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Effects of foreign aid on income through international trade

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Abstract: This paper presents a review of recent studies that estimate the trade effects of foreign aid. It also provides new results obtained using panel data techniques to estimate the direct effects of aid on international trade, accounting for countries' participation in free trade agreements, and the indirect effects that aid exerts on income through trade. A structural gravity model of trade augmented with aid and free trade agreement variables is estimated for a cross-section of 33 donor countries and 125 recipient countries over the period 1995 to 2016. In a second step, the indirect effect of aid on income is estimated using a control function approach and instrumental variable techniques. The main results indicate that development aid has a robust direct effect on donor exports (the effect on recipient exports, however, is not robust). It also has an indirect positive effect on income levels in the recipient countries. The effects are heterogeneous and vary by region.

Keywords: bilateral aid, exports, free trade agreements, gravity model

Tables: All tables author's own.

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1. Introduction

Rich countries have traditionally used foreign aid as a means of advancing their foreign policy aims in developing countries. Although each donor country has its own policies concerning aid distribution, donors tend to give bilateral aid to countries with which they have past or current colonial links, to countries that have the same official language and to those with which they have cultural and historical links (Nilsson, 1997). Political and economic interests have also influenced donors' aid policies and in many cases these strategic interests have been related to commercial aims (Arvin & Baum, 1997).

Over the years, the link between foreign aid and trade has generated significant academic interest and has been analysed in a number of different contexts (Cadot, Fernandes, Gourdon, Matto & de Melo, 2014). In general, the existing literature points towards a positive relationship between trade and foreign aid; this relationship is robust to various controls in the case of recipient imports, but not in the case of recipient exports (Martínez-Zarzoso, Nowak-Lehmann & Klasen, 2014; Nowak-Lehmann, Martínez-Zarzoso, Herzer, Klasen & Cardozo, 2013; Pettersson & Johansson, 2013; Silva & Nelson, 2012; Wagner, 2003). Most related studies focus on foreign aid and its link with trade, but do not address the link with bilateral or regional trade policies; there is thus scope for investigating the latter association. Therefore, this paper, after presenting a review of recent studies that estimate the trade effects of foreign aid, examines the extent to which aid policies help promote recipient countries' imports from and exports to donors, thereby contributing to the development process. Moreover, it examines whether bilateral aid and trade policies are complementary and explores the indirect effects that aid exerts on economic development through trade. This paper makes two novel contributions with respect to the previous literature, which has mainly focused on the trade–aid nexus (Martínez-Zarzoso et al., 2014; Nowak-Lehmann et al., 2013). First, in addition to the trade–aid link, it explores the interaction between trade agreements and bilateral aid. To that end, this paper estimates a gravity model of trade using data for a 22-year period and for trade between developed and developing countries, augmented with the interaction between bilateral aid and free trade agreements (FTAs). Second, it estimates and discusses the effect of aid on developing countries' total exports, and presents estimates of the indirect effects that aid exerts on income through international trade.

The main results indicate that bilateral aid has a direct effect on donor exports and an indirect positive effect on the income levels in the recipient countries. With respect to FTAs, the results indicate that the direct effect of aid on donor exports is mainly observed for recipient countries that do not have an FTA with the donor.

The rest of the paper is structured as follows. Section 2 presents a summary of the related literature. Section 3 presents the main empirical strategy used to evaluate the links between foreign aid and donor exports, recipient exports, FTAs and, in turn, recipient output. Section 4 discusses the main results and Section 5 concludes.

2. Literature Review

This section reviews the recent literature on the link between development aid, international trade and FTAs.

There are several channels through which foreign aid can foster exports from donors to recipients at the bilateral level. First, donors can use foreign aid as an 'door-opening policy' to establish or reinforce official relationships and to present the country as a trustworthy exporter. Second, when a donor gives aid for trade that is dedicated to infrastructure, to enhancing production capacity or to trade facilitation in general, these measures should reduce trade costs and hence boost exports. Third, under the premise that aid promotes trade, and trade influences income, aid can be seen as having an indirect effect on income. Tied aid has also been used to promote donor exports by linking the transfer to the purchase of goods and services from the donor (Arvin & Baum, 1997; Arvin & Choudhry, 1997). Finally, a long-term aid relationship can foster goodwill towards the donor, incentivizing firms in the recipient country to buy goods from the donor country (Arvin & Baum, 1997).

Recipient countries perceive aid as additional income that will eventually lead to an increase in demand and in imports (Temple & Van de Sijpe, 2017). For instance, development aid can be used to overcome financing constraints (Chenery & Strout, 1966). Aid transfers might also affect the recipient country's income in the medium to long term. In particular, private domestic savings could be substituted by external savings that come in the form of foreign aid (Doucouliagos & Paldam, 2006, 2008; Griffin, 1970; Griffin & Enos, 1970; White, 1992). Development aid could also be used by political leaders to substitute public revenue with external savings, in order to gain voter support (Crivelli & Gupta, 2017; Morrisey, 2001, 2015; White, 1992; among others).

Turning to the empirics, the gravity model of trade provides a suitable theoretical framework to evaluate the determinants of bilateral trade and, more specifically, to evaluate the trade–aid relationship. First used to estimate the determinants of bilateral trade by Tinbergen (1962), this model holds that bilateral trade is directly proportional to the gross domestic products (GDPs) of the trading countries and inversely proportional to the distance between them. The model has been widely used in the empirical trade literature to estimate the effect of a number of trade policies on bilateral trade. Starting with Anderson (1979), the theoretical literature has shown that gravity models can be derived from a range of trade theories (Anderson & van Wincoop, 2003; Bergstrand, 1985, 1989; Head & Mayer, 2014). This model is today considered a workhorse for empirical analysis of the international trade effects of policy measures, such as trade agreements, trade facilitation initiatives, tariff and non-tariff barrier reductions, etc. Head and Mayer (2014) summarize the recent literature and state that the estimation of theory-based gravity models requires the inclusion of proxies for the relative trade costs between a given country and its potential trading partners—the so-called multilateral resistance terms (MRTs). The research that uses the gravity model to examine the effect of development aid on trade is summarized below. Other modelling frameworks have already been reviewed by Zarin-Nejadan, Monteiro and Noormamode (2008, table 3.1).

Jepma (1991), Arvin and Baum (1997) and Arvin and Choudhry (1997) analysed the relationship between bilateral aid and bilateral exports, distinguishing between tied and untied aid, and found that both have a similar effect on promoting exports. In more recent years, there has been a gradual reduction in the tying of aid, partly due to pressure from the Development Assistance Committee of the OECD (OECD-DAC).

Nilsson (1997) was the first author to use the gravity model framework to investigate the relationship between bilateral aid and EU exports to developing countries. Estimating the traditional gravity model with data from 1975 to 1992, he showed that US$1 of aid increased EU exports by an average of US$2.60. Other authors have found similar effects for other countries (Pettersson & Johansson, 2013; Silva & Nelson, 2012; Wagner, 2003), while smaller effects have been found when applying panel data techniques and estimating a theory-based gravity model that accounts for MRT (Martínez-Zarzoso et al., 2014; Nowak-Lehmann et al., 2013; Silva & Nelson, 2012). Silva and Nelson (2012) used the *bonus vetus OLS* method proposed by Baier and Bergstrand (2009) to model multilateral resistance. Martínez-Zarzoso et al. (2014) investigated whether bilateral aid promoted bilateral exports to recipient countries during the period 1988–2007. The authors applied advanced panel data techniques considering time-variant MRT and endogeneity controls, and providing donor-specific export/aid elasticities. Overall, the findings showed a positive effect of bilateral aid on exports, which varied over time and across donors, and which depended on the extent to which donors tied aid to exports. The effect appeared to have decreased substantially over the period of study and was no longer statistically significant by the 2000s, indicating that donors had responded to the OECD-DAC's recommendations concerning the untying of aid. Pettersson and Johansson (2013) used bilateral exports between 180 countries to investigate third-country effects and the effects of aid on recipient exports, but did not control for the endogeneity of the aid variable and for time-varying MRTs.

Examples of single-donor studies are those by Martínez-Zarzoso, Nowak-Lehmann, Klasen and Larch (2009), Martínez-Zarzoso, Nowak-Lehmann, Klasen and Johannsen (2016) and Nowak-Lehmann, Martínez-Zarzoso, Klasen, and Herzer (2009) for Germany; Hansen and Rand (2014) for Denmark; Martínez-Zarzoso, Nowak-Lehman and Klasen (2017a) for the Netherlands; Zarin-Nejadan et al. (2008) for Switzerland; Otor (2017) for Japan; and Liu and Tang (2018) for China and the USA. The main results obtained in those studies are summarized in Table A1 in the Appendix, which is a more up-to-date and comprehensive version of table 1 in the paper by Hansen and Rand (2014, p. 19).

A few of the abovementioned papers disaggregated exports in some way (Martínez-Zarzoso et al., 2016, 2017a; Pettersson & Johansson, 2013). The findings indicated that the effects of aid on trade also differ by sector and seem to be more pronounced in sectors in which the exporter has a comparative advantage.

Regarding the effect of aid on recipient exports, thus far only Pettersson and Johansson (2013) and Nowak-Lehman et al. (2013) have investigated this effect. The first study found a positive and significant effect of aid on recipient exports, whereas the second found that the long-term impact of bilateral aid on recipient exports is not statistically significant. Pettersson and Johansson (2013) did not use bilateral fixed effects, which capture time-invariant pair heterogeneity, and reported that using bilateral fixed effects instead of country dummies yielded much weaker, though still significant, effects of aid.

The use of a full gravity model (Silva & Nelson, 2012) rather than just donor–recipient trade flows (Martínez-Zarzoso et al., 2014) to study the effects of bilateral aid on trade does not significantly change the results of the export/aid elasticity. Moreover, the results appear to be only slightly affected by not including zero-trade or zero-aid flows in the estimations. Notably, the way in which time-invariant unobserved heterogeneity is controlled for in the models seems to be the main source of differences in the results. In fact, the inclusion of trading-pair fixed effects to control for this type of endogeneity weakens the relationship between aid and recipient exports, but not the one between aid and donor exports.

In the last decade, more attention has been given to how aid can be used to promote exports from developing countries—the so-called 'aid for trade' principle (Morrisey, 2006). Aid-for-trade research has been at the forefront of the trade-and-aid literature since the mid-2000s, with most such studies using aid-for-trade data to investigate the effect of aid on recipient exports. Cadot et al. (2014) presents a summary of this growing literature, the main findings of which are mixed. For instance, this literature reports small effects of aid on trade for recipient countries that receive specific types of aid, mainly aid assigned to economic infrastructure or aid for building production capacity; moreover, these effects are found only for medium to large exporters (Martínez-Zarzoso, Nowak-Lehman & Reewald, 2017b).

The bilateral relationship between donor and recipient countries could also be used to promote FTAs. FTAs can reduce or eliminate artificial trade barriers between member countries, particularly tariff and non-tariff barriers. Since the 1970s, most aid recipients have benefited from lower tariffs due to their Most Favoured Nation (MFN) status and their participation in the Generalized System of Preferences (GSP); however, these trade preferences are non-reciprocal and apply only to exports, not imports, of capital goods. Moreover, there are other ways, besides the elimination of tariffs, in which being a signatory to a trade agreement can stimulate trade. FTAs and customs unions (CUs) are of particular interest in this regard, because they eliminate all tariff and non-tariff barriers between members and resolve uncertainty with respect to trade preferences. The difference between an FTA and a CU is that in the former members maintain their own trade policies with respect to third countries, whereas in the latter the members have a common external policy. For this reason, FTA member exporters must comply with the rules of origin for goods that originate in third countries and are in turn traded within the area.

Some donors have common external policies that simultaneously incorporate bilateral trade-and-aid policies, and treat them as complementary. In some cases, donors give aid to countries with which they have weak trade links, with the aim of establishing closer relations. The nexus between giving aid and forming FTAs has only been investigated in specific contexts, namely in the aid-for-trade literature (Vijil, 2014) and in research on trade flows between EU and North African countries (Martínez-Zarzoso, Nowak-Lehmann & Johannsen 2012). Vijil (2014) found complementarities between aid for trade and regional economic integration, while Martínez-Zarzoso et al. (2012) found that both aid and FTA/CU agreements promote trade in North African countries, and that the two measures complement each other.

In this paper, we extend this literature by focusing on North–South bilateral aid and regional trade agreements (RTAs), including FTAs and CUs, to investigate whether the complementarities found in previous literature are more generally applicable.

Finally, it should be noted that the body of research on the effect of trade and foreign aid on economic growth and economic development is very large, and a comprehensive review of the entire literature is beyond the scope of this paper. Therefore, the main arguments are outlined here and a number of highly influential papers are highlighted. This literature has followed two parallel paths. On the one hand, authors that have focused on the effect of openness on economic growth have tended not to include foreign aid in the growth regressions (see Alcalá & Ciccone, 2004; Dollar & Kraay, 2003; Frankel & Romer, 1999; and Singh, 2010 for reviews, among others). On the other hand, a number of papers investigating the effect of foreign aid on economic growth have included openness as a control and in many cases as part of an index that included several policy variables (Burnside & Dollar, 2000; Collier & Dollar, 2001; Dalgaard & Hansen, 2000). We refer readers to Addison, Morrisey and Tarp (2017) for an overview of the macroeconomics of aid, in which they describe five generations of aid research and the main controversies surrounding the aid–growth debate. Starting in the late 1990s and early 2000s, the aid and growth literature mostly focused on analysing whether aid was effective only when accompanied by a number of 'good' economic policies in the recipient countries—the so-called conditionality argument. After the seminal paper by Burnside and Dollar (2000), many scholars focused on validating the findings of that research, obtaining mixed evidence at best, as summarized by McGillivray, Feeny, Hermes and Lensink (2006, table A.2). In the 2010s, research showed that despite the shortcomings and complexities involved in the development aid process, foreign aid has been effective when an extended time frame is considered (Arndt, Jones and Tarp, 2010, 2015a, 2015b).

For a more in-depth discussion of the aid–growth debate in recent decades, we refer readers to Hansen and Tarp (2000, 2001) and to the literature reviews by Dalgaard, Hansen and Tarp (2004), Doucouliagos and Paldam (2008, 2015), Edwards (2005), Rajan and Subramanian (2008) and Arndt et al. (2015a, 2015b).

3. Empirical Strategy

This section describes the data, sources and variables and presents the main results concerning the bilateral trade–aid link, the complementarity of aid and trade policies, as well as the links between aid and total exports from recipients to donors and between aid and recipients' income levels.

3.1. Data, Sources and Variables

The data and variables used cover the period 1995–2016 for a cross-section of 33 donors and 125 recipients (see Table A2 for a list of variables and sources and Table A3 for a list of countries). Official development assistance (ODA) data are from the OECD. The countries selected are all those for which the OECD-DAC reports data on ODA, and which have been giving aid over the analysed period. All recipient countries in the sample engage in bilateral trade with the donors, although there are 3,815 non-reported data on exports, which could be potential zero-trade flows. Those represent only 10% of the observations used in the regressions. We consider net ODA disbursements, in current US dollars, because we are interested in the funds that were actually disbursed to the recipient countries in a given year. Disbursements record the actual international transfer of financial resources, or the transfer of goods or services, valued at the cost to the donor. Aid commitments are also used as proxies for the willingness to give aid. Bilateral exports are obtained from the UN COMTRADE database (UN COMTRADE has incomplete data for 2017 as some countries report with a lag of two years; for this reason our sample ends in 2016). Data on income and population variables are drawn from the World Bank (World Development Indicators Database, WDI-2018). Gravity variables such as distance between capital cities, common language, colonial relationship and common border are from the Centre d'Études Prospectives et d'Informations Internationales (CEPII). The variables RTA and currency unions are constructed from De Sousa (2012) and updated using data from the World Trade Organization (WTO) and central banks.

The additional variables used in the aggregate exports and income models—namely, population, consumer price index, gross capital formation, foreign direct investment and remittances—are also from the WDI-2018. Summary statistics of the main variables are presented in Table 1.

Table 1. Summary statistics

Variable	Observations	Mean	SD	Min.	Max.
*Recipient exports**					
Lexp	35,710	9.143	3.547	–5.521	19.517
Laid	35,710	0.717	2.492	–4.605	9.326
Laidcom	35,710	0.654	2.603	–4.605	9.186
Lgdp_don	33,849	27.328	1.397	23.376	30.523
Lgdp_rec	32,947	23.381	1.888	16.395	28.592
WTO	35,710	0.7541	0.4306	0	1
Comcur	35,710	0.0021	0.0458	0	1
Ldist	35,710	8.7478	0.6231	4.710	9.846
Landlock	35,710	0.4112	0.5659	0	2
Lang	35,710	0.1642	0.3704	0	1
Comcol	35,710	0.0075	0.0861	0	1
Border	35,710	0.0032	0.0567	0	1
Smctry	35,710	0.0016	0.0399	0	1
RTA	35,710	0.116	0.320	0	1
RTA_Europe	35,710	0.096	0.294	0	1
RTA_Asia	35,710	0.004	0.059	0	1
RTA_Africa	35,710	0.002	0.047	0	1
RTA_America	35,710	0.010	0.098	0	1
RTA_Pacific	35,710	0.001	0.030	0	1
*Donor exports***					
Lexp	37,356	10.051	2.670	–5.809	19.093
Laid	37,356	0.621	2.519	–4.605	9.326
Laidcom	37,314	0.556	2.611	–4.605	9.186
Lgdp_don	35,457	27.308	1.405	23.376	30.523
Lgdp_rec	34,590	23.341	1.881	16.395	28.592
WTO	37,356	0.770	0.421	0	1
Comcur	37,356	0.002	0.045	0	1
Ldist	37,356	8.754	0.617	4.7104	9.850
Landlock	37,356	0.398	0.561	0	2
Lang	37,356	0.168	0.374	0	1
Comcol	37,356	0.008	0.088	0	1
Border	37,356	0.003	0.056	0	1
Smctry	37,356	0.002	0.039	0	1
RTA	37,356	0.114	0.318	0	1
RTA_Europe	37,356	0.091	0.288	0	1
RTA_Asia	37,356	0.003	0.058	0	1
RTA_Africa	37,356	0.002	0.047	0	1
RTA_America	37,356	0.013	0.112	0	1
RTA_Pacific	37,356	0.001	0.030	0	1

Notes: * dataset used in Tables 2 and A5 and first part of Tables A7 and A8; ** dataset used in Tables 3 and A6 and second part of Tables A7 and A8. L denotes natural logs.

3.2. Model Specification

The main modelling framework is the gravity model of trade, and in this context we use a control function approach to investigate the effect of aid on donor and recipient exports. This approach shares some features with the standard approaches based on instrumental variables (IVs), which are also used as robustness checks. Most of the panel data applications we reviewed used models that are linear in the parameters (log-linearized version of the gravity model) and were estimated using IV methods with two-stage least squares (2SLS), generalized methods of moments (GMM) or dynamic ordinary least squares (OLS) to account for the endogeneity of the aid variable. The control function approach is an alternative proposed by Wooldridge (2010), which relies on similar identification conditions to the IV approach. The main advantage of the control function approach is that, unlike IV methods, it can be used in combination with the most recent techniques proposed to estimate gravity models of trade with panel data, which require the inclusion of three sets of multidimensional fixed effects (Correia, 2017).

In our specification, exports from country i to country j at year t (X_{ijt}) is the response variable; bilateral aid from country i to country j ($BAID_{ijt}$) is the endogenous explanatory variable; and Z is the 1xL vector of exogenous variables (Z_1 is a 1xL_1 strict sub-vector of Z). This can be specified as

$$X_{ijt} = Z_1\delta_1 + \alpha_1 BAID_{ijt} + u_{ijt}, \tag{1}$$

where BAID denotes net bilateral official development aid (disbursements). The Z_1 variables are GDPs for the donor and recipient countries, as well as the standard gravity variables—namely, distance between trading countries and dummy variables for common language, past or current colonial relationship and RTA (we omit subscripts for simplicity). In the preferred panel data specification, the effect of the bilateral time-invariant gravity variables will be subsumed in the dyadic fixed effects and the effect of GDPs on the time-variant MRTs.

First, consider the exogeneity assumption,

$$E\left(Z_1{}' \, u_{ijt}\right) = 0. \tag{2}$$

The reduced form for *BAID* is

$$BAID_{ijt} = Z\pi_2 + \epsilon_{ijt}, \tag{3}$$

where Z includes (in addition to the exogenous variables in Z_1) aid commitments (aid commitments were lagged two periods to avoid endogeneity concerns) and country-specific fixed effects as exclusion variables.

The linear projection of u_{ijt} on ϵ_{ijt} is:

$$u_{ijt} = \rho_2\epsilon_{ijt} + e_{ijt}. \tag{4}$$

Now, plugging (4) into (1), we obtain:

$$X_{ijt} = Z_1\delta_1 + \alpha_1 BAID_{ijt} + \rho_2\epsilon_{ijt} + e_{ijt}. \tag{5}$$

The two-step procedure consists of first regressing bilateral aid on all the exogenous variables to obtain the reduced form residuals $\hat{\epsilon}_{ijt}$, and then regressing exports on a subset of the exogenous variables, bilateral aid and $\hat{o}_{ijt}$. We use the same two-step procedure for recipient exports and for donor exports (recipient imports).

The OLS estimate from the second step is a *control function* estimate and gives consistent estimates. A simple test for the null of exogeneity is a *t*-statistic on the statistical significance of $\hat{o}_{ijt}$.

We combine this control function approach with the use of panel data and three sets of fixed effects. These are bilateral fixed effects that control for the unobservable heterogeneity attached to each trade flow (*ij*) and donor-and-time and recipient-and-time fixed effects as controls for MRTs, which have to be considered when estimating theory-based gravity models using panel data.

We use a first-step reduced form regression with aid as the response variable. The reduced form is a bilateral aid equation estimated with dyadic and country fixed effects. For aid flows, the donor dummies reflect, in part, the effect of common aid policies that govern the way in which aid is distributed, while the recipient dummies are proxies for the political and institutional environment in the recipient countries.

Reduced form estimations are presented separately for donor and recipient exports. Since we are also interested in the effect of trade policies in combination with aid policies, we add a number of RTA dummies and the interaction between RTA variables and aid to the empirical specification. For instance, we show estimates for RTA agreements signed between recipient countries (developing countries) and donors in the following regions: Asia, America (North and South America), Africa, Europe and the Pacific. The inclusion of interaction terms between the RTA dummies and development aid will allow us to investigate the extent to which trade-and-aid policies are complementary.

The related literature has recognized the importance of evaluating the effects of foreign aid on the trade and economic growth of the recipient countries (Doucouliagos and Paldam, 2006, 2015). One of the main issues in such an analysis is the endogeneity of aid in the trade and growth equations. We tackle this issue as follows. First, we use the results from the estimations of bilateral exports (1) from recipient to donor countries (donor to recipient countries; see Frankel & Romer, 1999) and bilateral aid (3) to obtain the corresponding residuals. Then, we take the exponential of the residuals and aggregate them over all donors to obtain an estimate for each recipient and time period:

$$R1_{jt} = \sum_i \exp\left(\widehat{\ln u_{ijt}}\right), \tag{5}$$
$$R3_{jt} = \sum_i \exp\left(\widehat{\ln \epsilon_{ijt}}\right). \tag{6}$$

Finally, these residuals in logs are used in a second-step estimation in which the dependent variables are the natural logs of total recipient exports and the natural log of recipient GDP per capita. The corresponding specifications are given by (7) and (8):

$$\ln Xrec_{jt} = \delta_j + \alpha_1 \ln BAID_{jt} + \alpha_2 \ln GDPpc_{jt} + CPI_{jt} + \alpha_3 Xdon_{jt} + \rho_1 \ln R3_{jt} + \theta_t + e_{jt}, \tag{7}$$
$$\ln GDPpc_{jt} = \delta_j + \alpha_1 \ln BAID_{jt} + \alpha_2 \ln Pop_{jt} + \alpha_3 \ln Xrec_{jt} + \alpha_4 \ln Xdon_{jt} + \rho_2 \ln R1_{jt} + \theta_t + e_{jt}. \tag{8}$$

The models are also estimated with IV using the second and third lag of aid commitments as instruments. Moreover, dynamic models that include the lagged dependent variables are also estimated as a robustness check.

4. Main Results

A gravity model of trade with bilateral fixed effects and MRTs is used to estimate the effects of bilateral aid on donor exports and recipient exports. The bilateral fixed effects control for unobservable country-pair heterogeneity as a source of the endogeneity of the aid variable, and the MRTs, allow us to estimate a theory-based structural gravity model, as described in the previous section. The results using this approach are shown in Table 2 for recipient exports and in Table 3 for donor exports.

Regarding the target variable, bilateral aid, the results indicate that it has a positive but small significant effect on recipient exports to donors (Table 2) and on donor exports to recipients (Table 3). This is also the case when aid is taken as endogenous in columns 4–6. The point estimate is 0.022 (Table 2, column 4) for recipient exports and 0.026 (Table 3, column 4) for donor exports, indicating that the effect is stronger for the latter. The estimates for donor exports are similar to those obtained by Nowak-Lehman et al. (2013) for the period 1988 to 2007 using Dynamic FGLS without MRTs, but with leads and lags of the variables in first differences. Similar estimates were also obtained for donor exports using GMM in a dynamic setting (as shown by Martínez-Zarzoso et al., 2014). In contrast to Nowak-Lehman et al. (2013), we also obtain statistically significant coefficients for recipient exports. However, only the results concerning donor exports are robust when a PPML (Poisson pseudo-maximum likelihood) estimator—a technique that tackles several econometric issues, including zero flows, selection bias and other sources of endogeneity—is used (see the results in Tables A5 and A6). In the case of recipient exports, bilateral aid turns out to be non-statistically significant when PPML is used (Table A5), in line with previous literature.

We add to the model the average effect of RTAs and its interaction with bilateral aid in column 2 and the effects of specific trade agreements and their interactions with bilateral aid in column 3 of Tables 2 and 3. The results show that the interaction between the RTA variable and bilateral aid is negative and statistically significant, indicating that the positive effect found for the aid variable vanishes for countries that have common RTAs. In particular, the partial effect of aid on recipient exports when RTA = 1, calculated using the results in column 2 of Tables 2 and 3, is not statistically significant (The marginal effect of aid on trade has been calculated using a test of joint statistical significance, *lincom* in Stata). Therefore, aid is only statistically significant on average when there are no RTAs between the donor and the recipient countries. The estimated coefficient for pairs of countries without RTAs indicates that a 10% increase in bilateral aid raises recipient exports by about 0.24% (Table 2, column 5), whereas for donor exports the corresponding effect is around 0.3% (Table 3, column 4). Moreover, the coefficient estimated for the RTA variable indicates that RTAs increase exports by around 17% for recipients and by 22% for donors for country pairs without RTAs (the effect is calculated as $\exp(0.163 - 1) \times 100$ using the coefficient of the RTA variable in column 5 of Table 2). These effects decrease with the amount of aid given, as indicated by the negative effect of the interaction variable (Laid*RTA).

Table 2. Gravity results for recipient exports

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)
ln rec. exports	HDFE	HDFE	HDFE	CF	CF	CF
Independent variables						
Laid	0.0164**	0.0187**	0.0193***	0.0224**	0.0245***	0.0252***
	[0.00717]	[0.00748]	[0.00750]	[0.00910]	[0.00908]	[0.00969]
RTA	0.140***	0.161***		0.142***	0.163***	
	[0.0390]	[0.0426]		[0.0495]	[0.0457]	
Laid*RTA		–0.0188**			–0.0185**	
		[0.00880]			[0.00922]	
RTA_Europe			0.113**			0.114**
			[0.0495]			[0.05411]
RTA_Asia			0.236**			0.238**
			[0.106]			[0.111]
RTA_Africa			0.571*			0.602*
			[0.309]			[0.3337]
RTA_America			0.135			0.134
			[0.117]			[0.123]
RTA_Pacific			–0.235			–0.225
			[0.258]			[0.322]
Laid* Europe			–0.0274***			–0.0270***
			[0.00955]			[0.0101]
Laid*Asia			–0.0516**			–0.0514**
			[0.0235]			[0.0253]
Laid*Africa			–0.0199			–0.0403
			[0.110]			[0.123]
Laid*America			0.0640*			0.0647*
			[0.0335]			[0.0365]
Laid*Pacific			–0.0665			–0.0569
			[0.199]			[0.269]
Residuals from aid equation				–0.0157	–0.0153	–0.0156
				[0.0112]	[0.0114]	[0.0117]
BFE, XT, MT	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,748	35,748	35,748	37,710	35,710	35,710
R-squared	0.914	0.914	0.914	0.917	0.914	0.914

Note: robust standard errors in brackets clustered by donor–recipient (default). Method: high-dimensional fixed effects (HDFE) linear regression. Fixed effects include: donor–year (XT), recipient–year (MT), donor–recipient (BFE). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. CF denotes the control function approach. All models estimated with the Stata command *reghdfe* from Correia (2017). Bootstrapped standard errors in columns 3–6 (1,000 replications).

Table 3. Gravity results for donor exports

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)
ln donor exports	HDFE	HDFE	HDFE	CF	CF	CF
Independent variables:						
Laid	0.0297***	0.0338***	0.0344***	0.0259***	0.0296***	0.0302***
	[0.00396]	[0.00413]	[0.00414]	[0.00488]	[0.00499]	[0.00501]
RTA	0.173***	0.204***		0.176***	0.207***	
	[0.0242]	[0.0257]		[0.0242]	[0.0258]	
Laid*RTA		–0.0329***			–0.0335***	
		[0.00493]			[0.00494]	
RTA_Europe			0.218***			0.222***
			[0.0307]			[0.0307]
RTA_Asia			0.0801			0.0803
			[0.0797]			[0.0797]
RTA_Africa			0.244			0.248
			[0.183]			[0.186]
RTA_America			0.121***			0.121***
			[0.0453]			[0.0453]
RTA_Pacific			–0.903***			–0.905***
			[0.242]			[0.241]
Laid*Europe			–0.0409***			–0.0414***
			[0.00551]			[0.00551]
Laid*Asia			0.0271			0.0272
			[0.0190]			[0.0190]
Laid*Africa			0.0307			0.0276
			[0.0825]			[0.0844]
Laid*America			–0.0276**			–0.0283**
			[0.0118]			[0.0118]
Laid*Pacific			–0.695***			–0.699***
			[0.188]			[0.188]
Residuals from Aid Equation				0.0101*	0.0110*	0.0111*
				[0.00610]	[0.00610]	[0.00610]
Observations	37,356	37,356	37,356	37,314	37,314	37,314
R-squared	0.952	0.952	0.952	0.952	0.952	0.952

Note: robust standard errors in brackets clustered by donor–recipient (default). Method: high-dimensional fixed effects (HDFE) linear regression. Fixed effects include: donor–year, recipient–year, donor–recipient. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. CF denotes the control function approach. All models estimated with the Stata command *reghdfe* from Correia (2017). Bootstrapped standard errors in columns 3–6 (1,000 replications).

The results in column 3 of both tables show that the effect is heterogeneous and varies by agreement. For instance, the bilateral RTAs signed mostly between the EU and EFTA (Europe) and recipient countries have a positive and significant effect on recipient exports—and also on donor exports—but this effect decreases with the amount of aid given. This is also the case for RTAs in Asia (see Table A4 for a list of agreements included). In terms of the RTAs signed by American countries, they seem to exert a statistically significant effect on donor exports only, and this effect also decreases with the amount of aid given. For the agreement involving the Pacific region (Australia–Singapore and TPP (Trans-Pacific Partnership) agreement), no significant effect of the RTAs on recipient exports is found, whereas the effect is negative and significant for donor exports.

Next, we estimate the effect of aid on aggregate recipient exports and on income per capita in the recipient countries by using the control function approach and alternative IV methods. The main results are presented in Tables 4 and 5. Column 1 shows the FE results and column 2 shows the results of the control function approach, when bilateral aid is estimated in a first step and the residuals are added as regressors. In columns 3 and 4 the models are estimated using IV for aid, while column 5 presents the results of a dynamic model that uses IV for aid and for the lagged dependent variable.

The results in Table 4 indicate that greater amounts of aid received and more imports from all donors lead to an increase in recipient exports, given that significant and positive effects are shown for foreign aid and for donors' exports. In particular, a 10% increase in ODA raises recipient exports by around 0.6% when using the control function approach, and the point estimate increases to 1.6 when using IV; however, the effect is statistically significant only at the 10% level. In addition, for each 10% increase in donor exports, recipient exports increase by around 2.6% (Table 4, column 2). These results are robust to the addition of control variables (column 3) and the lagged dependent variable (column 5) to the model. The long-run effects in column 5 were calculated by dividing the point coefficients by (1 – 0.77), with 0.77 being the coefficient of the lagged dependent variable. Tests for the validity of the instruments are included in the last two rows of Table 4. The Hansen test indicates that we cannot reject the validity of the instruments, and the Kleibergen–Paap statistic indicates that the instruments are not weak.

Table 4. Regression results for aggregate recipient exports

Dependent variable	(1)	(2)	(3)	(4)	(5)
ln rec. exports of goods and services	CTFE	CTFE-CF	CTFE-IV	CTFE-IV	IV-Dyn
Independent variables					
lgdppc	1.049***	1.041***	1.115***	1.113***	0.218**
	[0.118]	[0.121]	[0.130]	[0.138]	[0.0877]
lbaid_sum	0.0652**	0.0693**	0.157*	0.156*	0.0458**
	[0.0319]	[0.0327]	[0.0807]	[0.0860]	[0.0219]
lxdon_sum	0.246***	0.257***	0.191***	0.198***	0.0414*
	[0.0807]	[0.0826]	[0.0698]	[0.0707]	[0.0238]
lyd		0.172		0.247	0.0696
		[0.155]		[0.163]	[0.0620]
CPI		–8.73e–06***		–8.56e–06***	–6.56e–06***
		[2.32e–06]		[2.58e–06]	[9.85e–07]
lres_s	–0.00101	0.00187			
	[0.0175]	[0.0166]			
lresxd_s	–0.0254	–0.0248			
	[0.0372]	[0.0354]			
Lexp_gs(t-1)					0.771***
					[0.0432]
Observations	1,785	1,666	1,762	1,646	1,388
R-squared	0.693	0.696	0.683	0.687	0.911
Number of countries	115	108	100	96	93
Hansen st. (jp)			0.448	0.430	0.545
Kleibergen–Paap st.			18.34	15.71	18.34

Note: robust standard errors in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. CFE denotes country fixed effects, CTFE denotes country and time fixed effects, CF is the control function approach and IV is instrumental variables.

Column 1 in Table 5 shows the effect of trade on the recipient's income per capita. A 1% increase in exports from recipients to donors raises the income per capita in the recipient country by around 0.12%. Moreover, the same increase in donors' exports increases that income level by around 0.2%. As in other studies (Nowak-Lehman et al., 2013), the aid coefficient is not statistically significant in Table 5. However, aid is found to exert an indirect effect on income through trade, given that aggregate aid and imports from the donors are associated with higher recipient exports

(Table 4), and higher recipient exports have a positive effect on income (Table 5). The estimated coefficients in columns 1 and 2 of Table 5 are robust to changes in the specification and to the addition of a number of control variables. In particular, column 3 presents the results when population, foreign direct investment, remittances and gross capital formation are added to the model; the main difference is the reduction in the coefficient of donor exports, which is in part due to the smaller sample of countries for which data are available (121 in column 2 compared to 100 in column 3). In columns 4 and 5, the aid variable is instrumented with the first and second lag of aggregate aid commitments and the results remain similar to those in columns 2 and 3 using the control function approach. Finally, in column 5 the lagged dependent variable of income per capita is added to the model to incorporate dynamics. The coefficient of the lagged income variable is positive and significant, as expected, and the results for recipient exports and donor exports remain positive and significant: the long-run effects are 0.14 and 0.08 for each 1% increase in recipient and donor exports, respectively. As in Table 4, the last two rows of Table 5 include tests for the validity of the instruments.

Table 5. Regression results for recipient income per capita

Variables	(1) CTFE	(2) CTFE-CF	(3) CTFE_CF	(4) CTFE-IV	(5) CTFE-IV	(6) IV-Dyn
lbaid_sum	–0.0165	–0.0145	–0.00436	0.00130	0.0261	0.00646
	[0.0144]	[0.0156]	[0.0106]	[0.0323]	[0.0218]	[0.00694]
lxrec_sum	0.121***	0.119***	0.0939***	0.121***	0.108***	0.0285***
	[0.0291]	[0.0289]	[0.0331]	[0.0301]	[0.0333]	[0.00491]
lxdon_sum	0.208***	0.207***	0.0855***	0.223***	0.0782***	0.0176*
	[0.0422]	[0.0424]	[0.0286]	[0.0362]	[0.0288]	[0.0106]
lpop			–0.911***		–0.960***	–0.245***
			[0.129]		[0.142]	[0.0293]
lfdi			0.00168		0.00210	
			[0.00469]		[0.00449]	
lrem			0.00183		0.00223	
			[0.00876]		[0.00872]	
lgcf			0.110***		0.120***	0.0372***
			[0.0283]		[0.0274]	[0.00811]
lres_s		0.00485	0.00879			
		[0.0105]	[0.00599]			
lresxr_s		–0.0135	0.000895			
		[0.0106]	[0.00662]			
lresxd_s		–0.0452**	–0.0239			
		[0.0196]	[0.0144]			
Lgdppc(t-1)						0.799***
						[0.0168]
Observations	2,248	2,241	1,447	2,235	1,438	1,697
R-squared	0.667	0.670	0.843	0.663	0.836	0.961
Number of countries	126	121	100	122	96	110
Hansen st. (jp)				0.283	0.0239	0.793
Kleibergen–Paap st.				19.39	12.54	20.59

Note: robust standard errors in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. CFE denotes country fixed effects, CTFE denotes country and time fixed effects, CF is the control function approach and IV is instrumental variables.

The control function approach allows us to test for the endogeneity of aid and trade variables in the recipient exports and income equations estimated in Tables 4 and 5. The corresponding *t*-tests on the residuals from the first-step equations (for exports and for development aid) indicate that the coefficients of the residuals are generally not statistically significant when the model is estimated with country and time fixed effects, suggesting that the use of panel data mitigates potential endogeneity.

5. Robustness Checks

As a first robustness check, we have estimated the gravity models for recipient exports and imports using the usual gravity controls; namely, income in the trading countries and dummy variables for common language, common border, colonial relationship and belonging to the same country in the past. The results are shown in Table A7. In general, the aid coefficient is positive and significant, and higher in magnitude than in the main results. This is expected since the models in Table A7 do not control for time-variant MRTs, nor for all the bilateral unobserved heterogeneity in the gravity model.

We have also run separate models for different regions. Using the World Bank classification, we divide the world into regions as indicated in Table A8. The results for recipient exports shown in column 1 indicate that it is mainly aid sent to the Latin American and Caribbean region and to South Asian countries that has been effective in increasing recipient exports. Concerning donor exports, the results are shown in column 2 and indicate that aid to East Asia and the Pacific, to Europe and Central Asia, to South Asia and to sub-Saharan Africa increase exports, whereas the aid coefficient for Latin America and the Caribbean and the Middle East and North Africa is not statistically significant.

The income per capita model was also estimated in first differences with IV to avoid potential issues with spurious correlations, and the results hold (see Table A9). Finally, the model was also estimated for several lags of the aggregate aid variable and the results indicate that the aid was statistically significant in the income model when using the fifth lag as the regressor and the sixth-to-tenth lags as instruments. This is in line with recent reviews of the aid–growth literature (Table A10).

6. Conclusion

This paper reviews the recent literature on the bilateral trade–aid link that uses the gravity model as the main analytical framework. Existing studies find a robust positive effect of bilateral aid on bilateral exports from donor to recipient countries. The findings also indicate that there is a small but non-robust effect of bilateral aid on recipient exports. The claim for causality running from aid to exports is supported by the use of methods that account for the endogeneity of aid in the bilateral trade equation.

This paper confirms the abovementioned findings and adds trade policy variables, specifically RTA dummy variables, to the main setting. It has been argued that, in some cases, donors will seek to combine closer trade relations with more aid, whereas in other cases, aid and trade regional policies are unrelated. The results of this paper support the view that donors give aid to countries with which they have weak trade links with the aim of establishing closer relations.

Finally, when studying the effect of total aid on total recipient exports and GDP per capita, we find that the effect of aid on recipient exports is statistically significant and that aggregate exports and imports seem to have a positive and significant effect on the GDP per capita of the recipient countries. Hence, the part of trade that has been incentivized by foreign aid appears to foster economic development.

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Appendix

Table A1. Overview of studies on the effects of ODA on donor exports

Authors	**Countries**	**Period**	**Method**	**Export/aid elasticity**	**Average US$ return per US$1 aid**
Nilsson (1997)	EU-15 donors to 108 recipients	1975–1992	OLS	0.230 sr	2.6
Wagner (2003)	20 donors to 109 recipients	1970–1992	Bilateral FE/NLS	0.062 sr	0.35 direct 0.95 indirect
Zarin-Nejadan et al. (2008)	Switzerland to almost 100 recipients	1966–2003	Country FE/FD OLS	0.044 sr	0.84–0.96 (Swiss Fr.)
Martínez-Zarzoso et al. (2009)	Germany to 138 recipients	1962–2007	Bilateral FE/ Sys-GMM	0.051 sr 0.220 lr	0.64 1.10–1.52
Nowak-Lehmann et al. (2009)	Germany to 77 recipients	1962–2007	DOLS/DGLS	0.090 lr	1.04–1.50
Silva and Nelson (2012)	Bilateral exports between 180 countries	1962–2000	Bilateral FE	0.094 sr Neg. multilateral effect	Not comparable
Pettersson and Johansson (2013)	Exports among 180 countries	1990–2005	OLS/HMR country FE	0.09 sr	Not comparable
Martínez-Zarzoso et al. (2016)	Germany to 132 recipients (sectoral exports)	1988–2009	Bilateral FE/ DOLS	Sectoral elast. 0.06 lr	–
Hansen and Rand (2014)	Denmark to 144 recipients	1981–2010	Bilateral FE/GMM	0.059 sr 0.057 lr	0.30
Martínez-Zarzoso et al. (2017a)	The Netherlands to 130 recipients	1973–2009	Bilateral FE/ GMM/DOLS	0.06 sr 0.10 lr	0.29 sr 0.84 lr
Martínez-Zarzoso et al. (2014)	DAC donors to 130 recipients	1988–2007	Bilateral FE/ Sys-GMM	0.04 sr 0.12 lr*	0.50 sr 1.80 lr
Martínez-Zarzoso (2015)	22 donors to 132 recipients	1988–2007	Control function approach	0.052 sr	–
Otor (2017)	Japan to 15 Asian countries	1972–2008	DOLS		1.30–1.50 sr 1.41–2.62 lr
Temple and Van de Sijpe (2017)	Net imports for 88 aid recipients	1971–2012 three-year averages	FE and CCE	Aid/GDP increase net donor exports	Not comparable
Liu and Tang (2018)	USA and China to 26 and 30 African countries	2003–2012	FE/Dif-GMM	US ns China FE/0.06sr	

Note: see Zarin-Nejadan et al (2008) for studies in the 1990s and for studies on time-series bivariate models. NLS denotes non-linear least squares; CCE denotes common correlated effects, Dif-GMM denotes differenced generalized method of moments, FE denotes fixed effects, Sys-GMM denotes system generalized method of moments, DOLS/DGLS denotes dynamic OLS and dynamic generalized least squares; sr denotes short-run (from a static model) and lr long-run estimates (from a dynamic model). HMR denotes Helpman, Melitz, and Rubinstein (2008). *Calculated as an average of the LR coefficients of three periods.

Table A2. List of variables, definitions and sources

Variable	Variable description	Source
Aid	Bilateral official development aid net disbursements in current US dollars	OECD
Aidcom	Bilateral official development aid commitments in current US dollars	OECD
Xrec	Donor imports from the recipient in current US dollars	UNCTAD
Xdon	Recipient imports from the donor in current US dollars	UNCTAD
GDP_don	GDP of reporter country in current US dollars	WDI
GDP_rec	GDP of partner country in current US dollars	WDI
Pop_don	Population of reporter country in millions of inhabitants	WDI
Pop_rec	Population of partner country in millions of inhabitants	WDI
Dist	The distance in kilometres between the capital cities of reporter *i* and partner *j*	CEPII
Landlock	Variable that takes the value of 1 if the reporter country is landlocked (meaning that it does not have access to a sea or coastline), 2 if the partner country is also landlocked, and 0 otherwise	CEPII
Comcol	Binary variable that takes the value of 1 if the countries have ever had a colonial relationship, and 0 otherwise	CEPII
Border	Binary variable that takes the value of 1 if the reporter country *i* and partner country *j* share a common border and 0 otherwise	CEPII
Lang	Binary variable that takes the value of 1 if the trading countries have a common official language, and 0 otherwise	CEPII
Smctry	Binary variable that takes the value of 1 if both countries were part of the same country in the past and 0 otherwise	CEPII
Comcur	Binary variable that takes the value of 1 if the countries have a common currency, and 0 otherwise	De Sousa (2012)
RTA	Binary variable that takes the value of 1 if the countries belong to the same free trade agreement, and 0 otherwise	De Sousa (2012) and WTO
WTO	Binary variable that takes the value of 1 if the countries are WTO members and 0 otherwise	WTO
gkf	Gross capital formation	WDI
Lgdppc	Recipient GDP per capita in 2011 constant US dollars	WDI
CPI	Consumer price index	WDI
Exp_gs	Exports of goods and services	WDI
fdi	Foreign direct investment	WDI

Table A3. List of countries

Donors	**Recipients**		
Australia	Afghanistan	Gabon	Pakistan
Austria	Albania	Gambia	Palau
Belgium	Algeria	Georgia	Panama
Canada	Angola	Ghana	Papua New Guinea
Czech Republic	Antigua and Barbuda	Guatemala	Paraguay
Denmark	Argentina	Guinea	Peru
Estonia	Armenia	Guinea-Bissau	Philippines
Finland	Azerbaijan	Guyana	Rwanda
France	Bahrain	Haiti	Samoa
Germany	Bangladesh	Honduras	Sao Tome and Principe
Greece	Belarus	Indonesia	Saudi Arabia
Hungary	Belize	Iraq	Senegal
Iceland	Benin	Israel	Seychelles
Ireland	Bhutan	Jamaica	Sierra Leone
Israel	Bolivia	Jordan	Slovenia
Italy	Bosnia and Herzegovina	Kazakhstan	Solomon Islands
Japan	Botswana	Kenya	Somalia
Kuwait	Brazil	Kiribati	South Africa
Lithuania	Burkina Faso	Kyrgyzstan	Sri Lanka
Luxembourg	Burundi	Lebanon	Sudan
Netherlands	Cambodia	Lesotho	Suriname
New Zealand	Cameroon	Liberia	Swaziland
Norway	Central African Republic	Libya	Syrian Arab Republic
Poland	Chad	Madagascar	Tajikistan
Portugal	Chile	Malawi	Thailand
Slovenia	Colombia	Malaysia	Togo
Spain	Comoros	Maldives	Tonga
Sweden	Congo	Mali	Tunisia
Switzerland	Costa Rica	Malta	Turkey
Turkey	Croatia	Mauritania	Turkmenistan
United Arab Emirates	Cuba	Mauritius	Tuvalu
United Kingdom	Cyprus	Mexico	Uganda
United States	Djibouti	Mongolia	Ukraine
	Dominica	Morocco	Uruguay
	Dominican Republic	Mozambique	Uzbekistan
	Ecuador	Myanmar	Vanuatu
	Egypt	Namibia	Venezuela
	El Salvador	Nepal	Viet Nam
	Equatorial Guinea	Nicaragua	Yemen
	Eritrea	Niger	Zambia
	Ethiopia	Nigeria	Zimbabwe
	Fiji	Oman	

Source: Author, based on data from the OECD-DAC.

Table A4. List of free trade agreements

Europe	Asia
EU–South Africa	ASEAN–Australia–New Zealand
EU–Albania	ASEAN–Japan
EU–Bosnia	Japan–Indonesia
Turkey–Bosnia & Herzegovina	Japan–Malaysia
EU–Slovenia	Japan–Peru
EU–Chile	Japan–Philippines
EU–Cameroon	Japan–Viet Nam
EU–Colombia	Malaysia–Australia
Croatia–Turkey	Malaysia–New Zealand
EU–Algeria	Thailand–Japan
EFTA–Albania	Thailand– Australia
EFTA–Bosnia & Herzegovina	Thailand–New Zealand
EFTA–Chile	**Africa**
EFTA–Colombia	Egypt–Turkey
EFTA–Costa Rica	Morocco–Turkey
EFTA–Colombia	South Africa CU
EFTA–Egypt	Syria–Turkey
EFTA–Israel	Tunisia–Turkey
EFTA–Jordan	**America**
EFTA–Libya	Canada–Chile
EFTA–Morocco	Canada–Colombia
EFTA–Mexico	Canada–Costa Rica
EFTA–Panama	Canada–Honduras
EFTA–Peru	Canada–Jordan
EFTA–Tunisia	Canada–Panama
EFTA–Turkey	Canada–Peru
EFTA–Ukraine	Chile–Australia
EU–Egypt	Chile–Japan
EU–East Africa	Mexico–Chile
EU–Canada	Mexico–Japan
EU–Fiji	US–Mexico–Canada
EU–Georgia	US–Chile
EU–Jordan	US–Colombia
EU–Libya	USA–Israel
EU–Morocco	US–Jordan
EU–Mexico	US–Morocco
EU–Peru	US–Oman
EU–Singapore	US–Panama
EU–Syria	US–Peru
EU–Tunisia	USA–CAFTA–Dominican Republic
EU–Turkey	**Pacific**
Turkey–Israel	Australia–Singapore
EU–Ukraine	Trans-Pacific EPA
EU–CARIFORUM	

Source: Author, based on data from the WTO.

Table A5. PPML estimates for recipient exports

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)
Rec. exports	HDFE	HDFE	HDFE	CF	CF	CF
Independent variables:						
Laid	0.00720	0.00996	0.00834	0.00748	0.0112	0.00907
	[0.00713]	[0.00787]	[0.00776]	[0.00904]	[0.0101]	[0.0100]
RTA	–0.000415	0.0355		0.0196	0.0601	
	[0.0499]	[0.0548]		[0.0449]	[0.0568]	
Laid*RTA		–0.0118			–0.0216	
		[0.0135]			[0.0158]	
RTA_Europe			0.0217			0.0223
			[0.0727]			[0.0809]
RTA_Asia			0.444***			0.306***
			[0.122]			[0.0923]
RTA_Africa			–0.398***			–0.263**
			[0.154]			[0.132]
RTA_America			0.0727			0.111
			[0.0972]			[0.102]
RTA_Pacific			0.0400			–0.0381
			[0.292]			[0.317]
Laid*Europe			0.00927			0.00615
			[0.0145]			[0.0211]
Laid*Asia			–0.125***			–0.108***
			[0.0300]			[0.0276]
Laid*Africa			0.0923			0.0108
			[0.110]			[0.0909]
Laid*America			0.0119			–0.000121
			[0.0252]			[0.0254]
Laid*Pacific			–0.213			–0.142
			[0.257]			[0.217]
Residuals from aid equation				0.00672	0.00692	0.00733
				[0.00735]	[0.00725]	[0.00719]
Observations	36,089	36,089	36,089	36,051	36,051	36,051
R-squared	0.997	0.997	0.997	0.996	0.997	0.997

Note: standard errors in brackets. Method: PPML for structural gravity with high-dimensional fixed effects (HDFE). FE included: donor–year, recipient–year, donor–recipient. Clustered standard errors, clustered by donor–recipient (default). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. CF denotes the control function approach.

Table A6. PPML estimates for donor exports

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)
Donor exports	HDFE	HDFE	HDFE	CF	CF	CF
Independent variables:						
Laid	0.00916**	0.0187***	0.0201***	0.00447	0.0182***	0.0211***
	[0.00453]	[0.00511]	[0.00500]	[0.00601]	[0.00614]	[0.00584]
RTA	0.171***	0.250***		0.181***	0.253***	
	[0.0322]	[0.0355]		[0.0367]	[0.0377]	
Laid*RTA		–0.0270***			–0.0293***	
		[0.00721]			[0.00843]	
RTA_Europe			0.168***			0.179***
			[0.0364]			[0.0377]
RTA_Asia			0.447***			0.315***
			[0.115]			[0.116]
RTA_Africa			–0.00941			–0.0742
			[0.156]			[0.151]
RTA_America			0.429***			0.470***
			[0.0513]			[0.0551]
RTA_Pacific			–0.391**			–0.682***
			[0.163]			[0.191]
Laid*Europe			–0.0234***			–0.0277***
			[0.00693]			[0.00857]
Laid*Asia			–0.0681**			–0.0425*
			[0.0266]			[0.0248]
Laid*Africa			–0.0974			–0.0658
			[0.0830]			[0.0606]
Laid*America			–0.0455***			–0.0598***
			[0.0142]			[0.0146]
Laid*Pacific			–0.334**			–0.412***
			[0.143]			[0.115]
Residuals from aid equation				0.00948*	0.00949*	0.00992**
				[0.00488]	[0.00498]	[0.00482]
Observations	37,879	37,879	37,879	37,837	37,837	37,837
R-squared	0.999	0.999	0.999	0.998	0.999	0.999

Note: standard errors in brackets. Method: PPML for structural gravity with high-dimensional fixed effects (HDFE). FE included: donor–year, recipient–year, donor–recipient. Clustered standard errors, clustered by donor–recipient (default). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. CF denotes the control function approach.

Table A7. Gravity model with additional controls

	Recipient exports		Donor exports	
Dependent variable	(1)	(2)	(3)	(4)
ln exports	OLS-TFE	OLS-TCFE	OLS-TFE	OLS-TCFE
Independent variables.				
Lgdp_recipient	1.206***	0.778***	0.967***	0.822***
	[0.0329]	[0.117]	[0.0157]	[0.0370]
Lgdp_donor	1.229***	0.685***	0.925***	0.0416
	[0.0231]	[0.0775]	[0.0218]	[0.0717]
Laid	0.0330**	0.106***	0.118***	0.159***
	[0.0161]	[0.0140]	[0.00967]	[0.00928]
RTA	0.386***	0.240***	0.363***	0.183***
	[0.0886]	[0.0770]	[0.0535]	[0.0459]
Laidrta	0.0268	–0.0211	–0.0104	–0.0556***
	[0.0294]	[0.0227]	[0.0172]	[0.0139]
WTO	0.329***	0.206**	0.0875	0.0966*
	[0.0990]	[0.0838]	[0.0541]	[0.0529]
Comcur	1.279**	–0.270	1.130	0.328
	[0.604]	[0.474]	[1.057]	[0.554]
Ldist	–0.728***	–1.481***	–0.988***	–1.396***
	[0.0585]	[0.0803]	[0.0378]	[0.0515]
Landlock	–0.618***		–0.387***	
	[0.0764]		[0.0469]	
Lang	0.670***	0.479***	0.513***	0.421***
	[0.112]	[0.102]	[0.0711]	[0.0665]
Comcol	1.009***	–0.0278	0.690***	0.265
	[0.266]	[0.266]	[0.223]	[0.206]
Border	0.932**	0.255	0.533	0.289
	[0.443]	[0.466]	[0.442]	[0.581]
Smctry	2.280***	1.094**	0.906***	0.760*
	[0.414]	[0.431]	[0.325]	[0.443]
Observations	33,253	33,253	35,052	35,052
R-squared	0.628	0.757	0.767	0.844

Note: robust standard errors in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. TFE denotes time fixed effects. TCFE denotes time and country fixed effects.

Table A8. Regional specific coefficients for aid

Dependent variable	(1) ln recipient exports	(2) ln donor exports
Independent variable		
Laid_EAP	0.0233	0.0328**
	[0.0161]	[0.0142]
Laid_ECA	0.0333	0.0398***
	[0.0211]	[0.0119]
Laid_LAC	0.0436***	0.00816
	[0.0111]	[0.00662]
Laid_MENA	0.00976	0.0123
	[0.0208]	[0.00925]
Laid_SAS	0.0699***	0.0399**
	[0.0215]	[0.0159]
Laid_SSA	0.0135	0.0404***
	[0.0134]	[0.00721]
RTA	0.162***	0.201***
	[0.0429]	[0.0256]
Laid*RTA	–0.0173*	–0.0295***
	[0.00945]	[0.00510]
Residuals from aid equation	–0.0164	0.0120**
	[0.0110]	[0.00607]
Observations	35,710	37,314
R-squared	0.914	0.952

Note: robust standard errors in brackets clustered by donor–recipient (default). Method: High-dimensional fixed effects (HDFE) linear regression. Fixed effects include: donor–year, recipient–year, donor–recipient. *** p < 0.01, ** p < 0.05, * p < 0.1. CF denotes the control function approach. All models estimated with the Stata command *reghdfe* from Correia (2017). Bootstrapped standard errors in columns (1,000 replications). EAP = East Asia and Pacific; ECA = Europe and Central Asia; LAC = Latin America and Caribbean; MENA = Middle East and North Africa; SAS = South Asia; SSA = sub-Saharan Africa.

Table A9. Income per capita model in first differences

	(1)	(2)	(3)
Variables	CTFE-IV	CTFE-IV	IV-Dyn
D.lbaid_sum	–0.0540	–0.00860	–0.000816
	[0.0381]	[0.0205]	[0.00279]
D.lxrec_sum	0.0408***	0.0203***	0.0232***
	[0.00953]	[0.00778]	[0.00814]
D.lxdon_sum	0.0905***	0.0716***	0.0526***
	[0.0149]	[0.0130]	[0.0128]
D.lpop_exp		–0.648***	–0.429***
		[0.131]	[0.0612]
D.lfdi		0.00233**	0.00115
		[0.00106]	[0.000934]
D.lrem		0.000573	0.00282
		[0.00246]	[0.00213]
LD.lgdppc			0.649***
			[0.0560]
Observations	2,112	1,659	1,441
R-squared	0.054	0.227	0.273
Number of countries	122	115	112
Hansen st. (jp)	0.358	0.294	0.403
Kleibergen–Paap st.	5.850	3.119	21.24

Note: robust standard errors in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. CTFE denotes country and time fixed effects, IV denotes instrumental variables and Dyn the dynamic model. D. denotes variables in first differences.

Table A10. Income per capita model with aid in previous periods

	(1)	(2)
Variables	CTFE_CF	CTFE-IV
Lbaid_sum(t-5)	0.0158**	0.0252***
	[0.00642]	[0.00963]
Lbaid_sum(t-10)	0.0173*	
	[0.00939]	
Lxrec_sum	0.105***	0.0965***
	[0.0221]	[0.0206]
Lxdon_sum	0.129***	0.134***
	[0.0465]	[0.0391]
Lpop_exp	–0.792***	–0.811***
	[0.120]	[0.109]
Lfdi	–0.00488	–0.00208
	[0.00508]	[0.00459]
Lgcf	0.0693***	0.0677***
	[0.0213]	[0.0200]
Lres_s	–0.00725	
	[0.00610]	
Lresxr_s	–0.00876	
	[0.00848]	
Lresxd_s	–0.0301	
	[0.0187]	
Observations	1,541	1,538
R-squared	0.746	0.738
Number of countries	109	106
Hansen st. (jp)	–	0.314
Kleibergen–Paap st.	–	30.52

Note: robust standard errors in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. CTFE denotes country and time fixed effects, IV denotes instrumental variables and Dyn the dynamic model.