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Evaluating the impact of non-reciprocal trade preferences using gravity models

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Evaluating the Impact of Non-Reciprocal Trade Preferences Using Gravity Models

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1 Introduction

Over the last decade many studies have made use of the gravity model to evaluate the impact of non-reciprocal preferential trade policies (hereafter NRPTPs) on the export performance of developing countries. The aim of this paper is to provide new empirical evidence in this area of research.

A NRPTP is a concession granted to developing countries by a developed country on a unilateral basis, that is without reciprocal preferences for the donor's exports. Beneficiary countries either have duty-free access to the donor's market or enjoy preferential tariff and, as a result of this special treatment, an increase in their exports towards the preference-giving country is expected to occur. The main active NRPTP is the Generalized System of Preferences (GSP) recommended by UNCTAD in 1968 and implemented by major developed countries since the early '70s. Today, under the GSP, the exports of selected products of about 150 developing countries benefit from reduced tariffs when entering donor markets. Apart from the GSP, virtually all developing countries are members of at least one other preferential trade scheme granted by a developed country to favour their exports. Bhagwati (1995) defined the complex system of crisscrossing trade preferences as a *spaghetti-bowl*.[1]

The gravitational approach offers a framework for assessing whether NRPTPs affect trade flows from beneficiaries to donors. In its simplest form, the gravity model posits that the normal level of trade is positively affected by the economic mass of the trading countries (richer and larger nations both export and import more) and negatively influenced by the geographical distance between them. The "normal" level of trade is the average level of trade in a world free of trade barriers, preferential treatments and trade agreements. Such a "normal" level is defined as the counterfactual. When developed countries grant special treatment to exports from developing countries, they introduce a disturbance into the model that defines the counterfactual

[1] Another form of trade preference is represented by regional free-trade areas between developed and developing countries. However, this involves reciprocal preferences and does not constitute an example of trade preferences for developing countries in a strict sense.

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and, hence, *ceteris paribus*, deviations from the "normal" level of trade are interpretable as the effect of the preferential policy.

Gravity models have a long and well-established history in the explanation of trade (Tinbergen, 1962; Pöyhonen 1963) and they have been used to specifically study the impact of NRPTPs by Sapir (1981), Oguledo and Macphee (1994), Nouve and Staatz (2003), Persson and Wilhelmsson (2007), Nilsson (2002, 2007), Verdeja (2006), Lederman and Özden (2004), Subramanian and Wei (2007) and Goldstein et al. (2003). These papers share three common practices. The first is that they evaluate the impact of preferences granted by one or two donors only, usually the EU and/or the US. The second common denominator is their focus on total exports from the beneficiary to the donor countries, except for the work by Sapir (1981), which focuses on manufactured imports in both aggregate and disaggregated trade flows. Lastly, they model NRPTPs by augmenting the gravity model with a preference dummy.

These methodological choices are misleading if the aim of the analysis is to evaluate the impact of a specific trade policy – the preferential trade preference - which is conceived of as being applied at product level. To be more precise, the main motivation for this study lies in the belief that the objective of NRPTPs is not to affect the total trade of the beneficiaries, but to alter the incentives for developing countries to export more in those specific sectors in which preferences are granted. In light of these considerations, we argue that when overall exports are considered, the impact of NRPTPs might be not correctly estimated.[2] Hence, evidence based on disaggregated data is needed. Along this line, we use both total and 2-digit level trade flows as an attempt to verify the robustness of results passing from a higher to a lower aggregation of data.

We follow the literature with regards the framework of analysis to be used, that is the gravity model, and the method to measure the preferential treatment, which is gauged by using the dummy approach. All this allows us to pursue two aims. On one hand, when using aggregated data the outcomes we obtain are comparable to those of other studies that augment the gravity equation of total trade flows with preference dummies. On the other hand, given the empirical setting (gravity models and preference

[2] For instance, if the export shares of sectors that account for a higher margin of preference are small, then the aggregate flow probably does not change enough for the impact of NRPTPs to be picked up in the econometric analysis.

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dummies), the use of disaggregated data permits to verify if trade flows aggregation matters in determining the impact of NRPTPs. If it matters then we will shed some lights on the fact that the evidence achieved when using total trade and dummy variables should be read with extreme care. Nevertheless, the dummy approach is not exempt of criticism that we will outline in drawing some concluding remarks (see § 7).

The contribution of this paper is twofold. First, we consider three levels of data aggregation: total exports, total agricultural exports and export flows for ten groups of agricultural products at 2-digit level. Agricultural trade has been chosen because of the higher margin of trade preferences enjoyed by developing countries in agriculture with respect to other sectors. We expect that the regressions run at each level of data aggregation will yield different values for the coefficients associated with the preference dummy. In other words, when focusing on sectors enjoying a large margin of preferences, we expect that the estimates are higher than those obtained using aggregated data. Such differences will be considered as evidence in favour of the fact that aggregation matters in estimating the role of NRPTPs. If this is the case, we will argue that the conclusions about the effectiveness of NRPTPs should be drawn by looking at regressions run at the most disaggregated level to distinguish properly sectors in which preferences are granted from those where preferences are not given. Secondly, for each level of data aggregation we consider export flows, whatever the country-source, towards the OECD members which grant almost all one-way trade preferences (EU15, USA, Japan, Norway, Switzerland, Australia, Canada and New Zealand). Hence, the set of non-reciprocal preferential trade arrangements analysed in this study covers almost all one-way programs granted by developed to developing countries over the period under scrutiny (1995-2003).

By taking into account unobserved country heterogeneity, non-random selection, and the potential endogeneity of trade preferences, we find that NRPTPs granted by OECD countries enhance, on average, the exports of beneficiaries. However, results differ according to the data aggregation and to the preferential trade agreement analysed. For instance, we show that the total exports of eligible countries are not significantly affected by the ordinary GSP, while the GSP for LDCs is more effective. In this respect, the main source of trade gains for developing countries is represented by NRPTPs other than GSP. Furthermore, it emerges that preferential

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treatment affects total agricultural exports more than overall exports. Finally, we find that the estimated impact of NRPTPs at 2-digit level is heterogeneous.

The paper is structured as follows. Section 2 briefly overviews the related literature, while section 3 describes the gravity model. Section 4 presents data and variables used. Sections 5, describes how we deal with the main econometric issues thought to be present in gravity empirics. Section 6 presents the results obtained. Section 7 concludes.

2 Related Literature

The literature that uses gravity equations to specifically assess the impact of NRPTPs is comprised of the following papers:[3] Sapir (1981), Oguledo and Macphee (1994), Nouve and Staatz (2003), Persson and Wilhelmsson (2007), Nilsson (2002 and 2007), Verdeja (2006), Lederman and Özden (2004), Subramanian and Wei (2007) and Goldstein et al. (2003).[4]

Sapir (1981) quantifies the effects of the EU's GSP by considering the imports of manufactures from 10 developing countries. By estimating a gravity equation on a yearly basis from 1967 to 1978 he finds that EU GSP exerts a positive impact on trade, but he acknowledges that this "partly reflects our choice of beneficiaries which supply the bulk of EEC preferential imports" (Sapir, 1981: 351).

Oguledo and Macphee (1994) estimate the effect of GSP, Lomé, EFTA and Mediterranean agreements analysing total exports of 162 countries to 11 countries (EU as one, USA, Japan, Norway, Sweden, Australia, Austria, Canada, New Zealand, Finland and Switzerland) in 1976. To model trade preferences, the authors use dummies, which capture the trade *diversion* effect of preferences, and the import tariffs

[3] We do not survey all the gravity model literature where NRPTPs are used simply as controlling variables in models set up to study other trade issues (i.e. Rose 2005a and 2005b). Neither do we consider those papers which investigate the effects of GSP on developing countries total trade (i.e. Rose 2004). This is because we are interested in studying the impact of NRPTPs on export performance, rather than on trade openness. Besides, "all theories that underlie a gravity-like specification yield predictions on unidirectional trade rather than total trade" (Subramanian and Wei 2007: 157). For a review of the papers aimed at assessing the impact of preferential trade policies (reciprocal and non reciprocal) using gravity models see Cardamone (2007), while a detailed survey of the approaches other than gravity is provided by Nielsen (2003).

[4] We focus on the empirical applications of gravity models. However, many studies provide theoretical explanations for why gravity equations seem to explain trade patterns so well. Some recent influential contributions to the theory of gravity models are those by Anderson and Wincoop (2004), Bergstrand (1989) and Deardoff (1995).

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that gauge the trade *creation* effect of lower tariffs. Results show a significant effect on exports of both dummies and tariffs.

The study by Nilsson (2002) indicates that from 1975 to 1992 the EU's GSP and the Lomé Convention exert a positive and significant impact on the exports of beneficiaries. In a more recent study, Nilsson (2007) compares the effect of EU and US preferential trade policies from 2001 to 2003 and argues that developing countries gain more from EU policies than from US ones. The paper by Nouve and Staatz (2003) focuses on the impact of the African Growth and Opportunity Act (AGOA) on agricultural exports from Sub-Saharan African countries (SSA) to the US over the period 1999-2002. The authors find a positive, albeit insignificant, impact of AGOA. Moreover, their fixed effect model has a very low explanatory power and, hence, their findings cannot be considered as a reliable evidence of AGOA impact.

Persson and Wilhelmsson (2007) investigate the impact on EU imports of both trade preference schemes and EU enlargements from 1960 to 2002. Their argument is that when a country joins the EU, it will trade less than before with developing countries, but at the same time it will grant trade preferences to developing countries. The net impact of these two contrasting forces on EU imports appears negative. Only ACPs benefit from preferential agreements, once the negative enlargement effect is accounted for.

Verdeja (2006) analyses the effectiveness of NRPTPs granted by the EU to developing countries over the period 1973-2000. He estimates cross-section regressions and finds a substantial gain for ACPs. Moreover, the GSP positively affects the exports of beneficiaries, although its impact is lower than that estimated for ACPs. After controlling for country heterogeneity, the GSP dummy becomes negative. Verdeja (2006) argues that this outcome is due to the low utilization that the countries eligible make of GSP preferences.

Lederman and Özden (2004) consider US imports in 1997 and 2001 and the impact of NRPTPs is evaluated by following the dummy approach and using an index of the utilization made by countries eligible for preferences. The estimations show that, in 1997, the countries belonging to the Caribbean Basin Initiative (CBI) exported 136 percent more than other countries, the gain for Andean countries was 42 percent and the countries eligible for GSP treatment exported 17 percent less. After repeating the

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analysis for 2001, the authors find that the impact of CBI and Andean agreements was higher than that relative to 1997, while the impact of AGOA was negative. This evidence is ascribed to the high negative correlation between distance and the AGOA dummy, to the expanded preferential benefits of CBI and Andean programs in 2000 and to the increased experience of exporters in taking advantage of trade preferences.

Finally, Subramanian and Wei (2007) and Goldstein et al. (2003) focus on the impact of GSP, using an extensive sample of countries (more than 170) over a very long period [1948-2001 in Goldstein et al. (2003) and 1950-2000 in Subramanian and Wei, 2007)]. A significant and positive impact of GSP preferences on total trade is found in both studies. At a more disaggregated level, the GSP program positively affects trade in the clothing and food industries, but its effect is negative in footwear and agri-food sectors (Subramanian and Wei, 2007).

From a methodological perspective it is worth noting that Sapir (1981), Oguledo and Macphee (1994) and Nilsson (2002; 2007) use OLS on cross-sectional data. Thus, these papers disregard the role played by country-fixed effects: all the factors that potentially affect trade flows, besides gravity variables (GDPs and distance), are assumed to be common across countries. The more recent studies by Nouve and Staatz (2003), Persson and Wilhelmsson (2007), Verdeja (2006), Subramanian and Wei (2007) and Goldstein et al. (2003) attempt to overcome this shortcoming by using fixed effect estimators. Finally, no paper, except for Lederman and Özden (2004),[5] tests for endogeneity of NRPTPs and all the analyses are restricted to countries that trade with each other. The use of positive trade values might introduce a selection bias because the sample might no longer be random.

Summing up, this brief review reveals that the question of how properly to specify and estimate the gravity equation in order to assess the impact of NRPTPs is still open. We depart from these studies by analysing three datasets (total exports, total agricultural exports and 10 groups of agricultural products) and by using different procedures to control for potential biases in estimations.

[5] In order to take into account zero trade flows, Lederman and Özden (2004) consider a Tobit model, employ a two-step instrumental variable method to check for endogeneity of the preference dummy and the Heckman Maximum Likelihood estimator to control for data censoring bias.

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3 Empirical setting: the gravity equation

A gravity model states that the trade flows between two countries can be explained by three kinds of variables. The first describes the potential demand of the importers, the second considers the supply conditions of exporters and the third consists of all the factors that may hinder or favour the bilateral trade flow (i.e., distance, common border, language, past colonial ties, religion, tariffs, ect.). In all the applications of the gravity models, traders' GDPs are used as proxy of their demand and supply conditions. Populations are additional variables that gauge the economic masses of trade partners. Furthermore, geographical distance is used as a proxy of transport costs and cultural dissimilarities and it is expected to be negatively correlated to trade. GDPs, populations and distance are referred to as gravitational variables and are assumed to determine the "normal" pattern of trade in the absence of any disturbance.

The appeal of the gravity approach derives from the opportunity it offers to study deviations from the "normal" trade pattern. This is done by including in the model new variables affecting trade. In our case, we extend the model by considering the preferential trade policies, which entail unilateral reductions in trade barriers granted by developed to developing countries. Hence, other things being equal, they are expected to stimulate exports from developing countries to donors yielding a higher flow of trade than that which would "normally" be expected.

The specification of the gravity model adopted in this study is the following:

$$\begin{aligned}\ln(X_{ijt}) = {} & \alpha + \alpha_1 \ln(GDP_{it}) + \alpha_2 \ln(GDP_{jt}) + \alpha_3 \ln(POP_{it}) + \alpha_4 \ln(POP_{jt}) + \\ & + \lambda_1 \ln(DIS_{ij}) + \lambda_2 LANG_{ij} + \lambda_3 BOR_{ij} + \lambda_4 COL_{ij} + \lambda_5 ISL_{ij} + \lambda_6 LAND_{ij} + \lambda_7 RTA_{ijt} + \\ & + \beta_1 GSP_{ijt}^{ORD} + \beta_2 GSP_{ijt}^{LDC} + \beta_3 Other_{ijt} + u_{ijt}\end{aligned} \quad (1)$$

where subscript *i* refers to the exporters, *j* to the importers, and *t* to time. The dependent variable X differs according to the level of data aggregation used: X represents either the total exports, or the total agricultural exports or the exports of 2-digit agricultural products. GDP is the Gross Domestic Product, POP is the population and DIS is the distance between the capital cities. The component u_{ijt} is the error term whose structure will be discussed later (cfr § 5). To control for observable country-pair specific factors affecting bilateral trade, the model includes some dummy variables. In particular, LANG and BOR are two binary variables set to unity if the trade partners share a

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common language or border, respectively. COL is a binary variable which is unity if country *i* was a colony of country *j*. ISL and LAND are the number of islands and landlocked countries in the pair, respectively. The variable RTA (Regional Trade Agreements) is a dummy variable set to unity if *i* and *j* belong to the same RTA (such as, EFTA, NAFTA or a bilateral agreement between the trading countries), and zero otherwise.

Concentrating on the most interesting coefficients for our analysis, the GSP and Other dummies are intended to capture the marginal effect of different arrangements on export flows (we define these dummies in section 4). The sign of β_1, β_2 and β_3 is expected to be positive. The intuition behind this expectation is clear: the dummies attempt to capture the effect of preferential treatment. Presumably, a beneficiary country will be induced to export towards the preference-giving country more than it would do in the counterfactual, i.e. were it not receiving that specific trade preference.

4 Data and Variables

The trade statistics are drawn from the Comtrade dataset. The set of importing countries is comprised of the eight major OECD members (Australia, Canada, EU15 as a whole, Japan, New Zealand, Norway, Switzerland and USA), while the exporters are 184, that is all the countries for which trade statistics are available (the exporters are listed in Appendix A). In order not to have to deal with complications due to EU enlargements, the period under scrutiny covers the years from 1995 to 2003. Each annual bilateral export flow is an observation (the sample includes the exports from one OECD to the other OECD countries).

Working on three different levels of trade flows (total exports, total agricultural exports and the exports of ten 2-digit aggregation of agricultural products[6]) we have three unbalanced panel data of different sizes. If we only consider positive trade values over the period 1995-2003, there are 11457 observations in the case of total exports,

[6] The ten groups of products correspond to the 2-digit commodity SITC codes: Live Animals (00); Meat and Meat Preparations (01); Dairy Products and Bird Eggs (02); Fish, Crustaceans, Mollusc and Preparations Thereof (03); Cereals and Cereal Preparations (04); Vegetables and Fruit (05); Sugar, Sugar Preparations and Honey (06); Coffee, Tea, Cocoa, Spices and Manufactures Thereof (07); Feeding Stuff for Animals (08); Miscellaneous Edible Products and Preparations (09).

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9292 observations for total agricultural exports, and 43518 observations when the focus is on 2-digit agricultural products.

As far as the explanatory variables are concerned, data of GDP and population are from the World Development Indicators 2005. The geographical distance is the great circle distance between the capital cities of the two countries (the source is http://www.wcrl.ars.usda.gov/cec/java/lat-long.htm). The database provided by Rose (2004) is the source used to construct the observable pair-specific determinants of export flows (ISL, LAND, LAN, BOR and COL). Moreover, the dummy RTA is created using information drawn from a WTO database available at http://www.wto.org/english/tratop_e/ region_e/region_e.htm (the RTA we consider are listed in Appendix B). All variables in value are in constant 2000 US dollar.

In order to construct the key variables of our analysis (the dummies GSP and Other) we consulted the annual tariff schedules published by each preference-giving country and the handbooks of the eight GSP programs [7] and constructed the preference dummies starting from the most disaggregated level of data. For each country pair-line of products, the preference dummy Other is equal to unity if there is at least one individual good within that 2-digit line that receives a preferential treatment under a scheme other than GSP, whatever the type and the extent of the preference. This is done for every year over the period 1995-2003 and, hence, the dummies take also into account the inclusion/exclusion of individual countries from year to year on political or other grounds. The same criterion applies for the GSP dummies.

In the gravity models analysing total exports and total agricultural exports, the preference dummies are constructed using the information available at the commodity group level: hence, if Other (or GSP^{ORD}, GSP^{LDC}) is unity for at least one of the ten groups of agricultural products, then it will be unity in the other two aggregations (total

[7] To be more precise, for the US we used the annual General Notes of the Harmonized Tariff Schedule, whereas for the EU we take data from TARIC, available on the website of the Official Journal of the European Communities. For EU data not available on internet (from 1995 to 1998), we retrieved the relevant information from Persson and Wilhelmsson (2007). As far as Australia, Canada, Japan and New Zealand are concerned, data are taken from their National Customs Service. A list of worldwide data availability of tariffs is provided by the International Trade Administration of the US Department of Commerce at http://www.ita.doc.gov/td/tic/ (tariff and fee information section). As for GSP, we also used the handbooks and, for comparison, the "List of GSP beneficiaries" provided by the GSP office at UNCTAD and updated to 2001.

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agricultural exports and total exports).[8] The preferential schemes used to construct the dummy Other are specific for each OECD country (see Appendix B).

Before implementing the econometric analysis we address some data issues concerning the exports to the eight selected OECD countries. Like most sources of trade statistics, Comtrade only reports the positive trade flows declared by each country at face value. This problem is usually solved by treating all non-reported trade values as missing. This procedure is correct if all the left out data are missing and the restricted sample of positive trade pairs is not systematically different from the sample of missing country-pairs and from that of country-pairs which do not trade with each other. Since these conditions are not normally observable in international trade, we address the issue of non-reported data as follows: we assume that the accuracy of our group of OECD importers in recording data is high and, hence, the incidence of missing values in our dataset should be limited.[9] Consequently, all non-reported data with regards total imports are treated as zero-trade values.[10] This assumption made for the more aggregated level is also applied to the other two data aggregations. Therefore, we attribute zero to the non-reported 1-digit and 2-digit agricultural data.[11]

As table 1 indicates, many developing countries are eligible for more than one preferential treatment. This overlapping has been addressed by (a) properly defining the preference dummies and (b) introducing a count variable.

[8] It is worth noting that our preference dummies coincide with those that one would obtain using the criterion of country eligibility for preferential treatments. This may be due to the fact that tariffs are defined at a very disaggregated level (usually at 6-digit basis) and the 2-digit SITC codes are large enough to include at least one product that enjoys trade preferences.

[9] Our assumption is corroborated by some evidence. As we said before, for each country pair we use import values, as they are generally more accurate than export values. The discrepancy between export and import values is frequent in Comtrade, but the array of data declared by importers is far more complete than that obtained from exporters. This might be due to the fact that importers need to collect tariffs and, therefore, have an interest in proper recording. Similar incentives may be absent on the part of exporters.

[10] After a careful comparison of different trade statistics (Comtrade, national account statistics, data from WTO and IMF), Gleditsch (2002) shows that 80% of non-recorded data in IMF Direction of Trade Statistics (DoTS) are zero-trade values. Gleditsch (2002) takes into account trade flows of both developed and developing countries. Given the higher accuracy of developed countries in recording data, this percentage should be much higher for our selected OECD countries.

[11] We checked the consistency of the declared data in Comtrade. For example, we verified that total world imports of each OECD country at time t is always equal to the imports from each partner. The same applies at 1-digit agricultural level. However, as regards data at 2-digit level, we observe that the declared data at 1-digit agricultural level are often slightly different than the sum of the values at 2-digit agricultural level. However, we always substitute zero for the missing values as the differences obtained are negligible (the maximum being 76 US $ only).

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[Table 1, about here]

The first way of solving the overlapping of preferential treatments is based on the following assumption. We assume that the preferential treatment received by a developing country under one of the trade agreements subsumed in the dummy variable Other Preferences is more favourable than that received from GSP (Ordinary or for LDCs). Therefore, whenever a country is eligible under both the GSP and another preferential scheme, it will ask for the latter treatment.[12] This order allows us to define the preference dummies included in equation [1] as follows: the dummy GSP^{ORD} (GSP^{LDC}) is equal to unity if the exports of country *i* to country *j* enjoy preferential treatment *only* from the ordinary GSP (GSP for LDCs), while the dummy Other Preferences is equal to unity if country *i* enjoys preferential treatment from country *j* other than GSP and is zero otherwise.

Besides the use of three separate preference dummies, we deal with the presence of overlapping areas by defining a polytomous variable, named Pref Ord. It assumes higher values as the number of preferential schemes which a country belongs to increases. More precisely, it takes on the following values: zero if the export flow from country i to country j receives no preferential treatment (group A in table 1); one if it is regulated under the ordinary GSP only (group B1); two if there is a preference from the GSP for LDCs only (group B2); three if the only preferential treatment received is that from Other Preferences (group B3); four if the trade flow enjoys preferential treatment by ordinary GSP and Other Preferences (group B4); finally, Pref Ord is five if the exports flow is eligible for a preferential treatment from the GSP for LDCs and from Other Preferences (group B5).[13] The use of this polytomous variable is meant to provide an overall assessment of the effectiveness of trade preferences.

[12] This assumption is partially supported by the empirical evidence reported in Bureau, Chakir and Gallezot (2007). The authors show that some preferential agreements (i.e. the Lomé/Cotonou convention and the Caribbean Basin Economic Recovery Act) are systematically preferred by exporters to GSP when the preference regimes overlap in terms of product coverage.

[13] An example may help to explain the rationale underlying the variable Pref Ord. Let's assume that some exports of a beneficiary country are eligible for preferential treatment from GSP and Other Preferences (the country belongs to group B4 in table 1). Thus, the aggregated data include the exports of products benefiting from GSP preferences and exports of products enjoying Other Preferences. Therefore, both preferential schemes contribute to determine the aggregated trade flows of that country.

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5 Econometric issues: heterogeneity, endogeneity and non-random selection

One of the main issues to be addressed in using the gravity model to analyse trade flows is the country (and country-pair) heterogeneity. Heterogeneity may be due to observable and non-observable factors.[14] From an econometric perspective, the omission of such factors renders gravity equations mis-specified, and bound to produce biased and/or inconsistent estimates. When heterogeneity derives from observable determinants, which define the country-pair background, (i.e., common language, colonial past, border, religion, ect.) a set of dummies may be employed to capture their influence (cfr. eq. [1]). However, this approach does not thoroughly control for dyadic heterogeneity, unless all unobservable country-pair fixed effects are captured by the country-pair background. The use of fixed effects models allows controlling for non-observable heterogeneity.

In this paper, we adopt a general decomposition of the error term recently advocated in gravity empirics (Carrère, 2006; Egger and Pfaffermayr, 2003), expressed as follows:

$$u_{ijt} = \upsilon_{ij} + \varepsilon_{ijt} \qquad (2)$$

where υ_{ij} are time-invariant dyadic fixed effects and ε_{ijt} is the idiosyncratic error term.

An implicit assumption underlying the fixed effects estimations is that regressors are strictly exogenous. There is, of course, no a priori reason to expect this to be the case (Baier and Bergstrand, 2004). Indeed, on theoretical grounds, a reverse causation is likely to exist between imports and trade protection (and hence the margin of preference granted to preferred countries) of the preference-giving country. As Özden and Reinhardt (2005, p. 19) point out "GSP eligibility has been shown to be negatively affected by export volume". A similar argument may be provided for the RTA dummy: the trade flows between two countries may affect the probability of signing a RTA.

[14] For example, a nation may be characterized by a certain propensity to export (or import), which may be independent of GDP and time invariant. Moreover, the same country might experience business cycle effects, which vary over time and are country specific. Furthermore, historical and cultural links may distinguish the trade relationship between one country and another with respect to any other possible trader.

In order to verify if trade preferences are endogeneous, we implement the Davidson and MacKinnon (1993) endogeneity test, which compares the Least Squares Dummy Variable (LSDV) estimates and those obtained when using Instrumental Variables (IV) method.[15] The evidence is that the p-values of the endogeneity test allow the rejection of the hypothesis of endogeneity of the preferential variables in all regressions we run.[16]

Moreover, results could be flawed by the sample selection bias implied by the exclusion of zero-trade observations. Indeed, there could be a sample selection problem due to the fact that the process underlying the decision to export might be correlated to the gravity equation used to model the actual exports. If this correlation exists, disregarding the selection process yields biased estimates [see, i.e., the evidence provided by Helpman et al. (2008) and Piermartini and The (2005)]. Since we are considering dyadic fixed effects (eq. [2]), each pair of countries represents the statistical unit observed over time and we can test for the presence of non-random selection bias by adopting the method suggested by Wooldridge (1995), which "can be viewed as an extension of Heckman's (1979) procedure to an unobserved effects framework" (p. 124).[17] This procedure controls for unobserved heterogeneity by

[15] When we estimate the gravity equation with the dummies GSP^{ORD}, GSP^{LDC}, Other Preferences, and RTA the instruments are a polity score, a physical integrity rights index, a workers' rights variable and an empowerment rights index; when we run regressions with Pref Ord and RTA the instruments are a polity score and a physical integrity rights index only. The polity score is drawn from the POLITY IV database (available at http://www.cidcm.umd.edu/inscr/polity/) and ranges from -10 (high autocracy) to +10 (high democracy). The other variables are drawn from the Cingranelli-Richards Human Rights (CIRI) Database 2004. The physical integrity rights index is an additive index constructed from the torture, extrajudicial killing, political imprisonment and disappearance indicators. It ranges from 0 (no government respect for these four rights) to 8 (full government respect for these four rights). The Workers' Rights variable assumes the following values: severely restricted (0), somewhat restricted (1) or fully protected (2). The Empowerment Rights Index is an additive index constructed from the Freedom of Movement, Freedom of Speech, Workers' Rights, Political Participation, and Freedom of Religion indicators. It ranges from 0 (no government respect for these five rights) to 10 (full government respect for these five rights). In our samples the endogenous variables are strongly correlated with the instruments, even after sifting out the other exogenous variables in the equation (namely population, GDP, and trend). Hence, by assuming that the same indicators are not correlated with the regression error term, the two "key identification conditions" (Wooldridge 2003, p. 496) are met and thus the instruments are valid.

[16] Results are not reported, but are available upon request from the authors. The same applies to all other outcomes discussed but not presented throughout the paper.

[17] The issue posed by zero-trade flows is also addressed by Silva and Tenreyro (2006) who adopt a Poisson model to overcome the problem of heteroskedastic and non-normal residuals in gravity regressions. Recently, using Monte Carlo simulations, Martin and Pham (2008) assess the performance of different limited-dependent variable estimators concluding that "while the Poisson Pseudo-Maximum Likelihood estimator recommended by Silva and Tenreyro (2006) solves the

adopting a fixed effects (FE) model, where the unobserved components are allowed to be correlated to the explanatory variables. Furthermore, the idiosyncratic errors may have serial dependence of unspecified form.[18] As the Wooldridge (1995) test is almost never significant in estimations, the existence of selection bias is not supported in our sample. Given the results of the endogeneity and selection bias tests, we estimate the gravity model through a Fixed Effect Model and using the error decomposition as expressed in eq. [2]. When explaining the total exports and the total agricultural exports, we find that the estimated parameter associated with the Pref Ord variable is not significant. The same applies when using the three dummies Ordinary GSP,GSP for LDCs and Other preferences (only GSP for LDCs significantly affects total exports). We find analogous inconclusive findings when regressions are run at 2-digit level.

These are not surprising outcomes, because the term υ_{ij} in eq. [2] absorbs the effects of any country-pair fixed effects (coefficients from λ_1 to λ_6 of eq. [1] are not estimated), including those of the trade preferences to which we are mainly interested in. Indeed, over the span period we consider, the preferential treatments are seldom revised, and basically are time-invariant.[19] Their impact is likely to be subsumed by the dyadic effects. Therefore, we proceed by employing an alternative error term decomposition, which Brun et al. (2005, p.102) label as the "usual correction" for heterogeneity in gravity equations. Such an alternative method appears to be more suitable to the present study, as it allows estimation with greater accuracy of the coefficients of dyad variables displaying little time variation. Formally we assume that:

$$u_{ijt} = \alpha_i + \alpha_j + \varepsilon_{ijt} \qquad (3)$$

heteroscedasticity-bias problem when this is the only problem, it appears to yield severely biased estimates when zero trade values are frequent" (Martin and Pham, 2008, p. 1).

[18] The test proposed by Wooldridge (1995) requires to model two different, but potentially correlated, processes: the selection process, where the decision of whether to export or not is modeled through a probit equation, and the substantial process (equation [1]), in which the selection influence is taken into account by augmenting the regressions by the inverse Mills ratio (IMR or lambda) retrieved from the year-by-year probit estimates. The augmented regressions are estimated on the sample of positive export flows, and the significance of the IMR coefficient is tested by means of (robust) t-ratio. It is worth mentioning that the regressors included in the probit equation are the variables of the substantial equation. Therefore, the non-linearity of the inverse Mills ratio variable is the sole source of identification in the procedure we adopt to control for selection bias.

[19] Preferential dummies display a zero standard deviation over time for almost all the country-pairs in our sample (the percentage of zero standard deviation goes from a minimum of 93.5% for ordinary GSP to a maximum of 97.5% for GSP for LDC).

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where α_i and α_j are time-invariant importer and exporter country fixed effects, respectively, and ε_{ijt} is the idiosyncratic error term. The LSDV estimates obtained when using the decomposition [3] are summarized in tables 2 and 3. It is worth noticing that the standard errors are robust to heteroskedasticity and adjusted by clustering observations at the country-pair level. This adjustment allows for error terms correlation within each couple of countries over time. Finally, the Durbin-Wu-Hausman test confirms that the null hypothesis of endogeneity of NRPTPs may by rejected, whatever the data aggregation.

6 Results

When the gravity model is used to explain total exports (column 1 in tables 2 and 3), our evidence is consistent with that obtained by previous studies. Indeed, the standard gravity variables have the expected sign and the adjusted coefficient of determination (0.82) indicates that the model fits data quite well. More specifically, the GDPs of importers and exporters positively affect export flows and distance exerts a negative impact, whereas the coefficient associated with population is negative in the case of exporters and positive for importers. Furthermore, the variables LANG, COL, ISL, and RTA have the right sign, whereas BOR and LAND have not (however, results are significant for COL and ISL only). Similar evidence is found when analysing total agricultural exports, unless the change of the impact exerted by border (now positive and significant at 10%), island (now positive and highly significant), landlocked (now highly significant) and the change of the magnitude of other coefficients (i.e., GDP is much more important in explaining total exports than total agricultural exports; distance is less restrictive in the case of agricultural exports than for all goods). Finally, it is interesting to note that, in regressions of total agricultural exports, the LANG, COL and LAND parameters are higher than those obtained when explaining total exports. The picture changes when considering 2-digit agricultural products: we observe a reduction in the goodness of fit and numerous changes of the sign of the coefficients.[20]

[20] The adjusted coefficient of determination ranges from 0.67 (feeding stuff for animals) to 0.8 (miscellaneous edibles products), while the only variables with the same sign in all 10 regressions are distance (always negative and significant) and border (always positive and significant) (tables 2 and 3).

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As for the main aim of this paper, we find that all preferential dummies have a positive impact on total exports, even though the significance of GSP is very low (table 2, column 1). When using total agricultural exports we find that all preference dummies are still positive and GSP dummies become highly significant: the values of the estimated coefficients are 0.19 for GSP^{ORD}, 0.74 for GSP for LDCs and 1.06 for Other preferences (table 2, column 2). The positive impact of trade preferences obtained at the two most aggregate levels (all commodities and agricultural products) holds entirely when we summarize the preferential treatment by using the variable Pref Ord (table 3).

With regards the agricultural exports at 2-digit level, it emerges that only the meats sector gains from the ordinary GSP, whereas this program has a negative impact on the remaining sectors, albeit significantly in only two cases (live animals and sugar). Furthermore, the GSP for LDCs exerts a positive and significant effect in only one sector (vegetables and fruits), while in two sectors (live animals and dairy products) the impact is negative and significant. Finally, the largest impact comes from the dummy Other Preferences, whose estimated coefficient is positive and significant in 7 out of 10 groups of products (meat, fish, cereals, vegetables, sugar, coffee, tea, cocoa and spices, miscellaneous edible products and preparations) and negative and significant only in the sector of feeding stuff for animals (table 2). This heterogeneity in results decreases when regressions include the polytomous variable Pref Ord (table 3).[21, 22]

[Tables 2 and 3, about here]

Finally, in order to produce further evidence by allowing the specific country effects to vary over time, we run equation 1 in a cross-section setting for each year from 1995 to 2003. Rather than tabulating all the estimates obtained, we focus only on the findings obtained with the polytomous variable Pref Ord, whatever the data

[21] When using the variable Pref Ord, we obtain that NRPTPs positively affect the exports of beneficiary countries in six groups of products, while only the exports of feeding stuff for animals are penalized by the preferential treatments granted by the eight OECD members considered in the paper.

[22] In order to take into account multilateral trade resistance (Anderson and van Wincoop, 2004; Baldwin and Taglioni, 2006) all the estimations have been replicated by allowing the country-specific effects to vary over time. We find similar results to those reported in the paper and one reason may be that our panel spans a relatively short period.

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aggregation.[23] The estimated coefficients and their statistical significance using aggregated data are depicted over time in figures 1 and 2, while appendix C reports the 10 graphs concerning the agricultural exports at the 2-digit level.[24] When total exports are concerned (figures 1 and 2), the evidence confirms the positive significant impact of NRPTPs in each year of the period under scrutiny. If we split the sample along agricultural commodity lines, the impact of NRPTPs is positive and significant over most of the period analyzed in four sectors (fruit and vegetable, sugar, coffee and tea commodities and miscellaneous), while in the other cases the preferential coefficient is often not significant and sometimes negative.

The synthesis of previous results is that the ordinary GSP exerts a negative, albeit often not significant, impact in many 2-digit groups. This might be due to the high costs of complying with the relevant rules of origin that are required to exporters by OECD countries under the GSP scheme. Furthermore, the role of GSP for LDCs is positive for most of the sectors, although it is significant only for vegetables and fruits. This finding is partially consistent with the fact that the preferences of GSP for LDCs are larger than those given under the ordinary GSP. Finally, the effect of trade preferences other than GSP is positive and significant in several sectors and significantly negative only for the feeding stuff for animals industry.

[Figures 1 and 2, about here]

7 Conclusions

This paper contributes to the empirical literature which uses gravity models to assess the impact of non reciprocal preferential trade policies (NRPTPs) granted by developed to developing countries.

[23] As Subramanian and Wei (2007) highlight, this also allows the coefficients of the explanatory variables to vary over time, at the expenses of a potential loss of efficiency, which is negligible given the large dataset employed.

[24] The procedure to consider cross-section regressions on a yearly basis yields an impressive number of results (i.e., 18 regressions for total exports, 18 regressions for total agricultural exports and 180 regressions for products at 2-digit). We provide all these results upon request. Moreover, it is worth mentioning that, in all the cross-section regressions, specific country effects are included to account for multilateral resistance *à la* Anderson and Van Wincoop (2004), the observations have been clustered at the country-pair level and, to avoid multicollinearity problems with the country effects, the GDPs and populations enter the annual regressions as products (see, for instance, Rose 2004 and 2005b).

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After reviewing the related literature, we argue that the assessment of the impact of trade preferences should be carried out using disaggregated data rather than total exports, as discriminatory trade agreements apply at product level. In order to support our claim, we analyse export flows towards eight OECD members (EU, USA, Japan, Norway, Switzerland, Australia, Canada and New Zealand) and employ three levels of data aggregation (total exports, total agricultural exports and 2-digit agricultural products). The coverage of trade preferences is very comprehensive, as the OECD countries we consider grant most of the NRPTPs currently active.

The empirical results can be summarized as follows. Initial key evidence refers to the positive impact of trade preferences on total exports of beneficiaries. This finding is found in all the regressions we run using a polytomous variable to proxy the preferential treatments and is confirmed when we consider separate and mutually exclusive dummy variables for each preferential scheme, although in this case the main source of trade gains for beneficiaries is given by NRPTPs other than GSP.

A second outcome concerns the effectiveness of trade preferences at 2-digit level. It emerges that the effect of ordinary GSP, GSP for LDCs and Other preferences is not always positive and statistically significant. When this evidence is compared to that obtained at aggregated level it reveals how the aggregation influences the impact of trade preferences. We find that the NRPTPs granted by OECD members to developing countries are not always a story of success, something which emerges when using aggregated data. In fact, some sectors gain from the status of being preferred in terms of access into OECD markets, while others do not. When using the ordered variable at 2-digit level, we find that the effectiveness of NRPTPs is positive and significant only for some groups of products. This outcome might be due to the fact that the margin of trade preferences widely varies across sectors and donors and invites further investigation.

To summarize, although the NRPTPs increase, on average, the overall exports of beneficiary countries, we also show how the preferential impact is heterogeneous across 2-digit sectors and data aggregations. Therefore, the present paper should be considered as the first step in a promising line of research. While we have mostly focused on evaluating the impact of NRPTPs using gravity equations and modelling trade preferences with the dummy variables approach, future work should refine the measures of preferential treatments. Indeed, the dummy variables approach is

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problematic as dummies capture a range of other country-pair specific effects contemporaneous with preferential treatment. Moreover, dummy variables treat all the beneficiary countries as a homogenous group and they don't allow to discern among the different preferential trade policies (preferential tariff margins, preferential quotas, reduced "entry prices") as well as they do not measure the level of trade preferences (i.e., dummies impose that the level of preferential schemes under Ordinary GSP is the same of those under Everything But Arms Initiative). Hence, a natural next step of this paper is to conduct empirical analyses at very disaggregated levels and to include in the gravity equation explicit measures of the trade preferences granted to the exports of developing countries. Conclusions on the role of NRPTPs are likely to be revised after the refining of the measurement of preferential treatments.

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Appendix A: The exporting countries included in the sample

Afghanistan, Albania, Algeria, Andorra, Angola, Antigua and Barbuda, Argentina, Armenia, Aruba, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belize, Benin, Bermuda, Bhutan, Bolivia, Bosnia Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Cape Verde, Cayman Islands, Central African Republic, Chad, Chile, China, China Hong Kong SAR, China Macao SAR, Colombia, Comoros, Congo, Costa Rica, Croatia, Cuba, Cyprus, Czech Republic, Democratic People's Republic of Korea, Democratic Republic of the Congo, Djibouti, Dominica, Dominican Republic, EU15, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Estonia, Ethiopia, FS Micronesia, Fiji, Finland, French Polynesia, Gabon, Gambia, Georgia, Ghana, Greenland, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Iran, Iraq, Israel, Ivory Coast, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kiribati, Kuwait, Kyrgyzstan, Lao People's Democratic Republic, Latvia, Lebanon, Lesotho, Liberia, Libya, Lithuania, Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Marshall Islands, Mauritania, Mauritius, Mayotte, Mexico, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nether. Antilles, New Caledonia, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Republic of Korea, Republic of Moldova, Romania, Russian Federation, Rwanda, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Saudi Arabia, Senegal, Serbia and Montenegro, Seychelles, Sierra Leone, Singapore, Slovakia, Solomon Islands, Somalia, South Africa, Sri Lanka, Sudan, Suriname, Swaziland, Sweden, Switzerland, Syria, TFYR of Macedonia, Tajikistan, Thailand, Timor-Leste, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, USA, Uganda, Ukraine, United Arab Emirates, United Republic of Tanzania, Uruguay, Uzbekistan, Vanuatu, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe.

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Appendix B: Trade agreements covered

Bilateral trade agreements

USA-Israel (since 1985), USA-Jordan (since 2001), NAFTA (USA-Mexico and Canada, since 1994), Australia-New Zealand (since 2003), Australia-Singapore (since 2003), New Zealand-Singapore (since 2001), Australia-Papua New Guinea, Japan-Singapore (since 2002), Canada-Chile (since 1997), Canada-Costa-Rica (2002), Canada-Israel (since 1997), the RTAs of EU15 with Iceland, Norway/EFTA, Switzerland/EFTA, Algeria, Syria, Andorra (since 1991), Bulgaria and Romania (1993), Turkey (1996), Tunisia (1998), Israel (2000), Mexico (2000), Morocco (2000), South Africa (2000), Republic of Macedonia (2001), Croatia (2002) Jordan (2002), Chile and Lebanon (2003). Finally, we consider the preferences granted by EFTA members (Norway and Switzerland) to Turkey (1992), Bulgaria (1994), Israel and Romania (1993), Morocco (2000), Republic of Macedonia (2001), Mexico (2001), Croatia (2002), Jordan (2002) and Singapore (2003). We do not consider the RTA signed after 2003 [such as EU and Egypt (2004), USA and Chile (2004), USA and Singapore (since 2004), EFTA and Chile (2004)].

Non-Reciprocal Preferential Trade Policies

We considered the preferences that the EU grants to 77 African, Caribbean and Pacific countries (ACP) under the Cotonou Agreement (or before 2000 under the IV Lomé Convention), the preferences granted since 2001 to Western Balkan countries (Albania, Bosnia Herzegovina, Croatia, the TFYR of Macedonia, and Serbia and Montenegro), and those granted to the Overseas Countries and Territories (OCTs) constitutionally linked to Denmark, France, the Netherlands and UK. With regards the USA, one important unilateral trade arrangement is the African Growth and Opportunity Act (AGOA) through which, since 2001, exports of nearly 6500 products from 48 Sub-Saharan African countries have entered the US market duty-free. Furthermore, under the Caribbean Basin Initiative (CBI) 24 countries enjoy preferential treatment for access to the US market, as do Bolivia, Colombia, Ecuador and Peru who signed the US Andean Trade Promotion Act (ATPA) in 2001. With regards to Canada, we consider the Caribbean Commonwealth Countries Tariff (CCCT), which is a tariff treatment which has been unilaterally extended to 18 countries since the 1980s. Under the South Pacific Regional Trade and Economic Cooperation Agreement (SPARTECA), New Zealand and Australia have offered duty free access to exports of the 14 developing island member countries of the Forum Island Countries (FICs) since 1981. Norway, Japan and Switzerland offer preferential treatment to developing countries under the GSP scheme only.

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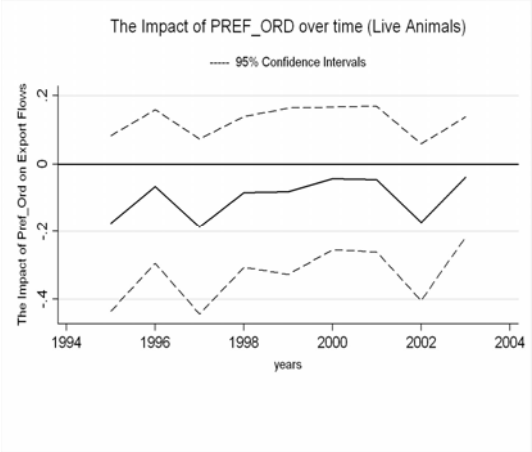
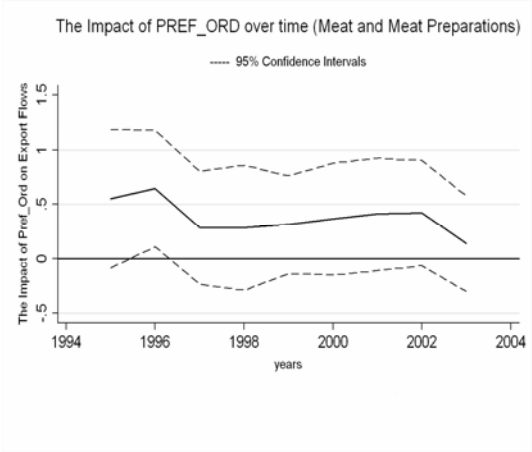
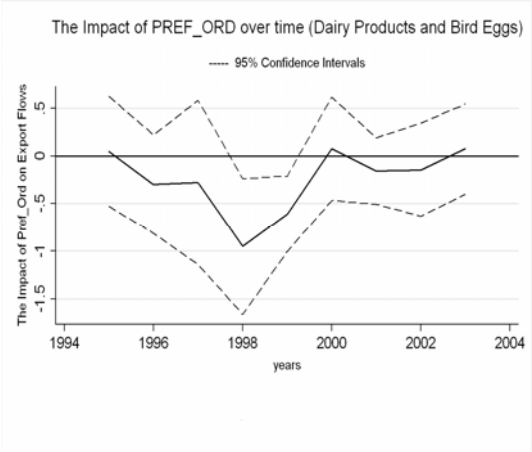
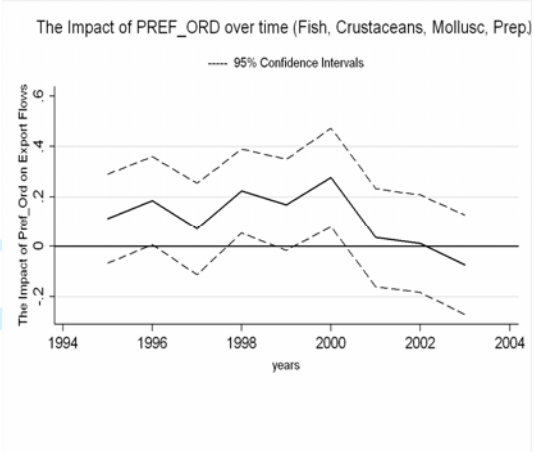
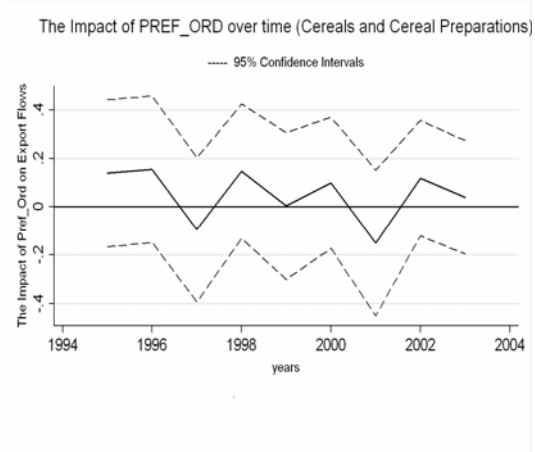
Appendix C: The impact of trade preferences over time. OLS estimates at 2-digit agricultural level.

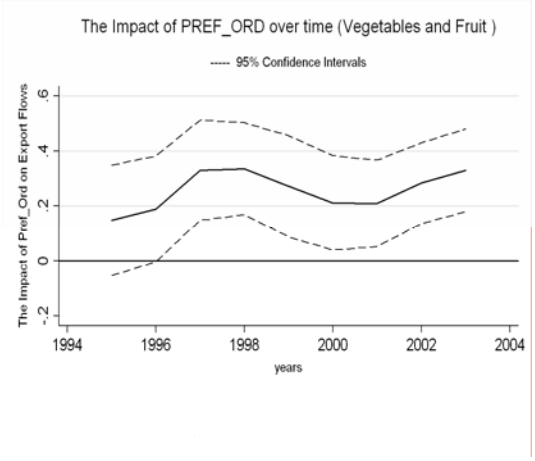


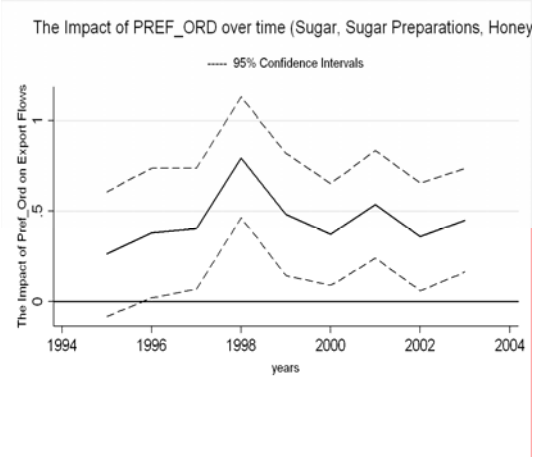











The Impact of PREF_ORD over time (Sugar, Sugar Preparations, Honey
95% Confidence Intervals
The Impact of Pref_Ord on Export Flovrs
0
.5
1
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1996
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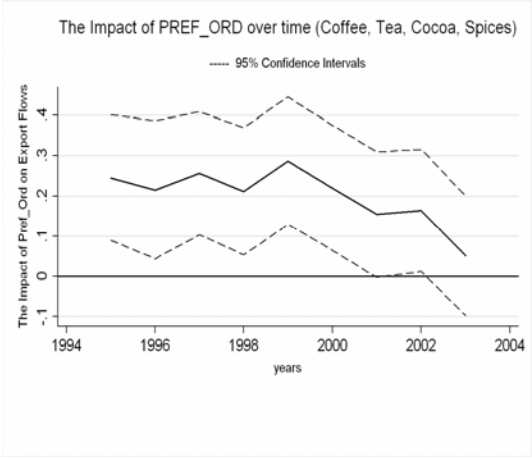
years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95% Confidence Intervals
The Impact of Pref_Ord on Export Flovrs
-.1
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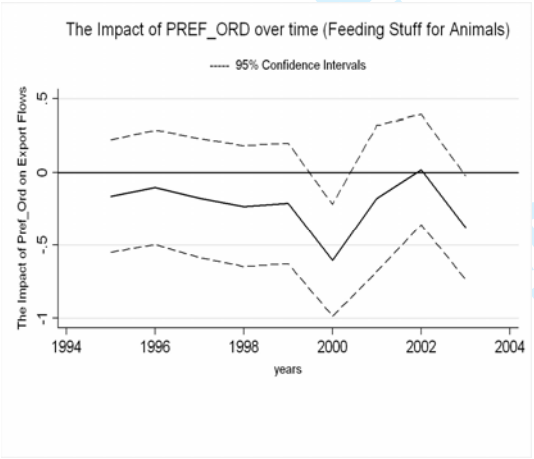
2004
years


The Impact of PREF_ORD over time (Feeding Stuff for Animals)
95% Confidence Intervals
The Impact of Pref_Ord on Export Flovrs
-1
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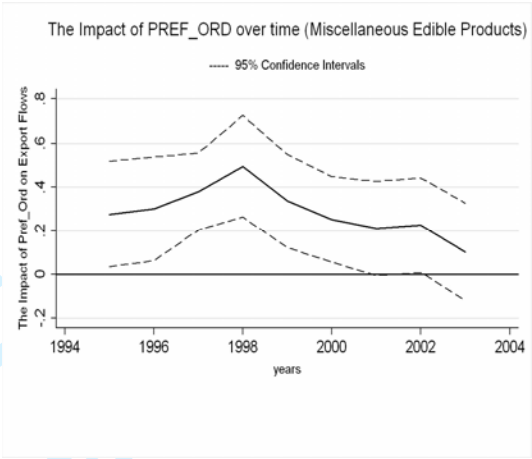
The Impact of PREF_ORD over time (Miscellaneous Edible Products)
95% Confidence Intervals
The Impact of Pref_Ord on Export Flovrs
-.2
0
.2
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.6
.8
1994
1996
1998
2000
2002
2004
years

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For Peer Review

Table 1: Bilateral Trade Flows by preference (1995-2003)

	Total Trade		Total agricultural products		2-digit agricultural products	
	Positive trade flows only	Full sample (positive and zero trade flows)	Positive trade flows only	Full sample (positive and zero trade flows)	Positive trade flows only	Full sample (positive and zero trade flows)
Not Preferred Trade Flows (A)	3295	3645	2524	3835	14563	38340
Preferred Trade Flows (B)	8162	8910	6768	8910	28955	89100
Ordinary GSP only (B1)	4725	5018	4085	5018	19420	50180
GSP for LDCs only (B2)	2154	2559	1459	2559	3121	25590
Other Preferences only (B3)	71	79	58	79	341	790
Ordinary GSP & Other Pref. (B4)	757	785	729	785	4117	7850
GSP for LDCs & Other Pref. (B5)	455	469	437	469	1956	4690
Total (A+B)	11457	12555	9292	12745	43518	127440

Source: own computations.

For Peer Review

Table 2: LSDV estimates of the gravity model by using dycotomous variables to measure trade preferences. Dependent Variable: real exports in logs to eight OECD countries (1995-2003).

	Total Exports	Total Agricultural Exports	Live Animals (SITC 00)	Meat and Meat preparations (SITC 01)	Dairy Products and Bird Eggs (SITC 02)	Fish, Crustaceans Mollusc and Aqua (SITC 03)	Cereals and Cereal Preparations (SITC 04)	Vegetables and Fruits (SITC 05)	Sugar, Sugar Preparations and Honey (SITC 06)	Coffee, Tea, Cocoa, Spices (SITC 07)	Feeding Stuff for Animals (SITC 08)	Miscellaneous Edible Products and Preparations (SITC 09)
	1	2	3	4	5	6	7	8	9	10	11	12
GSP^{ORD}	0.15	0.19	-0.61	0.34	-0.22	-0.02	-0.44	-0.03	-0.21	0.01	-0.01	-0.24
	(1.31)	*(1.61)*	*-(2.72)*	*(1.20)*	*-(1.10)*	*-(0.14)*	*-(2.50)*	*-(0.23)*	*-(1.21)*	*(0.10)*	*-(0.04)*	*-(1.72)*
GSP^{LDC}	0.09	0.74	-0.73	0.81	-1.37	0.32	0.11	0.97	0.63	0.40	-0.53	0.71
	(0.36)	*(3.21)*	*-(2.43)*	*(0.89)*	*-(2.30)*	*(0.84)*	*(0.30)*	*(2.08)*	*(0.96)*	*(0.92)*	*-(0.82)*	*(1.51)*
Other Preferences	1.13	1.06	-0.31	1.14	0.04	0.66	0.52	1.07	2.07	0.41	-1.16	1.16
	(5.81)	*(5.73)*	*-(1.06)*	*(2.30)*	*(0.10)*	*(2.34)*	*(1.55)*	*(4.18)*	*(4.83)*	*(1.73)*	*-(3.23)*	*(4.39)*
RTA	0.04	-0.13	0.79	-0.30	0.25	-0.28	0.86	-0.06	0.58	0.67	-0.40	0.59
	(0.17)	*-(0.60)*	*(1.87)*	*-(0.70)*	*(0.89)*	*-(1.02)*	*(2.81)*	*-(0.26)*	*(2.02)*	*(2.12)*	*-(1.32)*	*(2.38)*
ln(POP_importers)	0.87	0.82	1.49	1.23	0.31	0.32	0.63	1.61	1.52	1.30	0.71	1.71
	(4.61)	*(4.43)*	*(4.36)*	*(3.09)*	*(0.65)*	*(1.30)*	*(2.17)*	*(7.09)*	*(4.72)*	*(5.86)*	*(1.66)*	*(7.35)*
ln(GDP_importers)	0.35	0.28	-0.30	-0.04	0.55	0.96	0.17	-0.77	-0.62	-0.32	0.23	-0.88
	(2.02)	*(1.62)*	*-(0.95)*	*-(0.11)*	*(1.30)*	*(4.23)*	*(0.64)*	*-(3.61)*	*-(2.08)*	*-(1.55)*	*(0.59)*	*-(4.06)*
ln(POP_exporters)	-2.23	-1.27	-0.93	-1.22	-0.45	0.50	-0.79	0.59	-1.56	-1.52	-1.61	-1.48
	-(4.97)	*-(2.57)*	*-(0.82)*	*-(1.09)*	*-(0.38)*	*(0.59)*	*-(0.75)*	*(1.02)*	*-(1.20)*	*-(2.07)*	*-(1.43)*	*-(1.97)*
ln(GDP_exporters)	0.60	0.25	-0.02	0.23	-0.23	0.03	0.26	0.38	0.26	0.30	0.45	0.53
	(4.35)	*(2.32)*	*-(0.10)*	*(1.20)*	*-(0.88)*	*(0.20)*	*(1.33)*	*(3.38)*	*(1.55)*	*(2.42)*	*(1.70)*	*(3.30)*
ln(Distance)	-1.23	-1.15	-0.91	-0.72	-0.68	-1.15	-0.71	-1.19	-0.64	-0.70	-1.43	-0.87
	-(16.22)	*-(14.97)*	*-(7.06)*	*-(4.06)*	*-(4.70)*	*-(11.70)*	*-(6.22)*	*-(11.67)*	*-(5.48)*	*-(6.79)*	*-(9.04)*	*-(9.05)*
Border	-0.17	0.58	1.71	2.29	0.74	0.76	1.13	0.64	1.38	0.98	0.98	0.93
	-(0.57)	*(1.61)*	*(3.42)*	*(5.14)*	*(1.71)*	*(1.70)*	*(2.61)*	*(1.95)*	*(4.05)*	*(2.69)*	*(2.08)*	*(2.57)*
Language	0.09	0.13	-0.03	-0.04	0.21	0.29	0.87	0.22	-0.14	0.41	0.08	0.20
	(0.65)	*(0.97)*	*-(0.16)*	*-(0.10)*	*(0.71)*	*(1.58)*	*(3.80)*	*(1.32)*	*-(0.51)*	*(2.41)*	*(0.30)*	*(1.14)*
Colony	0.36	0.99	-0.28	0.03	-0.51	0.40	-0.15	0.91	0.20	0.25	0.80	-0.24
	(2.30)	*(6.43)*	*-(1.37)*	*(0.10)*	*-(1.72)*	*(2.14)*	*-(0.75)*	*(5.19)*	*(0.75)*	*(1.57)*	*(2.69)*	*-(1.39)*
Island	-0.30	0.40	0.41	1.10	0.81	1.21	0.36	-0.33	0.41	0.10	1.22	0.58
	-(2.79)	*(3.88)*	*(2.31)*	*(4.03)*	*(3.53)*	*(9.02)*	*(2.07)*	*-(2.37)*	*(0.21)*	*(0.71)*	*(5.54)*	*(3.78)*
Landlocked	0.21	0.55	0.67	2.66	-1.03	0.07	-0.32	0.70	0.00	0.72	-0.62	-0.16
	(1.29)	*(3.48)*	*(2.12)*	*(8.15)*	*-(2.23)*	*(0.29)*	*-(1.28)*	*(4.07)*	*(0.01)*	*(3.38)*	*-(1.68)*	*-(0.75)*
Constant	-57.11	27.19	22.14	93.82	-84.17	37.29	-127.05	53.09	4.04	75.41	-10.31	-117.71
	-(4.00)	*(1.82)*	*(0.81)*	*(2.50)*	*-(2.22)*	*(1.55)*	*-(4.63)*	*(3.01)*	*(0.15)*	*(3.82)*	*-(0.30)*	*-(5.51)*
Durbin-Wu-Hausman chi-sq. test	2.17	2.26	8.26	2.34	1.36	0.85	2.89	6.38	2.00	6.77	1.50	6.95
(p-value)	*(0.70)*	*(0.69)*	*(0.08)*	*(0.67)*	*(0.85)*	*(0.93)*	*(0.58)*	*(0.17)*	*(0.74)*	*(0.15)*	*(0.83)*	*(0.14)*
Observations	10644	8791	3167	2599	2359	5938	4078	6568	3978	6325	2809	4182
R-squared adj.	0.82	0.80	0.73	0.73	0.72	0.74	0.73	0.78	0.68	0.76	0.67	0.80

Note: All regressions include a trend variable.

t.students in parenthesis (robust to heteroskedasticity and adjusted by clustering observations at the country-pair level).

For Peer Review

Table 3: LSDV estimates of the gravity model by using a polytomous variable (Pref_Ord) to measure trade preferences. Dependent Variable: real exports in logs to eight OECD countries (1995-2003).

	Total Exports	Total Agricultural Exports	Live Animals (SITC 00)	Meat and Meat preparations (SITC 01)	Dairy Products and Bird Eggs (SITC 02)	Fish, Crustaceans, Mollusc and Aqua (SITC 03)	Cereals and Cereal Preparations (SITC 04)	Vegetables and Fruits (SITC 05)	Sugar, Sugar Preparations and Honey (SITC 06)	Coffee, Tea, Cocoa, Spices (SITC 07)	Feeding Stuff for Animals (SITC 08)	Miscellaneous Edible Products and Preparations (SITC 09)
	1	2	3	4	5	6	7	8	9	10	11	12
Pref_Ord	0.30	0.23	-0.05	0.23	-0.09	0.09	0.02	0.23	0.37	0.17	-0.28	0.21
	(6.54)	*(5.36)*	*-(0.88)*	*(1.95)*	*-(0.86)*	*(1.48)*	*(0.23)*	*(4.19)*	*(3.48)*	*(3.40)*	*-(3.17)*	*(3.11)*
RTA	0.05	-0.13	0.78	-2.29	0.26	-0.29	0.83	-0.03	0.59	0.72	-0.40	0.56
	(0.21)	*-(0.57)*	*(1.78)*	*-(0.69)*	*(0.90)*	*-(1.05)*	*(2.73)*	*-(0.14)*	*(2.10)*	*(2.32)*	*-(1.31)*	*(2.31)*
ln(POP_importers)	0.88	0.83	1.51	1.23	0.34	0.36	0.67	1.63	1.56	1.27	0.70	1.77
	(4.65)	*(4.48)*	*(4.50)*	*(3.09)*	*(0.71)*	*(1.48)*	*(2.26)*	*(7.19)*	*(4.84)*	*(5.69)*	*(1.62)*	*(7.44)*
ln(GDP_importers)	0.34	0.27	-0.31	-0.04	0.53	0.93	0.15	-0.79	-0.63	-0.03	0.24	-0.93
	(1.94)	*(1.57)*	*-(0.99)*	*-(0.10)*	*(1.26)*	*(4.09)*	*(0.55)*	*-(3.70)*	*-(2.11)*	*-(1.45)*	*(0.62)*	*-(4.16)*
ln(POP_exporters)	-2.23	-1.35	-0.85	-1.52	-0.64	0.41	-0.92	0.52	-1.86	-1.57	-1.36	-1.52
	-(4.96)	*-(2.70)*	*-(0.78)*	*-(1.38)*	*-(0.55)*	*(0.50)*	*-(0.87)*	*(0.90)*	*-(1.36)*	*-(2.16)*	*-(1.20)*	*-(2.08)*
ln(GDP_exporters)	0.60	0.26	-0.02	0.23	-0.22	0.04	0.28	0.39	0.25	0.30	0.43	0.52
	(4.38)	*(2.37)*	*-(0.15)*	*(1.22)*	*-(0.86)*	*(0.29)*	*(1.45)*	*(3.44)*	*(1.48)*	*(2.48)*	*(1.63)*	*(3.24)*
ln(Distance)	-1.25	-1.16	-0.99	-0.72	-0.72	-1.19	-0.79	-1.22	-0.73	-0.67	-1.40	-0.95
	-(16.91)	*-(15.68)*	*-(7.45)*	*-(4.18)*	*-(5.15)*	*-(11.93)*	*-(6.87)*	*-(12.33)*	*-(6.31)*	*-(6.67)*	*-(9.02)*	*-(9.90)*
Border	-0.16	0.58	1.74	2.26	0.72	0.72	1.15	0.67	1.40	1.07	0.94	0.93
	-(0.52)	*(1.58)*	*(3.23)*	*(5.09)*	*(1.63)*	*(1.59)*	*(2.57)*	*(1.98)*	*(4.00)*	*(2.95)*	*(2.01)*	*(2.50)*
Language	0.11	0.15	-0.03	-0.07	0.19	0.31	0.92	0.27	-0.12	0.42	0.07	0.24
	(0.79)	*(1.08)*	*-(0.16)*	*-(0.19)*	*(0.66)*	*(1.70)*	*(3.96)*	*(1.65)*	*-(0.45)*	*(2.45)*	*(0.24)*	*(1.38)*
Colony	0.39	0.93	-0.25	0.02	-0.52	0.38	-0.17	0.81	0.11	0.16	0.83	-0.27
	(2.57)	*(6.13)*	*-(1.19)*	*(0.06)*	*-(1.76)*	*(1.98)*	*-(0.82)*	*(4.59)*	*(0.41)*	*(1.01)*	*(2.78)*	*-(1.53)*
Island	-0.29	0.40	0.36	1.09	0.81	1.21	0.48	-0.28	0.19	0.13	1.20	0.67
	-(2.70)	*(3.94)*	*(2.05)*	*(3.96)*	*(3.56)*	*(8.97)*	*(2.72)*	*-(2.09)*	*(0.99)*	*(1.03)*	*(5.40)*	*(4.50)*
Landlocked	0.19	0.55	0.68	2.66	-1.04	0.06	-0.33	0.72	0.01	0.74	-0.64	-0.14
	(1.15)	*(3.49)*	*(2.18)*	*(8.12)*	*-(2.25)*	*(0.27)*	*-(1.32)*	*(4.13)*	*(0.02)*	*(3.48)*	*-(1.73)*	*-(0.68)*
Constant	-56.28	26.75	27.52	93.17	-80.28	36.23	-128.45	56.38	9.50	77.73	-13.02	-113.81
	-(3.93)	*(1.79)*	*(1.02)*	*(2.51)*	*-(2.13)*	*(1.52)*	*-(4.68)*	*(3.16)*	*(0.34)*	*(3.95)*	*-(0.38)*	*-(5.31)*
Durbin-Wu-Hausman chi-sq. test	0.54	0.51	4.03833	0.39	0.04	0.14	0.81	5.32	1.30	5.39	1.56	5.02
(p-value)	*(0.76)*	*(0.77)*	*(0.13)*	*(0.82)*	*(0.98)*	*(0.93)*	*(0.67)*	*(0.07)*	*(0.52)*	*(0.07)*	*(0.46)*	*(0.08)*
Observations	10644	8791	3167	2599	2359	5938	4078	6568	3978	6325	2809	4182
R-squared adj.	0.82	0.80	0.71	0.73	0.72	0.74	0.72	0.78	0.67	0.76	0.67	0.80

Note: All regressions include a trend variable.

t.students in parenthesis (robust to heteroskedasticity and adjusted by clustering observations at the country-pair level).

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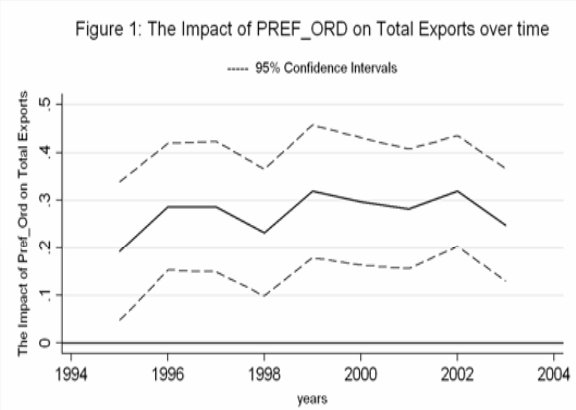
Figure 1: The Impact of PREF_ORD on Total Exports over time
----- 95% Confidence Intervals
The Impact of Pref_Ord on Total Exports
0
.1
.2
.3
.4
.5
1994
1996
1998
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2002
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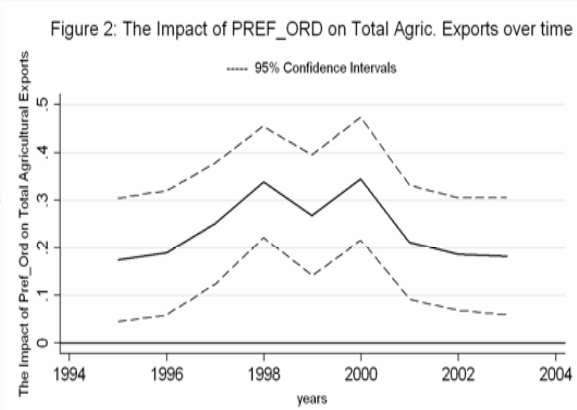
Figure 2: The Impact of PREF_ORD on Total Agric. Exports over time
----- 95% Confidence Intervals
The Impact of Pref_Ord on Total Agricultural Exports
0
.1
.2
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1994
1996
1998
2000
2002
2004
years

Evaluating the Impact of Non-Reciprocal Trade Preferences Using Gravity Models (AE-08-0034)

Reply to the first referee

Short Reply. In writing the revised version of the paper we have taken into account many of your suggestions and clarified many aspects that in the first version were confused. The current version takes great advantage of your remarks and we thank you for your very useful report.

General comments.
We fully agree with you in arguing that the dummy approach does not properly capture how trade preferences actually work. Indeed, the paper concludes reporting some caveats on the use of dummies and in the revised version we largely expand this discussion (pages 18-19).[1]

While a better alternative to dummies are tariffs, we have not used tariffs for two main reasons, the first of which depends on data availability, whereas the second is related to the main scope of our paper.

In respect of tariffs data availability, there is not, to the best of our knowledge, a source

- covering the period we consider,
- including all the preference-giving countries we are interested in, and
- providing data for each trade preferential program.

For instance, data from Macmap (a dataset provided by CEPII, http://www.cepii.fr/anglaisgraph/bdd/macmap.htm) is limited to 2001 and 2004 and applied tariffs do not distinguish among individual preferential program (GSP, ACP, AGOA, SPARTECA, ..).

DBTAR, the dataset by Gallezot (2005), includes only the trade preferences of European Union http://tradeag.vitamib.com/hnb/TRADEAG/TRADEAG.nsf/all/5574DF434B466138C12571EF0035BD18?opendocument.

[1] Incidentally, it is worth mentioning that in many already published papers in relevant journals, the use of dummies to measure trade issues similar to ours is still dominant. For instance, Sarker and Jayasinghe (2007, *Agricultural Economics*), in estimating the impact of EU's Regional Trade Agreements augment their gravity equation with a dummy, Lee and park (2005, *The World Economy*) use the same approach to investigate the effect of free trade areas in East Asia. Bun and Klaassen (2007, *Oxford Bulletin of Economics and Statistics*) employ the dummies to evaluate the Euro effect on trade. The same methodology is shared Rose ("Do We Really Know that the WTO Increases Trade?" *American Economic Review* 2004), Rose and van Wincoop ("National money as a barrier to trade: The real case for monetary union". *American Economic Review*, 2001), Rose ("One reason countries pay their debts: renegotiation and international trade. *Journal of Development Economics* , 2005), Medved ("Preferential Trade Agreements and Their Role in World Trade" *World Bank Research Working Paper, 2006)* n. 4038), Endoh ("Trade creation and trade diversion in the EEC, the LAFTA and the CMEA: 1960- 1994. *Applied Economics*, 1999), Fidrmuc and Fidrmuc ("Disintegration and trade" *Review of International Economics* , 2003), Frankel, Stein and Wei ("Trading blocs and the Americas: The natural, the unnatural, and the super-natural", *Journal of Development Economics*, 1995), Glick and Rose ("Does a currency union affect trade? The time series evidence, *European Economic Review*, 2002), Thom and B. Walsh ("The effect of a common currency on trade: lessons from the Irish experience. *European Economic Review*, 2002), Yeyati ("On the impact of a common currency on bilateral trade. *Economics Letters*; 2003).

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Another important source is WITS, the system developed by the World Bank and UNCTAD. WITS reports the MFN and the applied tariffs but has two relevant shortcomings. The first regards its time coverage, because of the many-many missing values over the period to which we are interested in. Secondly, and more importantly for our paper, it does not distinguish among preferential schemes. In other words, we cannot obtain tariffs for each individual preferential scheme separately. This second peculiarity impedes to use tariffs from this source, which are surely suitable to address trade issues other than those of our paper. That is to say, data from WITS are very useful to evaluate the impact of trade preferential policies granted by a developed country, when the analysts is not interest in knowing the impact of a specific preferential scheme (GSP or others), as it is, on the contrary, our case. Similar arguments apply for Macmap, although this source allows for cross sectional studies, only.

The second reason supporting the use of the dummy approach regards the fact that the paper intends to provide evidence on the heterogeneous impacts of NRPTPs when using a level of data aggregation different than that used in the related literature. The empirical setting using gravity models and dummies for individual preferential scheme allows us to shed some lights on the fact that the studies (ours and those by others) analysing the impact of NRPTPs on total trade flows provide results that must be carefully read. We have clarified this point in the introduction of the revised version of the paper (pages 2-3) and in the last lines of the conclusions.

Specific comments

1. We fully agree with your comment on note 2 of the first version of the paper. After long discussing we have decided to cancel the note because in so doing we do not lose any relevant information for our research. Furthermore, we also agree on the fact that the aggregation bias is also present if the use of tariffs was possible.[2] The way to avoid the aggregation bias is to use data (trade and tariffs) at very disaggregated levels, as we mention in the conclusions of the current version of the paper. This is another paper and is left for future work.

2. Prompted by the referee, in footnote 11 of the first version, on one hand, we acknowledge that there might be heteroskedasticity problems (as pointed out by Santos Silva and Teneyro 2006). On the other hand, we recall a recent contribution by Martin and Pham (2008), in which Santos Silva and Teneyro's findings are re-examined under data generating process that generate substantial numbers of true zero observations. We summarize this relevant question in the note 17 of the current version of the paper.

3. You are right. In the new version of the paper we eliminate the controversial statement "have seldom been used...". Moreover, we have followed your suggestion to shorten the literature review.

4. As you observe, the old footnote #5 could sound as a criticism. In our intention, it was meant just to describe a previous work, but we agree that it was not well written. In the new version, the footnote has been restated.

5. Following your suggestion, we now enumerate tariffs among the factors that may hinder bilateral trade flows.

[2] A recent discussion on this issue is provided by Cipollina M. and Salvatici L. (2008), "Measuring Protection: Mission Impossible?", *Journal of Economic Surveys* **22**:3, 577–616.

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6. Referring to previous footnote #9, you question the point that Helpman *et al* (2008) addresses another strand of the literature. You are right. In order to avoid sounding overstating our paper, the new introduction no longer enumerates the method that we adopt to deal with zero-trade observations as a relevant innovation of our contribution. Nevertheless, since it has been largely neglected by the extant literature, we still emphasise (page 14) the importance of controlling for non-random selection bias.

7. Welcoming your suggestion, we have shortened the discussion on zero bilateral trade flows (now the discussion is at the end of section 4). Furthermore, in new version of the paper, we have put together previous sections 4 and 5 and we have eliminated many redundancies.

8. We define the acronym LSDV on page 13.

9. The footnote #18 has been restated in, so as to clarify what the lambda the inverse Mills ratio variable refers to.

10. You question about the value added to report equations 3 and 4. After discussing, we have decided to delete the equations and maintain some parts of previous comments because we believe they are important to motivate the use of our error decomposition.

11. You are right. In writing the new version of the paper we have cancelled many redundancies in commenting the results and in rewriting the conclusions.

12. Prompted by you, the references have been updated.

For Peer Review

Evaluating the Impact of Non-Reciprocal Trade Preferences Using Gravity Models (AE-08-0034)

Reply to the second referee

In writing the revised version of the paper we have considered your suggestions and clarified many aspects that in the first version were confused. We thank you for your very useful comments.

In what follows we briefly describe our responses to your specific comment/suggestions.

1. We agree. The revised version of the paper (page 4, note 4) includes some references concerning the theoretical derivation of the gravity equation.

2. Following your suggestion, we drop section 5, giving a more concise discussion of the problem of zero trade flow at the end of the current section 4. We have also shortened the discussion on the way of solving the overlapping of preferential treatments.

3. In presenting our test on endogeneity we quote (page 12) the paper by Baier and Bergstrand (2004, JIE).

4 As suggested by you, we have reduced the description of the Wooldridge (1995) procedure (the analogue of the Heckman, 1979, method for an unobserved effects framework), previously reported at page 17, confining some details to footnote 18 of the revised version of the paper (page 14). To avoid cluttering, we have decided to omit the discussion of the first stage results. The reason is that the Wooldridge procedure is here adopted only to test for selection bias and involves estimating a large number of probit equations (namely a different probit for each year of the analysis).

5. We agree with you in specifying the gravity equation using the different decomposition of random disturbances that use time-variant fixed effects. We have re-estimated all our regressions with time-variant fixed effects, but the results are the same of those obtained when using time-invariant fixed effects. The note 22 at page 16 mentions what we have done.

6. We have clarified (page 15) what the statement “adjusted for clustering on country-pair fixed effect” means.

7. While the conclusion of the revised version of the paper includes new arguments against the dummy variable approach (as requested by the other referee), we have eliminated many redundancies of the old version, without loosing any qualitative result. The current conclusions are shorter than the previous ones.

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