Do Preferential Trade Policies (Actually) Increase Exports? An analysis of EU trade policies

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ABSTRACT

Trade preferences have been used by the European Union and most developing countries can export with preferential market access under different schemes. We study the trade impact of these policies using highly disaggregated 8-digit data in a theoretically grounded gravity model framework. We provide an explicit measure of preferential tariff margins, using alternative definitions based on a comparison between bilateral applied tariffs and two different reference points: the MFN duty or a CES price aggregator. From a policy perspective, preferential schemes have a significant impact on volumes of trade, although with significant differences across sectors. From the methodological point of view, our results show that the definition of the margin has a significant impact on the assessment of the policy impact.

JEL Classification: F13, F14

Keywords: Theoretical Gravity Model, Preferential trade agreements , Trade cost elasticity Sectoral trade flows.

1. Introduction

In recent years, developed countries have increased their use of preferential regimes in order to promote the economic development as well as the integration of poorest countries in the world trading system. Noting that many commentators tend to regard trade preferences as a failed policy , this work provides an assessment of the impact on trade of European Union (EU) preferences discussing several methodological issues that are relevant when determining preferences' trade-creating impact.

To examine this relationship empirically, we use a gravity equation approach in order to single out the contribution of preferential policies to the deviation from the 'normal' trade levels (Anderson and van Wincoop, 2003, 2004) and derive a theoretical grounded gravity equation including different goods.

One might expect – given the number of preferential schemes implemented over the past forty years – that the answer to the question posed in this paper's title is rather accurate. Even if the expectation of the positive impact of preferences on trade is by far and large confirmed, international trade economists can actually claim little firm empirical support for reliable quantitative estimates of the average effect of trade preferences on bilateral trade (all else constant).

This paper is part of the research effort that attempts to assess the various determinants of bilateral trade at sectoral level using the gravity model with highly disaggregated data (Baldwin et al., 2005; De Benedictis and Salvatici, 2011). Since trade policies are defined and implemented at a very detailed level, it is crucial to use disaggregated data and this is one of the strength of the present analysis since we use data at the 8-digit tariff line level distinguishing preferential and MFN trade flows. That is, we make use of all the available information about the preference utilization even if data do not allow to pin down each trade flow to a specific preferential scheme.

It is not an easy task to summarize the results of the large literature assessing the impact of preferences on trade. Over the past decade, the gravity equation has emerged as the empirical workhorse in international trade to study the *ex post* effects of trade preferences on bilateral merchandise trade flows. Studies report very different estimates, due to the fact that they differ greatly in data sets, sample sizes, independent variables used in the analysis and estimation methods.[1]

The most recent literature emphasizes the importance of the actual preferential margin(s) and the

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[1] Comprehensive surveys of the estimated preferential trade agreements (PTAs) impact are provided by Nielsen (2003) and Cardamone (2007) and, more recently, Cipollina and Pietrovito (2011).

need to work on highly disaggregated data. ns.

As far as the first issue is concerned, most previous work has compared the preferential rates for individual countries with MFN rates alone, with an apparent overstatement of the margin since the value of a preference to one country will in practice depend on how many other countries are competing in the same market with a preferential margin. The only exceptions builds on the work by Low et al. (2005) proposing a *competition-adjusted preference margin* calculated as the percentage point difference between the weighted average tariff rate applied to the rest of the world and the preferential rate applied to the beneficiary country, where weights are represented by trade shares in the preference granting market. The same approach is followed by Carrère et al. (2010), , Fugazza and Nicita (2011) and Hoekman and Nicita (2011). All of the previous approach compute the margins at the country level (i.e., aggregating across products), while only the first one takes into account preference utilization considering the volume of trade that actually benefits from the preference.

In the recent but rapidly growing literature using an explicit measure of the margin, several definitions have been used (Cipollina and Salvatici, 2011). We compute the preference margins in relative rather than absolute terms, as the ratio between a reference tariff and the applied rates faced by each exporter. Such a choice is consistent with the observation that bilateral trade depends not only on direct market conditions, but also on the market conditions applied to third countries. trade. As a matter of fact, the greater the relative advantage provided by the system of preferences the larger the trade flows are expected to be. However, some countries see part of their benefits eroded, sometimes substantially, by the deterioration in their relative market access conditions.

In this paper, we point out two possible sources of bias regarding the reference tariff calculation: the 'definition bias', regarding the choice of the most appropriate tariff(s) to be compared with the preferential ones, and the 'aggregation bias', arising when the reference is exporter-dependent (i.e., we deal with the vector of bilateral applied tariffs rather than with a scalar as in the case of the MFN or the maximum applied tariff) and we do not use a theoretically consistent weighting scheme.

With respect to the reference tariff definition, we need to decide what are the relevant tariffs to be compared with the preferential ones. We think that the most appropriate choice is represented by the duties paid by the countries competing with the one benefitting from the preference (Carrère et al., 2010; Fugazza and Nicita, 2011). We compare the estimates obtained using this definition with those resulting from a more 'traditional' reference choice, such as the MFN applied duty:[2] this provides an assessment of the definition bias.

The aggregation bias arises from the need of a single reference tariff for each product: accordingly, the exporter-specific reference duties need to be averaged across exporters. In this case, in order to avoid an overestimation of the margin one should take into account the competitive advantage with respect to other exporters/competitors. Preferential policies, as a matter of fact, present a 'multilateral nature', and the intensity of the preferential treatment depends both on the highest paid rate and on the share of exporters paying that rate. Following the basic intuition underlying 'multilateral trade resistance' in gravity models – namely, bilateral trade is influenced by the trade policies towards all the partners – we argue that bilateral preferential trade depends on the whole structure of applied tariffs preferences as well as the country-pair specific margins.

Accordingly, our aggregate reference tariff at the product-level is a weighted average of the bilateral applied tariffs computed as a CES price index. Such an index is consistent with the assumed gravity model, and in order to get consistency between the estimated elasticity and the one used to compute the index we adopt a recursive approach. In practice, we start computing the preference margins using the applied MFN duty. We use the estimated substitution elasticity to compute the CES reference tariff and this allows the computation of the new margins to be used in a second round of estimation: such a procedure is iterated until we get the desired level of convergence between the elasticity used *ex ante* (i.e., in the computation of the preference margins) and the one estimated *ex post*.

Computing the intensity of the preference margin associated with different trade flows is a significant departure from most of the literature estimating the impact of preferential agreements through a dummy variable for preferential policies. These studies typically use aggregate trade data and report positive coefficients ranging between 4% and around 400%, but some specification even find significant negative coefficients between 3% and more than 50% (Caporale et al., 2009; Peridy, 2005; Ruiz and Villarubia, 2007; Nilsson, 2002; Martìnez-Zarzoso et al., 2009). The policy dummy cannot catch the variability of margins across countries and products, and it is likely to lead to an overestimation of the impact of the preferential scheme and cannot provide an accurate assessment of policies that (by definition) often discriminate among products. Homogeneity is forced onto the estimation, and could have severe consequences on the end results.

[2] In both cases, using the applied rather than bound tariff we avoid the risk of including some 'water' (i.e. the binding overhang) into the preference margin.

Aggregate analysis is inherently unable to fully capture the complex structure of agreements, which do not provide the same benefits for each good since preferential margins differ between goods that are characterized by very uneven initial levels of protection. The use of highly disaggregated data raises two types of problems: (*i*) the elevated percentage of ‘zero trade flows’; (*ii*) the impossibility for some variables to get information at the level of detail at which tariff lines are specified. As far as the latter problem is concerned, in order to control for the unobservable country and product heterogeneity we introduce product- and country-specific fixed effects.

Regarding the former problem, the presence of zero values creates obvious problems in the log-linear form of the gravity equation. There has been a long debate concerning what is the best econometric approach in order to avoid the bias that would be implied by the drop of the observations with zero flows. Because of the presence of heteroskedasticity, estimates of the log-linear form of the gravity equation are biased and inconsistent, and this may lead to prefer the Poisson specification of the trade gravity model (Siliverstovs and Schumacher, 2007; Santos-Silva and Tenreyro, 2003, 2006, 2009; Burger et al., 2009). Accordingly, we estimate the gravity model in multiplicative form, using Poisson pseudo-maximum-likelihood (PPML) estimator, commonly used in the recent empirical analyses (Anderson and Yotov, 2011 and 2012).

We estimate cross-sectional models using data on imports at 8-digit level to EU (25 countries) for the year 2004. Apparently, this may not be a “representative” year. Many factors in addition to preferences influence imports, including macroeconomic conditions such as income growth and exchange rates. In this sense, it may be difficult to identify a “representative” year. However, the structure of the dataset is conditioned by the difficulty to build time series for a consistent trade, tariffs and utilization rate of preferences at the 8 digit level. Although an analysis based on data from more than a single year would enhance the results, the complexity in tariff schedules makes such an endeavor very difficult. In the case of preferential policies, though, panels do not necessarily add much in short horizons. Moreover, the theoretically grounded gravity equation proposed by Anderson and van Wincoop (2003) under the assumption that all bilateral trade costs are symmetric and never vary only works with cross section data (Baldwin and Taglioni, 2006).

We estimate the preferences impact for 21 aggregated sectors, following the EU sections of the Harmonized System (HS), listed in Table 1. EU trade preferences have taken and still take different shape depending on which the beneficiary countries are. All developing countries are eligible for the EU’s Generalyzed System of Preferences scheme, while only the African, Caribbean and Pacific (ACP) countries were eligible for the more far-reaching non-reciprocal preferences under the Lomé Conventions and the Cotonou Agreement, and are so for the on-going negotiations of reciprocal preferences under the latter's successor, the Economic Partnership Agreements. In addition, non-reciprocal preferences have been introduced for countries in the EU's neighborhood. The EU has also concluded free trade agreements with several countries (e.g., Mediterranean countries, Chile, Mexico and South Africa) and negotiations with other countries and/or regions are on-going. Even if the EU trade policy keeps changing over time, it should be noted that using 2004 allows to fully capture the effects of the important EBA program for LDCs (implemented in 2001 except for a very limited number of commodities (e.g., banana, sugar). Table 2 shows all preferential schemes included in our dataset which refers to year 2004.

Drawing on information in the 2004 MAcMap database, Cipollina and Salvatici (2010) perform estimates based on the size of each product's preferential margin. In the more specific framework of European fruits and vegetables, Emlinger et al. (2008) also explicitly incorporate tariff levels into their estimations. Also Cardamone (2011) using disaggregated trade data finds large differences in the preference impact across sectors. Finally, Cirera et al. (2011) using a unique dataset at CN-10 digits estimate a small positive impact of trade preferences on trade at the intensive margin, and a negligible or possibly even negative impact at the extensive margin, i.e. when we consider the scope for trade diversification.

Regarding the impact of specific preference schemes, several studies find that the EU schemes do provide a significant boost to LDCs exports (Aiello and Cardamone, 2010; Aiello and Demaria, 2010; Demaria, 2009), and to exports from Mediterranean countries (Nilsson and Matsson, 2009) as well as from ACP countries (Francois et al., 2006; Manchin, 2006) though some specifications report highly negative coefficients. In terms of different schemes, there is some evidence that EBA[3] has not been effective in increasing LDCs exports to the EU (Pishbahar and Huchet-Bourdon, 2008; Gradeva and Martinez-Zarzoso, 2009).

2. Theoretical gravity model

Our set-up is similar to in Lai and Trefler (2002) and Lai and Zhu (2004). Consumers have Cobb-Douglas preferences over sectors and CES preferences over products defined at the tariff line level. Let k index goods within each sector while i indexes producer countries. In the first stage a

[3] As a matter of fact, the EBA program implemented in 2001 has led to very minor changes in terms of applied protection faced by LDCs for which the previous GSP program was already close to a duty-free regime.

representative EU consumer allocates the budget, following Cobb-Douglas preferences and therefore, we can look at one product at a time.[4]

In the second stage the representative consumer maximizes the CES subutility function subject to the expenditure constraint M^k. We consider that each product *k* can be imported from *n* countries. A product originated in country *i* is associated to a quality μ_i^k. Therefore, the utility provided by the consumption of q_i^k physical units is im_i^k. We assume that

$$im_i^k = q_i^k \times \mu_i^k. \tag{1}$$

It is straightforward to derive import demand for product *k* originated in country *i* as:

$$im_i^k = \alpha_i^k M^k \frac{\left(PIM_i^k\right)^{-\sigma}}{\left(PM^k\right)^{(1-\sigma)}} \tag{2}$$

where σ is the elasticity of substitution between varieties (σ > 1), i.e., the origin of the product,[5] α_i^k is the consumer preference parameter, M^k is the expenditure on import *k*, PM^k is the product *k* import price index computed across all exporters *i*, and PIM_i^k is the domestic price of quality normalized imported good *k* from country *i*.

Prices differ between locations due to trade costs and tariffs. The domestic price of a physical unit is given by $PEX_i^k c_i^k \left(1 + t_i^k\right)$ where $c_i^k > 1$ captures the transport costs defined as

$$c_i^k = \beta_i \times \gamma^k. \tag{3}$$

Transport costs differ by product (γ^k) and by exporter (β_i), and t_i^k is the bilateral tariff. PEX_i^k is the FOB export price fixed competitively of a physical unit. Based on previous assumptions, it is straightforward to get the relation between the prices of the quality adjusted and physical units:

$$PIM_i^k = \frac{PEX_i^k}{\mu_i^k} \beta_i \gamma^k \left(1 + t_i^k\right). \tag{4}$$

[4] Therefore, we assume no cross price elasticity among different products. Such a strong separability assumption is necessary for implementing our estimation strategy.

[5] Therefore σ can be interpreted as the Armington assumption defined at the product – i.e., tariff line – level.

We assume that to produce a quality μ_i^k, exporters face a marginal cost $\left(\mu_i^k\right)^{\varepsilon}$, where ε is the cost elasticity to quality. Therefore the unit value of exports is given by

$$PEX_i^k = \left(\mu_i^k\right)^{\varepsilon} \tag{5}.$$

We also assume that export supply is not affected by other product specific variables (tariffs on other products or on other markets). The α_i^k parameters are chosen so that import quantities are scaled in order to make all the CIF prices (i.e., including transport costs) equal to 1. Accordingly, the price index can be written as

$$PM^{k^{(1-\sigma)}} = \sum_i \alpha_i^k \left(PEX_i^{k^{\left(1-\frac{1}{\varepsilon}\right)}} \beta_i \gamma^k \left(1 + t_i^k\right) \right)^{(1-\sigma)} = (1 + T^k)^{(1-\sigma)} \tag{6}$$

then, T^k is a weighted average tariff applied on product k computed (consistently with the import demand structure) as a CES price index.

Given our focus on exporter-specific preferences, in a cross section analysis we cannot identify the α_i^k parameters. So we impose symmetric preferences:

$$\alpha_i^k = \alpha_n^k = \bar{\alpha}^k \qquad \forall n. \tag{7}$$

Using the previous equations, we can rewrite Eq. (2) as:

$$im_i^k = \bar{\alpha}^k M^k \frac{\left(PEX_i^{k^{\left(\frac{\varepsilon-1}{\varepsilon}\right)}} \beta_i \gamma^k \left(1+t_i^k\right) \right)^{(1-\sigma)}}{\left(1+T^k\right)^{(1-\sigma)}}. \tag{8}$$

Taking the log we get:

$$\ln im_i^k = ln\bar{\alpha}^k + \ln M^k + \frac{(\varepsilon-1)(1-\sigma)}{\epsilon} ln\left(PEX_i^k\right) - (\sigma-1)ln\beta_i - (\sigma-1)ln\gamma^k - (\sigma-1)ln\left(1 + t_i^k\right) + (\sigma-1)ln(1 + T^k). \tag{9}$$

The previous expression is the gravity equation we are going to estimate:

- $\log im_i^k$ is the export of country *i*;
- $log\bar{\alpha}^k$ is the consumer preference parameter for the good *k*;
- $\log M^k$ is the market size,
- $(\varepsilon - 1)(1 - \sigma)/\varepsilon\, log(PEX_i^k)$ denotes the exporter's supply price impact $(1 - \sigma)ln(PEX_i^k)$ as well as the quality effect's impact $(\varepsilon - 1)/\varepsilon\, ln(PEX_i^k)$ on demand for commodity *k*: notice that such a coefficient can be either positive or negative;
- $(\sigma - 1)log\beta_i + (\sigma - 1)log\gamma^k$ trade cost component;
- $(\sigma - 1)log(1 + t_i^k)$ is the power of applied tariff;
- $(\sigma - 1)log(1 + T^k)$ is the overall price of imports and it is common for all exporters.

The preferential margins ($pref_i^k$) are given by:

$$pref_i^k = \frac{(1+T^k)}{(1+t_i^k)}, \qquad (10)$$

the critical issue is the measurement of T^k.[6]

In the case of the preference margin based on the applied MFN duty, T^k represents an upper bound of the applied tariffs distribution and this implies that margins can never fall below the value of 1 signalling the absence of a preferential treatment. This leads to an obvious overestimation of the competitive advantages enjoyed by exporting countries, since bilateral trade depends on the whole structure of the tariff preferences as well as the country-pair specific margins.

However, from an exporter's perspective market access depends on the relative advantages or disadvantages that exporters have versus competitors from other countries rather than with respect to the theoretical MFN rate. Such a reasoning is very much in line with the basic intuition underlying 'multilateral trade resistance' in gravity models, since trade is influenced by the trade policies *vis à vis* all the partners in the same way it is influence by relative rather than absolute trade costs. Accordingly, not only the applied tariff but also the reference tariff we use to compute the margin enjoyed by exporter *i* on product *k* is exporter-specific and computed as a CES index of the

[6] As noted by Fugazza and Nicita (2011) unless exports to country k from any trade partner all share the same composition in terms of products exported, T^kshould not be absorbed by the importer and time fixed effects, and as a consequence should be treated explicitly.

duties (CES) paid for the given product by each exporter (Eq. (6)).[7]

Note that any measure of preference margin could be negative, depending on the disadvantage of the country with respect to other competing exporters. In such a case, T^k can be lower than t_i^k and margins between 0 and 1 signal the existence of negative margins, i.e. exporters that are at disadvantage with respect to other competitors independently from the (nominal) existence of a preferential treatment.

In summary, $pref_i^k$ provides a measure of the tariff advantage (or disadvantage) provided to the actual exports from country i on product k, given the structure of the tariff preferences of the EU. As the $pref_i^k$ provides the relative advantage not with respect to the average, but to each trading partner, it also captures the discriminatory effects of the overall system of preferences.

3. Econometric approach

3.1 Estimation

Working at a highly disaggregated level implies the presence of many zero trade flows that create obvious problems in the log-linear form of the gravitational equation. All countries do not produce all available goods, nor do they all have an effective demand for all available goods. Accordingly, we distinguish between two different kinds of zero-valued trade flows: products that are never traded and products that are not traded, but could be (potentially, at least) traded. Hence, a distinction can be made between flows with exactly zero probability of positive trade, flows with a non-zero trade probability who still happen to be zero, and positive flows. Since preferential policies cannot possibly influence the first group, in our analysis we only keep exporters that have at least one export flow at the world level at the HS6 level for the product concerned during the period 2001-2004, assuming that excluded commodities are not produced in the countries not exporting. In the same vein, we exclude products that are not imported at all in the EU and for which it is impossible to compute a CES price index over imports. This avoids the inclusion of irrelevant information (we could call them "statistical zeroes") that may bias the estimate, and

[7] Our reference tariff turns out to be a weighted average of duties paid by actual exporters. This is a shortcoming of the CES functional form that does not take into account the potential competition coming from exporters facing prohibitive tariffs. In this respect our preference margins may be understated and this would lead to an overestimation of the preference impact.

greatly reduces the dimension of the dataset. it is shrunk from 1,861,842 couples of products/exporters to 1,014,435 relevant cases.

The reduced database still includes a large share (80%) of zero flows. These “structural zeroes” may be the result of rounding errors: for instance, products for which bilateral trade does not reach a minimum value, the value of trade is registered as zero. If these rounded-down observations were partially compensated by rounded-up ones, the overall effect of these errors would be relatively minor. However, the rounding down is more likely to occur for small or distant countries and, therefore, the probability of rounding down will depend on the value of the covariates, leading to the inconsistency of the estimators. The zeros can also be missing observations which are wrongly recorded as zero. This problem is more likely to occur when small countries are considered and, again, measurement error will depend on the covariates. As a consequence, the most common strategies to circumvent the ‘zero problem’ in the analysis of trade flows – i.e., to omit all zero – valued trade flows or arbitrarily add a small positive number to all flows in order to ensure that the logarithm is well-defined – leads to inconsistency.

Especially when there are a large number of cases in which the observed and expected flows are small, small absolute differences before performing a logarithmic transformation of the dependent and independent variables may lead to large differences in the log-normal estimation of the model: in the presence of such heteroskedasticity, not only the efficiency but also the consistency of the estimators is at stake (Santos Silva and Tenreyro, 2006). Accordingly, we tested for heteroskedasticity in the first-stage probit, using a two-degrees-of-freedom RESET test as suggested by Santos-Silva and Tenreryo (2009), and we could not accept the null hypothesis of homoskedasticity. The Poisson pseudo-maximum-likelihood (PPML) estimator of Santos-Silva and Tenreyro (2007) is used in the following to address the issues of heteroskedasticity and zeroes in bilateral trade flows. Prehn et al. (2012) argue that, from the estimation perspective, there is no reason why PPML should not be applied to disaggregate gravity trade models. Rather, PPML has an additional property which makes it even more preferable. As a matter of fact, Fally (2012) shows that estimation of gravity with PPML and exporter and importer fixed effects is consistent with a more structural approach as in Anderson and van Wincoop (2003).

In the following, we estimate the following specification:

$$im_i^k = \exp\left\{\bar{\alpha}^k + M^k + \frac{(\varepsilon-1)(1-\sigma)}{\epsilon} ln\left(PEX_i^k\right) - (\sigma-1)ln\beta_i - (\sigma-1)ln\gamma^k + (\sigma-1)\, ln\left(pref_i^k\right)\right\} + v \qquad (11)$$

with v as standard error. In the estimation, the trade cost components are proxied by fixed effects defined for exporter and product[8], whereas the exporter's supply price impact, as well as the quality effect's impact, is proxied by the unit value by exporter. These unit values are computed as trade-weighted averages at the HS-6 digit level since they include exports to all destinations.

A crucial issue is the value of the elasticity of substitution σ needed to compute the value of $pref_i^k$ value as defined in Eq. (10) when we consider the CES aggregated tariff. In this paper, we rely on an iterative approach in the spirit of what has been done by Anderson and Yotov (2010) a well as Head and Mayer (2013) to estimate the multilateral resistance indexes. Our computation of the relative preference margin involves assuming initial values of $\sigma_k = 4$. This gives a new set of substitution elasticities.[9] We iterate until the parameter estimates stop changing at the second decimal digit.[10] This method exploits the structural relationship between $pref_i^k$ and σ_k to estimate theoretically consistent preference margins: we therefore call them SIM (structurally iterated margins).

In order to highlight the relevance of the reference tariff definition in the assessment of the policy impact, we compare our preferred (Model 1) with Model 2 which is calculated replacing the CES index with the MFN tariff. Moreover, in order to highlight the relevance of the aggregation problem when we use the exporter-specific bilateral duties we use 2 additional margin definitions:

- Model 3 replaces the CES index by the simple average applied tariff.
- Model 4 replaces the CES index by the trade weighted applied tariff.

In general, we should expect that Model 2 to constitute an upper bound.

Using the measure of the preferential margin as defined in Eq. (10) would introduce an obvious element of endogeneity since the value of preferential imports form part of the calculation of the actual preferential margin on the right-hand side of the equation. Consequently, we compute the CES index of the duties paid for the given product by each exporter (Eq. (6)) excluding in each case

[8] Some authors use of published data on price indexes (Bergstrand 1985, 1989, Baier and Bergstrand 2001) as proxy of multilateral price terms, but the main weakness of the this method is that existing price indexes may not reflect true border effects accurately (Feenstra 2002). The use of importer and exporter fixed effects in the estimation is widely used in the literature, since it is a computationally easier way to account for multilateral price terms in cross-section analysis.

[9] If the estimated coefficient was not significant, we decreased the assumed elasticity value to the lowest possible bound (i.e., 1): in all these cases, we never get significant estimates.

[10] The number of iterations required to achieve convergence varied between 4 and 7.

the actual exporter.

It should be acknowledged, though, that our estimation set-up might be prone to more general endogeneity problems, because of the potential two-way feedback between the exports of a country and its preferential status: exports and tariffs faced by each exporter/product are likely to be determined simultaneously: that is, countries select to grant preferential treatments (and thus reduce the tariffs) to less competitive partners and/or products where trade flows are smaller.

In cross-section models such endogeneity is generally treated with the use of instrumental variables. However, instrumental variable estimation may not be fully satisfactory for treating policy variables, in large part because it is difficult to find instruments having an incidence on the likelihood of granting a preference but not on the intensity of bilateral trade (Baier and Bergstrand, 2007).[11] Such a difficulty, that would also affect methods based on Heckman control functions, is magnified by the fact that our unit of analysis is the export trade flow defined at the tariff line level and we are not aware of any compelling instruments at this level of detail.[12]

According to Baier and Bergstrand (2007) potential sources of endogeneity bias of RHS variables' coefficient estimates generally fall under three categories: omitted variables, simultaneity, and measurement error. As far as the first two categories are concerned, fixed effects can control for this, since they will account for any unobservable that contributes to shift the overall level of exports of a country and replace variables potentially affected by simultaneity, such as GDP. On the other hand, our results are not affected by the third possible bias since we use a continuous variable that accurately measure the degree of trade liberalization associated with each and every preference. Nonetheless, one has to keep in mind those endogeneity-related caveats when interpreting our results.

Since the coefficient associated with the preference margin is going to be estimated at the tariff line level, we assess the preference impact on the substitutability across exporters only, i.e. ignoring any possible substitution between imports and domestic production. This is a consequence of the lack of domestic data to be matched with highly disaggregated trade data (see next section), and it is consistent with the computable general equilibrium models literature assuming nested demand

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[11] For a review about the (mis)use of instrumental variables in the literature see Deaton (2010).

[12] Other possible solutions to the endogeneity problem may be provided by matching (i.e., comparing an exporter that benefits from preferences with another that has not, despite the same ex ante probability of getting the preference according to the observable explanatory variables) or difference in difference methods. In both cases, though, it is necessary to define an exporter control group that it is difficult to envisage in our case.

structures where the two-tiers functions are separable, so that the substitution in the second level between competing suppliers is independent of the first level substitution between the domestic variety and aggregate imports. Admittedly, this is quite a restrictive assumption, since preferences cannot create trade replacing less efficient domestic producers, and mostly affect trade through the trade diversion mechanism.[13] Accordingly, it may be argued that our estimates provide a lower bound for the true preference impact.[14]

Still focusing on the second level import demand function, another option could have been that of estimating the elasticity of substitution at a higher level of aggregation, i.e. assuming that consumers substitute both across exporters and products within a given sector. Such a choice leads to paradoxical results in terms of margins computation, since the elasticity parameter estimated on a sample mixing different exporter and tariff lines is a mix of cross price elasticity across different products and origins. It would lead to underestimate the impact of the preferences, since two products such as eggs and honey for instance, even if both are "animal products" belonging to the same HS2 chapter, are imperfect substitutes while eggs from two suppliers can be very similar.

To estimate the effects of preferential margins, then, we focus on the substitution between suppliers at the tariff line level than across products. We group products into section to estimate Eq. (12) and get an estimation of each parameter, including σ. Data availability forces to assume the same parameter value within each section, but we do allow for different elasticities across sections. In this respect our results are significantly different from those existing in the literature using aggregated data at the country level.[15] It should be noted, though, that differences also arise because the "macro" elasticity between home and import goods is in fact smaller than the "micro" elasticity between foreign sources of imports (Feenstra et al., 2012).

Finally, we compute the percentage change due to the hypothetical elimination of existing preferences as follows (Lai and Zhu, 2004):

$$\text{Preference effect} = \sum_{ijk}\left(E[m_{ijk} \mid pref_{ijk} > 0] - E[m_{ijk} \mid pref_{ijk} = 0]\right) / \sum_{ijk} E[m_{ijk} \mid pref_{ijk} > 0]\,. \qquad (12)$$

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[13] Fugazza and Nicita (2011) take into account the disadvantages that exporters face versus domestic producers. However, they only take into account the direct own price effects of tariffs and ignore any possible cross price effects.

[14] More generally, Head and Mayer (2013) point out that the elasticity estimate may not give a reliable estimate of the full impact on trade since it is estimated holding production and expenditure constant.

[15] In a recent paper, Ossa (2012) argues that "accounting for cross-industry variation in trade elasticities greatly magnifies the estimated gains from trade" (p. 10).

In calculating these results, we estimate the counterfactual change in the dependent variable, total EU imports, which would follow from the removal of the preferential advantage. This calculation may overestimate the total sum of the foregone exports, since indirect effects are not captured via changes in world prices. Since these trade flows would not take place in the absence of preferences, this could be considered a 'trade creation' effect. The remaining part of preferential trade flows is more likely to be the result of the diversion of previously existing export flows from other countries. Alternatively, if the same countries would have exported without preferential treatment, there are rents (potentially) accruing to the exporters on these trade flows even in the differentiated products framework implied by the CES model.

3.2 Data

All data – i.e., tariffs and trade – refer to 2004. EU25 trade flows are from the Eurostat database Comext[16], data are Cost-Insurance-Freight (CIF) values. We consider 234 exporters of 10,174 products at the 8-digit level of EU Combined Nomenclature classification to the EU (25 countries). Duties are from the *Tariff intégré de la Communauté Européenne* (TARIC). We exclude tariff lines with specific tariffs since the computation of the ad valorem equivalents on a bilateral basis would introduce a source of differentiation across exporters independent from preferential policies. We also exclude the tariff lines with tariff rate quotas since the import behavior in such cases is not influenced by price signals only. On the other hand, we are able to take into account preference utilization considering the volume of trade that actually benefits from the preference. To this end we distinguish preferential from non-preferential trade flows: the latter are associated with the MFN rate, the former with the lowest possible duty since data do not allow to distinguish the specific scheme under which import take place. In those cases when there were not trade flows, the zeroes are associated with the lowest rate.

Overlapping preferences imply that tariff lines may be eligible for several different treatments. Since information about the scheme under which imports actually take place isn't available, we assume that preferential import pay the lowest available rate. Even if this seems to be a reasonable assumption, it may lead to an overestimation of the preferential margins: Bureau et al. (2007) show that some schemes are systematically preferred over others due to compliance costs, which include

[16] The Comext database (http://fd.comext.eurostat.cec.eu.int/xtweb/) contains detailed foreign trade data distinguished by tariff regimes as reported by the EU member states.

non-price variables, such as the rules of origin attached to each agreement.

On the other hand, the differentiation between preferential and non-preferential trade flows allows us to take into account a very important factor: preference utilization. Non-utilization of preferences varies substantially across countries and products. From the practical point of view we distinguish preferential from non-preferential trade flows considering two observations for the same tariff line each time both flows are positive. An additional challenge is to define the preference margin for the zero flows: we compute the margins using the bilateral preferential duties, and this imply that these observations are particularly meaningful from the point of view of the actual preference utilization.

Table 3 shows the percentage of imports associated with positive trade, subject to MFN or preferential duties: in the case of MFN imports, we distinguish between duty free and positive tariffs. To give an idea of the relevance of each sector in total trade, we provide the value of imports and their respective shares. More than 50% of total imports enter duty-free under MFN arrangements, the residual is divided in one third as preferential imports and the remaining as imports paying positive MFN duties.

At the section level, EU imports products of section X (paper and paperboard and articles thereof) and XXI (works of art) under an MFN duty-free regime, while for the other sections the structure of trade differs considerably. The EU imports a large percentage of products of sections V (mineral products), IX (wood and articles of wood) and XIV (natural and precious metals) with a duty-free MFN access, and more than half of products of the remaining sections without any preferences. We exclude from the sample a few sectors where there are no preferences (Sections X and XXI), or only trivial preferential trade flows in either absolute (Section XIX) or relative terms (Sections V and XIV).

Table 4 presents the bilateral applied and the MFN tariff for the sections included in our analysis. According to the MFN rates the most protected sectors are the agricultural ones (I-IV) as well as Textiles and Footwear (XI and XII). Bilateral applied tariffs are much lower on average, and the absolute margins are proportional to the height of the MFN rates: considering the bilateral applied rates, though, the sections’ ranking does not change. However, with the exception of Textiles these are not the most relevant sectors both in terms of trade flows and number of tariff lines.

4. Results

In this section we first discuss the results of the estimations from the gravity model, we then illustrate some descriptive statistics of the different possible definitions of the preference margin.

We estimate several specifications of the gravity model testing the robustness of our results to the computations of the preference margin. Table 5 reports the estimated coefficients for the preference margin in the 17 sections under investigation based on equation (11). Results for the CES reference tariff (Model 1) indicate that trade preferences have a very different impacts across sectors and the intensity is not necessarily related to the size of the margin itself. As a matter of fact, the most sensitive sectors are Precision Mechanics (XVIII), Ceramic and glassware (XIII) and Wood products (IX) featuring double-digit elasticities; while in the case of the most preferred sectors (I, XI and XII) the elasticity is around 7.

The most striking result is that agricultural preferences, even if relevant in absolute terms, in several cases (sections II, III, IV) don't seem to have any significant impact. In the case of Vegetable products (Section II) this may be a consequence of the large share (70%) of duty-free imports, while it is more surprising in the case of Beverages and tobacco (Section IV) where one third of EU imports is preferential (Table 3). However, it is well-known that preferential access is often subject to stringent rules and regulations, such as rules of origin (Bureau et al., 2007) which add to overall trade costs. In agriculture, even if preferential margins are larger, the costs of using preferential access often outweigh the benefits, and thus traders find it more economically viable to pay MFN rates rather than to incur the cost associated with the use of the preferential rate. Moreover, it should be recalled that much of the observations excluded from our database (specific tariffs, TRQs and graduated products) are included in these sectors.

Model 1 is our preferred specification and we use it in Table 6 to compute the percentage change in total imports due to the hypothetical elimination of existing preferences according to equation (12), presenting the results only for sectors with a statistically significant estimated preference impact. The impact on trade depends both on estimated elasticity and margin size. Accordingly, sectors featuring a double digit positive impact on trade (XI, XIII and XII) include Ceramic and Glassware (with an elasticity around 14) as well as Textiles and Footwear with relatively high margins (see Figure 1). The amount of trade flows that would disappear without preferences also depends on the sections' shares of imports. As a consequence, the largest flows are associated with Textiles (Section XI) but also Machinery (Section XVI) and Metals (Section XV).

Using a reference tariff an 'average' of the duties paid by different exporters implies that some of them face a negative preference. As a consequence, trade preferences also reduce trade and these negative impacts are reported in Table 6. Indeed, it is always true that when we provide a preferential access to one exporter we are discriminating against all the others. Accordingly, it is not surprising that the sections presenting the largest positive impacts (such as XI and XVI) also present the largest negative ones. In these cases the net balance is still positive, and this is also the case for the overall figures (18,689 million € of additional trade flows vs. 15,487 million € of missing trade flows). However, this is not always the case and there are a couple of cases, namely Animals (Section I), and Precision mechanics (Section XVIII), where the opposite is true. In these sectors, preferences negatively affect some exporters more than they benefit the others.

We now turn to the sensitivity analysis of our results. Models 2, 3 and 4 in Table 5 reports the estimated coefficients for different definitions of the reference tariff used in the computation of the preference margins, while Figure 1 compares the average margins for each section. According to our definition (equation (10)) a value greater than 1 indicates a positive margin, and this is the case for all the values reported in Figure 1. It should be noted, though, that for all the definition but the MFN one these are simple averages across values both above and below 1 (signaling the presence of a negative margin).

We start by replacing the CES index with the standard reference provided by the MFN tariff (Model 2). By construction, MFN margins always exceed the CES ones (Figure 1), and in most cases this leads to an overestimation of the trade impact, though there are a few cases of underestimation (Sections I, XII and XIII). Apparently, there are large differences across sections: as a percentage of the CES impact errors implied by the use of the MFN margins range from 0.4 (Section XI) to 99 (Section XX) percent.

Models 3 and 4 allow to assess the relevance of the aggregation bias. If we look at the margins (Figure 1), it appears that the trade-weighted average turns out to be a better reference than the simple one since the (simple) average difference between trade-weighted and CES margins is around 6 percent while it averages 31 percent replacing trade-weighted with simple average margins (and reaches 40 percent using the MFN margins). The picture is more nuanced when we look at the estimates presented in Table 5, since in several cases estimates obtained using simple average margins are closer to those obtained using CES margins than the estimates associated with the trade-weighted margins.

Finally, it is worth mentioning, though, that by and large estimates provided by the MFN margins appear to be much more off the mark than those obtained acknowledging the existence of negative as well as positive margins. This implies that the definition bias is more relevant than the aggregation one, and the resulting message is: use the applied bilateral tariffs as a reference (even if you need to aggregate them).

5. Conclusions

After decades of gravity equation estimates of the (treatment) effect of preferential policies on trade flows — there seems no clear and convincing empirical evidence. This seems surprising in light of the proliferation of these policies in the last 15 years and widespread expectations that such treatments should increase trade. Our goal has been to provide a thorough empirical analysis of the EU preferential policies on trade, in light of prevailing knowledge on the theoretical foundations for the trade gravity equation and on modern econometric techniques.

The elasticity of substitution between goods from different countries, the Armington elasticity— is important for many questions in international economics, but its magnitude is subject to debate. We compute structural estimates allowing for heterogeneity at the sectoral level. Our results confirm that differences across sectors are such that the response of aggregate quantities estimated from aggregated may not be indicative of the average elasticity of substitution.

The most important finding of the paper is the fact that the results critically depend on how the advantage provided by the preferences measure is measured. More importantly, the margin definition should take into account not only absolute changes in bilateral duties but also relative changes in relation to those paid by other exporters. This feature should be acknowledged as the international trade literature recognized years ago the existence of a multilateral resistance component, capturing the fact that exports from country *i* to country *j* depend on trade costs across all possible suppliers.

Overall the results suggest that preferences have a relatively minor impact on trade. The additional flows generated by the preferences represent around 3% of EU imports, and such a percentage would be much lower if we consider that most of these flows crowds out other exporters. Even if our estimates represent a lower bound for the true preference impact since they are designed to account for trade replacing less efficient domestic producers, these figures may be quoted by those regarding trade preferences as a failed policy. It should be noted, though, that the picture is much more nuanced at the sectoral level, and preferences do have a significant impact in some sectors and for specific exporters.

Although our focus has been solely on trying to provide policymakers with more resolution on an unbiased estimate of the average treatment effect of EU trade policies, some caveats are necessarily in order. Our preference margins are calculated only with respect to tariffs and do not take into account any restrictive effects of non-tariff barriers (e.g. quotas, administered pricing, contingent protection measures, standards, etc.). A second caveat is that we don't discuss the impact of the rents generated by preferential policies. More generally, we have not addressed the welfare implications of preferential policies. These are topics left for future research.

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TABLES

Table 1

Commodity Classification

Sectors according to the EU Sections of the Harmonized Commodity Description And Coding System
Sections
I: Live Animals; Animal Products (Chapters 1-5)
II: Vegetable Products (Chapters 6-14)
III: Animal or Vegetable Fats and Oils and Their Cleavage Products; Prepared Edible Fats; Animal or Vegetable Waxes (Chapter 15)
IV: Prepared Foodstuffs; Beverages, Spirits, and Vinegar; Tobacco and Manufactured Tobacco Substitutes (Chapters 16-24)
V: Mineral Products (Chapters 25-27)
VI: Products of the Chemical or Allied Industries (Chapters 28-38)
VII: Plastics and Articles Thereof; Rubber and Articles Thereof (Chapters 39-40)
VIII: Raw Hides and Skins, Leather, Furskins and Articles Thereof; Saddlery and Harness; Travel Goods, Handbags, and Similar Containers; Articles of Animal Gut (Other Than Silkworm Gut) (Chapters 41-43)
IX: Wood and Articles of Wood; Wood Charcoal; Cork and Articles of Cork; Manufactures of Straw, of Esparto or of Other Plaiting Materials; Basketware and Wickerwork (Chapters 44-46)
X: Pulp of Wood or of other Fibrous Cellulosic Material; Waste and Scrap of Paper or Paperboard; Paper and Paperboard and Articles Thereof (Chapters 47-49)
XI: Textiles and Textile Articles (Chapters 50-63)
XII: Footwear, Headgear, Umbrellas, Sun Umbrellas, Walking-Sticks, Seat-Sticks, Whips, Riding-Crops and Parts Thereof; Prepared Feathers and Articles Made Therewith; Artificial Flowers; Articles of Human Hair (Chapters 64-67)
XIII: Articles of Stone, Plaster, Cement, Asbestos, Mica or Similar Materials; Ceramic Products; Glass and Glassware (Chapters 68-70)
XIV: Natural or Cultured Pearls, Precious or Semiprecious Stones, Precious Metals, Metals Clad with Precious Metal, and Articles Thereof; Imitation Jewellery; Coin (Chapter 71)
XV: Base Metals and Articles of Base Metal (Chapters 72-83)
XVI: Machinery and Mechanical Appliances; Electrical Equipment; Parts Thereof; Sound Recorders and Reproducers, Television Image and Sound Recorders and Reproducers, and Parts and Accessories of Such Articles (Chapters 84-85)
XVII: Vehicles, Aircraft, Vessels and Associated Transport Equipment (Chapters 86-89)
XVIII: Optical, Photographic, Cinematographic, Measuring, Checking, Precision, Medical or Surgical Instruments and Apparatus; Clocks and Watches; Musical Instruments; Parts and Accessories Thereof (Chapters 90-92)
XIX: Arms and Ammunition; Parts and Accessories Thereof (Chapter 93)
XX: Miscellaneous Manufactured Articles (Chapters 94-96)
XXI: Works of Art, Collectors' Pieces and Antiques (Chapter 97)

Table 2

EU Preferential schemes in 2004

Generalized System of Preferences (GSP), including Everything But Arms (EBA), GSP-Drugs, GSP-Labor Rights schemes
Cotonou Agreement
EU-Chile Association Agreement
EU-Mexico Free Trade Agreement
Euro-Mediterranean partnership
European Economic Area (EEA) Agreement
EU-Turkey Custom Union
Trade, Development and Co-operation Agreement (TDCA) [South Africa]

Table 3

EU25 share of import trade flows by type of tariff regime (period 2004)

Sections	% of MFN duty-free	% of MFN duty (no preference)	% of Preferential duty	Total trade (Ml of €)	Share in total imports (%)
Overall	56	26	18	622,670	100
I	14	39	47	10,938	1.8
II	69	15	16	14,568	2.3
III	17	20	63	1,056	0.2
IV	45	22	33	13,415	2.2
V	98	1	2	93,989	15.1
VI	55	35	10	65,954	10.6
VII	11	56	33	18,131	2.9
VIII	34	33	33	3,561	0.6
IX	76	8	16	8,630	1.4
X	100	0	0	10,557	1.7
XI	4	41	55	44,819	7.2
XII	0	35	65	6,519	1.0
XIII	14	42	44	4,853	0.8
XIV	89	6	6	26,860	4.3
XV	55	21	24	48,301	7.8
XVI	57	28	15	151,831	24.4
XVII	31	53	16	52,303	8.4
XVIII	63	24	12	32,497	5.2
XIX	16	68	16	232	0.0
XX	47	27	25	11,324	1.8
XXI	100	0	0	2,332	0.4

Table 4

Simple average tariffs (%) for commodity groups with preferential trade flows

Sections	Bilateral applied tariff	(Standard Deviation)	MFN tariff	Observations (Positive flows)
Overall	1.07	(0.03)	6.52	65,555
I	1.31	(0.02)	11.37	2,091
II	1.44	(0.03)	6.60	1,584
III	1.83	(0.03)	9.44	290
IV	3.43	(0.06)	15.57	2,939
VI	0.24	(0.01)	5.57	4,080
VII	0.24	(0.01)	5.75	3,507
VIII	0.34	(0.01)	4.57	1,595
IX	0.39	(0.01)	4.75	1,245
XI	2.39	(0.04)	9.48	18,258
XII	1.09	(0.03)	7.59	2,225
XIII	0.77	(0.02)	4.92	3,072
XV	0.23	(0.01)	3.81	6,119
XVI	0.04	(0.01)	2.85	10,709
XVII	0.55	(0.02)	5.06	2,101
XVIII	0.07	(0.00)	3.29	2,162
XX	0.07	(0.00)	3.47	2,848

Table 5

Preference margin $(\sigma - 1)$ impact by commodity groups: different reference tariffs

Sections	Model 1 (CES tariff index)	Model 2 (MFN tariff)	Model 3 (Simple average tariff)	Model 4 (Trade-weghted average tariff)	Obs
I	6.19***	4.77***	5.68***	6.24***	46,825
	(1.33)	(1.62)	(1.85)	(1.58)	
II	1.73	-7.13	-3.66	-0.27	28,312
	(2.81)	(3.62)	(3.56)	(3.59)	
III	6.61	3.27	2.78	7.82	6,813
	(4.67)	(3.01)	(2.40)	(5.23)	
IV	1.02*	1.48*	1.75*	1.34**	50,762
	(0.59)	(0.77)	(0.91)	(0.67)	
VI	0.67	-1.41	-9.99**	3.32	91,061
	(3.03)	(3.25)	(4.24)	(3.25)	
VII	6.91***	11.82***	5.61**	9.22***	42,239
	(1.87)	(2.38)	(2.58)	(2.07)	
VIII	-0.40	-2.20	4.74	2.94	16,608
	(3.31)	(3.32)	(3.57)	(3.69)	
IX	10.23***	2.07	12.15***	13.15**	20,586
	(4.32)	(5.09)	(4.56)	(5.42)	
XI	6.09***	6.46***	6.41***	6.41***	129,237
	(0.88)	(0.92)	(0.92)	(0.94)	
XII	6.89***	6.42***	6.58***	7.47***	13,862
	(1.82)	(1.73)	(1.76)	(1.95)	
XIII	13.29***	12.95***	13.06***	14.97***	27,052
	(2.04)	(2.09)	(2.12)	(2.14)	
XV	9.31**	12.81**	12.76**	13.24**	96,533
	(4.59)	(6.02)	(6.11)	(6.20)	
XVI	8.87***	11.38***	11.97***	12.06***	211,597
	(2.40)	(2.52)	(2.40)	(2.38)	
XVII	-4.43	-2.40	1.85	-11.74	34,560
	(4.03)	(4.24)	(4.50)	(8.53)	
XVIII	22.68***	23.45***	21.08***	25.21***	43,948
	(7.04)	(6.86)	(7.37)	(5.92)	
XX	7.38*	14.68***	11.34**	13.08**	30,311
	(3.97)	(5.11)	(4.88)	(5.53)	

TABLE 6. The estimated preference effect – Results for commodity groups with a significant preference impact.

Sections	REFERENCE: CES TARIFF			
	Trade increase (%)	Additional flows at world prices (Ml of €)	Trade decrease (%)	Missing flows at world prices (Ml of €)
I	9.4	1,083	12.1	1,397
IV	2.0	271	1.7	226
VII	6.8	1,238	5.2	950
IX	3.9	336	3.4	290
XI	14.3	6,447	10.2	4,606
XII	12.0	782	6.6	432
XIII	13.3	645	9.2	445
XV	4.6	2,213	4.0	1,936
XVI	2.3	3,555	1.9	2,954
XVIII	5.3	1,713	6.3	2,038
XX	3.6	405	1.9	212
TOTAL	**5.3**	**18,689**	**4.4**	**15,487**

Figure 1

Preference margins (sample of positive trade flows)