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The impact of EU trade preferences on the extensive and intensive margins of agricultural and food products

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Abstract

In this article, we study the trade creation effects of EU preferential trade agreements (PTAs) in the agriculture and food sectors for a large sample of developing countries in the period 1990–2006. We investigate the extent to which the PTAs affect trade through the extensive margin—number of exported products—or the intensive margin—volume of existing products. We use a gravity framework in a panel data setting, and different estimators to deal with the issues of zero trade flows and the presence of an upper bound in the dependent variable. The results show that EU PTAs positively affect the extensive margin in agricultural trade, but not in processed foods. As regards the intensive margin, the effect is driven by the role of tariffs alone, whereas the other provisions of PTAs do not exert any other significant impact on agricultural or food products.

JEL classifications: F13, Q17, F14

Keywords: Extensive/intensive margins; Gravity equation; EU trade preferences; Developing countries

1. Introduction

The EU is the largest trading partner for the majority of developing countries and in particular for the least developed countries (LDCs). In 2014, EU imports of agri-food products from LDCs reached almost €3 billion, with the other top world importers—United States, China, Japan, Russia, and Canada—together importing only €2.5 billion from LDCs. The EU was also the first importer to introduce preferential policies, and since the 1971 Generalised System of Preferences (GSP), the number of preferential schemes as well as reciprocal trade concessions has continued to rise. Yet, whether and to what extent the trade policies of the EU actually contribute to increasing the exports of developing countries is a widely debated issue. Many studies have assessed the trade creation effect of the EU preferences and a number of recent papers, based on firm-heterogeneity models of international trade, have decomposed the overall trade effects of preferential policies into the intensive and extensive trade margins, that is, an increase in the volume of traded products and in the number of exported products (Cipollina and Salvatici, 2011; Foster et al., 2011; Gamberoni, 2007; Persson and Wilhelmsson, 2015). This approach adds a further perspective on the trade creation effects of preferential trade agreements (PTAs) as it offers insights on a rather sensitive issue, namely the effect of PTAs on the export diversification of developing countries. Indeed, export diversification has long been of primary concern for the policy-makers of developing countries. A limited range of exports, often in primary goods, is considered potentially harmful because it leaves export revenues, and consequently the national income, exposed to the volatility of a small number of commodity markets. Reduction of dependency on such a small number of commodities has long been a priority for many developing countries and is now among the objectives of a number of EU preferential trade policies.[1]

It has often been argued that EU preferences have contributed much less than expected to increasing developing countries' exports for a number of reasons (e.g., Brenton, 2003; Collier and Venables, 2007). First, the limited coverage of preferences has stimulated the concentration of exports to the EU in a few

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[1] The promotion of export diversification is one of the objectives stated in the section "Economic and Trade Cooperation" of the Cotonou Agreement between the EU and the African, Caribbean and Pacific countries. Diversification is also mentioned as one of the main aims of the EU Generalised Tariff Preferences Scheme (http://ec.europa.eu/trade/policy/countries-and-regions/development/generalised-scheme-of-preferences/).

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Abstract: In this paper we study the trade creation effects of EU preferential trade agreements (PTAs) in the agriculture and food sectors for a large sample of developing countries in the period 1990-2006. We investigate the extent to which the PTAs affect trade through the extensive margin – number of exported products – or the intensive margin – volume of existing products. We use a gravity framework in a panel data setting, and different estimators to deal with the issues of zero trade flows and the presence of an upper bound in the dependent variable. The results show that EU PTAs positively affect the extensive margin in agricultural trade, but not in processed foods. As regards the intensive margin, the effect is driven by the role of tariffs alone, while the other provisions of PTAs do not exert any other significant impact on agricultural or food products.

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1. Introduction

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2007; Brenton 2003). First, the limited coverage of preferences has stimulated the concentration of exports to the EU in a few highly favored commodity tariff lines, instead of in manufactured goods. Second, the instability of the preferential schemes, which are subject to frequent revision, may have discouraged long-term investments in new products/industries. Finally, strict rules of origin are likely to reduce the take-up of preferences, thereby discouraging diversification.

This article investigates the effect of the EU preferential trade agreements (PTAs) on the extensive and intensive margins of agricultural and food products, by using a panel gravity framework.[2] Our contribution to the literature is three-fold. First, unlike most papers, we consider a direct measure of export diversification based on the theoretically-founded decomposition of overall trade into the extensive and intensive margins, as originally proposed by Feenstra (1994 and 2004) and further developed by Hummels and Klenow (2005) and Feenstra and Kee (2008). Second, we use different estimators for our gravity model of the extensive margin. Besides the standard Poisson pseudo maximum likelihood (PPML), we also use the flexible estimator recently proposed by Santos Silva *et al.* (2014). Indeed, as recently shown by these authors, the number of exported products has both a lower and an upper bound. Ignoring the double-bounded nature of the dependent variable could lead to misspecification and erroneous conclusions. Finally, and most importantly, to assess the impact of PTAs on the two margins, we include both preferential tariffs, to capture the impact of a reduction in the variable costs associated with the PTA, and a PTA dummy, to capture the non-tariff provisions of a PTA. The consensus is that PTAs positively affect trade through the reduction of the variable trade costs, by means of a

[2] It is worth clarifying that this paper deals with *product* diversification. Geographic diversification is a relevant policy issue as well, which has also been investigated (e.g. Helpman et al 2008); however, the focus here is on the impact of the EU trade policies on the exports of developing countries to the EU markets; their impact outside EU markets is beyond the scope of this article.

decrease in tariffs, or by a reduction of non-tariff barriers; however, PTAs may also imply fixed costs, for example, the cost of complying with the rules of origin. By including both tariffs and PTAs dummies we aim to unravel these different possible impacts.

Our findings not only confirm the positive impact of EU preferential tariffs on the export diversification of agricultural products of developing countries, but also provide further insights. First, agricultural tariffs exert an asymmetric effect on the extensive margin between PTA members and third countries. Second, the extensive and intensive margins to trade policy variables respond differently in the case of agricultural and processed foods. Third, our findings confirm that the magnitude of the estimated impact of the policy variables on the extensive margin can be influenced by the choice of both the dependent variable and the estimator used.

The article is organized as follows. The next section provides the background. Section 3 illustrates the measures of the extensive and intensive margins used. Section 4 deals with the empirical specification and the econometric issues, while Section 5 illustrates the data. Section 6 discusses the results, while the final section provides the conclusions.

2. Margins of trade and PTAs: background

While there is an extensive literature analyzing the impact of trade preferences on the export volumes – mostly based on trade-creation and trade-diversion impacts – the effect of a PTA on export diversification has been much less discussed. Firm-heterogeneity trade models provide important insights on the link between preferences and export diversification. These models highlight how a reduction of variable trade costs, by lowering the (firm) productivity threshold, allows more firms to export and, as a consequence, increases the extensive margin (Melitz, 2003; Chaney, 2008). At the same time, a reduction in variable trade costs also increases average exports by incumbent exporters, i.e. the intensive margin of trade. Instead, a reduction of the fixed costs of exporting has no impact on incumbent exporters (the intensive margin), but increases the number of exporting firms (the extensive margin), as new firms are now able to cover the fixed export costs. The extent to which trade liberalization affects the two margins depends upon the elasticity of substitution in the industry (see Chaney, 2008). Indeed, with high substitution elasticities (homogeneous goods) lower trade costs mainly increase the intensive margin, while the extensive margin effect is weak, as only few firms become new exporters; on the contrary, when the elasticity of substitution is low (differentiated products) the reduction of trade costs mainly increases the extensive margin of trade. Helpman *et al* (2008) show how to obtain estimates of the intensive and extensive margin by using country-level data. If firms produce differentiated products, the firm-level extensive and intensive margins translate into product-level margins; hence, the main predictions of the Melitz/Chaney models apply also to the extensive and intensive *product* margins. According to the Melitz/Chaney model, we should, therefore, expect that a reduction of trade costs influences trade margins for agricultural products (with higher elasticity of substitution) in a different way from those regarding food products.

The various PTAs signed by the EU, through their effect on trade costs, have probably induced changes in both the extensive and intensive margin. Preferential tariffs have been a central component of trade policies. Non-reciprocal preferences for low and middle-income countries have been widely used by the EU since the 1960s - e.g. Generalised System of Preferences (GSP) and the conventions with the African, Caribbean and Pacific (ACP) countries. In more recent years, non-reciprocal preferences have been limited to the GSP, GSP+ and the Everything But Arms initiative (EBA), while the Economic Partnership

Agreements (EPA) with the ACP countries signed after 2007 involve reciprocal preferences, as well as the other Free Trade Agreements (FTAs) in place with developing countries - such as those with Chile, Mexico, South Africa and the Mediterranean countries.

EU PTAs imply a reduction of tariffs, but can also affect fixed and variable trade costs, due to the various requirements that the exporters need to meet to become eligible for preferential treatment. One important source of compliance costs is the rules of origin (RoO). Binding RoO may increase the marginal cost of production because firms are constrained to deal with (more expensive) local sources.[3] In addition, fixed costs may rise because of the administrative costs incurred in complying with the RoO. [4]

Recent FTAs also include a number of trade-related provisions aimed at reducing, or harmonizing, non-tariff barriers (NTB) that preferential exporters face when accessing the EU market (so-called deep integration). The most significant are those related to the Technical Barriers to Trade (TBT) and the Sanitary and Phytosanitary Measures (SPS) (Li and Beghin, 2012; Olper, 2016). The potential effectiveness of these provisions in terms of a reduction of trade costs varies considerably from one agreement to another, depending mainly upon the inclusion of commitments that go beyond the relevant WTO agreements.

Table 1 summarizes the expected impact of PTAs on the exporters' fixed and variable trade costs and, consequently, on the extensive and intensive margins of trade. As the administrative costs are likely to impact traders by increasing fixed costs, they are expected to influence the number of firms and the number of exported varieties negatively, but not the average exports of individual firms. Non-tariff barriers may affect both the fixed and

[3] In theory RoO are likely to affect traders' costs in a number of different ways. For example, agreements allowing for full cumulation, such as the ACP-Cotonou agreement, should be less restrictive than those allowing only diagonal cumulation, as in the case of GSP.

[4] These can be considered as fixed because they involve the firm in finding the relevant information and setting up *ad hoc* administrative procedures (Candau and Jean 2009).

the variable costs of traders and, hence, negatively influence both margins.

The overall impact of PTAs on the margins of trade, therefore, depends on whether the (positive) tariff reduction effect on margins outweighs the (negative) impact of the cost of compliance with the preferential scheme, and on how the preferential scheme affects the non-tariff barriers.

Available evidence about the impact of PTAs on the margins of trade is somewhat hazy, also because of the different data and specifications used. In addition, very few studies concern the EU or the agricultural and food industries and even fewer focus on both EU and the agri-food industry. Persson and Wilhelmsson (2015) found that ACP preferences initially has had a positive impact on the extensive margin, while since the last Cotonou Agreement overall export concentration has tended to rise; both GSP and EBA have a positive impact on the extensive margin. Grant and Boys (2012) found that the increase of agricultural trade due to WTO membership is driven mainly by the extensive margin. Cipollina and Salvatici (2011) have shown that EU preferences have a significant positive impact on the extensive margin only for agricultural and food products. Gamberoni (2007) found that ACP preferences exerted a positive impact on both the extensive margin and the intensive margin of trade, but only for agricultural products. Feenstra and Kee (2008) have estimated the impact of US tariffs on the export variety (the extensive margin) in various industries and found that in agriculture and other sectors, except for textiles and electronics, export variety are negatively correlated with tariffs.

3. Measuring the intensive and extensive margins

A number of papers have used an indirect approach to decompose the impact of trade policies on the extensive and intensive trade margins (Gamberoni 2007; Cipollina and

Salvatici 2011; Grant and Boys 2012). Others have used direct measures, such as the number of products exported within a certain industry/category and export concentration indexes (Cadot *et al* 2011; Dennis and Shepherd 2011; Persson and Wilhelmsson 2015) or, in a choice modeling framework, the probability that a zero bilateral flow becomes positive (Debaere and Mostashari, 2010). In this paper, we use the decomposition of trade into two margins, originally proposed by Feenstra (1994) and further developed by Hummels and Klenow (2005) and Feenstra and Kee (2008). This has two main advantages. First, it is theoretically-grounded;[5] second, it takes into account the economic weight of the products; simple counting of the number of products as a measure of the extensive margin, albeit transparent, could be flawed by the assumption that products have the same economic weight, which might not be the case.

Let *k* be a given industry and *r* the category of a product within this industry. R_{ijt}^{k} is the exporting country *j*'s categories set exported (i.e., with positive trade flows) to the EU country *i*, in year *t*; while R_{iW}^{k} is the world's categories set exported to the EU country *i* over all the years here considered. If $\bar{V}_{iWr}^{k}$ is the average value of the world's exports to country *i* of the category *r* over the years, then the bilateral extensive margin for industry *k* in year *t* is:

$$EM_{ijk,t} = \frac{\sum_{r \in R_{ij,t}^{k}} \bar{V}_{iWr}^{k}}{\sum_{r \in R_{iw}^{k}} \bar{V}_{iWr}^{k}} \ . \qquad (1)$$

Hence, the extensive margin can be considered as a weighted count of exporter *j*'s categories in year *t*, relative to the average world categories exported to *i* over the whole

[5] As shown by Feenstra (1994), the two indexes are consistent with the consumer price theory and can be formally derived by exploiting the property of the constant elasticity of substitution (CES) utility function.

period considered. [6]

The intensive margin compares the export trade values of country *j* to country *i* of products in a certain set of goods in year *t* with the average export trade values of the world to country *i* for the same set of products. Again, if $V_{ijr,t}^{k}$ is the value of exports of country *j* to *i* of the category *r* at time *t*, the bilateral intensive margin in industry *k* is:

$$IM_{ijk,t} = \frac{\sum_{r \in R_{ij,t}^{k}} V_{ijrt}^{k}}{\sum_{r \in R_{ij,t}^{k}} \bar{V}_{iWr}^{k}} \ . \tag{2}$$

Thus, the intensive margin equals *j*'s nominal exports relative to *W*'s (world) average exports in those categories *r* in which *j* exports to *i* at time *t*. Hence, it measures country *j's* overall market share within the set of categories it exports to *i*.

Note, moreover, that the product of the two margins equals the share of country *j* on the world exports to *i*:

$$EM_{ijk,t} * IM_{ijk,t} = \frac{\sum_{r \in R_{ij,t}^{k}} V_{ijr,t}^{k}}{\sum_{r \in R_{iW}^{k}} \bar{V}_{iWr}^{k}} = \frac{X_{ijk,t}}{\bar{X}_{ik}} \tag{3}$$

where $X_{ijk,t}$ is the total export of product sector *k* from *j* to *i* and $\bar{X}_{ik}$ is total imports of *k* to *i*. Thus the product of two margins equals total bilateral exports as a fraction of the destination country's average (world) imports. In a gravity context, this relation has an intuitive appeal, as the log of coefficients of the extensive and intensive margins added together yields exactly the traditional gravity coefficients, once importer-country-sector fixed effects, which sweep out the term $\bar{X}_{ik}$, are included.

[6] This weighting in principle could enlarge the extensive margin for countries exporting goods for which the (EU) country imports are larger. Hummels and Klenow (2005) do not find this to be the case empirically. Also in our context this is not relevant because we work with 4 digit (ISIC Rev.3) industry.

In our empirical exercise, industry *k* is defined at the 4-digit level of the ISIC rev. 3 classification, and the *r* category at the 8-digit level.[7]

Figure 1 provides a preliminary look at the evolution of the two margins, for PTA and non-PTA countries.[8] As for agricultural products, while PTA countries have increased the extensive margin over the whole period, since the second half of the nineties the extensive margin of non-PTA countries has significantly declined. On the contrary, during the whole period, both groups of countries have increased the intensive margin.

A slightly different pattern can be observed for the food industry. In fact, while PTA countries have increased their extensive margin also in this industry, in the case of non-PTA countries the extensive margin, after an initial increase in the early nineties, does not show any appreciable change thereafter. The intensive margin increased for both groups of countries.

Assessing the role of trade policies in determining this pattern is the objective of our econometric work in the following sections. However, it can be noted here that the sharp decrease of the agricultural extensive margin for non-preferred countries dates from the mid-nineties, when the Uruguay Round Agreement on Agriculture came into force. In other words, agricultural export concentration for non-preferred countries occurs along with the progress in the multilateral trade liberalization. On the other hand, during the same period PTA countries continued to increase their agricultural export diversification toward the EU, despite the progress towards multilateral liberalization that generated, to some extent, an erosion of agricultural preferences.

[7] More details on this are provided in the data section.

[8] The figure plots a local polynomial smooth of the extensive (intensive) margins of trade over time.

4. Empirical model and econometric issues

4.1 Specification of the gravity equation

Following a consolidated tradition, we investigate the impact of PTAs on the trade margins by using a gravity-like equation on panel data.

The standard gravity model on cross-sectional data can be represented by the following equation:

$$\ln m_{ij} = \beta_0 + \beta_1 Z_{ij} + \beta_2 PTA_{ij} + \ln GDP_i + \beta_2 \ln GDP_j + \varepsilon_{ij} \qquad (4)$$

where m_{ij} is the trade flow to country *i* from country *j*; Z_{ij} is a vector of other covariates including standard bilateral gravity terms (distance, common language, common border, and colonial relationships) and country fixed effects to account for multilateral price terms; PTA_{ij} is a dummy variable equal to 1 if country *i* grants a preferential tariff to country *j*; and finally GDP_i (GDP_j) is the nominal gross domestic product in the destination (origin) country (see Anderson and van Wincoop 2003; Baier and Bergstrand 2007).

In this context, the dependent variable is decomposed into the extensive and intensive margins; further, our specification includes a time dimension and a number of fixed effects discussed below. To capture the impact of trade agreements most papers have used a simple dummy variable as in equation (4), while direct measures of trade policies such as tariffs (Buono and Lalanne, 2012; Dennis and Shephard, 2011) or the preference margin (Cipollina and Salvatici, 2011; Raimondi *et al.* 2012) have been little used. We incorporate both the applied tariffs and a dummy for the PTAs of the EU. The idea is that, once the tariff component of the preferences is controlled for, then the PTA dummy captures all other aspects related to the preferential policy different from tariffs, such as the increase in fixed and variable costs due to the RoO or changes in the exporters cost due to harmonization or mutual recognition of NTBs under the PTA regime (see Feenstra and Kee, 2008).

Thus, our benchmark panel gravity models for the extensive ($EM_{ij,t}$) and intensive ($IM_{ij,t}$) margin, can be written as follows:[9]

$$\ln EM_{ij,t} = \beta_{e1}\ln\left(1+\tau_{ij,t}\right) + \beta_{e2}PTA_{jt} + \gamma_e Z_{ij,t} + \mu_{ij,t}, \quad (5)$$

$$\ln IM_{ij,t} = \beta_{s1}\ln\left(1+\tau_{ij,t}\right) + \beta_{s2}PTA_{jt} + \gamma_s Z_{ij,t} + \pi_{ij,t}, \quad (6)$$

where $\tau_{ij,t}$ is the (applied) *ad valorem* tariff of country *i* faced by country *j*; PTA_{jt} is a dummy equal to 1 for countries that benefit from a preferential scheme, and 0 otherwise; $Z_{ij,t}$ is a vector of other covariates including standard bilateral gravity terms (distance, common language, border, and colonial relationships), time dummies and a number of fixed effects, as explained below; β_{e1}, β_{e2} and γ_e and β_{s1}, β_{s2} and γ_s are parameters to be estimated, and $\mu_{ij,t}$ (and $\pi_{ij,t}$) is assumed to be log-normally distributed error term.

Our expectation is that tariffs should negatively influence both margins, i.e. $\beta_{e1} < 0$ and $\beta_{s1} < 0$ (see Table 1). The impact of all other provisions of the PTA may or may not positively influence the margins, depending on whether the (positive) impact of a possible reduction of non-tariff barriers associated with the PTA, more than offsets the negative impact of the costs of compliance with the RoO. Thus, the coefficients β_{e2} and β_{s2} are, *a priori*, of uncertain sign.

As discussed on section 3, a cursory glance the data reveals that, while PTA countries have increased their agricultural extensive margin toward the EU, agricultural export concentration for non-preferred countries has occurred in tandem with the progress of

[9] For simplicity we here omit the product term k from the dependent variables (EM and IM), the tariffs (τ), and the fixed effects that are included in vector Z and are explained later in the text. k refers to the four-digit ISIC industry (see section 5).

multilateral trade liberalization. To check the role of PTAs in determining this different pattern we propose a second specification where the tariff interacts with the PTA dummy:

$$\ln EM_{ij,t} = \beta_{e4} \ln\left(1 + \tau_{ij,t}\right) + \beta_{e5} \ln\left(1 + \tau_{ij,t}\right) * PTA_{jt} + \\ + \beta_{e6} PTA_{jt} + \gamma_e Z_{ij,t} + \mu_{ij,t} \qquad (7)$$

$$\ln IM_{ij,t} = \beta_{s4} \ln\left(1 + \tau_{ij,t}\right) + \beta_{s5} \ln\left(1 + \tau_{ij,t}\right) * PTA_{jt} + \\ + \beta_{s6} PTA_{jt} + \gamma_s Z_{ij,t} + \pi_{ij,t}. \qquad (8)$$

The coefficient β_{e4} (β_{s4}) captures the elasticity of the extensive (intensive) margin to tariff for *non*-preferential countries, while $\beta_{e4} + \beta_{e5}$ (or, $\beta_{s4} + \beta_{s5}$) captures the elasticity of the extensive (or the intensive) margin to tariff for PTA countries. Instead, the coefficients on the PTA dummy, β_{e6} (β_{s6}) captures the effect of the PTA on the extensive (intensive) margin when the tariff is zero. Finally, $\beta_{e6} + \beta_{e5} \ln\left(1 + \tau_{ij,t}\right)$ [$\beta_{s6} + \beta_{s5} \ln\left(1 + \tau_{ij,t}\right)$] represents the non-tariff PTA effect when tariffs are higher than zero, $\tau_{ij,t} > 0$.

A key issue of our gravity specification is how to control for multilateral price terms and the possible endogeneity of PTAs and tariffs (see Anderson and van Wincoop 2003; Baldwin and Taglioni 2006; Baier and Bergstrand 2007). In a panel data setting, the multilateral price terms tend to be time-variant, and so we should include exporter-year and importer-year fixed effects, which also control for the variation in GDPs. However, as regards EU countries as importers, neither the PTA dummy nor tariffs vary across (EU) countries, and the exporter-year fixed effects also absorb the PTA dummy. Further, we need to control for asymmetric changes of multilateral resistance across products due to the product dimension of the analysis. For these reasons, our specification always includes exporter-product fixed effects, importer-product-year fixed effects, and time/product fixed effects to control for any common time/product shocks.[10]

As for the potential endogeneity of PTAs and tariffs, we follow Baier and Bergstrand (2007) who show that in a panel gravity context the inclusion of country-pair fixed effects represents the most consistent way to account for problems of endogeneity, due in particular to selection and omitted variable bias. In our baseline specification we decide to use the standard gravity covariates, such as distance, language, contiguity and colonial ties to control for this bilateral heterogeneity.[11]

4.2 Econometric issues

As recently highlighted by Santos Silva *et al* (2014), the number of exported products used as dependent variable, can give rise to specific problems. First the number of products being exported is a count variable, and therefore bounded below by zero. This is the standard problem in the gravity literature, which is tackled by using such strategies as the Heckman selection correction (Helpman *et al* 2008) or the PPML estimator (Santos Silva and Tenreyro 2006). Yet, measures of the extensive margin are not only bounded from below by zero, but also from above by the number of the respective product categories, or by 1 if exporting sectors are normalized by the existing product categories, as in our *EM* index. This double bound nature in the data implies that the partial effect of the regressors on the conditional mean of the extensive margin (the dependent variable) cannot be constant and must approach zero as the conditional mean approaches its bound (Santos

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[10] We run the estimations by also including exporter-product-year fixed effects. The results, which are not reported because of space constraint, show the findings do not change as for the traditional gravity variable coefficients and the tariff, while the omission of the PTA dummy (due to perfect collinearity) increases the size of the interaction term coefficient, both in agricultural and food products estimations.

[11] To check the robustness of our results, we performed alternative specifications including country-pair-product fixed effects as well. The enormous amount of dummies needed, precludes the possibility of implementing this specification with the other complex estimators used in the paper. The results, which are not reported because of space constraint, are both qualitatively and quantitatively similar to those reported in regressions of Tables 2 and 4. Thus, our main findings appear to be robust to potential endogeneity problems.

Silva *et al* 2014). Thus, the OLS estimator could well be unsuitable as the linear model assumes that the partial effects are constant, a property that is inconsistent with the nature of the data in question. Moreover, the standard estimators accounting for zero trade, like the Heckman selection model, the Poisson Pseudo Maximum Likelihood (PPML) or other count data estimators, could be not appropriate, because these approaches ignore the upper bound of the extensive margin (see Santos Silva *et al* 2014).

Santos Silva *et al* (2014) proposed a specific functional form directly derived from the Helpman *et al* (2008) firm heterogeneity model. In this setting, the (normalized) number of sectors exporting from *j* to *i*, omitting for simplicity the time and sectors subscripts, can be written as:

$$EM_{ij} = 1 - \left(1 + \omega \exp\left(x_{ij}^{'} \beta\right)\right)^{\frac{-1}{\omega}} + \varphi_{ij}, \tag{9}$$

where $\omega > 0$ is a shape parameter, and x_{ij} denotes a vector of regressors, including tariffs and the PTA dummy, standard gravity covariates, as well as importer and exporter fixed effects. This model has the complementary log-log model as a limit case when $\omega \rightarrow 0$, and for $\omega = 1$ reduces to the logit specification suggested by Papke and Wooldridge (1996). Note moreover that, EM_{ij} is bounded between 0 and 1, and φ_{ij} can simply be defined as $\varphi_{ij} = EM_{ij} - \mathrm{E}\left(EM_{ij} \middle| x_{ij}\right)$, which implies that $\mathrm{E}\left(\varphi_{ij} \middle| x_{ij}\right) = 0$. Estimation of the parameters β and ω of equation (9) is then obtained following Papke and Wooldridge (1996) by means of the Bernoulli pseudo-maximum likelihood, which is consistent under very general conditions and more efficient than the least square estimator (Santos Silva *et al* 2014).

One shortcoming in the interpretation of the parameter in (9) is due to the non-linearity of its functional form; further it is interpreted as an approximation to the probability that a randomly drawn sector in country j will export to destination i. Thus, the estimation of β is not particularly informative in terms of the magnitude of the economic effect. Inference could be based on average partial effects of the regressors of interest and not on the parameter estimates. However, when the specification includes interaction terms, as in equation 7, the computation and interpretation of these partial effects, aside their complexity, is not meaningful.

We also estimate the extensive margin by using the PPML estimator with the aim of comparing the results obtained by using the two estimators (PPML *versus* SSTW). Moreover, the use of PPML allows us to measure the marginal effect of the interacted term - which cannot be easily derived from the SSTW estimations – and to compare the extensive margin results to the intensive margin and the total trade estimates. Indeed, these last two dependent variables do not suffer from the upper bound problem discussed above.

5. Data

Our database includes exports from 173 non EU exporting countries (both developed and developing) to 27 EU countries over the period 1990-2006.[12] Trade data derive from ComExt-Eurostat dataset (http://epp.eurostat.ec.europa.eu/newxtweb/) and are classified according to the Combined Nomenclature (CN) system, an eight-digit subdivision of the Harmonised System (HS). In order to keep the maximum amount of information on the number of products exported by each country to the EU, we have used the highest level of disaggregation available for the EU trade data; hence, r is the eight-digit CN level product. In our empirical applications k is the four-digit International Standard Industrial

[12] We limit the analysed period to 2006, to omit the price shock of 2007-2008 and the subsequent trade collapse induced by the global crisis. Trade data include only extra-EU flows.

Classification (ISIC) Revision 3 industry, which includes five sectors for agriculture and eighteen sectors for food.[13]

Bilateral applied tariff data come from the Unctad-TRAINS database (http://databank.worldbank.org/data/) at the six-digit level of the Harmonized System (HS). Average tariffs are computed by aggregating at the ISIC 4-digit level the HS 6-digit bilateral tariffs using import weights based on the reference group proposed by Bouët *et al* (2008). Tariffs here do not include non-tariff barriers, such as quotas, but do include tariff rate quotas, widely used by the EU in the agricultural and food sectors, by considering the in quota-tariff. [14]

The PTA dummy has been built by considering, for each year, the presence of a PTA with the EU already in force. Hence, in addition to the GSP preferential schemes, we have included the PTAs signed with the ACP, South Africa, the Mediterranean countries, Chile and Mexico and the initiative EBA. Moreover, as reported in Table A1 of the Appendix, we split the PTA dummy into four groups: the ACP countries who signed preferential agreements with the EU, countries included in the GSP, Least Developing Countries (LDC) benefitting from EBA, and Other Preferential Schemes. [15]

Data on distance, with dummies for other trade costs normally used in similar exercises (contiguity, language, and colony), are taken from CEPII (Centre d'Etude

[13] The five ISIC agricultural sectors include 731 CN codes at 8-digit; the eighteen ISIC food sectors include 1,854 CN codes. We have chosen the four-digit ISIC industry classification, rather than the two-digit HS one (which includes overall 24 agri-food industries), because in the former agricultural raw materials and food products are, by and large, clearly identified.

[14] This implies that when tariff rate quotas are in place and there are positive out-of-quota imports, then TRAINS data may underestimate the degree of protection, as the average applied tariff should take into account also of the out-of-quota tariff. In the specific context of EU agricultural preferences over the period considered, this potential underestimation of protection could be limited. Indeed, for many agricultural products out-of-quota exports are limited because PTAs countries are not competitive at the MFN tariff.

[15] For countries eligible in the same year for more than one preferential treatment, we assume that their products enter under the most favorable one. More specifically, EBA is assumed to be more favorable than the agreements with ACP, with the GSP being the least favorable preferential regime.

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6. Results

6.1 The impact of PTAs on the extensive margin

Table 2 reports the results of the estimations for agricultural products of the baseline equations (5) and (7). The results are obtained by using the Bernoulli pseudo-maximum likelihood estimator proposed by Santos Silva *et al* (2014) (hereinafter SSTW) and the PPML estimator.[16]

The estimated effects of the standard gravity covariates are always significant and with the expected sign. In particular, distance reduces the extensive margin, while common language, contiguity and colonial ties increase the likelihood of trade. The SSTW and PPML results have a very similar pattern.

As for the policy variables (tariffs and PTAs), bearing in mind that a positive sign for tariffs (PTA) means that trade liberalization reduces (increases) the extensive margin, it should first be noted that the signs of the coefficients are the same for the two estimators. When we consider the SSTW coefficients of columns (1) we find that the presence of PTAs increases the extensive margin by 28%[17] and this partial effect is higher when estimated with the PPML estimator (36%, column 3).[18]

The specification that includes the two policy variables and their interaction term (columns 2 and 4) confirms the importance of distinguishing the impact of tariffs within

[16] As a robustness check, we also estimated the OLS and the Heckman selection model; the results, not reported here for space constraints, are available upon request from the authors, but they do not diverge significantly from those presented in Tables 2 and 4.

[17] To derive the partial effect for the SSTW estimator we follow the approach developed by Santos Silva *et al* (2014). We thank the authors for kindly introducing us to this rather complex procedure and for sharing their Stata commands. The magnitude of the PPML partial effect is computed as $exp\ (\beta_{e6}) - 1$.

[18] To check robustness, we run the estimations by using as dependent variable a simple count of the products exported by the country. The results, which are not reported for space constraints, are qualitatively similar, i.e. PTA increases the number of exported lines by 19% (SSTW estimator).

and without the PTAs. In other words, the effect of tariffs on the likelihood of trade appears to be conditional on the presence of a PTA. The sign of the coefficients provides some apparently counter-intuitive results. First, tariffs on countries without a PTA exert a positive impact on the extensive margin; this means that trade liberalization with non-PTA countries (mostly developed countries) has reduced, rather than increased, the number of products exported to the EU, a result apparently in contradiction with the prediction of the Melitz/Chaney models. Yet, this finding rather confirms the data reported in Figure 1, which shows a clear decrease in the extensive margin of non-PTA countries during the year of the Uruguay Round Agreement implementation. Staying outside (inside) the PTAs has led to export concentration (diversification).[19]

Second, and conversely, preferential tariffs exert a negative impact on the extensive margin, with the effect in the PPML estimation equal to 0.99;[20] this means that a decrease in the preferential tariff of 1% produces a similar increase in the extensive margin (+0.99%). Third, the positive and significant coefficient of the PTA variable suggests that, when tariffs are equal to zero, membership of a PTA significantly contributes to an increase in the extensive margin. Instead, when tariffs are greater than zero the overall effect of non-tariff impacts of a PTA, equal to $\beta_{e6} + \beta_{e5} \ln(1 + \tau_{ij,t})$, varies depending on the tariff level.[21]

For further insight into the impact of the different PTAs signed by the EU, we have

[19] In the PPML estimation the results indicate that a 1% decrease in the tariff applied to non-preferential countries yields a decrease of 0.68% in the extensive margin.

[20] The impact of preferential tariffs for the PPML estimation is equal to $\beta_{e4} + \beta_{e5}$ (see equation 7). As above mentioned, the effect of variables in the SSTW estimation is not derived from the parameters reported in Table 2; hence, because of the presence of the interaction term we cannot directly compare the overall effect of tariffs and non-tariff effects of PTAs across the two estimators.

[21] Using the PPML results (column 4), if the ad valorem tariff is lower than 29%, then the non-tariff provisions of PTAs exert a positive influence on the extensive margin; conversely, for tariff levels above this threshold the effect is the opposite, namely, non-tariff provisions of PTAs exert a negative impact on the extensive margin.

split the PTA variable into four dummies: the first is equal to 1 only for the ACP countries; the second for the countries benefiting from the GSP; the third for the group of LDC countries that after 2001 were included in the Everything But Arms initiative; and the fourth captures the impact of all other PTAs. Table 3 reports the results of the SSTW estimations, which show that the effect of preferential tariffs across the various PTA groups is heterogeneous. Indeed, while tariffs are confirmed to exert an overall negative and significant impact for ACP, GSP and LDC, they turn out to affect the extensive margin of countries members of other PTAs positively. Hence ACP, GSP and LDC countries increase their export diversification with tariff reductions, while the opposite occurs with the other PTA countries. The impact of non-tariff features of PTAs differs across the various preferential regimes. In particular, they do not exert any significant effect on the extensive margin for LDC and ACP countries, while they positively affect the extensive margin of the GSP and other PTAs countries. This suggests that the potential negative influence of the rules of origins applied to GSP countries over the period here considered has been more than counterbalanced by the positive non-tariff effects linked with the GSP scheme.

The results are slightly different for processed food (see Table 4). While for the standard gravity covariates (distance, common language, colonial ties and contiguity) expectations are confirmed, when we consider trade policy variables the main findings differ, to some degree, from those for agricultural products. First, when the SSTW estimator is used, the tariff coefficient does not appear to be significant (Column 2). This means that tariffs applied to non-PTA countries do not affect the extensive margin of processed food. Conversely, for PTA countries the impact of tariffs is negative and significant. The PTA dummy is significant and positive suggesting that, also for processed food, the non-tariff provisions of PTAs increase the extensive margin when tariffs are below a certain threshold, and determine export concentration otherwise. [22]

Finally, Table 3 (Columns 3 and 4) reports results for the food products when the PTA variable and the interaction term are split for the four different groups of PTAs. Unlike agricultural products, the interaction term here is significant only for GSP and other PTAs, with the coefficient for ACP countries being negative and significant at the 5% level. Hence, in the case of food products, preferential tariffs do not exert any significant impact on the extensive margins of LDC, but stimulate export diversification from countries members of "Other PTA" and GSP. Thus, the non-tariff features of these PTAs do not seem to exert any influence on processed foods. Only for the 'Other PTA' countries is the coefficient positive and significant at the 5% level.

6.2 The impact of PTAs on the intensive margin and overall trade

Table 5 reports regression results for the intensive margin and the overall effect on trade for the agricultural products, based on the PPML estimator only, as these two dependent variables do not suffer from the double bound problem discussed above.[23] Concerning the effect of the standard gravity covariates, the results here are quite different. Only the distance coefficient is systematically negative and significant with a magnitude similar to those found in the gravity literature (see Disdier and Head 2008). On the contrary, contiguity, language, and colonial tie dummies do not exert any significant effect on the intensive margin, nor on agricultural trade. These results simply suggest that the intensity

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[22] The threshold tariff level estimated with the PPML approach, is equal to 74%, a value under which most of food products falls (98% of our observations).

[23] Here, 'Trade' refers to the product between the Extensive and the Intensive margins, as explained in section 3.

of agricultural imports to the EU is affected neither by a common border nor cultural ties.[24] Apart from the difference in the size of the distance coefficients, the results from the intensive margin and trade regressions are quite similar.

However, when policy variables are considered things change. We find a strong negative and significant effect of tariffs, with trade elasticity ranging between −0.8 for only products already exported (intensive margin) and −1.7 when trade of new products is also considered (Column 3). This means that a decrease of 1% in the *ad valorem* tariff, on average, induces an increase in trade of about 1.7%, and an increase in the intensive margin, of about 0.8%. Thus, from results of table 2 (Column 3) and table 5 (Column 1), we find that the agricultural intensive trade margin appears more sensitive to variable trade costs than the extensive margin. This result is in line with the predictions of the Melitz/Chaney model, regarding the relatively high elasticity of substitution of agricultural products. The effect of the PTA dummy on the intensive margin is not significantly different from zero; this is probably because the non-tariff PTA components impact mainly trade by affecting the fixed costs of exporting, and this does not influence the intensive trade margin. This is confirmed by the specification that includes the tariffs and PTA interaction effect (Column 2): the linear PTA effect and its interaction term are not significant.[25] Instead, the PTA dummy significantly increases trade flows (Column 3). Hence, the non-tariff provisions of PTA increase trade, largely through an increase in the extensive margin, i.e. export diversification.

Results for the overall trade also show that the interaction term between tariff and PTA

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[24] These results are in line with the Santos Silva and Tenreyro (2006). After controlling for bilateral distance, they find that, using the PPML estimator, a shared border (or colonial history) does not necessarily influence trade flows.

[25] An F-test on the joint significance of the tariffs and PTA effects (and their interaction) is indeed systematically rejected.

dummy is only barely significant (Column 4); thus the effects of preferential tariffs and the tariffs applied to non-PTA countries on the intensive margin are similar, while this is not the case for the extensive margin (see results of Table 2).

Table 6 reports the same set of regressions for processed foods. Overall, the results on the intensive margins are quite similar to those for agricultural products. One main difference concerns variables capturing cultural ties, namely, a common border and a common language, now systematically positive and significant. The estimated effect on overall trade (Column 3) shows an elasticity to tariff of processed food products significantly lower than that of agricultural products. This is hardly surprising, if one considers that the higher degree of differentiation in food products translates into lower substitution elasticity. Further, we find a positive impact of tariffs for non-PTA countries on food trade (see Column 4).

To sum up, we find robust evidence that, as regards the intensive trade margin for agricultural and processed food, the main effect of EU preferential policy is through the tariff component.

7. Conclusions

The issue of the impact of EU PTAs on agriculture and food export diversification has been addressed, by means of a panel gravity model, by decomposing the overall effect into the extensive and intensive margins of trade, and by distinguishing between preferential tariffs and non-tariff provisions of PTAs.

Results confirm our hypothesis that the effect of tariffs on the extensive margin is conditional on the PTA dummy and that PTAs could also exert an effect through non-tariff provisions of the agreement, such as RoO and reduction of NTMs. The inclusion of tariffs, PTA dummy and their interaction term provide new insights on the impact of EU preferences, with potentially interesting policy implications.

First, results show a clear asymmetry between PTA and non-PTA countries. Indeed, tariff reductions to developed (non-PTA) countries produce an overall reduction of the agricultural extensive margin. Conversely, developing (PTA) countries, over the same period increase their agricultural export diversification, despite the erosion of preferences due to multilateral liberalization. These results tend to confirm the findings of Persson and Wilhelmsson (2015) and Grant and Boys (2012) on the positive effect of EU preferences and WTO membership on the extensive margin. Similarly, our results are consistent with those of Cipollina and Salvatici (2011) who showed that EU preferences mainly affected the extensive margin of agri-food products, although this was not the case for processed food.

Second, our results also show that the non-tariff effects of PTAs on the agricultural extensive margin are, by and large, positive. Hence, any negative impact due to increased variable and fixed trade costs - linked with the rules of origin and the other administrative burdens incurred in accessing preferential treatment - are more than offset by the positive effects such as the reduction of NTMs.

Third, the results also confirm the strong negative impact of tariffs on the intensive margin, regardless of whether the country is or is not a member of a PTA. Hence, whatever the context, a reduction in agricultural tariffs increases the volume of existing traded products. This is consistent with our expectations, based on the predictions of the Melitz/Chaney model, as the non-tariff impacts of PTAs mainly affect the exporters' fixed costs; hence, they do not influence their decisions on the volume of existing products traded.

Fourth, we find evidence that trade liberalization may have different implications for agricultural raw materials *vis-à-vis* processed food products. Indeed, for agricultural products we show that a reduction in tariffs increases the intensive more than the extensive margin; again, considering the relatively high elasticity of substitution of agricultural products, this result appears consistent with the predictions of the Melitz/Chaney model. Overall, we find no clear-cut evidence of a tariff impact on the extensive margin for non-PTA countries, while the positive impact of tariff reductions on the intensive margin is confirmed but this appears to be less so for agricultural products.

Finally, our results confirm that ignoring the double bound nature of the extensive margin index may lead to an overestimation of the impact of PTAs on the extensive margin. Indeed, the partial effects of the PPML estimation are higher than those obtained by using the Santos Silva *et al* (2014) estimating procedure (SSTW).

In terms of policy implications, one important matter of concern is the lack of clear-cut evidence of a positive effect of both tariff and non-tariff provisions of PTAs on developing countries' food exports to the EU. This is an unexpected result because the current wave of globalization mostly involves processed foods, also in developing countries. One possible explanation is that the high quality and safety food standards of developed countries, and particularly of the EU, and the related process of harmonization on a regional, and not multilateral, basis, represents a complex behind-the-border barrier for developing country exporters.

In conclusion, we believe that the effort to disentangle the impact of tariffs and the other effects of EU PTAs on the intensive and extensive trade margins of agricultural exports *vis-à-vis* processed food exports has provided some valuable findings which, nevertheless, call for further analyses in a number of important directions. One is, among others, the improvement in the use of the SSTW estimator by computing the partial effects – an issue left out from current analysis given its complexity. In addition, future analysis should give a direct account of the effect of NTMs, to clarify which component affects the different trade margins, and in which direction.

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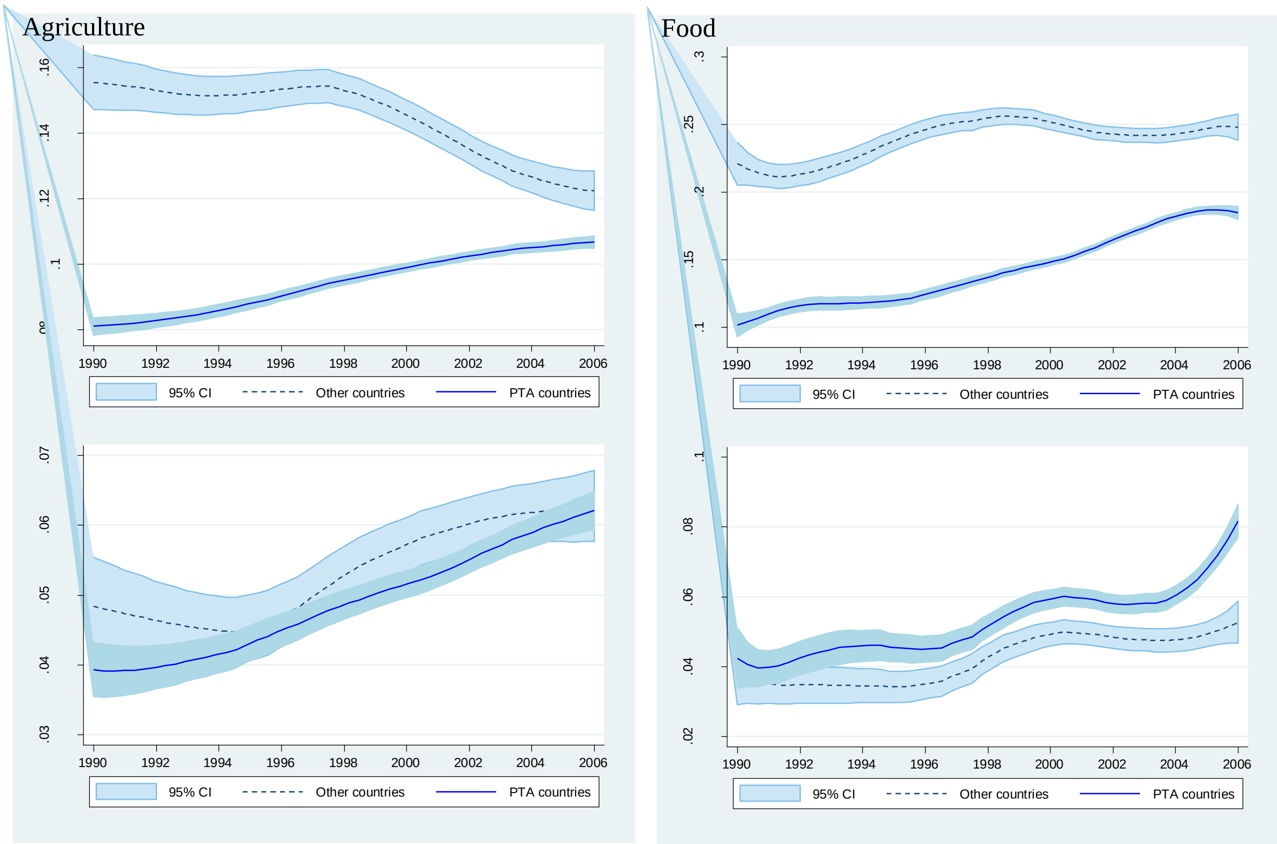

Figure 1.
EU agricultural and food products extensive and intensive trade margin

Notes: The figures show the evolution of the (smoothed) average extensive (intensive) margin, and their 95% confidence interval (computed using Stata's command for local polynomial smooth plots with CIs lpolyci), calculated across PTA and non-PTA countries.

Table 1.
The Expected Impact of Trade Policies on the Extensive and Intensive Margins

	Fixed costs	Variable costs	Extensive margin	Intensive margin
Tariffs	0	+	-	-
Rules of origin:				
Administrative costs	+	0	-	0
Input sourcing requirements	0	+	-	-
Non-tariff barriers	+	+	-	-

Table 2.
PTA Effects on the Extensive Margin:
Regression Results for Agricultural Products

	SSTW		PPML	
	(1)	(2)	(3)	(4)
Log distance	-1.38***	-1.37***	-0.80***	-0.81***
	(0.05)	(0.05)	(0.08)	(0.08)
Contiguity	1.04***	1.03***	0.28**	0.29**
	(0.10)	(0.10)	(0.13)	(0.13)
Common Language	0.31***	0.31***	0.19**	0.19**
	(0.04)	(0.04)	(0.08)	(0.08)
Colonial tie	0.68***	0.68***	0.25***	0.25***
	(0.05)	(0.05)	(0.08)	(0.08)
Log (1 + tariff)	-1.11***	0.89***	-0.62***	0.68***
	(0.10)	(0.18)	(0.12)	(0.19)
PTA	0.49***	0.77***	0.31***	0.49***
	(0.14)	(0.15)	(0.07)	(0.09)
Log (1 + tariff) * PTA		-2.51***		-1.67***
		(0.21)		(0.22)
No. of obs.	125,018	125,018	124,960	124,960

Notes: The extensive margin is measured using the theoretically-founded decomposition of trade proposed by Feenstra and Kee (2008). Robust standard errors clustered within exporting countries in parenthesis. Exporter-product fixed effects (FE), Importer-product-year FE, Year FE, Product FE included in all regressions. Each regression includes an omitted constant. SSTW coefficients are not the marginal effects (see text). ***p < 0.01; **p < 0.05; *p < 0.1

Table 3.
Effects on the Extensive Margin for different PTAs (SSTW Estimator)

	Agriculture		Food	
	(1)	(2)	(3)	(4)
Log distance	-1.32***	-1.37***	-1.11***	-1.11***
	(0.05)	(0.05)	(0.03)	(0.03)
Contiguity	0.98***	1.04***	1.10***	1.11***
	(0.10)	(0.10)	(0.06)	(0.06)
Common Language	0.29***	0.30***	0.42***	0.42***
	(0.04)	(0.04)	(0.03)	(0.03)
Colonial tie	0.66***	0.68***	0.60***	0.60***
	(0.04)	(0.05)	(0.03)	(0.03)
Log (1 + tariff)	-1.09***	0.91***	-0.50***	-0.04
	(0.10)	(0.18)	(0.05)	(0.09)
ACP	-0.45	0.15	0.05	0.20
	(0.28)	(0.27)	(0.21)	(0.21)
GSP	0.36**	0.85***	0.05	0.18*
	(0.16)	(0.16)	(0.10)	(0.10)
LDC	-0.57**	-0.03	-0.15	-0.07
	(0.28)	(0.27)	(0.21)	(0.21)
Other PTA	0.49***	0.36**	0.12	0.18**
	(0.14)	(0.14)	(0.08)	(0.08)
Log (1 + tariff) * ACP		-4.32***		-0.44**
		(0.28)		(0.20)
Log (1 + tariff) * GSP		-3.49***		-0.82***
		(0.24)		(0.12)
Log (1 + tariff) * LDC		-1.64***		0.67*
		(0.32)		(0.40)
Log (1 + tariff) * Other PTA		1.78***		-0.37***
		(0.28)		(0.13)
No. of obs.	125,018	125,018	205,503	205,503

Notes: The extensive margin is measured using the theoretically-founded decomposition of trade proposed by Feenstra and Kee (2008). Robust standard errors clustered within exporting countries in parenthesis. Exporter-product fixed effects (FE), Importer-product-year FE, Year FE, Product FE included in all regressions. Each regression includes an omitted constant. SSTW coefficients are not the marginal effects (see text). ***p < 0.01; **p < 0.05; *p < 0.1

Table 4.
PTA Effects on the Extensive Margin:
Regression Results for Food Products

	SSTW		PPML	
	(1)	(2)	(3)	(4)
Log distance	-1.11***	-1.11***	-0.61***	-0.61***
	(0.03)	(0.03)	(0.10)	(0.10)
Contiguity	1.10***	1.11***	0.38**	0.38**
	(0.06)	(0.06)	(0.15)	(0.15)
Common Language	0.42***	0.42***	0.07	0.07
	(0.03)	(0.03)	(0.10)	(0.10)
Colonial tie	0.60***	0.60***	0.40***	0.40***
	(0.03)	(0.03)	(0.09)	(0.09)
Log (1 + tariff)	-0.50***	-0.04	-0.41***	-0.27***
	(0.05)	(0.09)	(0.04)	(0.07)
PTA	0.12	0.21***	0.11*	0.14**
	(0.08)	(0.08)	(0.06)	(0.06)
Log (1 + tariff) * PTA		-0.62***		-0.19**
		(0.11)		(0.08)
No. of obs.	205,503	205,503	205,387	205,387

Notes: The extensive margin is measured using the theoretically-founded decomposition of trade proposed by Feenstra and Kee (2008). Robust standard errors clustered within exporting countries in parenthesis. Exporter-product fixed effects (FE), Importer-product-year FE, Year FE, Product FE included in all regressions. Each regression includes an omitted constant. SSTW coefficients are not the marginal effects (see text). ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

Table 5.
PTA Effects on the Intensive Margin and Trade:
Regression Results for Agricultural Products (PPML Estimator)

	Intensive		**Trade**	
	(1)	(2)	(3)	(4)
Log distance	-0.74***	-0.74***	-1.30***	-1.30***
	(0.10)	(0.10)	(0.22)	(0.22)
Contiguity	0.11	0.11	0.28	0.28
	(0.18)	(0.18)	(0.32)	(0.32)
Common Language	0.06	0.06	0.17	0.17
	(0.12)	(0.12)	(0.16)	(0.16)
Colonial tie	-0.01	-0.01	0.07	0.07
	(0.11)	(0.11)	(0.15)	(0.15)
Log (1 + tariff)	-0.81***	-0.59	-1.66***	-0.56
	(0.26)	(0.53)	(0.39)	(0.85)
PTA	0.50	0.53	0.48***	0.62***
	(0.35)	(0.36)	(0.14)	(0.18)
Log (1 + tariff) * PTA		-0.28		-1.53*
		(0.59)		(0.90)
No. of obs.	124,960	124,960	124,960	124,960

Notes: The intensive margin is measured using the theoretically-founded decomposition of trade proposed by Feenstra and Kee (2008). Trade is obtained combining the Intensive and the Extensive margins (see text). Robust standard errors clustered within exporting countries in parenthesis. Exporter-product fixed effects (FE), Importer-product-year FE, Year FE, Product FE included in all regressions. Each regression includes an omitted constant. ***p < 0.01; **p < 0.05; *p < 0.1

Table 6.
PTA Effects on the Intensive Margin and Trade:
Regression Results for Food Products (PPML Estimator)

	Intensive		**Trade**	
	(1)	(2)	(3)	(4)
Log distance	-0.74***	-0.74***	-1.00***	-1.00***
	(0.10)	(0.10)	(0.16)	(0.16)
Contiguity	0.47***	0.47***	1.09***	1.10***
	(0.13)	(0.13)	(0.23)	(0.23)
Common Language	0.28***	0.28***	0.43***	0.43***
	(0.10)	(0.10)	(0.15)	(0.15)
Colonial tie	0.01	0.01	0.27*	0.27*
	(0.10)	(0.10)	(0.15)	(0.14)
Log (1 + tariff)	-0.99***	-0.09	-0.82***	0.70**
	(0.16)	(0.25)	(0.25)	(0.32)
PTA	-0.06	0.10	-0.14	0.15
	(0.27)	(0.26)	(0.31)	(0.31)
Log (1 + tariff) * PTA		-1.23***		-2.20***
		(0.31)		(0.46)
No. of obs.	205,503	205,503	205,503	205,503

Notes: The intensive margin is measured using the theoretically-founded decomposition of trade proposed by Feenstra and Kee (2008). Trade is obtained combining Intensive and Extensive margin (see text). Robust standard errors clustered within exporting countries in parenthesis. Exporter-product fixed effects (FE), Importer-product-year FE, Year FE, Product FE included in all regressions. Each regression includes an omitted constant. ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

APPENDIX:

TABLE A1

COUNTRY	PREFERENTIAL REGIME
Antigua and Barbuda	(ACP)
Bahamas	(ACP)
Barbados	(ACP)
Belize	(ACP)
Botswana	(ACP)
Cameroon	(ACP)
Congo	(ACP)
Cote d'Ivoire	(ACP)
Dominica	(ACP)
Fiji	(ACP)
Gabon	(ACP)
Ghana	(ACP)
Grenada	(ACP)
Guyana	(ACP)
Jamaica	(ACP)
Kenya	(ACP)
Mauritius	(ACP)
Nigeria	(ACP)
Papua New Guinea	(ACP)
Saint Kitts and Nevis	(ACP)
Saint Lucia	(ACP)
Saint Vincent and the Grenadines	(ACP)
Seychelles	(ACP)
Suriname	(ACP)
Swaziland	(ACP)
Tonga	(ACP)
Trinidad and Tobago	(ACP)
Zimbabwe	(ACP)
Angola	(ACP LDC)
Cape Verde	(ACP LDC)
Chad	(ACP LDC)
Djibouti	(ACP LDC)
Equatorial Guinea	(ACP LDC)
Ethiopia	(ACP LDC)
Gambia	(ACP LDC)
Guinea	(ACP LDC)
Guinea-Bissau	(ACP LDC)
Kiribati	(ACP LDC)
Lesotho	(ACP LDC)
Liberia	(ACP LDC)
Madagascar	(ACP LDC)
Malawi	(ACP LDC)
Mali	(ACP LDC)
Mauritania	(ACP LDC)
Mozambique	(ACP LDC)
Niger	(ACP LDC)
Rwanda	(ACP LDC)
Samoa	(ACP LDC)
Sao Tome and Principe	(ACP LDC)
Senegal	(ACP LDC)
Sierra Leone	(ACP LDC)
Solomon Islands	(ACP LDC)
Somalia	(ACP LDC)
Sudan	(ACP LDC)
Tanzania	(ACP LDC)
Togo	(ACP LDC)
Uganda	(ACP LDC)
Vanuatu	(ACP LDC)
Zambia	(ACP LDC)
Cook Islands	(ACP GSP)
Dominican Republic	(ACP GSP)
Marshall Islands	(ACP GSP)
Micronesia	(ACP GSP)
Namibia	(ACP GSP)

COUNTRY	PREFERENTIAL REGIME
Haiti	(ACP LDC)
Maldives	(LDC GSP)
Yemen	(LDC GSP)
Myanmar	(LDC)(*)
Afghanistan	(LDC)
Bangladesh	(LDC)
Benin	(LDC)
Bhutan	(LDC)
Burkina Faso	(LDC)
Burundi	(LDC)
Cambodia	(LDC)
Central African Republic	(LDC)
Comoros	(LDC)
Eritrea	(LDC)
Lao People's Democratic Republic	(LDC)
Nepal	(LDC)
Argentina	(GSP)
Armenia	(GSP)
Aruba	(GSP)
Azerbaijan	(GSP)
Bahrain	(GSP)
Belarus	(GSP)
Bermuda	(GSP)
Bolivia	(GSP)
Brazil	(GSP)
Brunei Darussalam	(GSP)
Cayman Islands	(GSP)
China	(GSP)
Colombia	(GSP)
Costa Rica	(GSP)
Cuba	(GSP)
Ecuador	(GSP)
El Salvador	(GSP)
Falkland Islands (Malvinas)	(GSP)
French Polynesia	(GSP)
Georgia	(GSP)
Gibraltar	(GSP)
Greenland	(GSP)
Guatemala	(GSP)
Honduras	(GSP)
India	(GSP)
Indonesia	(GSP)
Iran (Islamic Republic of)	(GSP)
Iraq	(GSP)
Kazakhstan	(GSP)
Kuwait	(GSP)
Kyrgyzstan	(GSP)
Libyan Arab Jamahiriya	(GSP)
Macau	(GSP)
Malaysia	(GSP)
Mongolia	(GSP)
New Caledonia	(GSP)
Nicaragua	(GSP)
Oman	(GSP)
Pakistan	(GSP)
Panama	(GSP)
Paraguay	(GSP)
Peru	(GSP)
Philippines	(GSP)
Qatar	(GSP)
Russian Federation	(GSP)
Saudi Arabia	(GSP)
Sri Lanka	(GSP)
St. Pierre and Miquelon	(GSP)
Tajikistan	(GSP)

COUNTRY	PREFERENTIAL REGIME
Thailand	(GSP)
Turkmenistan	(GSP)
Turks and Caicos Islands	(GSP)
Ukraine	(GSP)
United Arab Emirates	(GSP)
Uruguay	(GSP)
Uzbekistan	(GSP)
Venezuela	(GSP)
Viet nam	(GSP)
Virgin Islands (British)	(GSP)
Wallis and Futuna Islands	(GSP)
Chile	(GSP OTHER)
Mexico	(GSP OTHER)
Algeria	(OTHER)
Andorra	(OTHER)(*)
Croatia	(OTHER)(*)
Egypt	(OTHER)
Faroe Islands	(OTHER)(*)
Iceland	(OTHER)
Israel	(OTHER)
Jordan	(OTHER)
Lebanon	(OTHER)
Macedonia, the Former Yugoslav Republic	(OTHER)(*)
Morocco	(OTHER)
Norway	(OTHER)
San Marino	(OTHER)(*)
Switzerland	(OTHER)
Syrian Arab Republic	(OTHER)
Tunisia	(OTHER)
Turkey	(OTHER)

COUNTRY	NO PREFERENCES
Albania	(*)
Australia	(*)
Bosnia and Herzegowina	(*)
Canada	(*)
Hong Kong	(*)
Japan	(*)
Korea	(*)
Korea, Democratic People's Republic of	(*)
Moldovia	(*)
New Zealand	(*)
Singapore	(*)
United States	(*)