DOES GERMAN DEVELOPMENT AID PROMOTE GERMAN EXPORTS?

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Abstract

This paper uses a static and dynamic gravity model of trade to investigate the link between German development aid and exports from Germany to the recipient countries. The findings indicate that in the long run German aid is associated with an increase in exports of goods that is larger than the aid flow, with a point estimate of 140 percent of the aid given. In addition, the evolution of the estimated coefficients over time shows an effect that is consistently positive but which oscillates over time. Interestingly, after a decrease in the nineties, the estimated coefficients of the effect of aid on trade show a steady increase in the period between 2001 and 2005. The paper distinguishes among recipient countries and finds that the return on aid measured by German exports is higher for aid to countries considered "strategic aid recipients" by the German government. We also find some evidence that aid given by other EU members reduces German exports.

Key Words: F10; F35

JEL Classification: International Trade; Foreign Aid; Germany

1. INTRODUCTION

The United Nations Millennium Development Goals (MDG8) are to promote growth and to reduce poverty in developing countries. In support of this effort, MDG8 calls for a new partnership for development, encompassing the goal of providing higher levels of aid to countries committed to poverty reduction. In recent decades, a great deal of research effort has been devoted to investigating the effects of development assistance on the economic performance of the recipient countries (e.g., Burnside and Dollar, 2000; Hansen and Tarp, 2001) and to clarifying the recent debate on how aid can help increase the level of exports from developing countries, in line with the "aid for trade" concept (Morrissey, 2006).

Although promoting economic development is one of the main objectives of foreign-aid programs, the motivations for giving aid are diverse and include historical ties and political and strategic goals, as well as consideration of the economic interests of aid-giving countries (Alesina and Dollar, 2000).

Given that the economic interests of aid-giving countries play a role in aid allocation, it is surprising that only a few authors have investigated the economic effects of aid from a donor's perspective (McKinlay, 1978; McKinlay and Little, 1979; Berthélemy and Tichit, 2004 and Berthélemy, 2006). In particular, the question arises whether the official development assistance (ODA) promotes exports from donors to recipient countries (Nilsson, 1997; Wagner, 2003; Osei, Morrissey, and Lloyd, 2004). This question is of special interest to Germany since the German government is committed, according to EU plans, and in line with various international commitments, to increase its official development aid to 0.7 percent of GDP by 2015. In the late 1990s and early 2000s, German ODA was below 0.3 percent of GDP, rising to 0.37 percent (or about 9b. US$) in 2005. To reach the goal of 0.7 percent and accounting for economic growth in the interim will imply that German ODA must more than double in real terms in the next eight years.

A few studies have investigated the impact of aid on exports from the donor countries and generally found quite sizable effects. The study with the largest effect is by Vogler-Ludwig et al. (1999). Using data for the period 1976 through 1995 and simple ordinary least squares (OLS) panel regressions, the authors found that $1 spent on ODA increased exports by $4.3. The purpose of this paper is to address this issue more comprehensively by using a longer time horizon, a much larger country sample, a more comprehensive set of control variables, and more advanced panel econometric techniques than previous studies, as well as using a number of robustness checks and fixed effects for country groups and different time periods. We estimate a static and a dynamic gravity model of German exports to 138 recipients augmented with development aid for the period 1962 to 2005.

To summarize our main results, we find that the increase in exports flowing from German aid is somewhat more moderate: around $1.4 US increase of exports for every aid dollar spent which is lower than the estimates from previous studies. In addition, the effect is greater for developing countries which are target countries of the German Ministry of Development (so called "BMZ countries"), i.e., countries where German aid is given based on agreements between the German government and the recipient-country government.[1] The overall effect is remarkably robust but oscillates over time. It is always positive and has increased in recent years (after a decline in the 1990s). Interestingly, we find some evidence that aid from other EU countries displaces German exports (while presumably promoting exports from those countries) although that effect is not significant in our preferred specifications. .

Section 2 presents the theoretical background. Section 3 reviews the recent literature on trade and aid. Section 4 discusses the structure of German aid over time and across recipients. Section 5 presents the model specification, data sources and variables and main results. Finally, Section 6 presents the conclusions.

2. THEORETICAL BACKGROUND

In international trade theory researchers have long studied the welfare implications of bilateral transfers for donor and recipient countries. The first public discussion of this topic was the Keynes-Ohlin debate in relation to the paradoxical effects of German reparations (Keynes (1929a,1929b,1929c) and Ohlin (1929a,1929b)). Leontieff (1936) also raised the possibility of transfer paradoxes in that foreign aid can be donor-enriching and recipient-immiserizing; these effects arise due to terms-of-trade effects associated with the aid flows.

[1] Other developing countries also receive aid, but through different channels, such as funding from private foundations that receive support from the German government, government scholarships to students from these countries to study in Germany, and government support for German NGOs providing emergency assistance and other project support in that country. In these cases, the aid flow was not a result of German aid policy targeted to that particular country but rather an outcome of the policies and processes of these different programs.

Since then, the theoretical literature on transfer paradoxes has been extended to cover more general settings and the findings indicate that while such paradoxes can still occur under certain conditions, both donors and recipients can benefit from aid transfers (Gale, 1974; Brecher and Bhagwati, 1981, 1982; Bhagwati, Brecher, and Hatta, 1983, 1984). Bhagwati et al. (1984) present an early survey of this literature.

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 already considered the impact of aid on donor exports. They find 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 favour 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 Period Two loss is sufficiently high, making its present value smaller than the Period One gain.

In this paper we focus exclusively on the effect of aid on the donor's exports. With this aim and taking into account the above-mentioned theoretical considerations, we expect that, in the context of an intertemporal model of trade, development aid could lead to an increase in the donor's exports for several reasons. First, there might be an impact as a result of the fact that a considerable share of donor aid in the time period we analyze was previously tied to exports from the donor country. Up until the 1990s, approximately 50 percent of the donors' development aid was tied to exports. However, this number is much smaller today, and for the German case amounts to only 7 percent of development aid (Development

Assistance Committee, OECD (2008)). While tied aid is on the decline and now rarely given, it might have an effect. This "tied aid" effect would clearly be smaller than the amount of aid sent, as a considerable share of aid is spent paying local labor, funding technical assistance, and purchasing local supplies, and would thus not show up as exports from the donor country. Second, we hypothesize that there may be habit-formation effects in the sense that donor-funded exports for aid-related projects might increase the proclivity of recipient countries to buy goods from the donor, as discussed in the model of Djajic et al (2004). Such an effect would go beyond tied aid and might be much larger than the direct effect of tied aid. Third, we assume that the aid relationship promotes a trade relationship in the sense that it creates "goodwill" towards donor exporters and as donor countries might often combine aid missions and negotiations with trade missions, the aid relationship might "open the door" for donor exporters.

In order to evaluate the total effect that could arise out of tied aid, habit formation or goodwill effects of aid on exports empirically, we below apply a gravity model of trade as a basic framework. 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). 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.

3. EMPIRICAL LITERATURE ON AID AND TRADE

We now turn to the existing empirical literature on aid and trade. There is a vast literature on the determinants of aid allocation (e.g. McKinlay, 1978; McKinlay and Little, 1979; Maizels and Nissanke, 1984; Fleck and Kilby, 2006; Berthélemy and Tichit, 2004 and Berthélemy, 2006). With respect to the impact of trade on aid allocation, Berthélemy (2006) used bilateral exports as a percentage of the donor GDP as one of the proxies for "the self-interest-of-donor argument". The dependent variable is aid commitments rather than aid disbursements, because according to the author (and as discussed in the related literature) this variable reflects the donor decisions. They obtain a positive influence of trade linkages on aid allocation and identify three clusters of donors according to the estimated elasticity of aid to trade intensity: Altruistic, moderately egoistic and egoistic. Germany is classified in the middle group with an estimated elasticity of aid to exports of 0.29 which is significant at the one percent level. Since this literature indicates that the aid and trade link can also go from exports to development aid, we will need to deal with the simultaneity bias issue in the empirical section of the paper.

In the remainder of the literature review, in line with the focus of our study, we concentrate on the reverse causal link, i.e. from trade to aid flows. In recent years, a number of researchers have investigated the relationship between aid and bilateral trade flows from donors to recipients. Some of them focus on quantifying the impact of donors' aid on trade. Since in many cases aid was once contingent upon purchasing goods from the donor, tied aid may automatically create such export effects (Michaelowa, 1997).

The recent literature on the effect of aid on exports from donor countries has been divided. Most studies use the gravity model of trade as the empirical framework. Among those who found a positive effect of aid on trade was Nilsson (1997), who analyzed the link between aid and exports for European Union donors to 108 recipients. He estimated a static

specification of the gravity model for the period 1975 to 1992 (three-year averages) and found an elasticity of exports with respect to aid of 0.23 that translates into a $2.6 US increase of exports for each dollar of aid given. He also computed donors' specific elasticities, and for Germany the return on foreign aid was a $3.16 increase in exports for each dollar of aid given. Wagner (2003) also used a gravity model of trade to investigate the effect of aid on trade for twenty donors to 109 recipient countries for the years 1970 to 1990. He obtained elasticities of trade with respect to aid in the range of 0.062 (for fixed-effects (FE) specification) to 0.195 (for the pooled OLS). The estimated average return on donors' aid according to the OLS (FE) result was $2.29 in OLS ($0.73 in FE) of exports per dollar of aid. The author also obtained estimates using a non-linear model in order to decompose the direct and indirect effects of aid on trade. He found that the direct effect was only a 35-cent increase and much lower than the indirect effect (98 cents). In addition, he concluded that the effect of past aid on trade was positive although very small (18 cents) and for Germany the return on aid obtained with the non-linear model was 1.15$ of exports per dollar of aid.

In the second subset of the literature, we find some studies that deviate from the gravity model framework. A few authors studied the direction of the causality by using Granger causality tests. On the one hand, Arvin, Cater, and Choudhry (2000) examined the direction of the causality between untied assistance and exports using German data for the period 1973 to 1995. Their findings provide some support for the export-promotion hypothesis whereby untied aid disbursements generate goodwill for the donor. On the other hand, Lloyd, McGillivray, Morrissey, and Osei (2000) examined data on aid and trade flows for a sample of four European donors and 26 African recipients over the period from 1969 to 1995. Using Granger causality tests, they found evidence showing that trade Granger-caused aid in 14 percent of the country pairs, aid Granger-caused trade in 13 percent of the cases and bi-directional causality was found in 8 percent of the pairs. Further, they find that a more common link is that trade relations are a factor influencing donor allocation, rather than that

aid generates these trade relations. Along the same lines, Osei, Morrissey, and Lloyd (2004) extended the analysis to more countries and also found no evidence that aid generates trade when testing for the relationship between aid and trade for different subsamples, although donors providing a higher share of aid tend to trade more with the recipients. They conclude that donors appear to be concerned with relative aid and trade shares rather than absolute volumes. In the study here we consider a much larger sample of countries and use a panel-data approach which is particularly appropriate in situations when the number of cross-section observations is large and one is particularly interested in identifying an average effect.[2]

Our challenge and contribution in this paper is to consider dynamic effects of aid, as in the second strand of the literature, but relying on the gravity model of trade, as in the first strand of the literature. In addition, we will examine a longer time period, more recipient countries, more covariates, and a more advanced econometric framework, and will use extensive robustness checks.

4. THE VOLUME AND STRUCTURE OF GERMAN AID

The standard used to measure development funding is the Official Development Assistance as a percentage of Gross National Income (ODA/GNI ratio). The repository of official information on aid is the Development Assistance Committee (DAC) of the OECD. DAC used to distinguish between two types of recipient: part I (least developed (LDC), low and middle-income countries) and part II (transition and high-income) countries. Due to frequent changes in those lists, the DAC therefore decided in 2005 to revert to a single List of ODA Recipients, abolishing Part II.

[2] The time series approach by Lloyd et al. (2000) and Osei et al. (2004) is an alternative to the panel-data approach particularly when the number of cross-sections is smaller than the time dimension of the data. However, when the number of cross-section (recipient countries) is large and the main interest is to find out an average effect, a panel data approach could be more appropriate. See also Nowak-Lehmann et al (2008) for an analysis of the impact of German aid on exports using a time series approach.

Development aid has to satisfy three criteria to be classified as ODA. First, it has to be undertaken by official agencies. Second, the main objective of aid has to be the promotion of economic development, and third and finally, it has to have a grant element of at least 25 percent. It is worth noting that neither private aid given by non-governmental organizations nor military aid is considered part of ODA.

ODA is further classified into bilateral ODA (given directly by a donor country) and multilateral ODA (given by an international institution such as the World Bank or the United Nations). As with most studies on aid, we focus on bilateral ODA, but specifically, that given by Germany. We also consider the effect of bilateral ODA given by the EU members (excluding Germany). We do this to find out whether a specific bilateral aid relationship could also be affected by the bilateral aid relationships of other individual donor countries. In particular, we hypothesize that aid from other EU members might displace exports from Germany and thus have a negative effect.

How much does Germany spend on development? The German ODA-to-GNI ratio over the period from 1964 to 2005 varied between 0.47 percent in the early eighties and 0.26 percent in 1999. Aid flows increased in the late 1970s and decreased in the 1980s and 1990s. After 1999 aid flows started increasing again. In terms of relative importance, in the past three decades Germany has been among the five most important donors in terms of bilateral aid. According to OECD figures, German bilateral aid accounts for around 10 to 15 percent of total bilateral aid.

Concerning the geographical distribution, German aid is more evenly distributed among recipients than is aid from the other donors. A higher percentage is directed to Sub Saharan Africa, the Middle East, and North Africa, especially in the most recent years, whereas aid shares to Latin America and Asia show a decreasing trend.

5. SPECIFICATION AND ESTIMATION OF THE GRAVITY MODEL

5.1 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). 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 traditional gravity model is specified as

$$X_{ij} = \alpha_0 \; Y_i^{\alpha_1} Y_j^{\alpha_2} POP_i^{\alpha_3} POP_j^{\alpha_4} DIST_{ij}^{\alpha_5} F_{ij}^{\alpha_6} \; u_{ij}\,, \qquad (1)$$

where Y_i (Y_j) indicates the GDPs of the exporter (importer), POP_i (POP_j) are exporter (importer) populations, $DIST_{ij}$ is geographical distances between countries i and j, and F_{ij} denotes other factors impeding or facilitating trade (e.g., trade agreements, common language, or a common border).

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 German exports, we augment the traditional model with bilateral aid from Germany and other EU countries and also with exchange rates[3]. Usually the model is estimated in log-linear form. Taking logarithms in Equation 1, restricting the income and population coefficients to be equal ($\alpha_1 = \alpha_2$ and $\alpha_3 = \alpha_4$) and introducing time variation, the static specification of the gravity model is

[3] When the gravity model is estimated using panel data (with a time dimension), exchange rates are generally included as important determinants of bilateral trade flows over time.

$$LX_{jt} = \gamma_0 + \phi_t + \delta_j + \alpha_1 LYY_{Tt} + \alpha_3 LPOP_{Tt} + \alpha_5 LDIST_j + \alpha_6 LEXRN_{jt} + \\ + \alpha_7 LBAIDG_{jt} + \alpha_8 LEUAID_{jt} + \alpha_9 PTA_j + \alpha_{10} INDEP_{jt} + \alpha_{11} WTO_{jt} + \eta_{jt} \quad (2)$$

where:

L denotes variables in natural logs;

X_{jt} are the exports from Germany to country j in period t in current US$;

$LYY_{Tt}=ln(Y_{Gt} * Y_{jt})$, where Y_{Gt} and Y_{jt} indicates Germany's and the recipient's GDP, respectively, in period t at current PPP US$;

$LPOP_{Tt}=ln(POP_{Gt}*POP_{jt})$, where POP_{Gt} and POP_{jt} denotes the population of Germany and country j respectively, in period t in thousand inhabitants;

$DIST_{ij}$ is the great circle distance between Germany and country j;

$EXRN_{jt}$ is the nominal bilateral exchange rate in monetary units of the recipient currency per Euro;

$BAIDG_{jt}$ is bilateral official gross development aid from Germany to country j in current US$; and $EUAID_{jt}$ is EU official gross development aid by EU countries (except Germany) to country j in current US$;

The model includes dummy variables for African, Caribbean, and Pacific trading partners sharing preferential trade agreements with the EU (PTA), for independent countries (INDEP), and for countries belonging to the GATT/WTO (WTO); it is important to note that all these variables are time-varying as independence, membership in PTA and GATT/WTO trade agreements occurred during the time period studied for many countries. ϕ_t are specific time effects that control for omitted variables common to all trade flows but which vary over time. δ_j are importer effects that proxy for multilateral resistance factors. When these effects are included, the influence of the variables that vary only with the "j" dimension cannot be directly estimated. This is the case for distance; therefore its effect is subsumed in the country

dummies. Since the variable of interest is development aid, the income and population coefficients are restricted to be equal.

Considering that trade relations once established might last for a long time, it makes sense to consider that current export volumes also depend on past exports. Therefore, we estimate a dynamic version of Equation 2. In order to model dynamics, we consider the introduction of the Koyck geometric lag structure that includes the lagged dependent variable as an additional regressor. The main problems of this specification are related to the statistical difficulties caused by the combination of an endogenous regressor (lagged exports) and autocorrelated errors. As a result, the OLS estimates are biased and inconsistent (the coefficient of the lagged dependent variable is biased towards unity, whereas the remaining coefficients are biased towards zero).

Nevertheless, these difficulties can be overcome using more sophisticated estimation techniques that control for endogeneity of the explanatory variables and for autocorrelated errors. The dynamic specification is given by

$$\ln X_{jt} = \gamma'_0 + \phi'_t + \delta'_j + \lambda \ln X_{j,t-1} + \beta_1 LYY_{Tt} + \beta_2 LPOP_{Tt} + \\ + \beta_4 LEXRN_{jt} + \beta_5 LBAIDG_{jt} + \beta_6 LEUAID_{jt} + \varepsilon_{jt} \qquad (3)$$

where most of the variables are described above and $X_{j,t-1}$ is exports from Germany to country j in period t-1 in current US$.

According to equations 2 and 3 we are assuming that the relationship between German aid and German exports is linear. This is plausible upon inspection of a scatter plot between both variables (available upon request) and also given the small magnitude of the aid figures in comparison to the export figures. Specification tests also rejected the inclusion of a quadratic aid-term in the estimated equation.

As discussed above, there might be another endogeneity issue referring to aid being 'caused' by exports, rather than the reverse. This is an issue we will take up below, where we report on further robustness and specification checks using different methods.

5.2 Data sources and variables

Official Development Aid data are from the OECD Development Database on Aid from DAC Members. We consider gross ODA disbursements in current US$[4], 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. Bilateral exports are obtained from the UN COMTRADE database. Data on income and population variables are drawn from the World Bank (World Development Indicators 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 kilometres, latitudes and longitudes from the CIA World Fact Book.

5.3 Results

A static and a dynamic version of the model are estimated for data on German exports and development aid (ODA) to 138 recipient countries during the period from 1962 to 2005. Table 1 reports the main estimation results. The first and second column show the results obtained for the static model. Individual (country) effects (modelled as fixed) are included to control for unobservable heterogeneous effects across recipients. Those effects are also a proxy for the so-called "multilateral resistance" factors modelled by Anderson and Van Wincoop (2003). Time-fixed effects are also included to model specific unobservable time effects. We rely on the two-way FE estimates, since a Wald test indicates that the individual effects are jointly significant, while a Hausman test indicates that these effects are correlated

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

with the error term. Since our data consists on a time span of more than 40 years and a cross-section of 138 countries, we tested for the presence of autocorrelation and heteroskedasticity. The results of the Wooldridge test for autocorrelation in panel data and the 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 model is re-estimated with HAC (heteroskedastic and autocorrelated consistent standard errors) that are robust to autocorrelation and to heteroskedasticity. Column 2 reports the results for the two-way FE estimates with a common AR(1) term.

With respect to the variable of interest, bilateral aid, controlling for autocorrelation slightly decreases the magnitude of the estimated coefficient from 0.088 to 0.051. The estimated coefficient is always positive and significant, indicating that a one-percent increase in German aid raises German exports by 0.051 percent. The effect is small compared to that shown in previous studies that did not control for country and time effects, but still positive and significant. However, the estimated coefficient for the official gross development aid of other EU members is negative and statistically significant in the first specification, whereas it is not statistically significant when controlling for autocorrelation. This suggests that Germany does not benefit from aid given by other EU members and might actually be hurt by it. In fact, when other EU-countries give higher amounts of aid, the "goodwill" and "habit formation" factors mentioned above could promote those countries' exports generating an indirect negative effect on German exports.

Most of the other variables present the expected sign and are statistically significant. The explanatory power of the model is good, since the included variables explain approximately 70 percent of the variation of German exports. The coefficient of total income is positive and significant and slightly lower than the theoretical value of unity. The coefficient of total population is negative and statistically significant at the 5 percent level in the first specification without controlling for autocorrelation and heteroskedasticity. The same

holds for the coefficient of the bilateral exchange rate that has a negative coefficient that is only statistically significant when autocorrelation and heteroskedasticity are not controlled for. The negative sign indicates that depreciation of the Euro (a decrease in the exchange rate) with respect to the recipient currencies would, as to be expected, have a positive effect on German exports. The effect of distance could not be directly estimated in the two-way FE estimation. Since distance is constant over time, its effect is subsumed in the country dummies. The PTA dummy for membership in the preferential trade agreement with the EU is negative and significant indicating that Germany exports less to PTA participaiting countries than to the rest of the countries in the sample and the "independent state" dummy presents a positive sign and is significant in both estimations. While the preferential trade agreements might promote exports from these countries to the EU, they apparently do little to promote exports from Germany to these countries.

For comparison purposes, Equation 2 was also estimated on data of five-year averages, to reduce the effects of temporary shocks and to avoid cyclical effects. Two main differences are encountered with respect to the estimation for yearly data. First, the effect of German aid on German exports is considerably higher in magnitude than before (0.11). Second, the coefficients of populations, EU aid, and "independent state" dummy are no longer significant, according to the RE and FE estimates. Using the results in column 2, we find that, in static terms, the average return on aid for German exports is approximately a 0.64 US dollar increase in exports for every aid dollar spent. This average is calculated as

$$\beta_{LBAIDG} = \frac{\partial X}{\partial BAIDG} * \frac{BAIDG}{X} \Rightarrow \frac{\partial X}{\partial BAIDG} = \beta_{BAIDG} * \frac{X}{BAIDG} = 0.051 * \frac{229000}{18234} = 0.64$$

Columns 3 to 6 in Table 1 show the main estimation results obtained for the dynamic model (Equation 3). In general, the estimated parameter for lagged exports is always statistically significant and with the expected positive sign pointing towards the importance of

persistence in export flows. The short-term coefficients of the variables are smaller than the long-term coefficients and the latter are slightly higher than those obtained before (static model) with the signs remaining generally unchanged.

Column 3 presents the parameter estimates of the dynamic model with the variables in levels. Model 3 was estimated using 2SFGLS (two stages feasible generalised least squares) with fixed effects to control for the endogeneity of the lagged dependent variable and for heteroskedastic and autocorrelated in the error term. The Hausman test indicates that only the within estimator[5] is consistent, since the null hypothesis (orthogonality between the individual effects and the regressors) is rejected. In addition, the 2SFGLS within estimates are less precisely (higher standard errors), but consistently, estimated.

According to the above figure, the long-term average return on aid for German exports is a 1.4-dollar increase in exports for every aid dollar spent. Therefore, aid appears to be export-creating when dynamics are modelled and the magnitude of the effect is higher than the one obtained using the static model.

With respect to the other variables included in the model, the expected positive coefficient for income is obtained; Germany exports more to countries with higher incomes. Population in the recipient countries shows a negative coefficient which is only significant at ten percent level in the 2SFGLS results. Aid from other EU members shows, as in the static model, a negative effect; however, this effect is not significant when controlling for autocorrelation and for endogeneity of the lagged dependent variable.

Lagged aid was initially added to the list of explanatory variables, however, we found that the corresponding estimated parameter was not significant. A similar result was found by Wagner (2003), who stated in page 171: "The trade benefit appear to be limited almost entirely to the year that the donation is made". The reason for this could be that we, as well as Wagner, are using aid disbursements and it is the announcement of the policy decision (aid

[5] Although the Hausman tests point towards the inconsistency of the random-effects estimates (not reported), the coefficient estimates for bilateral aid are practically equal in magnitude and sign.

commitment) which is the factor primarily influencing future donor's exports, whereas the actual international transfer (disbursements) has an effect exclusively on present exports.

Next, in order to test for the stability of the estimated coefficients over time, equation 3 is estimated for eight different sub-periods. Although the first-differences GMM estimator suggested by Arellano and Bond (1991) has commonly been used in the literature of dynamic panel data estimations for short time spans, when data are highly persistent, as in the case of bilateral export flows, Blundell and Bond (1998) argued that this procedure can be improved by using the system GMM estimation, which supplements the equations in first differences with equations in levels; for the former, the instruments used are the lagged levels, and for the latter, the instruments are the lagged differences. Columns 4 to 6 in Table 1 show the results using system GMM for three subperiods. We keep the number of years in each period below eight because the number of instruments tends to explode upwards with time. The use of too many instruments, can over-fit endogenous variables and weaken the power of the Hansen test to detect over-identification. In the present case, the Hansen test does not reject the null hypothesis of validity of the instruments and the autocorrelation tests indicate that second-order autocorrelation is not present in the data. The results concerning bilateral aid indicate that the return on German aid was much lower in the late 1960s and in the 1970s (around 60 cents of exports for each dollar of aid) than in the early eighties (two dollars for each one dollar of aid) and it has been quite stable since 1986 onwards (around 1.5 dollars per dollar of aid). This result is reassuring and very similar to the average effect found for the whole sample using 2SFGLS ($1.4 per dollar of aid). These results also suggest that tied aid is not the most important driver of these export effects. While the export effects seem to have increased over time, tied aid was on the decline.

As a first robustness check, we estimated Equation 3 for different groups of countries in order to ascertain whether the effect of bilateral aid could vary among recipients. The groups we consider are countries where Germany has a formal aid relationship (BMZ countries),

countries where aid flows are the results of state support for NGOs and private foundations doing projects or emergency relief, scholarships and training programs for people from these countries (non-BMZ countries), countries that now belong to the group of states enjoying preferential access to the EU (ACP) least developed countries (LDC). Since we are interested in the within-country variation and in the average-long-term effect, the 2SFGLS with fixed effects provides the preferred estimates. The results are shown in Table 2. It is worth noting that the return for exports on German aid is markedly higher for BMZ countries ($2.33 of exports for each dollar of aid), in fact, it is almost twice the average effect for all countries. This is quite plausible as only in these countries we would expect the export-increasing effects. Also, for the group of non-BMZ countries the coefficient of bilateral aid is not statistically significant. Finally, the return for exports is relatively low for ACP countries (0.30), and even lower for least-developed countries, for which one dollar of aid generates only 19 cents of exports. These results indicate that what might have appeared to be differences in the variances of the disturbances across groups may well be due to heterogeneity associated with the coefficient vectors.[6]

A second robustness check consists on re-estimating the 2SFGLS fixed-effect model with time variant coefficients for the bilateral aid variable. Figure 1 shows the obtained estimates. The evolution of the estimated coefficients over time shows a positive long-term trend. Interestingly, after a decrease in the nineties, the estimated coefficients of the effect of aid on trade show a steady increase in the period between 2001 and 2005. Concerning the significance of the coefficients, in only in three short periods (1965 to 1972, 1980 to 1984, and 1996 to 2000) were they not significant. In order to control for the high variation of the bilateral aid coefficients over time, we also re-estimated the model, averaging the data over five-year periods. The time effects show a decreasing trend until 1985 and from then onward,

[6] This issue is also investigated in Nowak-Lehmann D. et al. (2008) where the time series variation of the data is exploited and the focus is exclusively on the German aid-trade relationship for BMZ countries, which seems to be more robust.

an increasing effect of bilateral German aid on German exports (the results are available upon request).

Previous studies found a larger effect of development aid on German exports. For example, we obtained a lower return on aid for German exports than Nilsson (1997) and Wagner (2003). On the one hand, Nilsson reported an average return on aid for exports of a roughly $2.6 increase in exports for every dollar spent, whereas in this study, the average return is around $1.5 (although larger for the BMZ countries). There are two explanations for the different results obtained. First, in Nilsson (1997), the period under study is from 1975 to 1992, whereas we considered the period from 1960 to 2005. The larger time span give rise to a lower average return on aid. In fact, the results from the regressions for different subperiods indicate that the return on aid was higher in the 1980s and early 1990s than it was for the early seventies and the late 1990s. Second, in Nilsson (1997), the data were converted to three-year averages of constant 1987 dollars and fixed effects were not included; only specific aid coefficients for donors and a trend were specified. On the other hand, the fixed effects results obtained by Wagner (2003) implied that exports derived from a dollar of aid amount to 73 cents for a sample of twenty donors, 108 recipients and 5 years (1970, 1975, 1980, 1985 and 1990). This result, in the context of a static gravity model, is close to ours (64 cents as reported in the last row of column 2 in Table 1 for the 2-Way FE model). However Wagner was not able to control for autocorrelation in the error term and our results show that controlling for it reduces the estimated elasticity. Wagner also reported the implied returns for all donors. For Germany the return on aid was estimated at 1.15$ of exports for each dollar of aid, but those estimates were based on a non-linear relationship without fixed effects.

Finally, we also considered the existence of reverse causation. Causation may run from exports to aid, as well, since a strong export performance may encourage the donor country to increase its level of aid to the recipient. A way to overcome this problem is to model German aid as an endogenous variable. Therefore, we also instrumented for

development aid in the 2SFGLS regression and in the GMM regressions using the lagged values of aid (in addition to instrumenting for the lagged dependent variables).[7] We then performed and endogeneity test. Under the null hypothesis that the specific endogenous regressor can actually be treated as exogenous, the test statistic is distributed as a chi^2 with one degree of freedom. The results of the tests are shown at the end of column 3 in Table 1 and indicate that its null that bilateral German aid may be treated as exogenous cannot be rejected.

As an alternative robustness check, we performed the pre-tests of Osei, Morrissey, and Lloyd, but using a general to specific approach. We specified a VAR model including all the "gravity variables" and in this context, we tested for cointegration in the full sample (138 countries). Pedroni's residual panel-cointegration test indicated cointegration, i.e. the null hypothesis of "no cointegration" could not be rejected in the majority of the cases. We also tested whether aid Granger causes exports using an error correction model. We found that aid Granger causes trade in the long run. Granger causality could not be observed for the short run. We also tested whether exports Granger cause aid. We found that exports do not Granger cause aid in the long run. Granger causality could only be observed for the short run (results are available upon request).[8] These robustness checks suggest that the results are quite robust and point indeed to the causality running from aid to exports.

6. CONCLUSIONS

There are three basic messages in this paper. First, German aid has a positive effect on German exports. Although the effect is not as large as predicted by previous studies, it is still relevant. Our findings indicate that the average return for exports on German aid is about a

[7] These results are not shown but available on request.

[8] For the second causality test and according to the literature on aid allocation, it would be more reasonable to use aid commitments instead of aid disbursements, but we stuck to this specification to compare it to our own results. See also Nowak-Lehmann et al. (2008) for a more detailed examination of the impact of aid on trade using time series approaches, including also Granger causality tests. The findings from that paper are remarkably similar to the results here, suggesting that the methods used do not drive the results.

1.4-dollar increase in exports for every dollar spent. Second, this effect differs among groups of recipients. The return on German aid for exports is much higher for developing countries which have a real aid relationship with Germany (BMZ countries). Third, there is some evidence that aid from other EU countries displace German exports, although that result is significant only in a few specifications.

This investigation and the related literature suggest that the impact of aid on trade depends on the specific pair of trading countries evaluated and on the type of aid given, and also that the impact can change over time. The relationship between trade and aid could be more closely analyzed by using more donor countries, focusing on country case studies, or using disaggregated aid data and sectoral trade data to have a more precise characterization of the direction of causality and the quantification of the effects. Further research would also be desirable on the interactions between development aid and the recipient's trade policy to investigate the existence of complementarities.

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Tables

Table 1. Effect of bilateral aid on German exports

Variables:	Static 2-Way FE	Static 2-Way FE-CAR(1)	Dynamic 2SFGLS with FE	Dynamic System GMM (1991-95)		Dynamic System GMM (1996-2000)	Dynamic System GMM (2001-05)
	(1)	(2)	(3)	(4)		(5)	(6)
LX(-1)	-	-	0.664		-0.0117	0.587	0.645
	-	-	15.994		-0.070	4.010	7.090
LYY	0.780	0.678	0.291		0.938	0.446	0.405
	19.108	16.012	6.515		5.570	2.500	3.840
LPOP	-0.279	0.010	-0.1		0.0754	-0.0863	-0.080
	-2.351	0.090	-1.079		0.66	-1.33	-1.41
LEXRN	-0.021	-0.019	0.005		-0.037	-0.008	-0.011
	-2.291	-1.367	0.682		-1.190	-0.670	-0.680
LBAIDG	0.088	0.051	0.037		0.165	0.0935	0.0780
	6.294	4.849	2.707		2.470	2.010	2.780
LEUAID	-0.026	-0.004	-0.007		-0.123	-0.056	-0.033
	-2.083	-0.289	-0.728		-1.680	-1.740	-0.900
PTA	-0.087	-0.085	-0.066				
	-2.074	-1.283	-1.967				
INDEP	1.068	1.699	1.221				
	3.187	7.194	4.825				
WTO	-0.048	0.072	-0.005				
	-1.424	1.400	-0.19				
CONSTANT	2.968	0.573			-10.79	-4.611	-4.557
	0.672	4.167			-4.850	-2.190	-3.390
Time Effects	Yes	Yes	Yes		Yes	Yes	Yes
LongRun Aid Coeff			0.11		0.163	0.226	0.220
Adj. R Sq.	0.695	0.585	0.766				
Nobs	3793	3662	3536		438	472	474
Wooldridge Test Autoc.	F(1,128)=19.424 Prob=0.00			**N Instr.**	18	18	18
LR Test Hetero.	$Chi^2(130)$=2321 Prob=0.00						
Return on Aid	**1.105**	**0.641**	**1.389**		**1.631**	**1.364**	**1.520**
Bhargaba et al.[(1)] DW			2.06	**Ar1**	-2.618**	-2.615**	-1.977
Log-Likelihood			-1752.038	**Ar2**	-0.447	-0.500	0.757
RMSE			0.405	**Hansen**	4.956	10.240	9.610
Hansen (Probability)			1.389 (0.239)	**Hansendf**	8	8	8
Endogeneity test (Probability)			1.260 (0.261)				

Note: The first two columns present estimations of the static model, columns 4 to 6 the dynamic model. Columns 2 and 3 control for autocorrelation and column 3 additionally, for the endogeneity of the lagged dependent variable. All the variables are in natural logarithms. The dependent variable is bilateral exports at current prices, LYY is the product of GDPs of Germany and recipient country j, LPOP is the product of populations of Germany and recipient country j, LBAIDG is gross bilateral German aid to country j, and LEUAID is aid of EU countries (except Germany) to country j. PTA denotes countries that are part of the preferential trade agreements with the EU, INDEP denotes independent states and WTO denotes members of GATT and WTO. CAR(1) denotes a common AR(1) term, that was added to the regressions in column (2). t-statistics reported. [(1)] Bhargaba et al. (1982) Durbin-Watson indicates that first order autocorrelation is not longer present.

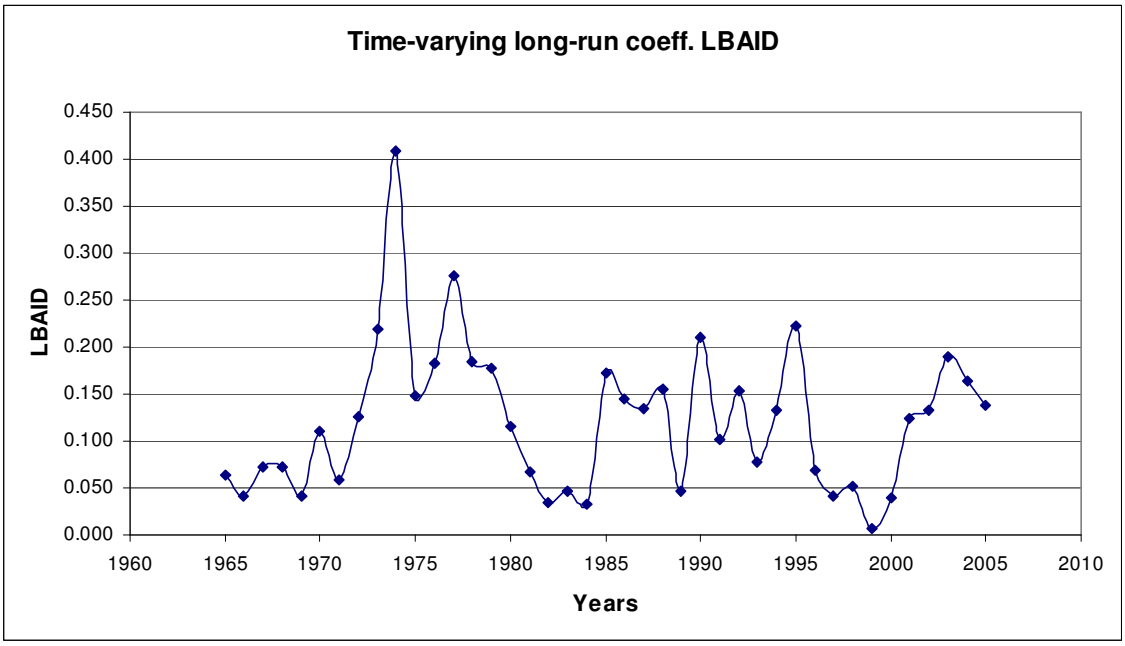
Table 2. Dynamic gravity model estimation results for sub-groups of countries

(Dynamic 2SFGLS with FE, Equation in levels, yearly data)

Variables	BMZ	Non_BMZ	LDC	ACP
LX(-1)	0.768	0.414	0.563	0.447
	23.176	3.648	7.2	4.173
LYY	0.218	0.449	0.257	0.295
	5.291	4.833	3.353	4.023
LPOP	-0.295	0.001	0.113	-0.083
	-2.516	0.003	0.4	-0.503
LEXRN	0.008	-0.001	-0.022	-0.018
	1.373	-0.039	-1.396	-1.232
LBAIDG	0.047	0.028	0.056	0.042
	4.099	1.146	2.618	2.101
LEUAID	-0.025	0.026	0.045	0.013
	-2.431	1.218	1.743	0.688
PTA	-0.02	-0.276	-0.167	0.041
	-0.567	-2.699	-1.956	0.422
INDEP		2.078		1.719
		4.048		3.842
WTO	0.02	-0.091	-0.138	-0.081
	0.851	-1.38	-2.293	-1.319
Time Effects	Yes	Yes	Yes	Yes
Long-Run Aid Coeff	0.203	0.048	0.128	0.076
Adj. R Sq.	0.862	0.549	0.563	0.551
Nobs	1926	1337	1187	1693
Log-Likelihood	-167.522	-1006.945	-748.412	-1046.267
Hansen test	3.172	1.316	1.354	4.955
Probability	0.529	0.859	0.852	0.292
Return on Aid	**2.328**	**1.020**	**0.191**	**0.296**

Note: The dependent variable is bilateral exports at current prices, LYY is the product of GDPs of Germany and recipient country j, LPOP is the product of populations of Germany and recipient country j, LEXCHRN is the bilateral exchange rate at current prices, LBAIDG is gross bilateral German aid to country j, and LEUAID is European Union aid to country j. PTA denotes countries that are part of the preferential trade agreements with the EU, INDEP denotes independent states and WTO denotes members of GATT and WTO. All the equations were estimated in levels. BMZ denotes Federal Ministry for Economic Cooperation and Development. t-statistics reported.

Figure 1. Estimates of time-varying coefficients for bilateral aid in the 2SFGLS fixed-effects model



Appendix. Country Classifications

BMZ		LDC	ACP	
Afghanistan	Mongolia	Afghanistan	Angola	Rwanda
Albania	Morocco	Angola	Antigua and Barbuda	Samoa
Algeria	Mozambique	Bangladesh	Barbados	Sao Tome and Principe
Armenia	Myanmar	Benin	Belize	Senegal
Azerbaijan	Namibia	Bhutan	Benin	Seychelles
Bangladesh	Nepal	Burkina Faso	Botswana	Sierra Leone
Belarus	Nicaragua	Burundi	Burkina Faso	Solomon Islands
Benin	Niger	Cambodia	Cape Verde	Somalia
Bolivia	Nigeria	Cape Verde	Central African Republic	South Africa
Bosnia-Herzegovina	Pakistan	Central African Republic	Chad	St. Kitts and Nevis
Brazil	Paraguay	Chad	Comoros	St. Lucia
Burkina Faso	Peru	Comoros	Congo, Dem. Rep.	St. Vincent and the Grenadines
Burundi	Philippines	Congo, Dem. Rep.	Congo, Rep.	Sudan
Cambodia	Rwanda	Djibouti	Cote d'Ivoire	Suriname
Cameroon	Senegal	Equatorial Guinea	Cuba	Swaziland
Chad	Serbia and Montenegro	Eritrea	Djibouti	Tanzania
Chile	South Africa	Ethiopia	Dominica	Timor-Leste
China	Sri Lanka	Gambia	Dominican Republic	Togo
Colombia	Sudan	Guinea	Equatorial Guinea	Tonga
Congo, Dem. Rep.	Syria	Guinea-Bissau	Eritrea	Trinidad and Tobago
Costa Rica	Tajikistan	Haiti	Ethiopia	Uganda
Croatia	Tanzania	Kiribati	Fiji	Vanuatu
Dominican Republic	Thailand	Laos	Gabon	Zambia
Ecuador	Tunisia	Lesotho	Gambia	Zimbabwe
Egypt	Turkey	Liberia	Ghana	
El Salvador	Uganda	Madagascar	Grenada	
Eritrea	Ukraine	Malawi	Guinea	
Ethiopia	Vietnam	Maldives	Guinea-Bissau	
Georgia	Zambia	Mali	Guyana	
Ghana		Mauritania	Haiti	
Guatemala		Mozambique	Jamaica	
Honduras		Myanmar	Kenya	
India		Nepal	Kiribati	
Indonesia		Niger	Lesotho	
Iran		Rwanda	Liberia	
Jordan		Samoa	Madagascar	
Kazakhstan		Sao Tome and Principe	Malawi	
Kenya		Senegal	Mali	
Kyrgyz Republic		Sierra Leone	Marshall Islands	
Laos		Solomon Islands	Mauritania	
Lebanon		Somalia	Mauritius	
Lesotho		Tanzania	Micronesia	
Madagascar		Timor-Leste	Mozambique	
Malawi		Togo	Namibia	
Mali		Uganda	Niger	
Mauritania		Vanuatu	Nigeria	
Mexico		Yemen	Palau	
Moldova		Zambia	Papua New Guinea	