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Aid and Trade from a Donor's Perspective

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Abstract

Aid is given for various purposes. Its impact on donors' exports usually depends on whether it is given for altruistic reasons (to overcome human tragedies and disasters) or in an understanding to promote development (to finance infrastructure or social projects). As to humanitarian aid the impact of aid on donors' exports will be most probably lower than in the latter case where related and unrelated imports for realizing development projects have been explicitly or implicitly agreed upon. Germany is known to be a country that ranks below average in tying its aid among the EU countries. Nonetheless there have been studies that found an extremely high positive impact of German bilateral aid on German exports. This finding will be re-examined in this study. An augmented gravity model is utilized to evaluate the impact of German bilateral aid on German exports. Stochastic and deterministic trends in the series are controlled to avoid spurious regression results.

Keywords: bilateral aid, donors' exports, time series properties of panel data, ECM and DOLS estimation in a panel context

JEL: F14, F35, C 23

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Aid and Trade from a Donor's Perspective

1. Introduction

The primary objective of German bilateral aid is to contribute to overcome worldwide poverty, underdevelopment and distress. Nonetheless, German development agencies and the German taxpayer are interested in learning about the impact of aid on Germany's economy. The investigation of this issue is even more important as the German government is not only willing but even obliged in the EU "Stufenplan" to noticeably increase its official development aid in the years to come. The "Stufenplan" aims at fulfilling the UN goal of 0.7 % (rich countries should spend at least 0.7% of their GNP on official development aid (ODA)) in the year 2015. According to the "Stufenplan", 0.5% of German GNP should be spent on development aid in 2010. Currently the German government spends 0.28 % of its GNP on ODA (7.5 billion US-$) implying that German ODA will have to strongly increase in the next eight years.

In 1999 German scientists studied the impact of German bilateral aid on German exports. Amazingly, they found -based on 1976-1995 data- that one mark spent on ODA would increase exports by 4.3 marks. Since this figure appears remarkably high, a follow-up study was done for Germany based on 1962-2005 data to get a clearer understanding of the impact of Germany's bilateral aid on German exports. This study uses a more complex model and more modern estimation techniques compared to most other studies. It differs from earlier 'aid and trade' studies in two respects: First, compared to the 1999 study it utilizes a set of control variables that are indispensable for obtaining plausible and reliable results. Second, it takes the time series properties of the analyzed data into account thus avoiding results that are spurious[5].

[5] Driven by pure correlations over time.

The plan of the paper is as follows: In Chapter 2 an overview of the aid and trade literature will be given. Chapter 3 contains the econometric model and the estimation techniques. In Chapter 4 the empirical results are presented and Chapter 5 concludes.

2. Overview of Related Literature

In the last decades, a great research effort has been devoted to investigate the effects of development assistance on the economic performance of the recipient countries (e.g. Alesina and Dollar, 2000) and to clarify the recent debate on "aid for trade" (Morrisey, 2006). Only little attention has been devoted to the reverse problem of quantifying the impact of aid on donors exports which is in the interest of donor countries' taxpayers.

Arvin and Baum (1997) and Arvin and Choudry (1997) studied the relationship between bilateral aid and bilateral exports with and without tying. They showed that aid without tying was roughly as export-promoting as tied aid. They explained this phenomenon by recipient countries' good will and/or parallel trade agreements and trade concessions. On these grounds a formal tying of aid is not recommendable any longer (Jepma, 1991; Arvin and Baum, 1997; Arvin and Choudry, 1997). Benefits for donors through tying are usually small whereas tying noticeably reduces the benefit of aid for recipients (Jepma, 1991; Wagner, 2003). Consequently tying has been stepwise reduced, partly due to pressure from the Development Assistance Committee (DAC).

The relationship between aid and exports was examined in several country studies neglecting the possible occurrence of spurious regressions.[6] Therefore, a word of caution is needed regarding the results since the figures have been derived from trending series. Non-stationarity of the series and/or autocorrelation of the disturbances have not been (sufficiently)

[6] Spurious regression results occur when either autocorrelation of the disturbances is not taken into account or if regressions with non-stationary series are run. Autocorrelation and non-stationarity of the series are interlinked as they result from memory of the series.

taken into account even though some authors tried to reduce spuriousness in the regressions by averaging over time and plugging in a time trend or by utilizing data in five year intervals. Vogler et al. (1999) found that one mark spent on ODA would increase exports by 4.3 marks, using data for the period 1976-1995 for Germany's aid and trade relationship. The authors included 43 recipient countries in the study and the average impact of aid on trade was calculated only for 23 of those countries. A study done by Nilsson (1997) on the aid and trade relationship of EU countries and developing countries showed that one US-$ aid increased exports by US-$ 2.6 (average for EU countries) and by US-$ 3.2 (figure for Germany). The period of study ran from 1975 to 1992. The author utilized a common intercept for all the EU countries, three-years averages and a time trend. Studying the aid and trade relationship between OECD-donors (especially Japan) and recipient countries Wagner (2003) computed the impact of one dollar of aid to be approximately $ 2.3 utilizing pooled data for the years 1970, 1975, 1980, 1985, and 1990 to minimize distortions from autocorrelation.[7]

A totally different approach was followed by Lloyd, McGillivray, Morissey, Osei (2000), Arvin, Cater and Choudry (2000) and Osei, Morissey and Lloyd (2004). The authors tested Granger causality and cointegration[8] getting mixed results for the aid and trade relationship. For some country pairs the authors could not find an aid-trade link, for some country pairs the aid-trade link existed and for some country pairs they could identify a bi-directional relationship. This bi-directional relationship eventually led us to control for a possible endogeneity of the aid variable.

Finally, a few studies that focused on quantifying the impact of donor's aid on trade utilized the gravity model of trade (Nilsson 1997; Wagner, 2003). We also believe that the gravity model is well suited to study the impact of aid on trade since it allows controlling for the impact of regular factors on trade such as income (production capacity and income variety

[7] This procedure may reduce autocorrelation, but is unable to eliminate it. In the presence of autocorrelation the residuals in 1990 will still be correlated with the residuals of 1985 and from earlier years.

[8] The requirement for testing cointegration that all variables must be integrated of the same order, i.e I(1) or I(p) was not fulfilled in the majority of the countries examined.

effect), population (absorption and economies of scale effect) and distance in a world where also trade agreements, exchange rates and aid can influence trade.

We deviate from most of those studies by exploiting the time series properties of the series in a more appropriate manner. We find that half-way dealing with or neglecting the time series properties does severely change the regression results. Therefore, we do control for trends and memory in the series thus avoiding spurious regression results. The study period of 1962 to 2005 will allow us to do so. Besides, we can distinguish between the short-run and the long-run impact of aid and trade by applying a semi- and a fully dynamic error correction model (ECM). We also control for the endogenity of aid by estimating the aid-export relationship with Dynamic Ordinary Least Squares (DOLS) and Dynamic Feasible Least Squares (DFGLS).

3. Model and Estimation Techniques

3.1 Modeling the Aid-Trade Link

In this paper we focus exclusively on the effect of aid on the donor's exports. In international trade theory researches have long studied the welfare implications of bilateral transfers for donors and recipient countries. The first public discussion of this topic was the Keynes-Ohlin debate in 1929 in relation to the paradoxical effects of German reparations. 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. They find that the net benefits of an aid transfer may change over time for both the donor and the recipient. Assuming stability, a temporary transfer of income in the first period increases period-one welfare of the recipient and lowers that of the donor. But, in the presence of habit formation effects, aid in period one shift preferences of the recipient in favour of the donor's export good in period two. When the terms of trade effect associated with this shift is sufficiently large and the real rate of interest in the donor country is sufficiently low, the second-period welfare gain of the donor (at the

expense of the recipient) dominates its period-one loss. In addition, this transaction can also result 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. Lahiri (2005) presents a survey of this literature.

With this aim and taking into account the abovementioned theoretical considerations, we expect that, in the context of an intertemporal model of trade, development aid will lead to an increase in the donor's exports mainly due to the presence of habit formation or "goodwill" effects. In order to evaluate this effect empirically, we have chosen the gravity model of trade as a basic framework.

The gravity model is nowadays the most commonly accepted framework to model bilateral trade flows. According to the underlying theory, trade between two countries is explained by the nominal incomes and the populations of the trading countries, the distance between the economic centers of exporter and importer and by a number of other factors aiding or preventing trade (colonial history, common language etc.) between them. In 1979 Anderson gave a theoretical foundation for the gravity equation based on the concept of product differentiation in the American Economic Review. Our version of the gravity model goes back to Bergstrand (1985) who derives the gravity model from a general equilibrium model of trade. If trade flows are perfect substitutes and not differentiated by origin then the gravity model can do without a price term as an Eq. (1) below. Under realistic assumptions, however, a price term must be added to avoid misspecification (see Eq. (2) below). This price term takes care of the imperfect substitutability of trade flows and/or large and persistent deviations of national price levels from purchasing power parity (PPP). The bilateral exchange rate can be used as a proxy for prices.

According to the original *gravity model of trade*, the volume of exports between pairs of countries, X_{ij}, is a function of their incomes (Y_i, Y_j), their populations (POP_i, POP_j), their geographical distance $(DIST_{ij})$ and a set of dummies (F_{ij}),

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

In line with Bergstrand, Eq. (1) was augmented to accommodate the role played by exchange rates, our proxy for prices. Income transfers, namely bilateral and multilateral aid, are added as well giving us

$$X_{ij} = \alpha_0 \; Y_i^{\alpha_1} Y_j^{\alpha_2} POP_i^{\alpha_3} POP_j^{\alpha_4} EXRN_{ij}^{\alpha_5} BAIDG_{ij}^{\alpha_6} EUAIDG_{ij}^{\alpha_7} DIST_{ij}^{\alpha_8} F_{ij}^{\alpha_9} \; u_{ij} \qquad (2)$$

Eq. (2) is a reduced form from a partial equilibrium subsystem of a general equilibrium trade model with nationally differentiated products. Y_i (Y_j) indicates the GDPs of the exporter (importer), POP_i (POP_j) are exporter (importer) populations, $EXRN_{ij}$ stands for the bilateral exchange rate between countries i and j, $BAIDG_{ij}$ measures the amount of gross bilateral aid going from Germany to developing country j, $EUAIDG_{ij}$ measures the amount of gross EU aid that is given to developing countries, $DIST_{ij}$ measures the distance between the two countries' capitals (or economic centres) and F_{ij} represents any other factors aiding or preventing trade between pairs of countries, such as adjacency, language, island or belonging to a certain trading bloc. u_{ij} is the error term.

Since we will work in the fixed effects framework[9] all factors that are cross-section specific and do not vary over-time (distance, adjacency, language, island), will interfere with the cross-section specific intercepts and cannot be directly estimated thus leading to

$$X_{ij} = \beta_{ij} \; (Y_i \; Y_j)^{\beta_1} POP_i^{\beta_2} POP_j^{\beta_3} EXRN_{ij}^{\beta_4} BAIDG_{ij}^{\beta_5} EUAIDG_{ij}^{\beta_6} u_{ij} \qquad (3)$$

This model is usually linearized[10] and then estimated in its log-log form ,

[9] The Hausman test rejected the random effect model due to correlation between the random country effect and error term.

$$\ln X_{ijt} = \mu_{ij} + \beta_1 \ln Y_{it} Y_{jt} + \beta_2 \ln POP_{it} + \beta_3 \ln POP_{jt} + \beta_4 \ln EXRN_{ijt} + \beta_5 \ln BAIDG_{ijt} + \beta_6 \ln EUAIDG_{ijt} + u_{ijt} \quad (4)$$

where:

ln denotes variables in natural logs.

X_{ijt} are the exports from country i to country j in period t at current US$ (hundreds of million US$).

Y_{it}, Y_{jt} indicate the GDP of countries i and j respectively, in period t at current PPP US$ (in billions).

POP_{it}, POP_{jt} denote the population of countries i and j respectively, in period t in thousand inhabitants.

$BAIDG_{ij}$ measures gross bilateral aid[11] flowing from Germany (i) to country j in million of US$.

$EUAIDG_{ij}$ stands for gross EU aid allocated to country j in million of US$.

μ_{ij} are the specific effects associated to each bilateral trade flow. They serve as control for all the omitted variables that are specific for each trade flow and that are time invariant.

A high level of income in the exporting country indicates a high level of production, which increases the availability of goods for export, and a high level of income in the importing country implies strong demand. Therefore we expect β_1 to be positive. The coefficient estimate for population of the exporters, β_2, may be negatively or positively signed, depending on whether the country exports less when it is big (absorption effect) or whether a big country exports more than a small country (economies of scale). The coefficient of the

[10] Santos Silva and Tenreyro (2006) suggested to estimate the non-linear model with the Pseudo Poisson Maximum Likelihood technique (PPML) pointing to Jensen's inequality (a problem linked to the error term that arises in the linearization process) and a better ability to deal with heteroskedasticity. However, empirical applications of the PPML technique to real trade data were less promising. Heteroskedasticity remained a problem and the model assumptions proved.difficult to be fulfilled.

[11] According to DAC gross ODA comprises total grants (position 201) and loans extended (position 204).

importer population, β_3, also has an ambiguous sign, for similar reasons. Another factor that may influence the coefficient estimates for population is the composition effect that influences supply and demand. Each country produces and exports a different mix of commodities (supply) and the mix of goods demanded is also different for each country. The coefficient estimate of the bilateral exchange rate (which is in quantity quotation) β_4 is expected to have a negative impact on exports as an appreciation of the exchange rate harms exports. The coefficient of bilateral aid β_5 is expected to be positive reflecting the income transfer effect of aid. The coefficient of multilateral aid β_6 can be either positive or negative depending on whether recipient countries like to import from known channels or whether they go for a diversification of their import channels.

Equation (4) represents the static model which allows drawing conclusions for the long-run equilibrium. This model, however, can lead to spurious regression results when the variables entering the model contain a deterministic or stochastic time trend. Deterministic time trends are eliminated when each series is regressed on time t and the remaining residual is utilized in the new regression. Stochastic trends are taken care of by using the first, second or p-th differences of the series. Estimating Eq. (4) with Pooled Least Squares and Fixed Effects results in a R^2 of 0.96 and a Durbin-Watson statistic (DW) of 0.54 which is far away from the ideal of 2.00. As R^2 exceeds the DW we have an indication of a spurious relationship and of spurious regression coefficients.

3.2 Data Sources, Variables and German Cooperation Countries

Official Development Aid data are from the OECD Development Database on Aid from DAC Members[12]. Bilateral exports are obtained from the UN COMTRADE Database. Data on income and population variables are drawn from the World Bank (World Development

[12] www.oecd.org/dac/stats/idsonline.

Indicators Database 2006). Bilateral effective 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. In the Appendix A.2 is a list of cooperation countries of German Development cooperation (BMZ countries). See also http://www.bmz.de/en/countries/laenderkonzentration/tabelle.html.

3.3 Estimation Issues

Since spuriousness is to be avoided alternative estimation methods will rely on an error correction model (ECM) or a long-run model with built-in leads and lags to control for endogeneity of the explanatory variables. Error correction models allow drawing inferences that are not driven by spuriousness. All 'a priori' stationary variables are excluded from the ECM as they do not contribute to the long-run equilibrium. Only if the series are integrated of the same order and cointegrated in the long-run (i.e. if the residual of Equation (4) is stationary) they can enter the model.

The semi-dynamic error correction model is given by

$$\begin{aligned}\Delta \ln X_{ijt} &= \mu_{ij} + \beta_1 \Delta \ln Y_{it} Y_{jt} + \beta_2 \Delta \ln POP_{it} + \beta_3 \Delta \ln POP_{jt} + \beta_4 \Delta \ln EXRN_{ijt} \\ &+ \beta_5 \Delta \ln BAIDG_{ijt} + \beta_6 \Delta \ln EUAIDG_{ijt} + \beta_7 (\ln X_{ijt-1} - b_1 \ln Y_{it-1} Y_{jt-1} - b_2 \ln POP_{it-1} \\ &- b_3 \ln POP_{jt-1} - b_4 \ln EXRN_{ijt-1} - b_5 \ln BAIDG_{ijt-1} - b_6 \ln EUAIDG_{ijt-1}) + u_{ijt}\end{aligned} \quad (5)$$

Both short-run ($\beta_1,...,\beta_6$) and long-run coefficients ($b_1,...,b_6$) can be estimated. β_7 describes the adjustment to the long-run equilibrium. The term $(\ln X_{ijt-1} - b_1 \ln Y_{it-1} Y_{jt-1} - b_2 \ln POP_{it-1} - b_3 \ln POP_{jt-1} - b_4 \ln EXRN_{ijt-1} - b_5 \ln BAIDG_{ijt-1} - b_6 \ln EUAIDG_{ijt-1})$ is the error correction term and contains the long-run elasticities. The short-run relationship is described by the variables in differences[13], thereby removing their stochastic trend (Hendry, 1995; Mukherjee et al. 1998).

[13] Δ means that the variables enter the model in first differences.

The short-run dynamics of the above ECM can be improved by modeling them as an autoregressive distributed lag model (ARDL). Stock (1987) and Pesaran et al. (2001) also suggested using an ECM based on an ARDL[14].

The dynamic ECM is then of the following form

$$\Delta \ln X_{ijt} = \mu_{ij} + \sum_{p=0}^{p=k} \beta_{1p} \Delta \ln Y_{it-p} Y_{jt-p} + \sum_{p=0}^{p=k} \beta_{2p} \Delta \ln POP_{it-p} + \sum_{p=0}^{p=k} \beta_{3p} \Delta \ln POP_{jt-p} + \sum_{p=0}^{p=k} \beta_{4p} \Delta \ln EXRN_{ijt-p} + \sum_{p=0}^{p=k} \beta_{5p} \Delta \ln BAIDG_{ijt-p} + \sum_{p=0}^{p=k} \beta_{6p} \Delta \ln EUAIDG_{ij-tp} + \sum_{p=1}^{p=k} \lambda_p \Delta \ln X_{ijt-p} + \beta_7 (\ln X_{ijt-1} - b_1 \ln Y_{it-1} Y_{jt-1} - b_2 \ln POP_{it-1} - b_3 \ln POP_{jt-1} - b_4 \ln EXRN_{ijt-1} - b_5 \ln BAIDG_{ijt-1} - b_6 \ln EUAIDG_{ijt-1}) + u_{ijt} \quad (6)$$

The maximum lag length k is determined by the Schwarz criterion. In our case k is equal to three. Hendry's (1995) general- to- specific method is applied to Eq. (6) thus eliminating the least significant variables. We end up with the following ARDL-based ECM:

$$\Delta \ln X_{ijt} = \mu_{ij} + \beta_{10} \Delta \ln Y_{it} Y_{jt} + \beta_{11} \Delta \ln Y_{it-1} Y_{jt-1} + \beta_{20} \Delta \ln POP_{it} + \beta_{40} \Delta \ln EXRN_{ijt} + \beta_{43} \Delta \ln EXRN_{ijt-3} + \beta_{50} \Delta \ln BAIDG_{ijt} + \beta_{61} \Delta \ln EUAIDG_{ijt-1} + \sum_{p=1}^{p=3} \lambda_p \Delta \ln X_{ijt-p} + \beta_7 (\ln X_{ijt-1} - b_1 \ln Y_{it-1} Y_{jt-1} - b_2 \ln POP_{it-1} - b_3 \ln POP_{jt-1} - b_4 \ln EXRN_{ijt-1} - b_5 \ln BAIDG_{ijt-1} - b_6 \ln EUAIDG_{ijt-1}) + u_{ijt} \quad (7)$$

However, an increase in donors' exports resulting from aid given might make it more attractive to give more bilateral aid in turn. Trade can lead to further aid if donors preferably allocate their aid to countries with which they have the greatest commercial links. Since it is therefore debatable whether the variable *ln BAIDG* is truly exogeneous a control for possible endogeneity is called for. In case of endogeneity problems estimation of the gravity model by means of Dynamic Ordinary Least Squares (DOLS) is recommendable. DOLS is based on a modified version of Eq. (4) that includes past, present, and future values of the change in the regressors (Stock and Watson, 1993 and 2003). When estimating Eq. (8)

[14] Irrespective of whether the regressors are I(0) or I(1) an ARDL can be applied. Pesaran et al. compute the critical values for a cointegration test in the ARDL framework for time series (Pesaran et al. , 2001).

$$\ln X_{ijt} = \alpha_{ij} + \chi_1 \ln Y_{it} Y_{jt} + \chi_2 \ln POP_{it} + \chi_3 \ln POP_{jt} + \chi_4 \ln EXRN_{ijt}$$
$$+ \chi_5 \ln BAIDG_{ijt} + \chi_6 \ln EUAIDG_{ijt} + \sum_{p=-k}^{p=+k} \delta_p \Delta \ln Y_{it} Y_{jt} + \sum_{p=-k}^{p=+k} \varepsilon_p \Delta \ln POP_{it} +$$
$$\sum_{p=-k}^{p=+k} \phi_p \Delta \ln POP_{jt} + \sum_{p=-k}^{p=+k} \varphi_p \Delta \ln EXRN_{ijt} + \sum_{p=-k}^{p=+k} \gamma_p \Delta \ln BAIDG_{ijt} + \sum_{p=-k}^{p=+k} \eta_p \Delta \ln EUAIDG_{ijt} + u_{ijt} \quad (8)$$

consistent regression coefficients can be obtained. In this case, the Schwarz criterion suggested to take two leads and two lags (i.e. k=2).

If the dependent variable and the regressors are cointegrated, which has to be tested beforehand, then the DOLS estimator is efficient in large samples. Moreover, statistical inferences about the cointegration coefficients $\chi_1,...,\chi_6$ and the $\delta_p, \varepsilon_p, \phi_p, \varphi_p, \gamma_p, \eta_p$ in Eq. (8) based on HAC standard errors are valid. This is so because the t-statistic constructed using the DOLS estimator with HAC standard errors has a standard normal distribution in large samples. And if the regressors were strictly exogenous, then in Eq. (8), the coefficients $\chi_1,...,\chi_6$ would be the long-run cumulative multipliers, that is, the long-run effect on exports of a change in the explanatory variables. If the regressors are not strictly exogenous, then the coefficients do not have this interpretation.

3.4 Requirements for Non-spurious Estimation

The semi-dynamic and the dynamic ECM require the change-variables to be integrated of the same order (e.g. I(1)) and to have a long-run relationship (i.e. the long-run relationship has to be stationary (I(0)).

Table 1 shows the test results for the variables. After inspecting the graphs an intercept and trend were assumed and a lag length of 4 was chosen. According to the ADF-Fisher Chi-square test, which allows for individual unit roots, all variables that enter the regression model are I(1).

Table 1: Results from the ADF-Fisher Panel Unit Root Test

Variable tested	Null Hypothesis	Unit root test utilized	Probability	Observations	Variable is integrated
lx	Individual unit root process	ADF-Fisher Chi-square 142.79	0.33	2279	I(1)
lyy	Individual unit root process	ADF-Fisher Chi-square 72.10	1.00	2198	I(1)
lpopg	Unit root process	ADF-test statistic 86.34	1.00	2847	I(1)
lpopj	Individual unit root process	ADF-Fisher Chi-square 92.60	1.00	2831	I(1)
lexrn	Individual unit root process	ADF-Fisher Chi-square 96.19	0.97	2185	I(1)
lbaidg	Individual unit root process	ADF-Fisher Chi-square 89.04	0.99	2210	I(1)
leuaidg	Individual unit root process	ADF-Fisher Chi-square 141.55	0.27	2282	I(1)

However**,** words of caution are called for. Clearly, unit root tests that assume individual unit roots (for each cross-section)[15] are to be preferred over unit root test that assume a common unit root process[16] since the first are much more flexible. But still, the available panel unit root tests can lead to implausible results, especially when the number of cross-sections is large. E.g. as to the aid and trade data utilized, we know from the unit root test results on the country-level (pure time series Phillips-Perron Fisher unit root test, the ADF test and the Im, Pesaran and Shin test) that our series are non-stationary (integrated of order 1, I(1) variables) in the vast majority of countries. As to our experience, the ADF-Fisher unit root test reproduced best the results obtained on an individual level, whereas the PP-Fisher unit root test concludes much too often that the series are stationary while they are non-stationary on a

[15] Such as the Im, Pesaran and Shin unit root test, the ADF- Fisher Chi-square unit root test and the PP-Fisher Chi-square unit root test.
[16] Such as the Levin, Lin & Chu unit root test and the Breitung unit root test.

country-level (an individual level). The results of the Im, Pesaran, Shin (IPS) test lie somewhere in between the ADF-Fisher and the PP-Fisher unit root test. These varying results have to do with the way the null and the alternative hypothesis are formulated.[17] In the alternative hypothesis statements are made on whether either "all" or a "significant portion" of the cross-sections is stationary.

When testing for cointegration, i.e. the existence of a long-run relationship in the aid and trade equation, we follow residual-based unit root tests (Kao, 1999). The idea of a residual-based cointegration test goes back to Engle and Granger (1987), who applied it to time series. As to regressions with time series, if the residual (u_t) of a regression is built around variables with the same order p of integration (i.e., the variables ~ I(p)) are stationary, i.e. $u_t \sim I(0)$), it is said that the I(p) variables are cointegrated, and therefore a long-run relationship does exist. However, these tests not only tend to suffer from unacceptably low power when applied to series of moderate length, but also have to use special critical values (e.g., Kapetanios' critical values)[18] to test for stationarity of the residuals (Kapetanios, 1999).

Pooling data across individual members of a panel when testing for cointegration is therefore advantageous. Pooling increases the power of the unit root test by making available considerable more information regarding the cointegration hypothesis[19]. But testing for cointegration in a panel setting is also more complicated since two types of cointegration can be present and must be taken into account: first, between series over time (the type prevailing in time series) and second, between cross-sections[20] (the type potentially existing in a panel

[17] H_0: All of the individuals of the panel have a unit root (the series has a unit root in all cross-sections), H_1: The Series is stationary in all cross-sections or according to the IPS test H_0: The series has a unit-root in all cross-sections, H_1: Not all but some fractions of the individuals are (trend) stationary.

[18] MacKinnon's critical values cannot be used when testing the non-stationarity of residuals. In this case adjustments for the number of regressors in the regression equation are necessary and different critical values result.

[19] H_0: The variables of interest are *not* cointegrated for each member of the panel and H_1: For each member of the panel, there exists a single cointegrating vector, although this cointegrating vector does not have to be the same for each member (Pedroni, 1999).

[20] Cross-sectional correlation can be tackled by the Seemingly Unrelated Regression (SUR) technique, but only if T is large and substantially larger than N, i.e. N must be quite small. In our case SUR would not work.

setting) (Banerjee et al., 2004; Breitung and Pesaran, 2005; Urbain and Westerlund, 2006). We choose Pedroni's panel cointegration test which belongs to the single equation approaches[21] (Pedroni, 1999, 2004). It involves estimating the hypothesized cointegrating regression separately for each country (73 countries) and then testing the estimated residuals for stationarity with adequate critical values using seven test statistics. Four of these statistics pool the autoregressive coefficients across different countries while performing the unit root test and thus restrict the first order autoregressive parameter to be the same for all countries. Pedroni (1999) refers to these statistics as panel cointegration statistics. The other three statistics are based on averaging the individually estimated autoregressive coefficients for each country. Accordingly, these statistics allow the autoregressive coefficient to vary across countries and are referred to as group mean panel cointegration statistics. Both panel cointegration statistics and the group mean panel cointegration statistics test the null hypothesis H_0: "All of the individuals of the panel are not cointegrated". For the panel statistics, the alternative hypothesis is H_1: "All of the individuals of the panel are cointegrated", while for the group mean panel statistics, the alternative is H_1: "A significant portion of the panel members are cointegrated" (Pedroni, 2004).

Pedroni's test revealed (see Table 2) that the residuals of all countries were stationary and the variables *lx, lyy, lpopg, lpopj, lexrn, lbaidg* and *leuaidg* are cointegrated (p-value 0.00) and therefore in long-run equilibrium.[22] The error when rejecting the null hypothesis of 'no cointegration' is 0.00 looking at the weighted panel v-statistic, the panel rho-statistic, the panel PP-statistic and the panel ADF-statistic and 0.00 respectively 0.05 when looking at the group mean panel cointegration statistics (group rho, group PP and group ADF statistics).

Westerlund (2007a, 2007b and 2007c) develops a more general solution to cross-unit correlation. He allows for cross-sectional dependence by assuming that the correlation can be modeled using a common factor structure.

[21] It also belongs to the first generation panel cointegration tests. The first generation panel cointegration tests assume cross-sectionally independent panels (Wagner and Hlouskova, 2007).

[22] The program and the results are available upon request.

A weakness of the Pedroni (1999, 2004) approach is that it requires the long-run cointegrating vector for the variables in levels being equal to the short-run adjustment process for the variables in their differences (Herzer et al. , 2008). If this is empirically incorrect, residual-based (panel) cointegration tests may suffer from a significant loss of power (Westerlund, 2007b). A simulation study of Wagner and Hlouskova (2007) showed that amongst the single equation tests for the null hypothesis of no cointegration (Pedroni type tests) the panel and mean-group tests of Pedroni applying the ADF principle perform best, whereas all other single equation tests (Westerlund (2005); Breitung (2002)) are partly severely undersized and have very low power in many circumstances. For T<=25 there is practically no acceptable power. In simulations Pedroni's test statistics are the least affected by the presence of cross-unit cointegration. In contrast, system based (VAR based or Johansen type) cointegration tests (Larsson, Lyhagen and Löthgren (2001); Breitung (2005) perform very poorly for small values of T, but also suffer partly from problems when N is too large in a simulation study done by Wagner and Hlouskova (2007).

Table 2: Results from the Panel Cointegration Test[23]

Pedroni Residual Cointegration Test
Series: LX LYY LPOPG LPOPJ LEXRN LBAIDG LEUAIDG
Sample: 1962 2005
Included observations: 3212
Cross-sections included: 65 (8 dropped) in non-parametric (PP) test; 64 (9 dropped) parametric (ADF) test
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Lag selection: fixed at 1
Newey-West bandwidth selection with Bartlett kernel

[23] H_0: The variables of interest are *not* cointegrated for each member of the panel and H_1: For each member of the panel, there exists a single cointegrating vector, although this cointegrating vector does not have to be the same for each member (Pedroni, 1999).

Alternative hypothesis: common AR coefs. (within-dimension)				
			Weighted	
	Statistic	Prob.	Statistic	Prob.
Panel v-Statistic	-2.2293	0.0332	-5.144386	0.0000
Panel rho-Statistic	13.1965	0.0000	13.22518	0.0000
Panel PP-Statistic	-5.6646	0.0000	-7.473047	0.0000
Panel ADF-Statistic	-1.1058	0.2165	-3.733835	0.0004
Alternative hypothesis: individual AR coefs. (between-dimension)				
	Statistic	Prob.		
Group rho-Statistic	16.2232	0.0000		
Group PP-Statistic	-11.0141	0.0000		
Group ADF-Statistic	-1.9893	0.0552		

Overall, both the panel unit root test and Pedroni's panel cointegration test justify estimating the aid and trade relationship by OLS, either in an ECM-model or in an DOLS-set up. In both cases cointegration is a prerequisite for engaging in estimation.

4. Empirical Findings on the Impact of Aid on Trade

As discussed earlier we estimated the aid and trade relationship by means of an augmented gravity model which allows to control for other factors influencing exports and by applying both the ECM and the DOLS technique. The results obtained by a semi-dynamic ECM (Eq. (5)) and a dynamic ARDL based ECM (Eq. (7)) are rather similar (see Table 3).

A 1% increase of bilateral aid increases exports by 0.16% in the semi-dynamic ECM and by 0.15 % in the ARDL-based ECM resulting in a long-run return of bilateral of EUR 1.84 and EUR 1.72 respectively[24]. The short-run impact of bilateral aid on exports is much smaller (as expected). In the standard ECM model the elasticity of aid is 0.07 and in the ARDL-based

[24] Multiplying through with the mean of exports (US-$ 229,000,000) over the mean of bilateral aid (US-$ 18,23444) of the period 1962 to 2005 yields .

model it is 0.06. Both specifications point to the short-run relevance of bilateral exchange rates and their long-run irrelevance[25] and to the importance of exporter and importer incomes. The estimated coefficient for the EU official gross development aid is negative and significant in Table 3. One reason could be that most of EU programmes are dominated by non-German interests so that German exports are crowded out and Germany's EU partners profit in terms of exports. In the short-run, Germany's population increase (excess absorption) can lead to a short-run decrease in exports and the importer's population growth (import substitution and economies of scale) may eventually result in a long-run decrease in exports.

Table 3: The Impact of Bilateral Aid in the ECM Estimation

1963-2005	**Semi-dynamic ECM (BMZ-countries) ♠ Eq. (5)**		**Dynamic ECM (BMZ-countries) Eq. (7)**	
Variable	**L.r. coeff.**	**t-statistic**	**L.r. coeff.**	**t-statistic**
LYY	0.74***	11.93	0.74***	9.77
LPOPG	-0.19	-0.61	-0.28	-0.86
LPOPJ	-1.15***	-4.38	-0.95***	-3.28
LEXRN	-0.02	-1.23	-0.00	-0.04
LBAIDG	**0.16*** **	3.94	**0.15*** **	3.17
LEUAIDG	-0.13***	-2.83	-0.17***	-3.11
EC-Term	-0.28***	-19.73	-0.27***	-15.31
L.r. Return on EUR 1.00 bilateral aid	**EUR 1.84**		**EUR 1.72**	
	S.r. coeff.	**t-statistic**	**S.r. coeff.**	**t-statistic**
D(LYY)	0.59***	12.64	0.60***	11.47
D(LPOPG)	-0.41**	-2.28	-0.49***	-2.72
D(POPJ)	-0.28	-0.36	----	----
D(LEXRN)	-0.09***	-4.29	-0.07***	-2.40
D(LBAIDG)	0.07***	5.45	0.06***	-1.64
D(LEUAIDG)	-0.02	-1.16	------	5.41
S.r. return on EUR 1.00 bilateral aid	**EUR 0.80**		**EUR 0.69**	----
Fixed-Effect	Yes		Yes	
Adj. R^2	0.22		0.23	
Log likelihood	-299.78		-194.29	
DW-Statistik	2.09		1.96	
F-Statistik	8.24		7.82	
Prob(F-Stat)	0.00		0.00	

[25] A beggar-the-neighbour policy (through currency devaluation) can only work in the short-run, not in the long run.

♠ BMZ-countries includes all 73 countries with whom the German Ministry for Economic Development and Cooperation (BMZ) has signed treaties and to whom official development aid is given (and for which data were available).. Therefore the BMZ sample shrinks from 77 countries (see Appendix: A2) to 73 countries.

Table 4 presents the results that are obtained by means of a DOLS estimation. First we estimate a regular DOLS[26] (Eq. (8)) and then a DFGLS (Dynamic Feasible Generalized Least Squares) controlling for autocorrelation[27].

Table 4: The Impact of Bilateral Aid in the DOLS Estimation

1965-2003	**DOLS** **(BMZ countries)** **Eq. (8)**		**DFGLS [correction of autocorrelation]** **(BMZ countries)** **Eq. (8)**	
Variable	**L.r. coeff.**	**t-statistic**	**L.r. coeff.**	**t-statistic**
LYY	0.87***	37.77	0.82***	16.64
LPOPG	-0.53***	-3.13	-0.43	-1.44
LPOPJ	-1.18***	-8.99	-1.32***	-5.12
LEXRN	-0.04***	-4.37	-0.04***	-2.14
LBAIDG	**0.19*** **	7.34	**0.13*** **	2.88
LEUAIDG	-0.24***	-9.31	-0.08	-1.41
L.r. return on bilateral aid	**EUR 2.18**		**EUR 1.49**	
2 leads and 2 lags	Yes		Yes	
Fixed effects	Yes		Yes	
Adj. R^2	0.96		0.98	
Log likelihood	-842.50		-158.08	
DW-Statistics	0.62		2.01	
F-statistic	409.60		786.69	
Prob (F-stat.)	0.00		0.00	

Here again, the results obtained by estimating Eq. (8) without and with control for auto-correlation are rather similar. Control for autocorrelation is based on the Cochrane-Orcutt procedure in which the correlation coefficient ρ of the disturbances is estimated in a first

[26] Not reporting the short-run coefficients.
[27] Not reporting the short-run coefficients.

step. Then all series (including of course the residuals) are transformed into (stationary) "soft" first- or "quasi" first-differences before applying DOLS. This procedure will be called DFGLS.

We find that the assertion by applied economists that using leads and lags in the DOLS approach takes care of the problem of autocorrelation is over-optimistic. The DW-statistic being 0.62 (Table 4, second column) indicates clearly the presence of autocorrelation. The DFGLS estimators correcting for autocorrelation (DW=2.01) are more conservative and freed from spuriousness. The bilateral aid elasticity drops from 0.19 to 0.13. According to the superior DFGLS estimator a 1 EUR increase in bilateral aid increases exports by EUR 1.49.

4. Conclusions

The augmented gravity model allows controlling for a variety of factors that influence export flows thus reducing the aid-export elasticity found in studies without control variables. Panel unit root and panel cointegration tests enable us to obtain non-spurious regression results based on either error correction models or the Dynamic Ordinary Least Squares technique. We find that the elasticity of bilateral aid estimated by means of two versions of ECMs and DFGLS lies in an interval between 0.13 and 0.16 translating into a EUR return in the range from EUR 1.49 to EUR 1.84. The study clearly shows that Germany's bilateral aid promotes own exports thus giving further arguments to eventually reach the 0.7 % UN goal of official development assistance. In contrast to earlier studies, the impact of bilateral aid is well below the previously computed impact of EUR 4.3 or 3.2 for Germany.

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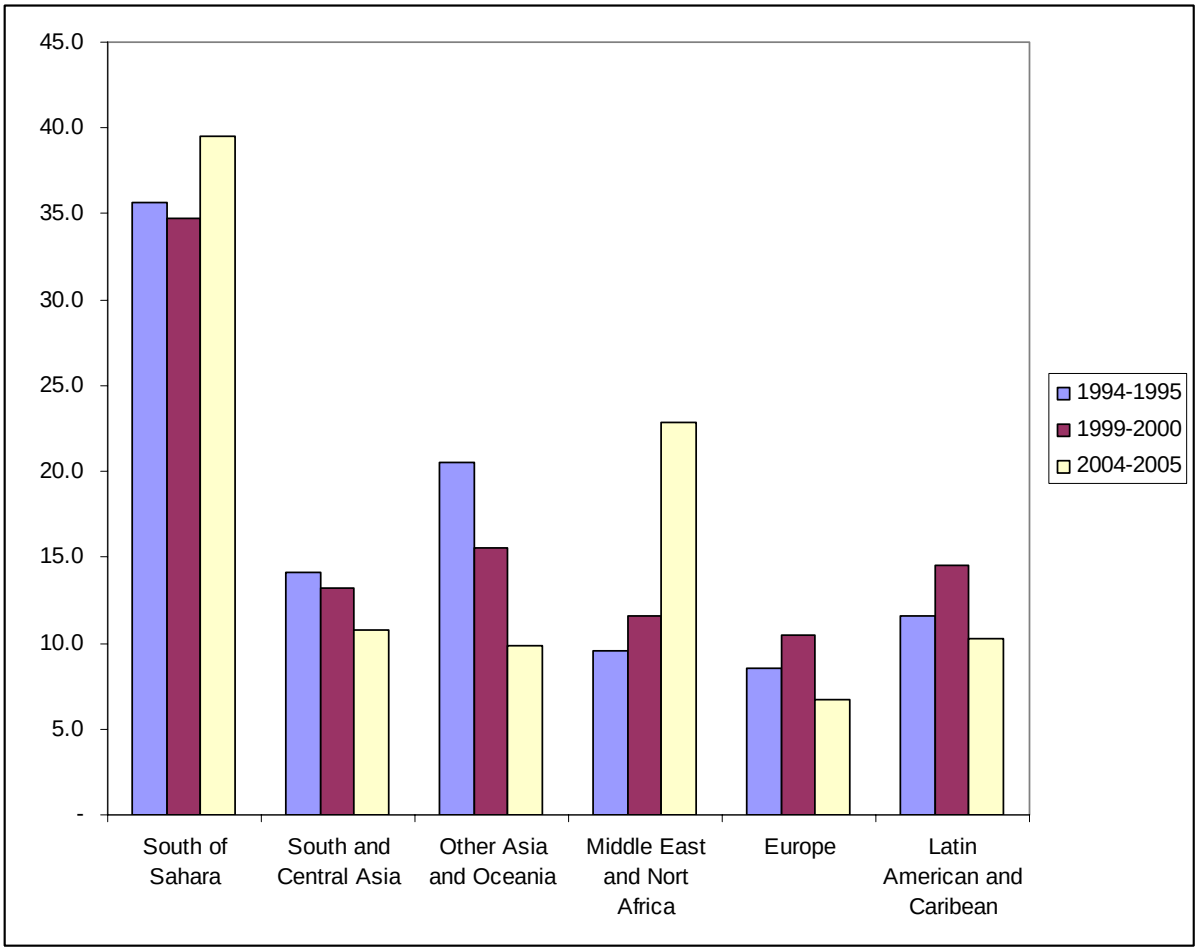
Appendix:

A.1. Regional distribution of German ODA in per cent



Source: OECD (http://www.oecd.org/dataoecd) and own elaboration.

A2. Country Classifications

Countries	BMZ cooperation countries of German Development cooperation
1	Afghanistan
2	Albania
3	Algeria
4	Armenia
5	Azerbaijan
6	Bangladesh
7	Belarus
8	Benin
9	Bolivia

10	Bosnia-Herzegovina
11	Brazil
12	Burkina Faso
13	Burundi
14	Cambodia
15	Cameroon
16	Chad
17	Chile
18	China
19	Colombia
20	Congo, Dem. Rep.
21	Costa Rica
22	Croatia
23	Dominican Republic
24	Ecuador
25	Egypt
26	El Salvador
27	Eritrea
28	Ethiopia
29	Georgia
30	Ghana
31	Guatemala
32	Honduras
33	India
34	Indonesia
35	Iran
36	Jordan
37	Kazakhstan
38	Kenya
39	Kyrgyz Republic
40	Laos
41	Lebanon
42	Lesotho
43	Madagascar
44	Malawi
45	Mali
46	Mauritania
47	Mexico
48	Moldova
49	Mongolia
50	Morocco
51	Mozambique
52	Myanmar
53	Namibia
54	Nepal
55	Nicaragua
56	Niger
57	Nigeria
58	Pakistan

59	Paraguay
60	Peru
61	Philippines
62	Rwanda
63	Senegal
64	Serbia and Montenegro
65	South Africa
66	Sri Lanka
67	Sudan
68	Syria
69	Tajikistan
70	Tanzania
71	Thailand
72	Tunisia
73	Turkey
74	Uganda
75	Ukraine
76	Vietnam
77	Zambia