maintain the dimensions needed for dynamic panel approaches (small T, large N). Finally, to mitigate concerns about reverse causality, we rely on initial values for some covariates, i.e., only the first observation in each five-year average enters the estimator.

We acknowledge common concerns about the assumed endogeneity of aid and other determinants of growth (Boone, 1996; Burnside and Dollar, 2000; Hansen and Dalgaard, 2001; Easterly et al., 2004). To maintain independence in Eq. (1), we instrument aid and all time-varying covariates internally, i.e., we use the lagged levels of the endogenous regressors as instruments for the differenced terms. In the case of *lgdppc*, we assume, for example, that $\forall\, j = 0, \dots, T$ $lgdppc_{i,t-2}$ and $\Delta u_{i,t}$ are mutually independent, whereas $lgdppc_{i,t-2}$ and $\Delta lgdppc_{i,t-1}$ are sufficiently correlated. By estimating the resulting model using GMM, we construct the difference GMM (Diff-GMM) framework as proposed by Hansen and Singleton (1982) and further developed by Arellano and Bond

(1991). We further acknowledge some of the known problems of the Diff-GMM estimator. Since lagged levels only weakly correlate with first differences, we additionally rely on the system GMM framework (sys GMM) proposed by Blundell and Bond (1998), which increases instrument power by additionally estimating Eq. (1) in levels, where endogenous variables in levels are instrumented by their lagged differences. Both instruments from the diff GMM and sys GMM frameworks rely on validity testing, and we report the results of a test for overidentifying restrictions proposed by Hansen (1982) to check for general instrument exogeneity. Finally, the GMM estimates produce downward biased standard errors, which we control by applying the Windmeijer (2005) correction.

We further acknowledge the weak instrument concerns suggested by Clemens et al. (2012). The authors were able to demonstrate that the low explanatory power of internal instruments outweighs their potential benefits in terms of endogeneity even in the context of system GMM. In line with Clemens et al. (2012), we reduce the number of weak instruments by internally instrumenting only the logarithm of GDP per capita since its endogeneity is undeniably strong. To strengthen the independence of our aid variable, we rely exclusively on bilateral aid flows, which are considered to be significantly more independent of economic growth than aggregated aid and further lag it by one period due to concerns of reverse causality. All other variables are treated as fully exogenous. Finally, we add dummies for sub-Saharan Africa and East Asia to the system GMM frameworks to allow for region-specific effects in the level equations. Our working model is as follows:

$$\Delta Growth_{i,t} = \gamma_1 \Delta lgdppc_{i,t} + \beta_1 \Delta Bilaid/GDP_{i,t-1} + \beta_2 \Delta Bilaid/GDP^2{}_{i,t-1} + \beta_3 \Delta X_{i,t} + SSA_i + EA_i + \varphi_t + \Delta u_{i,t} \quad (2)$$

In (2), $Bilaid/GDP_{i,t-1}$ is the once-lagged ratio of bilateral ODA to GDP, and $lgdppc_{i,t}$ is the initial log of per capita GDP, where changes are instrumented by $\{lgdppc_{i,t-2}\}_{i=0}^{T}$. $X_{i,t}$ is the vector of exogenous covariates, some of which are in initial values, and SSA_i and EA_i are dummies if a country belongs to Sub-Saharan Africa or East Asia.

As a final step, we transform our aid variable so that our model can consistently estimate the symmetric and asymmetric effects of bilateral aid on growth. Although asymmetric effects for panel data have been analyzed before, York and Light (2017) was the first study to formalize a consistent method for their estimation when using panel data. The authors were able to show that a consistent asymmetric (positive/negative) coefficient of a variable with panel structure $X_{i,t}$ is given by estimating the interaction of (positive/negative) changes in $X_{i,t}$ with its first differenced values, i.e.,

$$X\_pos_{i,t} = \Delta X_{i,t} * X_{i,t}{}^{+}, \text{where } X_{i,t}{}^{+} := \begin{cases} X_{i,2} - X_{i,1} \text{ if } (X_{i,2} - X_{i,1}) > 0 \\ 0 \qquad\qquad \text{otherwise} \end{cases}$$

$$X\_neg_{i,t} = -\Delta X_{i,t} * X_{i,t}{}^{-}, where\ X_{i,t}{}^{-} := \begin{cases} X_{i,2} - X_{i,1} \text{ if } (X_{i,2} - X_{i,1}) < 0 \\ 0 \qquad\qquad \text{otherwise} \end{cases} \tag{3}$$

However, the framework in (3) cannot be applied to first-differenced equations such as our working model in (2). To estimate the asymmetric effects of our first-differenced (bilateral) aid variable, we rely on Allison (2019), who showed that adding up the positive and negative changes $X_{i,t}{}^{+}$ and $X_{i,t}{}^{-}$, separately and including these terms in an undifferenced equation, first differencing and estimating this equation yields the same coefficients as estimating the interaction terms in (3), i.e.,

$$\Delta \sum_{s=1}^{t} X_{i,s}{}^{+} = \Delta X_{i,t} * X_{i,t}{}^{+}, \qquad as\ well\ as \qquad \Delta \sum_{s=1}^{t} X_{i,t}{}^{-} = -\Delta X_{i,t} * X_{i,t}{}^{-} \tag{4}$$

Applying the transformation in (4) to our bilateral aid variable and including this term in the model in (2), we end up with the following asymmetric effect model:[6]

$$\Delta Growth_{i,t} = \gamma_1 \Delta lgdppc_{i,t} + \beta_1 \Delta Bilaid/GDP\_pos_{i,t-1} + \beta_2 \Delta Bilaid/GDP\_neg_{i,t-1} + \beta_3 \Delta Bilaid/GDP^2{}_{i,t-1} + \beta_4 \Delta X_{i,t} + SSA_i + EA_i + \varphi_t + \Delta u_{i,t} \tag{5}$$

where

[6] For further variable descriptions, see Equations (1) and (2)

$$Bilaid/GDP\_pos_{i,t-1} \;=\; \sum_{s=1}^{t-1} Bilaid/GDP_{i,s}{}^{+} \text{ and}$$

$$Bilaid/GDP\ neg_{i,t-1} \;=\; \sum_{s=1}^{t-1} Bilaid/GDP_{i,s}{}^{-}.$$

4 Results

In the first step, we estimate the effect of development aid on growth by employing the same model used in RS, thus neglecting the potential problems of weak instruments and asymmetric effects. Table 2 shows the results of estimating the panel specification of RS in Eq. (1) with the original RS database via difference and system GMM.

The most significant influence on growth rates comes from the initial log of per capita GDP, as a higher GDP per capita is generally followed by lower growth. A one percent increase in GDP per capita is followed by a growth deficit between 0.02 and 0.08 percent of GDP per capita, depending on the model used.[7] The second consistent effect arises from consumer prices: a one percent increase in the inflation rate is associated with a decrease in growth of 0.012 to 0.019 percent, ceteris paribus. Finally, the models show that strong institutions are pro-growth, leading to an increase of 4-7 percentage points in economic activity. Most importantly, the models find no consistent relationship between aid flows and growth rates. There is some minor evidence of a weak negative impact in the different GMM frameworks, which disappears once we account for potential diminishing returns to aid. All the diff-GMM results shown are exact replications of the original paper, while some of the coefficients of the sys-GMM estimates show small deviations to the first or second decimal place[8]. We note that the generous instrumentalization strategy of RS leads to problems with the specification tests. As described in Roodman (2009), the statistics of the Hansen test are strongly biased upward when the

[7] The results of the diff GMM framework should be interpreted with caution here. Looking at their ratio of instruments to observations, one can assume a certain overfitting of Models (I) and (II), later estimates confirm that the impact of *lgdppc* on growth in fact ranges between 0.02 and 0.04 percent, following the sys GMM models in (III) and (IV).

[8] The outputs shown in Table 2 correspond to the outputs in RS, Table 9; (1) and (2) (Diff GMM) and Table 10; (1) and (2) (Sys GMM).

number of instruments exceeds the number of cross sections. This is clearly the case for Models (I) to (IV), as reflected by p values of 1 for all models.

Table 2: Replicating panel specifications of Rajan and Submaranian (2008)

	(I) DiffGMM	(II) DiffGMM	(III) SysGMM	(VI) SysGMM
Aid/GDP	-0.151**	-0.0145	-0.0549	-0.225
	(0.0770)	(0.207)	(0.0709)	(0.158)
Aid/GDP sqrd		-0.00514		0.00483
		(0.00525)		(0.00446)
Initial Log of per cap. GDP	-8.347***	-7.998***	-2.471***	-2.398***
	(1.543)	(1.414)	(0.785)	(0.795)
Initial Life Expectancy	-0.393**	-0.209	0.183**	0.140*
	(0.183)	(0.157)	(0.0838)	(0.0830)
Initial Policy	-1.774*	-1.326	1.615*	1.005
	(0.933)	(0.843)	(0.836)	(0.956)
Institutional Quality	6.953**	5.665**	3.470	3.909*
	(2.767)	(2.225)	(2.245)	(2.172)
Log Inflation	-1.985***	-1.838***	-1.241**	-1.494**
	(0.671)	(0.596)	(0.610)	(0.639)
M2/GDP	-0.00198	-0.0145	0.0197	0.0199
	(0.0318)	(0.0374)	(0.0190)	(0.0156)
Budget Balance/GDP	0.164**	0.117	0.0900	0.118
	(0.0819)	(0.0764)	(0.0689)	(0.0758)
Revolutions	-0.972	-1.174*	-0.327	0.189
	(0.625)	(0.624)	(0.533)	(0.502)
Geography			0.0881	0.645
			(0.764)	(0.576)
Ethnic Fractionalization			0.943	0.912
			(2.553)	(2.082)
Observations	167	167	239	239
Number of Countries	68	68	72	72
Instruments	120	135	154	165
Hansen	1	1	1	1

Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1; All coefficients are estimated via the 2-Step GMM estimation. All standard errors are Windmeijer (2005)-corrected. All variables are first differenced and in 5-year averages. All variables except geography and Ethnofrac are internally instrumented with all available lags. All estimated models correspond to Eq. (1) and use the original database from RS (72 developing countries from 1980–2000).

In the next step, we estimate our updated working model with a larger database to see whether we obtain results closer to the literature. Table 3 shows the results of estimating the model from Eq. (2) with the updated database described in Table 1. In addition to diff GMM and sys GMM, we also report the results of an OLS estimation to ensure that the results are not driven by the estimator used.

Compared with the models shown in Table 2, we were able to almost double the number of observations entering the estimator. In general, we obtain much more consistent results than those from estimating the RS specification. However, the direction, strength and significance of the covariates remain largely unchanged. A one percent increase in GDP per capita is followed by a growth deficit of 0.032 to 0.034 percent of GDP per capita. Increasing the inflation rate by one percent is associated with a growth gap of 0.011 to 0.012 percent on average. With the updated data, the effect of institutions disappears, but we observe a consistently significant effect of political stability on growth rates: A revolution in the recipient countries accounts for a growth deficit of between 0.64 and 0.86 percent, ceteris paribus.[9]

Again, the models find no evidence that development aid is systematically associated with economic growth. We obtain some evidence of a moderate positive effect, the strength and direction of which are consistent with most of the published empirical literature (Burnside and Dollar, 2000; Hansen and Tarp, 2001; Hansen and Daalgard, 2001; Easterly et al., 2004; Clemens et al., 2012). An increase of one percentage point in bilateral aid may, ceteris paribus, generate a moderate growth increase of 0.11 percent on average. Hansen tests do not detect instrument endogeneity in any model; the test statistics are considered unbiased because the number of instruments is smaller than the number of cross sections. This is also reflected in the p values, which are now in line with the literature.

[9] At first glance, this effect appears to be surprisingly small. However, the underlying variable *Revolution* also reacts to smaller political events, such as opposition protests in the capital, whose economic impact on the country as a whole can be considered small.

Table 3: Results of the updated model

	(I) OLS	(II) DiffGMM	(III) DiffGMM	(IV) SysGMM	(V) SysGMM
Lagged Bilaid/GDP	0.112*	0.108*	0.122	0.104	0.115
	(0.0657)	(0.0638)	(0.158)	(0.0657)	(0.162)
Lagged Bilaid/GDP sqrd			-0.000357		-0.000237
			(0.00598)		(0.00618)
Initial Log of per cap. GDP	-3.42***	-3.340**	-3.408*	-3.191*	-3.263*
	(0.741)	(1.657)	(1.756)	(1.629)	(1.732)
Initial Life Expectancy	0.0286	-0.0378	-0.0348	-0.0309	-0.0265
	(0.0424)	(0.0668)	(0.0675)	(0.0654)	(0.0662)
Initial Policy	0.472	0.596	0.591	0.668	0.668
	(0.464)	(0.633)	(0.636)	(0.634)	(0.641)
Institutional Quality	-0.339			11.61	11.20
	(36.36)			(22.02)	(24.17)
Log Inflation	-1.053**	-1.181**	-1.164**	-1.203***	-1.180**
	(0.417)	(0.472)	(0.497)	(0.461)	(0.486)
M2/GDP	9.68e-05	-0.00868	-0.00953	-0.00687	-0.00771
	(0.0165)	(0.0189)	(0.0185)	(0.0194)	(0.0190)
Budget Balance/GDP	0.00217	9.43e-06	-3.96e-05	-1.01e-05	-4.14e-05
	(0.00154)	(0.000930)	(0.000963)	(0.000969)	(0.00100)
Revolutions	-0.861**	-0.683**	-0.672*	-0.658*	-0.638*
	(0.355)	(0.343)	(0.349)	(0.340)	(0.350)
SSA	9.867			-8.911	-9.078
	(19.96)			(10.98)	(10.93)
EA	17.40			2.352	2.711
	(31.04)			(9.988)	(10.77)
Geography	6.676			2.196	2.245
	(12.81)			(2.501)	(2.687)
Ethnic Fractionalization	-16.73*			10.48	10.82
	(8.833)			(22.25)	(22.45)
Observations	373	297	297	373	373
R-squared	0.579				
Number of countries		66	66	68	68
Instruments		34	35	41	42
Hansen		0.277	0.270	0.335	0.326

Notes: Only lgdppc is instrumented with all available lags; all estimated models correspond to Eq. (2) and use the updated database from RS (72 developing countries from 1970–2010). The OLS specification is not first differenced but contains a full set of country dummies. For more information, see Table 2.

Finally, we estimate our final specification, which may capture possible asymmetric effects. Table 4 shows the results of estimating the model from Eq. (5) on the updated database. We note that all the coefficients of the covariates are consistent with the results of the symmetric model in Table 3 in terms of the strength, direction and significance of the estimated effects. This also applies to the results of the specification tests.

Most importantly, we obtain robust evidence of significant asymmetry in the effect of our bilateral aid variable. There is no evidence that a purely positive change in bilateral aid is associated with a change in recipient country growth rates, which is consistent with most of the relevant literature and with the results of the symmetric analysis presented in Table 2 and Table 3. However, the coefficients of negative changes in aid provide strong and robust evidence that a decrease in bilateral aid flows is followed by relatively strong negative growth outcomes. A reduction in bilateral aid by one percentage point, ceteris paribus, is associated with an average reduction in growth between 0.26 and 0.42 percent, depending on the model used. These results show that the economy of the recipient country does not react significantly to an increase in (bilateral) development aid but reacts much more strongly to a reduction in the latter.

Table 4: Results of the asymmetric effect analysis

	(I) OLS	(II) DiffGMM	(III) DiffGMM	(IV) SysGMM	(V) SysGMM
Lagged Bilaid/GDP_pos	0.0522	-0.0449	0.0500	-0.0347	0.0412
	(0.0756)	(0.0991)	(0.149)	(0.103)	(0.159)
Lagged Bilaid/GDP_neg	-0.171**	-0.264**	-0.427*	-0.272**	-0.418*
	(0.0855)	(0.116)	(0.225)	(0.136)	(0.252)
Lagged Bilaid/GDP sqrd			-0.00462		-0.00417
			(0.00556)		(0.00589)
Initial Log of per cap. GDP	-3.741***	-4.288**	-4.471**	-3.570	-4.401**
	(0.662)	(1.836)	(1.755)	(2.265)	(1.801)
Initial Life Expectancy	0.0328	-0.0281	-0.0355	-0.0216	-0.0322
	(0.0410)	(0.0714)	(0.0630)	(0.0721)	(0.0633)
Initial Policy	0.416	0.268	0.368	0.366	0.381
	(0.448)	(0.596)	(0.619)	(0.645)	(0.660)
Institutional Quality	5.183			9.394	19.39
	(34.67)			(24.23)	(43.80)
Log Inflation	-1.037**	-1.335**	-1.321**	-1.399**	-1.313**
	(0.409)	(0.587)	(0.552)	(0.658)	(0.551)
M2/GDP	-0.000738	-0.00451	-0.00860	-0.00363	-0.00798
	(0.0158)	(0.0207)	(0.0194)	(0.0227)	(0.0202)
Budget Balance/GDP	0.00192	3.81e-06	-0.000642	0.000100	-0.000515
	(0.00154)	(0.00106)	(0.00101)	(0.00112)	(0.00118)
Revolutions	-1.082***	-0.847**	-0.829***	-0.764**	-0.794**
	(0.360)	(0.346)	(0.310)	(0.369)	(0.313)
SSA	6.110			-11.99	-15.19
	(19.13)			(18.94)	(14.21)
EA	11.89			-1.203	-5.461
	(29.66)			(9.708)	(15.25)
Geography	4.328			2.742	4.165
	(12.21)			(2.666)	(4.079)
Ethnic Fractionalization	-15.62*			14.65	18.47
	(8.518)			(35.65)	(31.26)
Observations	389	313	297	389	373
R-squared	0.575				
Number of countries		68	66	68	68
Instruments		35	36	42	43
Hansen		0.314	0.281	0.339	0.316

Notes: Only lgdppc is instrumented with all available lags; all estimated models correspond to Eq. (5) and use the updated database from RS (72 developing countries from 1970–2010). The OLS specification is not first differenced but contains a full set of country dummies. For more information, see Table 2.

5 Conclusion

We use updated panel data with large coverage to (re)assess the effectiveness of development aid. This is the first study to combine dynamic GMM techniques with asymmetric effect analysis following Allison (2019). Our results suggest significant asymmetry in the impact of aid on growth. Although there is no robust evidence that aid increases are followed by higher growth rates, which is in line with the literature, cuts in aid have a disproportionately large negative effect on economic growth. We corroborate the hypothesis that development aid can substitute, rather than complement, domestic resources (Burnside and Dollar, 2000; Easterly, 2003; Alemu and Lee, 2015). Our findings suggest that aid flows tend to replace services previously provided by the market in recipient countries. Thus, increases in aid flows do not lead to more growth, while reductions in aid are inevitably followed by growth gaps in the short term, the duration of which depends on the degree of substitution.

Based on our novel estimation approach, we may add a potentially new dimension to the debate on the determinants of aid effectiveness and provide guidance to donors on allocating development aid effectively. In addition, our results may stimulate a discussion of restructuring of aid to developing countries in favor of concessional loans rather than grants, which might improve the ratio of aid invested to aid consumed. However, it is important that the loan conditions are adapted to the conditions in the recipient countries. If interest rates are too high and repayment schedules are too inflexible, the resulting debt burden can inhibit economic growth. If the conditions are too favorable or the debt relief too frequent, policy-makers may, over time, regard it as roughly equivalent to grants (Gupta et al., 2004).

We acknowledge the limitations of our analysis. As with any empirical study, our results are based on a particular data sample specific to the time period and geography selected. It should be further noted that aid is a relative variable that fluctuates by only approximately four percentage points across the entire sample and over the entire time horizon. Compared with the average annual inflation rate of 10 percent in our sample of developing countries, the influence of development aid on economic activity remains relatively small compared with that of other determinants of growth. Some authors argue that cross-country analysis of aid effectiveness causes spurious outcomes due to the heterogeneity of aid flows and donor and recipient countries and argue that the true underlying effect can only be found at the micro level or for specific kinds of development aid (Asiedu and Nandwa, 2007). Other authors claim that regression results from aid–growth models are misleading since different types of development aid, such as aid for education, are earmarked for a specific goal, e.g., to reduce the illiteracy rate, which affects growth only in the long run or not at all (Mavrotas, 2005). We acknowledge these arguments but believe that a more general approach may also provide inspiration for academics, practitioners, and policy-makers to continuously discuss. As data coverage on aid has improved significantly, researchers may be able to take advantage of possible future introductions to complement and corroborate our findings.

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Contemporary Economic Discussions

HCED NO. 76

ISSN 1865-2441 (PRINT)
ISSN 1865-7133 (ONLINE)

ISBN 978-3-942820-66-0(PRINT)
ISBN 978-3-942820-67-7 (ONLINE)