THE ECONOMIC BENEFITS OF GIVING AID IN TERMS OF DONORS' EXPORTS

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Abstract

This paper uses the gravity model of trade to investigate the link between bilateral and multilateral foreign aid and donor's exports. There are three primary findings from this approach. First, in the long term, the average return, in terms of an increase in the donor's level of goods exports, is approximately $ 2.15 US for every aid dollar spent on bilateral aid. Second, multilateral aid has a positive effect on export levels only in the short term, whereas in the long term, the effect is negative. Third, aid from other donors does not give rise to a displacement effect for a given donor-recipient trade relationship. This paper also makes comparisons among donors and finds that aid has a positive and significant effect on most donors' export levels.

Key words: *exports, foreign aid, donors, panel data, sample selection, GLM*

JEL Classification: F10; F35

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Introduction

In international trade theory, researchers have long studied the welfare implications of development aid for donors and recipient countries. The first public discussion of this topic was the Keynes-Ohlin debate in relation to the paradoxical effects of German reparations[1]. Leontieff (1936) also raised the possibility of transfer paradoxes (foreign aid can be donor-enriching and recipient-immiserizing). Since those preliminary discussion, the theoretical literature on transfer paradoxes has been extended to more general settings (Gale, 1974; Brecher and Bhagwati, 1981 and 1982; Bhagwati, Brecher, and Hatta, 1983 and 1984). The findings indicate that the paradoxes are still possible but, under certain conditions both donors and recipients can benefit from transfers. More recently, Djajic, Lahiri, and Raimondos-Moller (2004) studied the welfare implications of temporary foreign aid in the context of an intertemporal model of trade and considered the impact of aid on donor exports. They found that the net benefits of an aid transfer may change over time for both the donor and the recipient. Assuming economic and political stability in the recipient country, a temporary transfer of income in the first period improves Period One welfare of the recipient and lowers that of the donor. But in the presence of habit-formation effects, aid in Period One may serve to shift preferences of the recipient in favor of the donor's export goods in Period Two. When the terms-of-trade effect associated with this shift is sufficiently large and the real rate of interest is sufficiently low, the second period welfare gain of the donor (at the expense of the recipient) overshadows its Period One loss. In addition, this transaction also results in a net increase in welfare of the recipient country if the real rate of interest used to discount the

[1] Keynes (1929a, 1929b, and 1929c) and Ohlin (1929a, 1929b).

Period Two loss is sufficiently high, making its present value smaller than the Period One gain.

As stated above, development aid has an effect on donor's exports and this effect is expected to be positive, according to trade theory. Surprisingly, only a few authors have analyzed the effect of aid on donor countries' export levels from a multi-donor perspective (Nilsson, 1997; Lloyd, McGillivray, Morrissey, and Osei, 2000; Wagner, 2003; Nelson and Juhasz Silva, 2008).

The objective of this paper is to analyze the relationship between development aid and donors' exports. Three key questions are addressed. First, we ask to what extent donor countries benefit from bilateral and multilateral development aid, in terms of greater exports to the recipient countries. Second, we question to what extent a given bilateral commercial link, a donor-recipient, displaces other donors' exports, generating a crowding-out effect. Finally, we examine and quantify the effect of development aid on each donor's export levels.

A major contribution of the paper lies in taking account of zero trade flows and firm heterogeneity and in using very recent panel data estimation techniques that provide consistent estimates in the presence of heteroscedasticity and endogeneity of some right hand side variables. Specifically, we apply panel-FGLS, Gamma Maximum Likelihood, Poisson-Pseudo Maximum Likelihood and Non-linear Least Squares estimation to a multiplicative model and also Difference- and System-GMM estimation to a dynamic linear model. Difference- and System GMM are especially apt to control for potential endogeneity of the explanatory variables (bilateral aid, multilateral, other donors' aid).

To summarize our main results, we find that the increase in the amount of donors' exports flowing from donors' aid in the long run is more moderate than in earlier studies: around a $2.15 US increase in exports for every aid dollar spent. The overall effect is remarkably robust, but oscillates over time. It is always positive and declined in the late 1990s. We do not find evidence of a displacement effect; on the contrary, a higher amount of

aid given by other donors increases exports from a given donor to a specific recipient. Interestingly, the evidence indicates that aid from some donors is not export-enhancing, whereas for some others, the effect is strong and robust to several specifications. The effect is greater for some donors (Switzerland, Canada, Austria, and France). But for others, there is no such effect (Australia, New Zealand, Ireland, and Greece).

Section 2 summarizes the related literature and the theoretical framework. Section 3 presents a description of the data. Section 4 presents the model specification, discusses the main results, and presents a number of robustness checks. Finally, Section 5 outlines some conclusions.

2. Literature Review and Theoretical Framework

In recent decades, extensive research effort has been devoted to investigating the effects of developmental assistance on the economic performance of the recipient countries and clarifying how aid can be used to promote exports from developing countries, the so-called "aid for trade" principle (Morrissey, 2006). Much less attention has been devoted to the issue of quantifying the impact of aid on donors' export revenues. A finding that aid flows promote exports from the donor countries would suggest that giving aid—if it also promotes development in the recipient country—can be a win-win situation for both parties and might also reduce taxpayer reluctance to devote resources to aid.

Interestingly, the literature on aid allocation has found that bilateral aid also strongly depends upon economic circumstances in the *donor* country, such as government performance and the donor's relative individual income (Chong and Gradstein, 2008). In this political-economic model, a donor's willingness to provide foreign aid is positively related to the citizens' satisfaction with the donor government's performance and to per capita income. A political-economic equilibrium exists where the median voter is decisive in determining the political outcome in terms of a majority-supported tax rate. Therefore, the aggregate amount

of foreign aid depends positively on the aggregate income in the donor economy and negatively on the degree of its inequality. While a donor's exports are not explicitly considered in this model, increased exports are likely to lead to an increase in GDP and thus increase a country's willingness to provide aid.

Other contributions to the aid allocation literature suggest that aid flows depend strongly upon historical ties and strategic and economic interests, and are only weakly dependent upon poverty levels or the existence of democratic governance in recipient countries (Alesina and Dollar, 2000). In this aid allocation context, an important question to examine is whether exports to a particular country promote subsequent aid flows to that country. If that reverse causality were present, this would be an important finding, further questioning the motivation of donors when giving aid.

Turning directly to studies that investigate the impact of aid on a donor country's exports, Arvin and Baum (1997) and Arvin and Choudry (1997) evaluated the relationship between bilateral aid and bilateral exports with and without tying of the aid. They found that aid without tying was roughly as export-promoting as tied aid and explained this as being due to the effects of the recipient countries' good will and/or parallel trade agreements and trade concessions. Accordingly, a formal tying of aid does not appear to provide additive benefits related to donor export levels (Jepma, 1991; Arvin and Baum, 1997; Arvin and Choudry, 1997). Benefits for donors through tying are therefore usually insubstantial, whereas tying noticeably reduces the benefit of aid for recipients (Jepma, 1991; Wagner, 2003). Consequently, tying has been progressively reduced, partly due to pressure from the Organization of Economic Cooperation and Development (OECD) Development Assistance Committee.

A number of studies analyzed the aid-trade link relying on the gravity model of international trade. For example, a study done by Nilsson (1997) on the aid and trade relationship of EU countries and developing countries from 1975 to 1992 showed that $1.00

US-worth of aid increased exports by an average of $2.60 US for EU countries. Nilsson used a common intercept for all the EU countries, three-year averages, and a time trend. Studying the aid and trade relationship between OECD donors (especially Japan) and recipient countries, Wagner (2003), using pooled data for the years 1970, 1975, 1980, 1985, and 1990 computed the donor-country export-level impact of $1.00 US of aid to be approximately a $2.30 US return when using pooled OLS, whereas it was reduced to $0.73 US when fixed country effects were added. Correspondingly, we apply a gravity model of trade as a basic framework, below. Solid theoretical foundations that provide a consistent base for empirical analysis have been developed in the past three decades for this model (Anderson, 1979; Bergstrand, 1985; Anderson and van Wincoop, 2003; Helpman, Melitz, and Rubinstein, 2008).

The major contribution of Anderson and van Wincoop (AvW) was the appropriate modeling of trade costs to explain bilateral exports. The AvW model has been recently extended to applications explicitly involving developed and less developed countries by Nelson and Juhasz Silva (2007). They present an extension of AvW to the asymmetric north-south case and derive some implications related to the effect of aid on trade. Their results indicate that if the economy of a donor country (GDP) is larger than that of the recipient country by at least the monetary value of the foreign aid, there is an increase in exports from the larger country to the smaller. The intuitive rationale behind this effect is that, as a result of the transfer, the two countries become more similar in size, and the more similar in size two countries are, the more they trade with one another.

In our own study, we extend the literature by using more recent data, additional covariates (multilateral aid, exchange rates), and more advanced econometric techniques, in line with Martinez-Zarzoso, Nowak-Lehmann, Klasen and Larch (2009). In particular, we follow Nilsson (1997) and Wagner (2003) in using an augmented gravity model which is well suited to studying the impact of aid on trade. We depart from these authors in the way we

control for unobserved heterogeneity and zero trade flows. This model allows controlling for the impact of other influences on trade, such as income (which affects production capacity and preferences for variety), population (absorption and economies-of-scale effects), and distance, in a world where common language, colonial ties, common borders, and aid can also influence trade. We augment the model with exchange rates and two types of aid—bilateral and multilateral.

3. Description of the Data

3.1 Development Aid

The Development Assistance Committee (DAC) is the section of the OECD which deals with development-cooperation matters. It comprises 22 donor countries. Total aid given (TOF=total official flows) by its members is reported as official development aid (ODA) and other official flows (OOF). The data contain the bilateral transactions, as well the multilateral contributions. The bilateral transactions are undertaken by a donor country directly with an aid recipient and the multilateral contributions are contributions of international agencies and organizations. The recipients include not only countries and territories, but also multilateral organizations that are also ODA eligible.

The total net ODA disbursements is the sum of grants, capital subscriptions, total net loans, and other long-term capital. The grants include debt forgiveness and interest subsidies in associated financing packages. The capital subscriptions to multilateral organizations are made in the form of notes and similar instruments unconditionally redeemable on sight by the recipient institutions. The total net loans and other long-term capital represent the loans extended, minus repayment received, and with the offsetting of entries for debt relief. Technical cooperation, development food aid, and emergency aid are included in grants and gross loans.

OOF are other official sector transactions which do not meet ODA criteria, for example, grants to aid recipients for representational or essentially commercial purposes, official loans intended to promote development but having a grant element of less than 25 percent, or official bilateral transactions, whatever their grant element, that are primarily export-facilitating in purpose. This category includes by definition export credits extended directly to an aid recipient by an official agency or institution ("official direct export credits"). Net acquisitions by governments and central monetary institutions of securities issued by multilateral development banks at market terms, subsidies (grants) to the private sector to soften its credits to aid recipients, and funds in support of private investment are also classified as OOF. The effect of direct export credits on donors' exports has been recently investigated for Austria by Egger and Url (2006).

The multilateral contributions of international agencies and organizations (also part of ODA) can be imputed back to the funders of those bodies. The OECD uses a specific methodology that we briefly explain. The approach will vary, depending upon whether the intention is to show the share of the receipts of a given recipient attributable to a particular donor or the share of a given donor's outflows that can be assigned to an individual recipient. As DAC statistics are primarily designed to measure donor effort, the second approach is the one taken in DAC statistical presentations. First, the percentage of each multilateral agency's total annual gross disbursements that each recipient country receives is calculated. This calculation is carried out only in respect to agencies' disbursements of grants or concessional (ODA) loans from core resources. Then, the recipient percentages derived in the first step are multiplied by a donor's contribution in the same year to the core resources of the agency concerned to arrive at the imputed flow from that donor to each recipient. This calculation is repeated for each multilateral agency. The results from the second step for all agencies are added to obtain the total imputed multilateral aid from each donor to each recipient country.

In practice, imputed multilateral percentages are calculated for about 20 agencies per year. These account for about 90 percent of donors' multilateral ODA. Core contributions to the remaining agencies, for which the OECD does not have outflow data, are not imputed back to donors. Therefore, imputed multilateral ODA remains slightly lower than donors' total contributions to multilateral aid. Total imputed multilateral flows, in combination with bilateral ODA, are assumed to provide the most complete picture possible of the total ODA effort the donor is making with respect to individual recipient countries. At present, there is no regular imputation of multilateral ODA flows by sector or other aid parameters, though this has been done occasionally in the context of sectoral studies (e.g., on aid to the water sector, to basic social services, or in support of HIV/AIDS control). Finally, it is worth noting as well that any methodology for imputing multilateral flows can only be an approximation because multilateral flows in a given year are not precisely imputable to donors' contributions in that year.

Figure 1 shows the ratio of ODA over GDP for the most important donors from 1988 through 2006. The Nordic countries (Sweden, Norway, and Finland) and the Netherlands show the highest figures. Throughout this entire period, they consistently gave more than 0.6% of GDP as ODA and in some years the percentage surpassed 1 percent for the Netherlands. The USA presents the lowest figures showing percentages that are in many years below 0.2 percent of GDP.

Figure 1. Donor's ODA-to-GDP ratio (1988-2006)

Figures 2 and 3 show the five largest recipients and the five largest donors in the 1980 to 2004 period. Egypt is the largest recipient, followed by Russia in the case of total official flows (TOF=ODA+OOF), and China with the ODA total net. With respect to TOF, China

appears in the fourth place. Indonesia appears at the third place and Israel takes the fourth place on ODA and the fifth on TOF. In the fifth position is Vietnam in terms of ODA.

Figure 2. Five largest recipients (1980-2004)

With respect to the largest donors (Figure 3), the United States and Japan keep the first position, followed by France and Germany. The United Kingdom ranks in fifth place with respect to total official flows and Italy is in fifth place with respect to ODA total net flows.

Figure 3. Five largest donors (1980-2004)

3.2 Data Sources

The datasets used are the following: ODA data from 1988 to 2004 are from the OECD Development Database on Aid from DAC Members. We consider bilateral gross ODA disbursements in current US$[2], instead of aid commitments, because we are interested in the funds actually released 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. We also consider imputed multilateral aid as a proxy for donors' total contributions to multilateral aid.

The original DAC member countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Sweden, Switzerland, the United Kingdom, and the United States. Other countries are also included in the data, but they became a donor many years later: the Czech Republic (1998), Greece (1996), Hungary (2003), Iceland (1988), Korea (1989), Latvia (2002), Lithuania (2001), the Slovak Republic, Spain (1987), and Turkey (1990). In the empirical estimations we included all original DAC countries plus Greece and Spain. Bilateral exports are obtained from the UN COMTRADE database. Data on income and population variables are drawn from the World Bank (World Development Indicators

[2] The gross amount comprises total grants and loans extended (according to DAC).

Database, 2007). Bilateral exchange rates are from the IMF statistics. Distances between capitals have been computed as Great Circle distances using data on straight-line distances in kilometers, latitudes, and longitudes from the CIA World Fact Book. Other dummy variables included in the model are from CEPII.

4. Model Specification and Main Results

4.1 Model Specification

The gravity model of trade is nowadays the most commonly accepted framework to model bilateral trade flows (Anderson, 1979; Bergstrand, 1985; Anderson and van Wincoop, 2003; Helpman, Melitz, and Rubinstein, 2008). According to the underlying theory, trade between two countries is explained by nominal incomes and the populations of the trading countries, by the distance between the economic centers of the exporter and importer, and by a number of trade impediment and facilitation variables. Dummy variables, such as trade agreements, common language, or a common border, are generally used to proxy for these factors. The gravity model has been widely used to investigate the role played by specific policy or geographical variables in explaining bilateral trade flows. Consistent with this approach, and in order to investigate the effect of development aid on donors' exports, we augment the traditional model with bilateral and multilateral aid (ODA). Among the variables facilitating trade, we add bilateral and imputed multilateral aid. Introducing time variation and bilateral exchange rates[3], the augmented gravity model is specified as

$$X_{ijt} = \alpha_0 \; Y_{it}^{\alpha_1} Y_{jt}^{\alpha_2} YH_{it}^{\alpha_3} YH_{jt}^{\alpha_4} DIST_{ij}^{\alpha_5} BAID_{ijt}^{\alpha_6} MAID_{itj}^{\alpha_7} \; F_{ij}^{\alpha_8} EXCHR_{ijt}^{\alpha_9} \; u_{ijt} \,, \qquad (1)$$

where X_{ijt} are the exports from donor i to recipient j in period t in current US$; Y_{it} (Y_{jt}) indicates the GDPs of the exporter (importer) in period t, YH_{it} (YH_{jt}) are exporter (importer) GDPs per capita in period t, $DIST_{ij}$ is geographical distances between countries i and j, and F_{ij}

[3] When the gravity model is estimated using panel data, it is recommended to add bilateral exchange rates, as well, as a control variable (Carrere, 2006).

denotes other factors impeding or facilitating trade (e.g., trade agreements, common language, a colonial relationship, or a common border). $BAID_{ijt}$ is bilateral official net development aid from donor *i* to country *j* in current US$; and $MAID_{ijt}$ is imputed multilateral development aid from donor *i* to country *j* in current US$; $EXCHR_{ijt}$ denotes nominal bilateral exchange rates in units of local currency of country *i* (donor) per unit of currency in country *j* (recipient) in year *t*. Finally, u_{ijt} is an idiosyncratic error term that is assumed to be well behaved. Note that aid variables could be inserted with lags, in accordance with the theoretical predictions. The number of lags will be determined with Hendry's general-to-specific methodology.

Usually the model is estimated in log-linear form[4]. Taking logarithms in Equation 1, the specification of the gravity model is

$$LX_{ijt} = \gamma_0 + \phi_t + \delta_{ij} + \alpha_1 LY_{it} + \alpha_2 LY_{jt} + \alpha_3 LYH_{it} + \alpha_4 LYH_{jt} + \alpha_5 LDIST_{ij} + \alpha_6 LBAID_{ijt} + \\ + \alpha_7 LMAID_{ijt} + \alpha_8 F_{ij} + \alpha_9 LEXCHR_{ijt} + \eta_{ijt} \qquad (2)$$

where L denotes variables in natural logs and the other explanatory variables are described above. ϕ_t are specific time effects that control for omitted variables common to all trade flows but which vary over time. δ_{ij} are trading-partner unobservable effects that proxy for multilateral resistance factors. When these effects are specified as fixed effects, the influence of the variables that are time invariant cannot be directly estimated. This is the case for distance; therefore, its effect is subsumed into the country dummies. Finally, η_{ijt} is an idiosyncratic error term that is assumed to be well behaved. The model will be estimated for all donors and also for each donor separately by restricting the income and income-per-capita coefficients to being equal ($\alpha_1 = \alpha_2$ and $\alpha_3 = \alpha_4$).

[4] We also estimate the model in its original multiplicative form.

As an additional control variable, we use aid from other donors (different from donor *i* to recipient *j* ($\sum LBAID_{kjt}$). The rationale of adding this variable is to control for cross-correlation effects due to the fact that other donors' aid could promote their own exports to recipient *j*, which may have a negative effect on donor *i* 's exports.

Considering that it may take some time before aid fully affects trade, we include a number of lags of the two types of aid (bilateral and imputed multilateral) in the model specification. To determine the number of lags added to the right-hand side, we follow the general-to-specific methodology. We start by adding more lags than one could reasonably expect to need and then disregard those that are statistically non-significant. The chosen number of lags is two for bilateral aid and one for imputed multilateral aid.

With respect to the specification of the country-pair effects, we not only considered the usual fixed-versus-random-effects approach, but also an attractive alternative approach, which is especially suitable when there are missing values and the time span is short, and consists of estimating the model, as proposed by Mundlak (1978), including within and between effects (Egger and Url, 2006). Basically, this approach involves modelling the correlation of unobserved heterogeneity under the assumption that the unobserved factors are correlated with the group mean of the explanatory variables, the extended model is given by

$$LX_{ijt} = \gamma_0 + \phi_t + \alpha_1 LY_{it} + \alpha_2 LY_{jt} + \alpha_3 LYH_{it} + \alpha_4 LYH_{jt} + \alpha_5 LDIST_{ij} + \alpha_6 LBAID_{ijt} + \alpha_7 LMAID_{ijt} + \\ + \alpha_8 F_{ij} + \alpha_9 LEXCHR_{ijt} + \alpha_{10} AVLYD_{ij} + \alpha_{11} AVLYR_{ij} + \alpha_{12} AVLYHD_{ij} + \alpha_{13} AVLYHR_{ij} + \alpha_{14} AVLODAGD_{ij} + \\ \alpha_{15} AVLAMULTI_{ij} + \alpha_{16} AVLEXCHR_{ij} + \eta_{ijt} \qquad (3)$$

where variables starting with AV refer to averages over time of the time-variant regressors that were described above. According to Mundlak (1978), the heterogeneity bias will be minimal, due to the fact that the correlation between the country-pair effects and the explanatory variables is captured in the model. FGLS estimation of model (3) will provide similar estimates to the within transformation and, therefore, unbiased estimates.

To continue our analysis we consider a modification to the previous specification that includes country-and-time effects to account for time-variant, multilateral price terms, as proposed by Baldwin and Taglioni (2006) and Baier and Bergstrand (2007). As stated by Baldwin and Taglioni, including time-varying country dummies should completely eliminate the bias stemming from the "gold-medal error" (the incorrect specification or omission of the terms that Anderson and van Wincoop (2003) called *multilateral trade resistance*). The main shortcoming of this approach is that it involves estimation of *2NT* (*N*=donors+recipients, *T*= years) dummies for unidirectional trade, in our case, 5,202 dummies. Nevertheless, within the panel, we have *2DRT* observations (D=donors, R=recipients), and with *N* and *T* relatively large (152 and 17, respectively), there remain many degrees of freedom.

The specification which accounts for the multilateral price terms in a panel data framework is given by

$$LX_{ijt} = \gamma_{ij} + \beta_1 LDIST_{ij} + \beta_2 LBAID_{ijt} + \beta_3 LMAID_{ijt} + \beta_4 F_{ij} + \beta_5 LEXCHR_{ijt} + \sum_{1}^{NT} P_{it}^{1-\sigma} + \sum_{1}^{NT} P_{jt}^{1-\sigma} + \varepsilon_{ijt} \quad (4)$$

where $P_{it}^{1-\sigma}$ and $P_{jt}^{1-\sigma}$ are time-variable, multilateral (price) resistant terms that will be proxied with *2NT* country and time dummies, and ε_{ijt} denotes the error term that is assumed to be well behaved. The other variables are the same as in Equation 2, above. Income and income-per-capita variables cannot be estimated because they are collinear with the exporter and time variables and importer and time multilateral resistance terms.

A third alternative specification is based on Helpman et al. (2008). The authors developed a two-stage estimation procedure that uses a selection equation in the first stage and a trade-flow equation in the second. They showed that the traditional estimates are biased and that the bias is primarily due to the omission of the extensive margin (number of exporters), rather than to selection into trade partners. In line with Helpman et al. (2008), we

also estimate the proposed system of equations. The first equation specifies a latent variable that is positive only if country *i* exports to country *j*. The second equation specifies the log of bilateral exports from country *i* to country *j* as a function of standard variables (income, distance, common language), dyadic random effects, and a variable, $\omega_{ijt,}$ that is an increasing function of the fraction of country *i* firms that export to country *j*. The resulting equations are

$$\rho_{ijt} = P(X_{ijt}) = \theta_0 + \zeta_t + \theta_1 LY_{it} + \theta_2 LY_{jt} + \theta_3 LYH_{it} + \theta_4 LYH_{jt} + \theta_5 LDIST_{ij} + \\ + \theta_6 LBAID_{ijt} + \theta_7 LMAID_{ijt} + \theta_8 F_{ij} + \theta_9 LEXCHR_{ijt} + \varsigma_{ij} + \eta_{ijt} \tag{5}$$

$$LX_{ijt} = \alpha_0 + \omega_{ijt} + \phi_t + \gamma_1 LY_{it} + \gamma_2 LY_{jt} + \gamma_3 LYH_{it} + \gamma_4 LYH_{jt} + \gamma_5 LDIST_{ij} + \\ + \gamma_6 LBAID_{ijt} + \gamma_7 LMAID_{ijt} + \gamma_8 F_{ij} + \gamma_9 LEXCHR_{ijt} + \upsilon_{ij} + \mu_{ijt} \tag{6}$$

where ς_{ij} and υ_{ij} are dyadic country-pair effects (specified as random in equation 5) to control for unobserved heterogeneity, and ϕ_t and ζ_t denote time-specific effects.

The new variable, $\omega_{ijt,}$ is an inverse function of firm productivity. The error terms in both equations are assumed to be normally distributed. Clearly, the error terms in both equations are correlated. Helpman et al. (2008) construct estimates of the ω_{ijt}s using predicted components of Equation 5. They propose a second stage non-linear estimation that corrects for both sample-selection bias and firm heterogeneity bias. They also decompose the bias and find that correcting only for firm heterogeneity addresses almost all the biases in the standard gravity equation. They implement a simple linear correction for unobserved heterogeneity (ω_{ijt}), proxied with a transformed variable ($\hat{z}^*_{ijt}$) given by,

$$\hat{z}^*_{ijt} = \phi^{-1}(\hat{\rho}_{ijt}), \tag{7}$$

where $z^{*}_{ijt} = \frac{z_{ijt}}{\sigma^{\eta}_{ijt}}$ and ϕ (.) is the cumulative distribution function (cdf) of the unit-normal distribution. $\hat{\rho}_{ijt}$ is the predicted probability of exports from country *i* to country *j*, using the estimates from the random-effects-panel-probit Equation 5. We also decompose the bias and used the inverse Mills ratio as a proxy for sample selection and the linear prediction of exports down-weighted by its standard error as a proxy for firm heterogeneity (ω_{ijt}), both obtained from Equation 5.

The inverse Mills ratio is given by

$$\lambda_{ijt} = \rho_{ijt}\sigma^{\mu}_{ijt} \tag{8}$$

where $\rho = corr(\eta_{ijt}, \mu_{ijt})$ and σ^{μ}_{ijt} is the standard error of the residuals in Equation 6.

The main difference between the Heckman and the Helpman et al. (2008) procedures is the inclusion of (ω_{ijt}) as a proxy for firm heterogeneity in the Helpman et al. (2008) procedure, since the inverse Mills ratio (λ_{ijt}), also called non-selection hazard, is included in both approaches as a way to correct for selection of firms into export markets.

Finally, as stated by recent research, it is commonly accepted that the underlying data-generating process of the gravity model of trade is a dynamic process. The existence of sunk costs borne by exporters to set up distribution and service networks in foreign markets generates persistency in exports; hence, a country exporting to another country in a given year will tend to continue doing so the year after. There have been different approaches in the recent literature trying to deal with this issue. The most commonly used approach has been to specify a model that includes lagged exports as an additional regressor in the gravity equation (De Grauwe and Skudelny, 2000; Egger, 2001; Bun and Klaasen, 2002; Martínez-Zarzoso and Nowak-Lehmann D., 2003; De Nardis and Vicarelli, 2004; De Benedictis, De Santis and Vicarelli, 2005; Martínez-Zarzoso, Nowak-Lehmann, and Horsewood, 2009). The dynamic

model is estimated via difference GMM (Arellano and Bond, 1991) and system GMM (Blundell and Bond, 1998).

In the next section, estimation results obtained with the outlined approaches are presented and discussed. We start with the static approaches (the two-stage Helpman approach and the Mundlak approach and some baseline models (OLS, FE (fixed effects) model)) and then proceed with dynamic models.

4.2. Main Results

Model 2 is estimated for data on 21 donors' exports and development aid (ODA) to 132 recipient countries during the period of 1988 to 2004. Table 2 reports the baseline estimation results for the static models. The first and second columns show the pooled OLS (only for comparative purposes). Time-fixed effects are also included in both columns. Individual (country-pair) effects (modeled as random) are included in Column 3 to control for unobservable heterogeneous effects across trading partners. Those effects have frequently been used as a proxy for the so-called "multilateral resistance" factors modeled by Anderson and van Wincoop (2003).

Table 2: Development Aid and Donors' Exports—Linear Models

A Hausman test indicates that the dyadic unobservable effects are correlated with the error term, hence the random effects approach, ignoring this correlation, leads to inconsistent estimators. The problem can be handled by using the fixed effects approach, which essentially eliminates the dyadic unobservable effects. The fourth column presents the two-way FE estimates that are consistent. Restricting the analysis to the within variation eliminates the bias due to unobserved heterogeneity that is common to each trading-pair meaning that the between variation is lost. Since we are interested in explaining both the within and the between-within variation, a useful way of producing unbiased and efficient estimates is to employ the methodology proposed by Mundlak (1978). Each time-variant variable is included twice, once in its original form and once averaged over time. FGLS on this model obtains

both within effects and the between-within effects in a single model. According to Egger and Pfaffermayer (2004), the former approximate short-run effects, and the latter additional long-run effects. The results are shown in Column 5 (Table 2). The within-coefficients on bilateral and multilateral aid are practically unchanged with respect to those in the FE specification (Column 4).

Since our data consists of a time span of a maximum of 17 years and a cross-section of 132 countries, we tested for the presence of autocorrelation and heteroskedasticity. The results of the Wooldridge test for autocorrelation in panel data and the Likelihood Ratio (LR) test for heteroskedasticity indicate that both problems are present in the data. Hence, given the strong rejection of the null in both tests, the Mundlak-type-model is re-estimated with a random-effects-FGLS model with a more flexible structure in the error term that allows for panel-specific variances and for first order autocorrelation; the results are shown in Column 6 (Table 2). This is our preferred static specification. A RESET-type test indicates that the model is correctly specified (last row in Table 2).

With respect to the variable of interest, bilateral aid, the estimated within-coefficient is always positive and significant, indicating that a one-percent increase in aid raises donors' exports by 0.068 percent (0.041+0.019+0.008). The effect is small compared to that shown in previous studies which did not control for country-pair unobserved heterogeneity, autocorrelation, and heteroskedasticity, but it is still positive and significant. Using the results in Column 6, we find that, in the short run, the average return on aid for donors' exports is approximately a \$0.80 US increase in exports for every aid dollar spent. This average is calculated as

$$\frac{\partial X}{\partial BAIDG} = \beta_{BAIDG} * \frac{X}{BAIDG} = 0.068 * \frac{243337}{20629} = 0.80$$

The fixed effects results obtained by Wagner (2003) implied that exports derived from a dollar of aid amount to $0.73 US for a sample of 20 donors, 108 recipients, and five years (1970, 1975, 1980, 1985, and 1990). This result, in the context of a static gravity model, is close to ours ($0.80 US using the coefficients of Model 6 in Table 2). It seems that the average return to aid in term of donors' exports is remarkably stable for different decades, although our results are not strictly comparable. Indeed, Wagner did not control for autocorrelation and heteroskedasticity in the error term and he included only data for five years during the 1970s and 1980s, whereas we examine the 1990s and early 2000s and use a wider sample of countries and years.

It is worth noting that the between-effect (the coefficient obtained for bilateral aid averaged over time) is much larger in magnitude (0.151) than the within effect, and considering that it could be taken as an approximation of the long-run effect, using this result, the average return on aid for donors' exports in the long term is approximately a $1.78 US increase in exports for every aid dollar spent.

The estimated coefficient for the official net development aid of other donors is also positive and statistically significant, but the magnitude is very low (0.022). This suggests that donors' exports could be positively influenced by aid given by other DAC members. When other donors give higher amounts of aid to a particular recipient, the direct income effect could promote recipient imports generating an indirect positive effect on a specific donor's exports.

With respect to imputed multilateral aid, the within-effect on donors' exports is always positive and significant once we control for unobserved heterogeneity. According to Model 6, an increase of 10 percent in multilateral aid increases exports by 0.54 (0.032+0.022) percent. However, the between-effect is negative signed and statistically significant at the one-percent level, indicating that imputed multilateral aid only has a small and positive short-run impact on bilateral exports, but in the long-run, this effect is reversed.

Most of the other variables present the expected sign and are statistically significant. The within-coefficient of donor income is negative and significant, indicating that higher income is associated with lower exports to developing countries in the short-run, but the between-effect is positive and significant. The within-coefficient of recipient income is non-significant but the between-effect is positive and significant, indicating that increases in recipients' income foster imports from developed countries in the long-run.

The within-coefficient of donors' and recipient's income per capita are both positive and statistically significant at the one-percent level in Model 6. The coefficient estimate for exporter's per capita income is interpreted by Bergstrand (1989) as a proxy for the exporter's K/L ratio. It may be positive signed if exports are dominated by capital-intensive industries.

The coefficient of the importer per capita income has also an ambiguous sign; it may be negative when the products imported are necessities and positive when they are luxuries (Bergstrand, 1989). In the FGLS estimations the distance coefficient is around unity and takes the expected negative value.

Table 3 provides results including time-varying nation dummies (Equation 4). According to Baier and Bersgtrand (2007) and Baldwin and Taglioni (2006), the estimates in Table 3 should be unbiased, since the multilateral price variables are correctly modelled. The two-way fixed effect within-estimator with robust standard errors has been used. Equation 4 is estimated for three different five-year periods. Now only the level and the first lagged ODA variables enter the model, since the second lag of ODA was not statistically significant. The same applies to ODA from other donors and the first lag of imputed multilateral ODA that are always not significant at conventional levels.

Table 3: Linear Model Results with Well-Specified Multilateral Resistance Terms

The results indicate that bilateral ODA has also a positive effect on donors' exports, but the effect does materialize in both the same and the previous period. The sum of the

estimated coefficients for the level and first lag of bilateral ODA is very stable over time and within the interval (0.058-0.064). Compared with the results obtained in Table 2 (Model 6), the results are very similar (0.068). However, the coefficient on imputed multilateral donors' aid is now non-significant, whereas it was positive and significant in Models 3 through 6 in Table 2. Assuming that adding time-varying nation dummies is an alternative way of capturing history, the results are also consistent with the fact that the between-coefficient of imputed multilateral aid is negative in Model 6 (Table 2).

To account for selection bias and firm heterogeneity (Helpman et al., 2008), Table 4 presents the results from estimating Equations 5 and 6, first considering only selection effects, showing the results of the first and second step estimation in the first two columns of Table 4, and second, considering selection effects and firm heterogeneity, with the results of the first and second step estimation given in columns 3 and 4. In the first-step estimation (column 3), we estimate a random-effects probit model with exporter and importer effects and time effects (Equation 5). From these estimates we obtained the linear predictions down-weighted by their standard error (ZHAT) and the inverse Mills ratio (INVMILLS). These two elements were incorporated as regressors in the second-step estimation. Column 4 in Table 4 incorporates into the second-step estimation firm heterogeneity and self-selection effects, along with random effects and time dummies. The ZHAT coefficient is positive signed and statistically significant at the 10-percent level, and the INVMILLS coefficient is not statistically significant, showing no evidence of selection effects. The coefficients obtained in Column 4 (Table 4) are comparable to those in the random-effects specification in Column 3 (Table 2). We observe that the total effect of bilateral aid on exports is now (0.139), whereas previously it was 0.088. Hence, disregarding firm heterogeneity slightly biases the estimates downwards.

Table 4: Results Heckman Selection Model and Heterogeneous Firms' Model Estimations

Next, we estimate a dynamic gravity model following the standard technique of adding lagged dependent variables as regressors. The results for two different sub-periods are presented in Table 5.

Table 5. Dynamic Specifications

The first two columns in this table present the results obtained by following a differenced-GMM approach for the periods 1988-1996 and 1997-2004, while Columns 3 and 4 present the results obtained for the same periods when estimating by the system GMM approach. This second method is commonly accepted as one of the best ways to estimate the determinants of bilateral export flows in a dynamic context. The results concerning the variable of interest obtained in Columns 3 and 4 are consistent with those obtained in Model 6 (Table 2), above. Indeed, the average return on aid for donors' exports in the long term, calculated using the average of the long term aid coefficients in both periods, is approximately a $2.15 US increase in exports for every aid dollar spent, which is slightly higher than the estimate found in the FGL-Mundlak model ($ 1.78 US).

4.3 Robustness Checks

As a first robustness check, the gravity model is also estimated in its original multiplicative form within the framework of generalized linear models (GLM). These models allow for a more flexible specification of the variance and the mean and deal with the problems of heteroskedasticity and zero values in the dependent variable simultaneously. The main results are presented in Table A.2 in the Appendix. Column 1 present the results obtained for a RE-Gamma model, column 2 for a RE-Poisson model and column 3 for a RE-NLS model. The main difference in the estimated elasticities of exports with respect to bilateral aid is that the results indicate even higher returns in terms of exports. According to the Gamma family (which is the best model in terms of AIC and BIC) the elasticity of exports with respect to bilateral aid is 0.186, indicating that a 10-percent increase in aid increases

exports by 1.86 percent. However the coefficient on multilateral aid is negative and significant.

As a second robustness check, we tested for endogeneity of bilateral aid and for non-linearities in a static and dynamic setting. Results are shown in the Appendix (Table A.3). Aid is found to be exogenous (last row of Table A.3) and the squared coefficient of bilateral aid reinforces the effect of aid.

Finally, in order to account for possible heterogeneity of the estimated coefficients across donors, we estimated separated regressions for each donor. Table 6 shows the results for the FGLS-Mundlak estimator. The effects of bilateral aid on exports vary among donors, with Norway, Canada, France, Austria, and Australia showing the greatest effects. It was also found that for six countries—Ireland, Greece, New Zealand, the Netherlands, Belgium, and Finland—such effect is not statistically significant. Greece and Ireland began giving aid in the 1990s and so the number of observations for them is lower than that for other donors.

Table 6: Development Aid and Donors' Exports—Results for Each Donor

Table 7 presents the monetary return on aid from single donors' exports. One US dollar spent on aid generates more than one dollar of exports for Australia, Austria, Canada, France, Norway, Spain, and Sweden. The highest return is found for Norway.

Table 7: Return On Aid from Donors' Exports

We also run single-donor regressions using alternative estimators. According to the results of the two-way FE within estimator[5], the average effect, calculated as the average of the estimated coefficients in single donor regressions, is similar to the one found using alternative estimators and is close to the average effect obtained in Model 6 (Table 2). A

[5] Results are available upon request from the authors.

dynamic specification, with lagged exports added as explanatory variable, was also estimated, but in half of the cases, the coefficient of lagged exports was not statistically significant[6].

In summary, our results indicate that in the short term, the average return on aid for donors' exports is approximately a $0.80 US dollar increase in exports for every aid dollar spent, whereas in the long run, this number is even larger. According to the results obtained from the dynamic model, the long run average return on aid for donors' exports is around $ 2.15 US-dollar increase in exports for every aid dollar spent. A battery of robustness check support this result and competing specifications (panel-GLM, Helpman et al. model) indicate that this estimate is conservative.

If all donors will follow the Millennium Development Goals' recommendations and spend 0.07 percent of their GDP on developmental aid, they will achieve two goals: first, they can increase their export levels, and second, they will contribute to the economic development of poor countries and to the improvement in the living conditions of the most impoverished citizens.

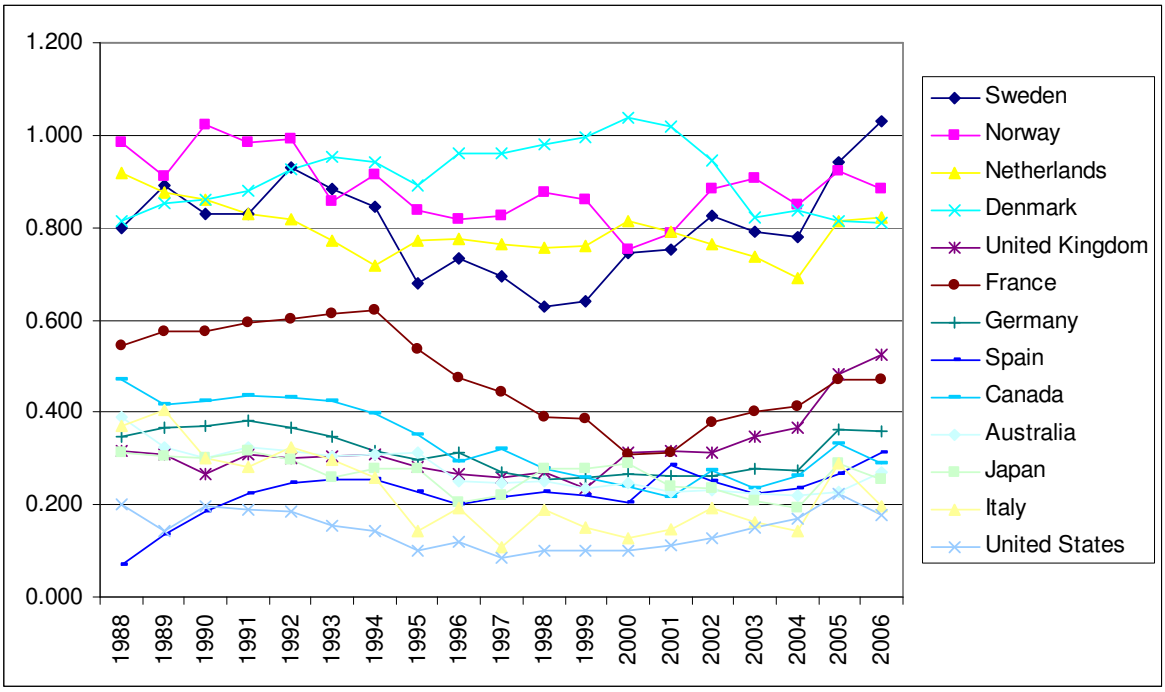
5. Conclusions

The purpose of this paper is to analyze the effects of development aid on donors' exports. The study period runs from 1988 to 2004. The main results can be summarized as follows. First, donors' bilateral aid has positively affected their exports to developing countries. The results point to large beneficial effects of bilateral aid upon donor's exports and to non-negligible effects of imputed multilateral aid in the short term. Second, the effects of bilateral aid on exports vary among donors, with Austria, Australia, Canada, France and Norway showing the greatest positive effects. Third, a particular donor's export levels to aid recipients are not, as was previously found in the

[6] Results are available upon request from the authors.

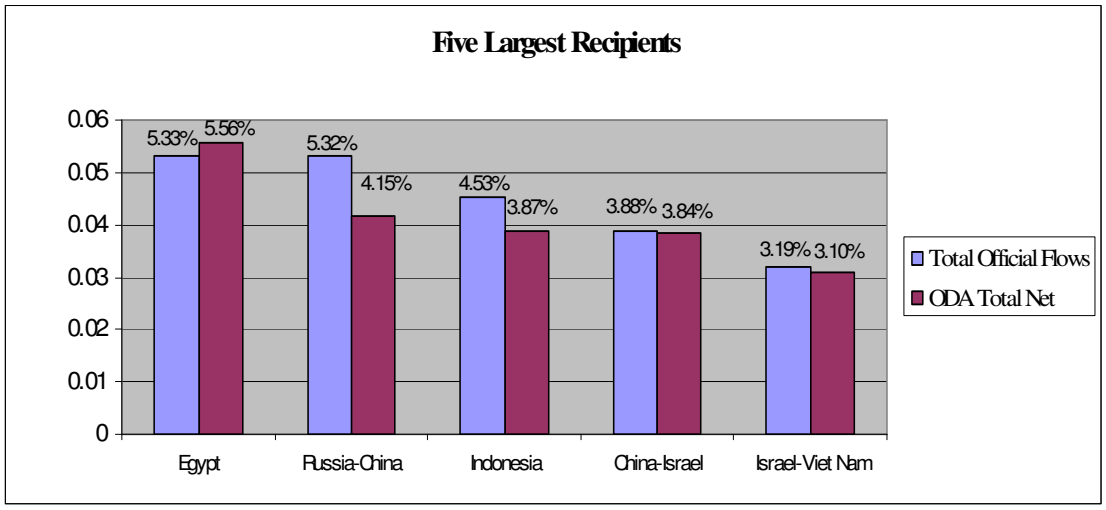
literature, negatively affected if other donors increase their aid. Fourth, and finally, the effects of aid on donors' exports do not appear to have grown over the period studied.

Figure 1. ***Donors ODA-to-GDP ratio (1988-2006)***



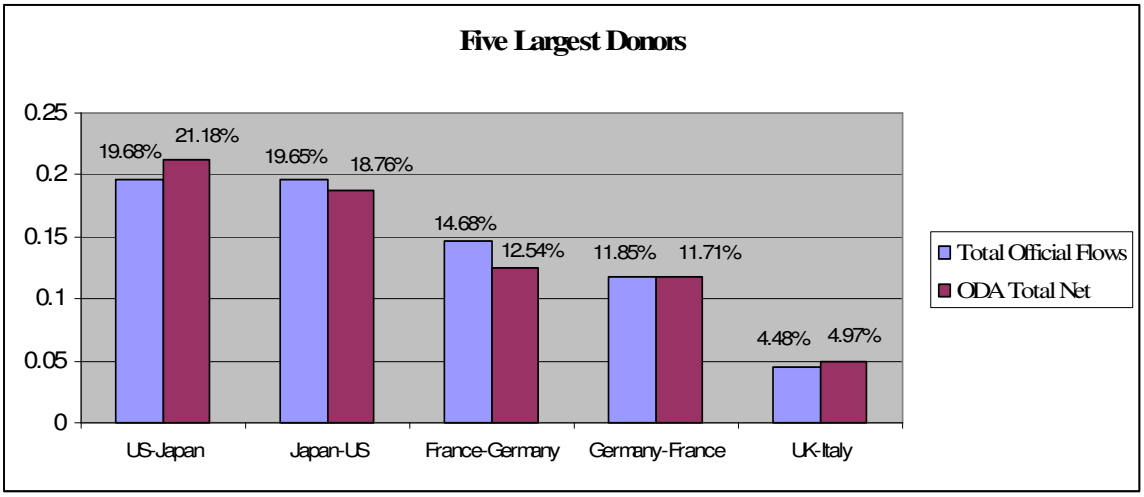
Source: OECD International Development Statistics (IDS) online databases on aid.

Figure 2. Five Largest Recipients



Source: OECD International Development Statistics (IDS) online databases on aid.

Figure 3. Five largest donors



Source: OECD International Development Statistics (IDS) online databases on aid.

Table 1. Summary statistics

VARIABLE	Obs.	Mean	Std. Dev.	Min.	Max.
LXDON	37336	16.154	2.882	3.912	25.511
LYD	47124	26.671	1.293	24.307	30.086
LYR	39606	23.693	1.831	19.260	29.665
LYHD	47124	9.985	0.273	9.185	10.589
LYHR	39606	7.917	0.929	5.956	10.102
LD	46030	8.341	0.579	5.158	9.376
LODAGD	34696	0.667	2.468	-4.605	9.326
LAMULTI	41036	-0.268	2.026	-4.605	6.705

VARIABLE	Obs.	Mean	Std. Dev.	Min.	Max.
XDON1000	37336	243336.9	1984338	0.05	1.20E+08
YD1000	47124	9.76E+08	1.79E+09	3.60E+07	1.17E+10
YR1000	39606	1.22E+08	4.56E+08	231408.6	7.64E+09
YHD1000	47124	22.50278	5.933512	9.747	39.676
YHR1000	39606	4.155313	4.047395	0.386	24.382
D	46030	4829.588	2344.654	173.826	11796.54
ODAGD1000	34784	20628.56	115763.2	-63440	1.12E+07
AMULTI1000	47124	3618.673	12334.67	-55340	816630

Note: The period considered is 1988-2004. L indicates natural logarithms and 1000 indicates thousand US$; XDON denotes bilateral donors' exports at current prices, YD and YR are donors' and recipients' GDPs, respectively; YHD and YHR and are donors' and recipients' GDPs per capita, respectively; LD is distance; ODAGD is gross bilateral aid from donor *i* to country *j*; and AMULTI is imputed multilateral aid to country *j*.

Table 2: Development aid and donors' exports—linear models

	OLS ,t	OLS, t	RE, t	Fe, t	Mundlak, t	Mundlak, Het. Ar(1)
	m1	**m2**	**m3**	**m4**	**m5**	**m6**
LYD	0.839***	0.829***	0.882***	1.374*	1.351***	-0.894***
	73.273	65.776	31.623	2.249	3.998	-3.478
LYR	0.846***	0.859***	0.807***	-0.476	-0.292*	-0.136
	108.769	104.221	43.947	-1.855	-2.165	-0.959
LYHD	0.008	-0.477***	-0.393***	-0.984	-1.011**	0.577*
	0.094	-4.976	-4.181	-1.456	-2.667	2.094
LYHR	0.537***	0.500***	0.657***	1.671***	1.656***	1.600***
	30.287	25.67	19.683	6.884	12.524	10.627
LD	-1.087***	-1.077***	-1.155***		-1.195***	-1.034***
	-65.354	-61.393	-21.103		-21.520	-69.80
LODAGDJ	-0.052***	-0.064***	0.045***	0.071***	0.049***	0.022***
	-4.542	-5.241	3.619	4.022	3.918	3.323
LODAGD	0.190***	0.064***	0.054***	0.048***	0.047***	0.041***
	34.620	5.637	9.185	6.755	7.962	12.019
LODAGD(-1)		0.048***	0.020***	0.016**	0.015*	0.019***
		3.873	3.295	2.603	2.426	5.346
LODAGD(-2)		0.087***	0.014*	0.007	0.007	0.008*
		8.118	2.538	1.059	1.336	2.342
LAMULTI	-0.056***	-0.042**	0.019*	0.023**	0.021**	0.032***
	-6.324	-3.053	2.422	2.723	2.658	7.515
LAMULTI(-1)		-0.037**	0.022**	0.018*	0.023**	0.022***
		-2.666	2.852	2.289	2.947	5.336
LEXCHR	0	0.001	0.003	0.003	0.002	0.001
	0.087	0.139	0.777	0.374	0.614	0.156
CONTIG	-0.476*	-0.638**	-0.772		-0.599	-0.331
	-2.29	-2.99	-0.954		-0.745	-1.597
COMLANG	0.219***	0.169***	0.256**		0.181	0.177***
	6.868	5.062	2.750		1.940	5.641
COLONY	0.794***	0.744***	0.922***		0.807***	0.714***
	18.979	17.196	6.318		5.435	19.462
AVLYD					-0.412	1.758***
					-1.212	6.833
AVLYR					1.150***	0.942***
					8.406	6.655
AVLYHD					1.757***	-0.152
					3.868	-0.523
AVLYHR					-1.213***	-1.218***
					-8.300	-8.000
AVLODAGD					0.161***	0.151***
					7.784	16.012
AVLAMULTI					-0.254***	-0.265***
					-6.289	-18.495
AVLEXCHR					0.021	0.007
					0.574	0.570
R-SQUARED	0.76	0.772	0.142	0.762	0.768	
N	18877	15556	15556	15732	15556	15493
RMSE	1.2134	1.153	0.566	0.537	0.563	
RESET	0.000	0.000	0.518	0.251	0.107	0.260

Note: The dependent variable is bilateral exports at current prices; LYD and LYR are donors' and recipients' GDPs, respectively; LYHD and LYHR are donors' and recipients' GDPs per capita, respectively; LD is distance;

LODAGDK is gross bilateral aid from other donors (different from i) to country j; LODAGD is gross bilateral aid from donor i to country j; and LAMULTI is imputed multilateral aid to country j. LEXCHR is the bilateral exchange rate at current prices; CONTIG, COMLANG, COLONY, COL45, and SMCTRY are dummies that take the value 1 when countries share a border and a language, have a colonial relationship, and had a colonial relationship before 1945, and when i and j were part of the same country in the past, respectively. Av denotes average values of the respective variables. t-statistics are reported.

Table 3. Linear model results with well-specified multilateral resistance terms

With exporter-and-time and importer-and-time multilateral resistance terms and dyadic fixed effects			
Period	**1988-1994**	**1995-1999**	**2000-2004**
	m1	**m2**	**m3**
LODAGD	0.039***	0.025**	0.037**
	3.402	1.980	2.900
LODAGD (-1)	0.026**	0.035**	0.021*
	2.231	2.789	1.654
LODAGD (-2)	0.003	-	-
	0.252	-	-
LAMULTI	0.0200	0.032	0.014
	0.79	1.406	0.486
LAMULTI (-1)	0.029	0.053**	0.043
	1.071	2.177	1.552
LEXCHR	0.014	0.008	-0.056*
	1.278	0.299	-2.54
CONSTANT	16.513***	16.697***	16.712***
	212.776	130.605	166.262
R-SQUARED	0.113	0.115	0.071
NOBS	5128	5130	5212
Log-Lik.	-2837.586	-2644.623	-2953.799
RMSE	0.513	0.504	0.531

Note: The dependent variable is bilateral exports at current prices, LODAGD is gross bilateral aid from donor i to country j, and LAMULTI is imputed multilateral aid to country j. LEXCHR is the bilateral exchange rate at current prices. t-statistics are reported. The variable representing aid from other donors is different from that for donor i (LODAGDj), and was non-significant in all the regressions.

Table 4. Heckman selection model and heterogeneous firms' model estimations

Models:	**Heckman two step model**		**Helpman et al two step model**	
	First step: Probit-RE	**Second step FGLS-het,psar(1)**	**First step: Probit-re**	**Second step: FGLS-het,psar(1)**
	xdon	**lxdon**	**xdon**	**lxdon**
LYD	15.740***	1.072*	-0.111	0.871***
	9.762	2.141	-1.125	103.159
LYR	0.366	-0.687***	0.491***	0.838***
	0.551	-3.506	7.424	142.226
LYHD	-15.266***	-1.200*	2.501***	-0.292***
	-8.614	-2.135	5.451	-4.873
LYHR	1.792**	2.065***	0.114	0.589***
	2.770	10.8	0.854	49.179
LD	-0.221*	-1.463***	-0.476**	-0.999***
	-1.973	-54.233	-2.664	-77.693
LODAGDJ	-0.329***	-0.040*	-0.188**	0.009
	-5.01	-2.22	-3.076	1.629
LODAGD	-0.062*	0.085***	-0.083**	0.059***
	-2.11	10.565	-2.608	26.514
LODAGD (-1)	-0.082**	0.041***	-0.088**	0.048***
	-2.627	4.63	-2.692	22.049
LODAGD (-2)	0.064*	0.043***	0.049	0.032***
	2.228	5.577	1.626	13.932
LAMULTI	-0.054	0.017	-0.082	0.002
	-1.298	1.544	-1.901	0.594
LAMULTI (-1)	-0.007	0.013	-0.008	-0.003
	-0.16	1.161	-0.2	-0.896
LEXCHR	-0.005	-0.009	-0.018	-0.002
	-0.262	-1.575	-0.899	-0.975
CONTIG	3.869	1.055***	28.889	-0.395*
	.	4.326	0	-2.313
COMLANG	0.146	0.157***	0.352	0.161***
	1.384	5.743	1.331	6.787
COLONY	0.352		0.868	
	1.614		1.367	
CONSTANT	-285.863	18.838*	-23.673***	-20.032***
	.	2.068	-4.339	-30.135
NOBS	19000	15493	19000	15493
MILLS		0.215**	**ZHAT4**	0.003
		2.828		1.616
			INVMILLS1	-0.031
				-1.512

Note: The dependent variable is bilateral exports at current prices; LYD and LYR are donors' and recipients' GDPs, respectively; LYHD and LYHR are donors' and recipients' GDPs per capita, respectively; LD is distance; LODAGDK is gross bilateral aid from other donors (different from i) to country j; LODAGD is gross bilateral aid from donor i to country j; and LAMULTI is imputed multilateral aid to country j. LEXCHR is the bilateral exchange rate at current price; CONTIG, COMLANG, COLONY, COL45, and SMCTRY are dummies that take the value 1 when countries share a border and a language, have a colonial relationship, and had a colonial relationship before 1945, and when i and j were part of the same country in the past, respectively. t-statistics are reported.

Table 5. Dynamic Specifications

	Difference GMM		System GMM	
	1988-1996	**1997-2004**	**1988-1996**	**1997-2004**
LXDON(-1)	0.173*	0.214***	0.758***	0.621***
	2.498	4.361	7.149	8.032
LYD	0.752	-0.483	0.187*	0.322***
	0.355	-0.675	2.131	4.442
LYR	-0.097	0.436	0.196*	0.331***
	-0.209	0.914	2.264	4.821
LYHD	0.208	0.784	-0.127	-0.037
	0.097	1.051	-1.019	-0.284
LYHR	0.754	0.849	0.141*	0.208***
	1.563	1.907	2.445	4.136
LODAGD	0.050***	0.031***	0.057**	0.049***
	5.118	3.930	2.750	4.414
LODAGDJ	0.072**	-0.006	0.002	-0.036*
	3.004	-0.275	0.127	-2.071
LAMULTI	0.009	0.019	-0.004	-0.004
	0.723	1.764	-0.349	-0.42
LAMULTI (-1)	-0.018*	0.023*	-0.034***	-0.002
	-2.193	2.378	-3.745	-0.17
LEXCHR	0.003	0.006	0.002	0.008
	0.257	0.378	0.308	0.642
LD			-0.264*	-0.406***
			-2.174	-5.054
COMLANG			0.01	0.130*
			0.19	2.106
COLONY			0.203	0.268**
			1.66	2.676
CONTIG				-1.40E-01
				-0.381
CONS			-3.249	-8.046**
			-1.283	-3.178
AR1	-6.25	-9.139	-7.057	-8.144
AR2	0.449	1.612	2.031	2.712
AR1(P)	0.000	0.000	0.000	0.000
AR2(P)	0.653	0.107	0.042	0.007
HANSEN	29.376	39.221	29.221	51.040
HANSEN (P)	0.343	0.148	0.255	0.094
NUMBER OF INSTRUMENTS	44	49	46	62
LODAGD--Long Run Coeff.	0.060	0.039	0.236	0.129

Note: The dependent variable is bilateral exports at current prices; LYD and LYR are donors' and recipients' GDPs, respectively; LYHD and LYHR are donors' and recipients' GDPs per capita, respectively; LD is distance, LODAGDK is gross bilateral aid from other donors (different from i) to country j; LODAGD is gross bilateral aid from donor i to country j; and LAMULTI is imputed multilateral aid to country j. LEXCHR is the bilateral exchange rate at current prices, CONTIG, COMLANG, and COLONY are dummies that take the value 1 when countries share a border or language or have a colonial relationship, respectively. t-statistics are reported.

Table 6. Development aid and donors' exports–results for each donor. (Mundlack approach)

	LODAGD		LODAGD (-1)		LAMULTI		LAMULTI (-1)		AVLODAGD	
Austria	0.059**	2.818	0.042**	2.12	-0.024	-1.004	0.041*	1.78	-0.071*	-1.891
Belgium	0.016	1.155	0.003	0.209	0.004	0.188	0.023	1.116	0.047	1.356
Denmark	0.038**	2.63	-0.004	-0.248	0.141***	3.745	0.036	1.501	0.147***	4.561
Finland	0.016	0.781	0.029	1.358	-0.001	-0.02	0.015	0.396	0.001	0.018
France	0.074***	3.831	0.033*	1.678	0.018	1.236	0.004	0.312	0.519***	14.284
Germany	0.031*	1.93	0.013	0.853	0.036**	2.837	0.01	0.784	0.240***	5.819
Greece	0.033	0.961	-0.017	-0.527	0.056	1.325	0.081*	1.735	0.429***	5.841
Ireland	-0.015	-0.457	-0.027	-0.909	0.012	0.273	0.037	0.924	0.117*	1.714
Italy	0.022**	3.265	0.019**	2.871	0.027**	2.125	0.015	1.363	0.169***	6.334
Netherl	0.013	1.202	-0.002	-0.16	0.027	1.166	-0.014	-1.016	0.001	0.042
Portugal	0.056*	1.873	0.01	0.303	0.072	1.446	0.041	0.882	0.606***	9.569
Spain	0.050***	4.283	0.042***	3.78	-0.002	-0.121	0.003	0.149	0.168***	6.206
Sweden	0.049**	3.167	0.039**	2.662	0.025	0.932	0.007	0.32	0.04	1.151
UK	0.030**	2.965	0.025*	2.344	0.034**	2.744	0.015	1.183	0.318***	10.343
Norway	0.124***	4.055	0.059*	1.989	-0.037	-0.664	0.028	0.71	-0.068	-1.246
Switzerland	0.032**	2.784	0.01	0.853	0.014	0.773	0.006	0.371	-0.095**	-3.152
Australia	0.095***	3.49	0.022	0.803	-0.021	-1.09	0.024	1.046	0.157*	2.235
Japan	0.053***	4.058	0.019	1.455	0.019*	1.675	0.018	1.469	-0.454***	-8.437
NewZealand	-0.018	-0.411	-0.02	-0.477	0.057	1.182	-0.025	-0.69	-0.187	-1.411
Canada	0.094***	3.91	-0.004	-0.171	0.050**	2.33	0.027	1.099	-0.499***	-7.472
US	0.02*	1.92	0.009	0.78	0.008	0.666	0	0.02	0.167***	6.204
Average Coeff	0.041		0.013		0.027		0.018		0.091	

Note: The dependent variable is bilateral exports at current prices, LODAGD is gross bilateral aid from donor i to country j, and LAMULTI is imputed multilateral aid to country j. AVLODAGD is average aid. t-statistics are reported next to the estimated coefficients.

Table 7. Return on aid from donors' exports (Mundlack aproach)

Donors	LODAGD	LODAGD (-1)	Return $1 US Aid in $X	
Norway	0.124	0.059	2.937	
France	0.074	0.033	1.717	
Austria	0.059	0.042	1.621	
Australia	0.095	0.022	1.525	
Canada	0.094	-0.004	1.509	
Spain	0.050	0.042	1.476	
Sweden	0.049	0.039	1.412	
Portugal	0.056	0.010	0.899	
UK	0.030	0.025	0.883	
Japan	0.053	0.019	0.851	
Italy	0.022	0.019	0.658	
Denmark	0.038	-0.004	0.610	
Switzerland	0.032	0.010	0.514	
Germany	0.031	0.013	0.498	
US	0.020	0.009	0.321	
Belgium	0.016	0.003	0.257	ns
Finland	0.016	0.029	0.257	ns
Greece	0.033	-0.017	0.530	ns
Netherlands	0.013	-0.002	0.209	ns
New Zealand	-0.018	-0.020	-0.610	ns
Ireland	-0.015	-0.027	-0.674	ns

Note: LODAGD is gross bilateral aid from donor i to country j. The return on aid is calculated using the results from Table 6 and taking into account only the estimates that are significant at the 1, 5 or 10% level.

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Appendix

A.1. List of Countries

List of Recipients (j)	132			List of Donors (i)	21
Afghanistan	Congo, Dem. Rep.	Jamaica	Peru	Australia	
Albania	Congo, Rep.	Jordan	Philippines	Austria	
Algeria	Costa Rica	Kazakstan	Qatar	Belgium	
Angola	Cote d'Ivoire	Kenya	Rwanda	Canada	
Argentina	Croatia	Kiribati	Samoa	Denmark	
Armenia	Cuba	Korea	Saudi Arabia	Finland	
Aruba	Djibouti	Kuwait	Senegal	France	
Azerbaijan	Dominica	Laos Dem. Rep.	Seychelles	Germany	
Bahamas	Dominican Republic	Lebanon	Sierra Leone	Greece	
Bahrain	Ecuador	Lesotho	Somalia	Ireland	
Bangladesh	Egypt	Liberia	South Africa	Italy	
Barbados	El Salvador	Libya	Sri Lanka	Japan	
Belarus	Eritrea	Madagascar	Sudan	Netherlands	
Belize	Estonia	Malawi	Suriname	New Zealand	
Benin	Ethiopia	Malaysia	Swaziland	Norway	
Bermuda	Fiji	Mali	Syria	Portugal	
Bhutan	Gabon	Mauritania	Taiwan	Spain	
Bolivia	Gambia	Mauritius	Tanzania	Sweden	
Bosnia and Herzegovina	Georgia	Mexico	Thailand	Switzerland	
Botswana	Ghana	Moldova	Timor-Leste	United States	
Brazil	Grenada	Mongolia	Togo	United Kingdom	
Brunei	Guatemala	Morocco	Tonga		
Burkina Faso	Guinea	Mozambique	Trinidad and Tobago		
Burundi	Guinea-Bissau	Myanmar	Tunisia		
Cambodia	Guyana	Namibia	Turkey		
Cameroon	Haiti	Nepal	Uganda		
Cape Verde	Honduras	Nicaragua	United Arab Emirates		
Central African Republic	Hungary	Niger	Uruguay		
Chad	India	Nigeria	Venezuela		
Chile	Indonesia	Oman	Vietnam		
China	Iran	Pakistan	Yemen		
Colombia	Iraq	Panama	Zambia		
Comoros	Israel	Paraguay	Zimbabwe		

A.2. Generalized Linear Models

Models:	Panel Generalized linear models		
	RE-Gamma	RE-Poisson	RE-NLS
	xdon	xdon	xdon
LYD	0.796***	0.770***	0.511***
	15.669	17.726	6.294
LYR	0.866***	0.703***	0.507***
	34.41	20.26	11.562
LYHD	-0.659*	0.378	1.151
	-2.319	1.181	1.68
LYHR	0.326***	0.530***	1.129***
	5.893	6.102	5.503
LD	-0.956***	-0.875***	-0.756***
	-9.503	-13.71	-7.701
LODAGDJ	-0.108	-0.034	0.009
	-1.862	-0.629	0.101
LODAGD	0.038*	0.075**	0.274***
	2.261	2.81	5.235
LODAGD (-1)	0.060***	0.068***	0.096*
	4.042	5.228	2.419
LODAGD (-2)	0.087***	0.115***	0.083*
	6.268	7.482	2.194
LAMULTI	-0.055*	-0.081**	-0.057*
	-2.236	-3.057	-2.032
LAMULTI (-1)	-0.120**	-0.093***	-0.056*
	-2.901	-4.667	-2.326
LEXCHR	0.001	-0.003	0.013
	0.077	-0.14	0.392
CONTIG	-0.59	-0.361	-0.229
	-1.081	-1.43	-0.855
COMLANG	0.043	0.049	-0.094
	0.367	0.398	-0.425
COLONY	0.796***	0.245	0.036
	4.448	1.836	0.154
CONSTANT	-12.177**	-20.592***	-23.002***
	-3.138	-5.972	-3.443
NOBS	19000	19000	19000
MILLS	19175.65	2.69E+12	3.10E+21
DEVIANCE	1.009245	1.42E+08	1.63E+17
DISPERS	36.549	1.42E+08	42.475
AIC	-167710.6	2.69E+12	3.10E+21

Note: The dependent variable is bilateral exports at current prices; LYD and LYR are donors' and recipients' GDPs, respectively; LYHD and LYHR are donors' and recipients' GDPs per capita, respectively; LD is distance,; LODAGDK is gross bilateral aid from other donors (different from i) to country j; LODAGD is gross bilateral aid from donor i to country j; and LAMULTI is imputed multilateral aid to country j. LEXCHR is the bilateral exchange rate at current prices; CONTIG, COMLANG, COLONY, and SMCTRY are dummies that take the value 1 when countries share a border and a language, have a colonial relationship, and when i and j were part of the same country in the past, respectively. t-statistics are reported.

Table A.3. Development Aid and Donors' Exports—Instrumental Variables and Non-Linearities

	Instrumental variables	Non-linearities	GMM-dynamic	GMM-dyn non-linearities
LYD	1.205**	1.445***	0.211	0.280
	2.686	4.27	0.590	0.787
LYR	-0.422*	-0.497***	-0.006	-0.057
	-2.259	-3.632	-0.036	-0.362
LYHD	-0.981*	-1.040**	-0.091	-0.194
	-1.983	-2.74	-0.225	-0.490
LYHR	1.617***	1.690***	0.622***	0.615***
	9.033	12.72	3.673	3.781
LODAGDJ	0.062***	0.066***	0.033**	0.027*
	3.786	5.307	2.578	2.153
LEXCHR	-0.001	0.002	0	-0.003
	-0.219	0.512	-0.114	-0.892
LODAGD	0.099***	0.047***	0.036***	0.035***
	4.401	8.015	6.16	6.989
LODAGD (-1)		0.014*	-0.008	
		2.393	-1.246	
LODAGD (-2)		0.006	0	
		1.046	-0.023	
LODAGD^2		0.008***		0.005***
		5.766		3.821
LAMULTI	0.030***	0.023**	0.013	0.009
	3.759	2.940	1.811	1.353
LAMULTI (-1)		0.017*		
		2.259		
LXDON (-1)			0.531***	0.546***
			13.132	15.72
CONSTANT		-13.060*		
		-2.186		
R-SQUARED	0.043	0.113	0.13	0.134
N	14700	15732	14206	15678
LL	-11390.41	-12512.34	-10300.74	-12057.27
RMSE	0.551	0.563	0.526	0.550
HANSEN Test	0.032		0.004	0.380
HANSEN Prob.	0.858		0.949	0.538
Endogeneity Test	4.482			
Prob.	0.0342			

Note: The dependent variable is bilateral exports at current prices; LYD and LYR are donors' and recipients' GDPs, respectively; LYHD and LYHR are donors' and recipients' GDPs per capita, respectively; LD is distance; LODAGDK is gross bilateral aid from other donors (different from i) to country j; LODAGD is gross bilateral aid from donor i to country j; and LAMULTI is imputed multilateral aid to country j. LEXCHR is the bilateral exchange rate at current prices, CONTIG, COMLANG, COLONY, COL45, and SMCTRY are dummies that take the value 1 when countries share a border and language, have a colonial relationship, had a colonial relationship before 1945, and if i and j were part of the same country in the past, respectively. t-statistics are reported.