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The Impact of Preferences on Developing Countries' Exports to the European Union: Bilateral Gravity Modelling at the Product Level

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Abstract Unilateral preferences aim at increasing exports from developing countries via reductions on applied tariffs and the incentives created by the preference margin. After decades of existence the evidence as to the extent to which preferential schemes have been genuinely effective in increasing exports is mixed. This paper evaluates the impact of the European Union's (EU) unilateral preferential regimes on the exports of developing countries using a bilateral gravity model at the product level. We use a unique dataset that allows us to determine the actual tariff rate paid by each export flow at the product level (Combined Nomenclature CN-10 digits) to the EU *and* the preferential regime of entry. This allows us to accurately specify the impact of each trade regime and to properly address the issue of utilisation and non-utilisation of trade preferences. The most important findings of the paper are that unilateral preferences have been effective in increasing exports to the EU both as a result of the direct effect of lower tariffs and positive preference margin, and because of secondary effects associated with the preference regimes; although the outcome of these secondary effects depends on the margin of trade considered.

Keywords Preferential Trade Agreements · Unilateral preferences · GSP · EBA · Gravity Models · Preference utilization

JEL-Classification: F13, F14, C23

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1 Introduction

Trade preferences have long been a central policy offered by developed countries in order to encourage exports from developing countries. The European Union (EU) has been a key player, granting unilateral preferential access to its market since the early 1970s via its preferences for the ACP[1] group of countries, through its Generalised System of Preferences (GSP), and since 2001 via the Everything but Arms (EBA) initiative for Least Developed Countries (LDCs). Other developed countries, notably the US, Canada and Japan have also offered improved access under GSP, and GSP-style schemes such as the Caribbean Basin Initiative (CBI), or the African Growth and Opportunity Act (AGOA). In more recent years, emerging developing countries such as India have also started to offer preferential access to less developed countries.[2] In the WTO, preferential access is covered under Article XXXVI of the GATT where the explicit motivation is to facilitate the growth and diversification of LDC exports "so as to provide them with expanding resources for their economic development".[3]

Unilateral preferences are a central pillar of the EU's strategy towards developing countries. The Lome convention, signed in 1975, allowed for preferential access to the EU for a group of 46 African Caribbean and Pacific states who were largely EU ex-colonies. This was replaced in 2000 by the Cotonou Agreement which provided for preferential access for 78 ACP states. For the period under consideration in this paper, under the GSP system, the EU had three variants: (i) The standard arrangement which offered preferential access to the EU market for developing countries in the form of reduced and zero tariffs for just over 70% of all goods. (ii) The GSP+ scheme which provided for the full removal of tariffs on largely the same products as those covered by the general GSP arrangement, and consequently reduced tariffs on a much smaller range of goods. These enhanced preferences were granted to countries who ratified and implemented certain international conventions relating to human and labour rights, environment and good governance. (iii) Everything But Arms (EBA) where 49 Least Developed Countries were granted duty free quota free access to the EU on all products, excluding weapons since 2001.[4] In 2014 a revised GSP scheme came into operation broadly with the same three variants but where a key change concerned the country eligibility criteria, such that the scheme was focussed more on those developing countries most in need.

The channels by which increased trade might impact on development are varied: increased export earnings, gains from specialisation according to comparative advantage, economies of scale, impact on productivity, impact on investment and capital accumulation, technology transfer, greater incentives to improve domestic physical and institutional infrastructures, as well as improved access to higher quality intermediates. Consequently and given the centrality of preferences for

[1] African, Caribbean, Pacific.

[2] India for example is proposing to offer duty-free, quota free access to 49 less developed countries.

[3] GATT Article XXXVI.

[4] In addition to weapons, banana and rice were excluded from EBA between 2006 and 2009, and sugar was transitioned until 2012 with minimum prices.

trade in development policy, it is important to understand whether trade preferences have had the expected positive impact on exports.

Unilateral preferences may impact on trade both directly and indirectly. In the first instance there is the preferential tariff effect - the lowering or removal of tariffs vis--vis exporters should lead to more trade. That increase in trade could either be at the intensive margin through increasing the level of already existing trade flows; or at the extensive margin by either encouraging product diversification, or the exports of the existing set of products to new markets. Preferential regimes could also have a secondary indirect impact on trade for the preference giving country. This could occur through more relaxed rules of origin; or through the interaction between the preference regime and any on-going trade-related technical assistance facilitating trade; and/or through any investment, domestic or foreign, in export industries, which may also have been stimulated by the presence of the preferences.

There are also a number of reasons why unilateral preferences may not have the desired trade effects. This could be because of the underlying complexity of the proffered regimes such as the rules of origin; or from the erosion of preferences as a result of the significant expansion in free trade agreements and from on-going multilateral trade liberalisation; from the conditionality which may be attached to some of the preference regimes with regard to domestic governance (as in the EU's GSP+ scheme); from the exclusion of key products from a number of schemes; from the uncertainty regarding the duration of the schemes; from the graduation clauses which are often built in; and from the possible distortionary impact of preference schemes which might encourage countries to specialise in areas in which they perhaps do not have a comparative advantage.

A number of empirical papers have analysed the impact on trade of preferential regimes. The evidence from the existing literature, which typically focuses either on EU or US preferential schemes, is somewhat mixed. Some papers indicate that preferences do impact positively on trade flows (see for example, Hoekman et.al., 2006, 2008; Ianchovichina et.al., 2001; Goldstein, 2003; Fraser and Van Biesebroeck, 2010; Agostino et.al 2007; Collier and Venables, 2007; Di Rubbo and Canali, 2008; Nilsson, 2009; Davis and Nilsson, 2013, Gamberoni, 2007; Lederman and Ozden, 2007; Subramaniam and Wei, 2007; Fugazza and Nicita, 2011; Cipollina, Laborde, and Salvatici 2013, Cipollina and Salvatici, 2010); while others find mixed evidence (Aiello, 2009, 2010) or suggest the converse. Ames (1993) suggests that the impact of preferential access to the US market for Caribbean economies was limited because of the improved access the US gave to competitors under other arrangements, such as the FTA with Mexico, and because of the variability associated with sugar quotas. Brenton and Hoppe (2006) suggest that while US AGOA preferences might have increased trade the more significant constraints on trade relate to domestic supply side constraints, poor infrastructure, and weak policy environments (see also Frankel 2010, Hoekman and Ozden 2006, and Edwards and Lawrence 2010). Ozden and Rienhardt (2004) argue that GSP schemes can discourage countries from undertaking domestic liberalisation, and that the uncertainty regarding the duration of GSP regimes can discourage investment. They find that countries' export performance improved once they were no longer part of the US' GSP scheme. Similarly Persson and Wilhelmsson (2007) and Herz

and Wagner (2007, 2011), who cover a wide range of GSP schemes since the 1950s, suggest that while unilateral preference may increase exports in the short-run, in the long run trade is lower. There is also work suggesting little impact either on diversification (Collier and Venables, 2007), or on encouraging higher value chain activity (Edwards and Lawrence, 2010). There are, however significant limitations to much of the existing literature, in particular the frequent use of aggregate trade data whereas preferences are granted at the product level, the inability to correctly capture preference regimes leading to the widespread use of dummy variables or the use of incorrectly specified preference margins. The central objective of this paper is to assess whether unilateral preferences have had an effect on exports to the EU more precisely than heretofore by addressing these lacunae.

We overcome the limitations outlined above by using a unique dataset on country and product level exports to the EU for the period 2002-2008. The dataset allows us to match for each partner country and for each product line at 10-digit level (Combined Nomenclature CN-10), the value of the trade flow with the trade regime actually used (i.e. whether the measured flow entered using GSP preferences, the Most Favoured Nation (MFN) regime or used some other trade preferences) and the actual tariff associated with that particular trade flow. This enables us to estimate a highly disaggregated bilateral gravity model and to contribute to the existing literature in several respects. First, it allows us to evaluate more precisely the direct effect of preferential access by using the actual tariff at the product line level rather than a dummy variable which is typically used with more aggregated trade. Secondly because our data enables us to precisely capture the direct tariff effect, we can then use preference margins and regime dummies in order to shed light on additional indirect impacts of trade preferences. Finally, building on the recent work of French (2012), we use product specific control variables in our regressions.

Overall, our results confirm that preferential regimes have been effective in increasing trade - lower tariffs and larger preference margins increase trade. With regard to the intensive margin we find that the FTA, GSP+, EBA and GSP regimes have been the most effective (and typically in that order), with a smaller and sometimes negative coefficient associated with the Cotonou regime. When considering all potential trade, at both the intensive and the extensive margin, we find that tariffs and preference margins have a smaller impact on trade, and that the additional effects on trade of the regimes that we can identify in the data, the EBA and GSP regime, are no longer positive. In all our specifications we also find that it is important to correctly define the preferential margin, as the size of the margin effect is sensitive to the definition. The effect on exports is larger when the margin is calculated in relation to MFN tariffs or to the average tariff than when taking our preferred measures, which take into account the degree of competition for each specific product.

The paper is organised as follows. Section 2 describes the channels and the empirical literature evaluating the impact of trade preferences. Section 3 outlines the coverage and use of preferential regimes in the EU. Section 4 specifies the gravity model to be used. Section 5 describes the data and methodology used. Section

6 estimates the impact of trade preferences on the intensive and the extensive margin of trade.[5] The last section concludes.

2 Depth, breadth and utilisation of preferential regimes in the EU

The EU currently has reciprocal and/or unilateral preferences with virtually all countries in the American and African continents.[6] Agreements differ in terms of product coverage and the preference margin being offered, which in turn is a function not only of the preferential tariff, but also of the size of the MFN tariff and the actual tariff applicable to competitors.[7]

As outlined earlier the EU's GSP scheme contains three variants, and the key differences between them can be seen in table 1. The table shows the differences in coverage and depth between the GSP, GSP+ and the EBA regimes, across the years in our sample. The first element to note is the number of tariff lines with Most Favoured Nation (MFN) zero rates which apply to all exporting countries. For these products, therefore, there is no preference margin, and the number of these increased from 16% to 22% of all tariff lines. The standard GSP scheme offers preferential access to developing countries in the form of either zero or reduced tariffs for their goods. In 2008 33.53% of tariff lines were duty free, and for 36.04% of tariff lines there was a positive though preferential tariff. In 8.32% of cases there was a positive MFN tariff to pay. The GSP+ offers improved preferences to countries who ratified and implemented international conventions relating to human and labour rights, environment and good governance. In contrast to the standard GSP, 68.15% of tariff lines were duty free, and for only 2.11% of tariff lines was there a positive preferential tariff. In 7.64% of cases there was a positive MFN tariff to pay. In the case of Everything But Arms (EBA) least developed countries have virtually duty free access in the EU market. 67.52% of tariff lines were duty free, there was a positive preferential tariff for 0.04% of tariff lines, and there was a positive MFN tariff in only 0.34% of cases.

The coverage and depth of trade preferences also varies across product and sectors. The larger MFN tariffs are in agricultural products, food processing and textiles. However, these larger tariffs imply larger margins only with respect to the EBA and GSP+ regime, since GSP and Cotonou tariffs are positive on average for these sectors. In addition, most average MFN tariffs have decreased from 2002 to 2008. Although they represent a small reduction, preference margins have been

[5] In this paper, the intensive margin of trade refers to changes in the level of already existing trade flows. As we only have one destination market, the EU, the extensive margin refers to new products being exported by a given country at some point during our time period to the EU, where previously that product was not being exported by that country to the EU.

[6] Excluding the US, Venezuela and Cuba in America and Mauritania in Africa.

[7] While the importance of unilateral preferences varies across exporters, it is worth noting that trade under these regimes is of comparatively low importance for the EU itself. More than 60% of total imports in the EU are in duty free tariff lines. Around 23% of the remaining imports face positive MFN tariffs, either because exporters are not eligible for preferences or because they do not utilise them. The share of imports using preferential regimes is only 15%, and more than half of this utilises other preferential regimes. The de facto share of EU imports via GSP/EBA is around 5%.

Table 1 Coverage of EU Preferential regimes (share of tariff lines).

	2002			2008		
	GSP	GSP+**	EBA	GSP	GSP+	EBA
MFN = 0	16.45	16.45	16.45	22.11	22.11	22.11
MFN ¿ 0 (no preference)	12.34	8.12	0.23	8.32	7.64	0.34
Pref. Duty Free	37.11	72.14	83.32	33.53	68.15	77.52
Positive pref. Tariff	34.1	3.29	0	36.04	2.11	0.04
Total	100	100	100	100	100	100

Source: CARIS (2010). GSP+** in 2002 refers to the special arrangement for drug trafficking prevention.

squeezed further, and for some minerals and manufactured sectors are below 2.5%. In addition to differential coverage across regimes, countries may be eligible for more than one preferential regime. For example, most EBA and GSP exporters could until 2008 also enter the EU using the Cotonou Agreement. Similarly those ACP countries that signed an Economic Partnership Agreement with the EU could either use the EPA regime or the relevant GSP preference scheme. Furthermore, not all product lines have the same relevance for exporting countries, since this depends on each country export basket.

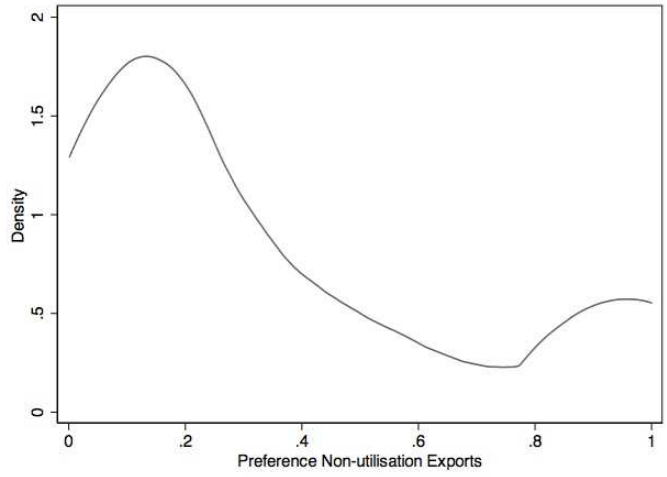
CARIS (2011) show that the importance of eligible preferences for existing exports varies by country, and there are striking differences. There are countries where the preferences and preference eligibility is somewhat insignificant typically due to a narrow export basket, and where most export flows are in any case eligible for the MFN=0 regime. This applies, for example, to Lesotho where 98.73% of exports to the EU face zero MFN tariffs, and similarly for Liberia (98.84%), East Timor(98.89%), Rwanda (98.94%) and the Central African Republic (99.03%). On the other hand there are countries such as Bangladesh who export primarily using preference eligible lines, with only 0.95% of existing exports eligible under MFN=0. A similar pattern is observed for countries such as Jamaica (2.91%) or Swaziland (3.78%).

In addition to preference eligibility, another important factor is whether preferences are utilised. The data shows that non-utilisation of preferences also varies substantially across countries and products. While most countries utilise most of their preferences, there is small cluster of countries with large preference non-utilisation as figure 1 shows.[8]

The preceding serves to highlight that the correct assessment of the impact of trade preferences on export flows requires identifying the depth and breadth of preferences that each scheme offers. Typically, and primarily due to the lack of available data, gravity models have resorted to the use of dummy variables to measure this impact. This, however, is misleading and potentially incorrect in four dimensions. First, because it associates bilateral flows to a preferential regime without considering the preferential lines being offered. Secondly, it does not take

[8] Some example of countries with significant exports to the EU and very large non-utilisation rates in 2007 (100% of preference eligible exports exported MFN) are Bouvet Island, Iraq, Kiribati and Palau

Fig. 1 Probability Distribution Function of Preference Non-utilisation Exports as a Share of Eligible Exports in 2007, by Country. Source: Author's own calculations



into consideration the extent of the preference margin. Thirdly, it fails to take into account the utilisation of the preferential regimes. Finally, dummy variables give equal weight across preferential regimes, and in the case of overlapping preferences, cannot clearly distinguish between the impact of each separate agreement. Our dataset and methodology allow us to address these concerns.

3 The gravity model and unilateral preferences

Gravity models have become a standard workhorse model for assessing the determinants of trade between countries, and in particular for focussing on the possible impact of policies on trade. There is now a fairly extensive literature (Anderson 1979; Baier and Bergstrand 1985, 1989; Helpman and Krugman 1985; Deardorff 1998, Anderson and Wincoop 2003, Anderson and Yotov 2012, Anderson 2011, French 2012, Head and Mayer 2013) providing theoretical justification for the structural gravity specification, and showing that the model is consistent with both comparative advantage models of trade, as well as imperfectly competitive trade models.[9]

[9] For an excellent exposition of the theoretical and empirical issues in gravity models see Anderson (2011).

A common formulation is to use standard Dixit-Stiglitz style CES preferences. The structural gravity model takes the following form:

$$X_{ij} = E_j Y_i \frac{P_j^{\epsilon-1}}{\Omega} \tau_{ij}^{1-\epsilon} \tag{1}$$

$$P_j = \left[\sum_{i=1}^{j} p_{ij}^{1-\epsilon} \tau_{ij}^{1-\epsilon} \right] \tag{2}$$

$$\Omega_i = \sum_{j} E_i P_j^{\epsilon-1} \tau_{ij}^{1-\epsilon} \tag{3}$$

Where X_{ij} gives exports from country i to country j; E_j is total expenditure in country j; the value of output in the exporting country is given by Y_i ; and τ_{ij} represents the gross bilateral costs (one plus the ad valorem trade cost (T)) such as tariffs, of trading between i and j. P_j and Ω_j are what Anderson and Wincoop referred to as the inward and outward multilateral resistance terms respectively. These can be interpreted as representing the average trade costs faced by the buyers (inward) and sellers (outward). P_j is the price index in country j, with p_{ij} being the price of the good being exported from i to j and ϵ is the elasticity of substitution parameter. Hence, exports from i to j depend on activity levels in both countries (consumption or GDP in country j, production or GDP in country i), tariffs between i and j and the price index in country j, relative to the price indices in all other countries, and where these price indices depend on the costs of trade - be this tariffs or distance between all countries, hence the notion of multilateral resistance.

The most common use of the gravity model is at the aggregate level, though it can also be applied at the sectoral or product level. At the aggregate level the appropriate activity variables are the respective GDPs of the importing and exporting countries. However, at the disaggregated level, comparative advantage will influence particular sectors or products which are exported. Therefore, the correct specification should include production in the exporting country and consumption in the importing country at the level of aggregation at which the model is being run.

Nevertheless a number of authors use GDP even if the model is being run at a disaggregated level. French (2011) demonstrates that this is only correct under the extreme assumption that the volume of trade flows is independent of the distribution of output and expenditure across product/sectors. He derives a theoretically consistent model which provides for an alternative approach, which is to use total trade at the given sectoral level of aggregation for the activity variables. Hence, total sectoral exports for the exporting country, and total sectoral imports for the importing country can be used to control for production and consumption respectively.

In our case as there is only one importing country in our regressions - the EU - any activity variable to capture consumption would be absorbed by our fixed effects, and hence is not needed. To capture sectoral production in each exporting country, following French, we should use total sectoral exports. However, this

raises two issues. First, our data consists of bilateral 10-digit flows only between the EU and its partner countries. The data on total exports to all destinations by each country is not available. To overcome this we can take the total exports of each country at the relevant 6-digit level. However, this leads to the second issue which is that at such a disaggregated level total sectoral exports may be highly correlated with exports to the EU, which then leads to endogeneity in the regression.

There is a trade-off here. The greater the level of disaggregation used for the activity variable, the more likely it is that there is an issue of endogeneity. And there is no completely satisfactory way of dealing with that endogeneity as it is impossible to find suitable instruments at this high level of disaggregation, and the data is not suitable for GMM estimation. On the other hand, the greater the level of aggregation used (e.g. GDP) the greater the misspecification because of the failure to account for underlying comparative advantage. In order to deal with this issue, and also for robustness we employed three different specifications where we used total trade at the 2-digit level, total trade at the 6-digit level and GDP as the activity variables. In the results reported here we use total trade calculated at the 2-digit level. The results using 6-digit trade and GDP are highly comparable in terms of sign and significance and are included in the Appendix D to this paper.

Anderson and Wincoop (2003) showed that the results may be sensitive to the assumptions made about trade resistance and that the absence of the appropriate treatment of multilateral resistance produces biased estimates.[10] Baier and Bergstrand (2009) suggest a Taylor-series expansion approximation. Other authors have used price indices to control for these terms. However, price indices tend to include information on prices of non-tradable goods, and also capture both preferences and distance. A common approach, suggested by Anderson and Wincoop and subsequently employed by a number of authors, is to model this multilateral resistance term with country fixed effects. However, country dummies may not capture time variation of the multilateral resistance terms which would requires the use of country-year fixed effects. In the context of our model, where we are working at the product level, this is problematic since using product-country-year fixed effects would not allow identification of the trade policy (tariff) variables. We therefore use exporter-product fixed effects, and use the time variation to identify trade policy variables at the product level.

We also follow the approach of Carrere et al.(2009) based on Baier and Bergstrand (2009) who suggest the use of a multilateral resistance index (MRI) based on the remoteness of the country with regards to all countries. This is constructed as the weighted average of each country's distance to other markets weighted by the share of each market in world GDP. This term is sometimes incorrectly used (see Head and Mayer, 2013) as a proxy for multilateral resistance in the spirit of Anderson and Wincoop. In our context the MRI should be seen as a more sophisticated proxy for relative distance which varies over time (note that with our exporter-product

[10] See also Feenstra (2004), pp.144-163, and Anderson (2011) for a more detailed discussion of these issues.

fixed effects the standard distance variable would get dropped).

$$MRI_{it} = \sum_{i=1}^{n} \frac{Y_{it}}{Y_{wt}} log(Dist_{ij}) \tag{4}$$

A central concern in this paper is the treatment of tariffs, distance and trade costs. The usual procedure in the derivation of the model (see for example Baier and Bergstrand, 2009, Anderson and Yotov, 2012) is to assume that gross trade costs depend on geographical and cultural proximity such as distance (Dist), common border (Border), common language or colonial ties; as well as variables related to specific trade agreements such as tariffs (T) or preferences (Pref):

$$\tau_{ij}^{1-\epsilon} = e^{\alpha_i Dist_{ij} + \alpha_2 Border_{ij} + \alpha_3 Pref_{ij} + ... + \alpha_n T_{ij}} \tag{5}$$

An issue which then arises concerns the measurement of the preference effect. Numerous papers based on aggregate trade flows use trade regime dummies ($Pref_{ij}$) to capture the role of preference such as regional trade agreements or GSP schemes. However, this is not particularly satisfactory. The impact of preferences occurs via the lower tariff paid by the exporter, and this varies by trade regime, product and whether preferences are utilised, all of which the dummy cannot appropriately capture. In addition, the value of the preference will depend on the size of other countries' tariffs for the same product - the preference margin (Carrere et al., 2008, Low, 2009).[11] Hence others (e.g. Nilsson and Matsson, 2009; Cipollina et al., 2013) explicitly include the preference margin in order to capture the tariff effect.[12]

However, this is not necessary if tariffs are correctly identified. The correct procedure is to identify the actual tariffs paid as a result of any preferential arrangement as the margin is then identified by the estimation itself. This is exactly what we do in this paper. Our data includes the tariffs paid by all countries for all products and all preference regimes exporting to the EU. To our knowledge our paper is the first to precisely identify for each flow the regime of entry and the actual tariff paid, and therefore to correctly identify the tariff effect. For example, where there are flows from country j to the EU for a given product in a given year but which use different regimes (eg. MFN, GSP, EBA) then these are captured separately in our regressions.

Preferential regimes, however, are also associated with additional possible costs and benefits in addition to the pure tariff effect. On the one hand, there may be administrative costs of compliance with such regimes related to registration and acquisition of valid certificates of origin. These may involve an additional cost for exporters (Anson et al., 2005). On the other hand preferential regimes could instead provide for more relaxed rules of origin, or may impact on trade

[11] Indeed much of the policy discussion around regionalism and multilateral trade negotiations has been concerned with the issue of preference erosion, and how preferential margins are decreased as countries liberalise trade with other partners (see Low et al., 2009, Fugazza and Nicita, 2011).

[12] Cipollina et.al. derive a version of the gravity model with an explicit preference margin term. However in order to do so a number of extreme assumptions need to be made regarding the symmetry of trade costs

more indirectly through the interaction between the preference regime and any on-going trade-related technical assistance facilitating trade, and/or through any investment, domestic or foreign, in export industries which may also have been stimulated by the presence of the preferences. Secondary effects could, therefore, also impact on trade positively or negatively.

Ideally we would like to capture both the direct tariff effects associated with preferential regimes, as well as any indirect effects (e.g. incentives with regard to investment, trade facilitation, or rules of origin). As discussed above, the direct tariff effects we capture through the inclusion of the actual tariffs paid on each flow. More difficult are the indirect effects. As these are not possible to explicitly identify our strategy is twofold. First we include a dummy variable which captures the preference regime used by each flow. Note that, unlike other papers in this area, we can associate each flow with the actual preference regime used. Our data allows us to identify where a product is exported by a given country to the EU using different preference regimes. As we are already controlling for direct tariff effects these preference dummies are designed to capture any additional impact on trade arising from each trading regime as discussed above.[13]

Second, it is plausible that the indirect effects could be correlated with the size of the preference margin, where the greater the preference margin the greater might be the incentive, for example, for foreign direct investment in that particular sector.[14] Of course, the preference margin is not capable of identifying what the actual mechanisms are, and is being used here as a proxy to see whether there is any evidence of additional effect on bilateral trade. As with the use of dummies, this is in addition to the direct tariff effects. The margin for a given product is defined as:

$$Margin_{ij} = ln(1 + (T^{ref} - T^{pref})) \tag{6}$$

Where T^{pref} is the preferential tariff and T^{ref} is the reference tariff. This raises the question as to what is the appropriate reference tariff, T^{ref}. Often the preference margin is calculated in relation to the MFN tariff. However, as Low et al. (2009) and Fugazza and Nicita (2011) suggest, this measure should be taken as an upper bound of the preferential advantage, since in reality the margin needs to be adjusted to the tariff paid by the main competitors in each specific product category. As a result we use and compare the results for four different reference tariffs capturing different degrees of competitive advantage: the MFN tariff (Margin 1), the weighted average tariff of all exporters of that product (Margin 2), the tariff of the largest exporter (Margin 3) and the simple average tariff of all exporters of that product (Margin 4).

[13] As an alternative we also explored using a variable which ranged between 0 and 1 for each preference regime based on the share of trade for each country and product and time period which enters the EU via each regime. While the results were consistent with those reported here, these share variables are clearly the result of endogenous decisions by the exporting firms/countries and therefore determine the composition of exports entering under different regimes. Use of these shares is therefore problematic.

[14] An oft cited classic example is the increase in textile investment in Mauritius as a result of the US African Growth and Opportunity Act

To summarise the preceding discussion, we use equations (1) to (6) and transform into a log-linear form in order to derive what is a standard gravity equation but at the product level. The equation we therefore estimate is given by:

$$log(X_{ikt}) = \beta_0 + \beta_1 log(HS2exports_{ist}) + \beta_2 MRI_{it} + \beta_3 log(1 + T_{ikt}) + \beta_4 Margin_{ikt} + \sum_n \gamma_n regime_n + \sum_t \delta_t year_t + \alpha_{ik} + e_{ikt} \quad (7)$$

where $log(X_{ikt})$ is the natural logarithm of exports of good k from country i to the EU in period t; T_{kit} is the actual tariff paid by the export flow[15]; $margin_{ikt}$ is the preference margin as defined by equation (6); $log(HS2exports_{ist})$ is the natural logarithm of country i's total exports to the world defined at two-digit level as discussed earlier; MRI_{it} is as defined in equation (4); $regime_n$ are dummy variables that indicate the preference regime used by each flow to enter the EU; $year_t$ is a set of year dummies.

There is an issue of the possible endogeneity between the observed trade flows and the explanatory variables. Gravity models do not lend themselves well to IV estimates owing to the difficulty of finding suitable instruments especially in a panel data framework. That difficulty is compounded when dealing with trade flows at the 10-digit level. Hence, in order to be theoretically consistent, and following common procedure we employ resistance terms that are country and product specific. As a result, we use α_{ik} which are exporter-product fixed effects. These fixed effects absorb all time-invariant country and product effects, such as distance or common language, allowing us to identify in a theoretically consistent way the impact of tariff, margins and preferential regimes.

4 Data and Methodology

The dataset used includes export flows to the EU from 219 country partners for the period 2002 to 2008. Export flows are disaggregated by exporting country, Combined Nomenclature (CN-10) product, tariff regime and year. Such a fine level of disaggregation allows us to handle different degrees of coverage, depth and utilisation of preferential regimes as described above, and is a major advantage of our dataset. A limitation of this approach, however, is that beyond the 6-digit level, trade classifications across countries are not harmonised. This implies that we can only estimate the bilateral gravity model on exports to the EU, and, therefore, the results need to be interpreted as the impact of the preferential regimes on exports to the EU.

A key issue is that more than one export flow from the same product, country and year is possible, since exports may enter the EU via different tariff regimes. The tariff regimes are: MFN; GSP, GSP+ or EBA; other preferential regimes; tariff

[15] For each of these flows we use the average tariff for each regime in a given year. For example, in a given year if exports from country j using the MFN regime paid two different MFN tariffs due to changes in the MFN structure, we use the average of both tariffs. In most cases, however, there is only one tariff for regime and year. As discussed earlier, where there are flows from country j to the EU for a given product in a given year but which use different regimes (eg. MFN, GSP, EBA) then these are captured separately.

suspension, and; MFN under quota or preferential under quota. Although we cannot identify each specific regional trade agreement, we can differentiate between the GSP/EBA regime and Cotonou/other PTAs. For around 80% of the observations we only observe one tariff regime in the same year, but in the remaining cases we observe more than one tariff regime (more than two in only 1 percent of observations). Import data is then carefully matched with tariff data from TARIC, which enables us to identify the actual tariffs paid by exporting country, CN-10 product and tariff regime. This lengthy process required conversion to ad valorem tariffs for some agricultural products (see CARIS, 2011 for a detailed explanation).

Country, product and year flows that have more than one regime of entry to the EU are aggregated in value, and we calculate the share of each trade regime in the export flow and the weighted average tariff that the flow faces in the EU.[16]

An additional challenge is to define the preference margin for the zero flows. For each product and year we extrapolate on the basis of the existing defined margins for positive flows. When these are not defined, we construct the margin according to whether the country is EBA or GSP. For EBA countries the potential margin is constructed using a preferential tariff of zero. For GSP eligible products and GSP eligible countries we use the GSP tariff (see Appendix A for a more detailed explanation). We also use specific tariffs regarding specific country rates due to FTAs and other specific cases that appear in the tariff book. The main difficulty is for countries eligible for more than one preferential regime, GSP and Cotonou, or from 2008 GSP and EPA. Since we cannot identify which regime these countries would use for these products we use the minimum tariff available, and when both are the same we allocate the flow to the GSP/EBA regime. This implies that for some flows we are likely to over emphasise the role of the GSP and EBA regimes. Our methodology minimises the risk of including potential positive preference margins for products excluded from preferential regimes.

The final dataset has around 10.7 million trade flows, including 18,765 different product lines. We have dropped all the product lines that disappear at some point during the sample period and some those that are new additions to the tariff book, mainly representing a split from other product lines due to changes in tariff regimes or other customs controls.

Summary statistics for all the variables used in our specifications are displayed in table 2. We consider three different samples: sample 1 includes all potential and actual trade flows from the partners to the EU; sample 2 includes all product lines for which there is at least one positive flow over time; sample 3 includes only positive flows. As we can see from the first column, the percentage of zero flows, that is potential trade flows between the EU and its partners, is about 88%. Comparing the first column with the last column gives us a first idea of which ones are the actual EU's trade partners and why omitting zero trade flows could be potentially

[16] Trade data can be noisy due to errors when inputting customs information. In order to detect extreme and unlikely flows, we calculate unit values and search for outliers by applying Hadi's (1992) filter. These extreme values are then removed from the database. In addition, very low value flows, below 500 Euros, are also removed. These small flows are likely to be the result of private individuals moving goods rather than firms, and therefore more likely to be subject to proportionate errors.

Table 2 Descriptive statistics.

	Sample 1	Sample 2	Sample 3
Dummy=1 if Trade value>0	0.114	0.580	1
Trade value	653.358	3,498.230	5,824.980
Log of Trade value			4.624
Log of (1+Tariff)	0.025	0.028	0.031
MRI	6.574	6.511	6.493
Log of HS2exports	8.156	11.971	12.754
EBA	0.243	0.042	0.010
GSP	0.389	0.262	0.121
Other FTAs			0.236
Cotonou			0.020
GSP+			0.019
Contiguity	0.103	0.249	0.285
Common language	0.646	0.498	0.467
Colony	0.798	0.718	0.698
Log of Distance	8.643	8.392	8.338
Margin 1 (MFN)	0.032	0.023	0.020
Margin 2 (weighted tariff)	0.009	0.002	-0.001
Margin 3 (largest export)	36.780	2.406	-0.000
Margin 4 (average tariff)	91.417	18.792	0.000
N	10,771,994	1,981,255	1,225,809

problematic. Exports to the EU come from countries with a higher level of activity in the sector and geographically closer, as we would expect. What is noticeable is that the products that are actually exported face higher tariffs and lower preference margins compared to the products that are never exported (which constitute the biggest number of observations in sample 1). Also the actual trade of products that are covered by GSP and EBA preferences is very low compared to all of the possible trade flows included in these preference schemes. Clearly GSP and EBA countries have a very small export basket as summarised in table 3. Here we can see that non-zero trade flows as a percentage of all possible trade flows, is between 3% and 3.5% for GSP countries and between 0.4% and 0.7% for EBA, much lower than the average for all countries and as expected for the richest countries.

Descriptive statistics for the three different samples highlight that omitting all zero flows between exporters and the EU could result in biased coefficient estimates on the intensive margin, where the intensive margin of trade refers to any changes in the level of existing trade flows. If zero flows and the decision to export are correlated with trade costs, then using only positive flows may underestimate the impact of different trade regimes on exports. Adding zero flows to the dataset allows us to estimate the impact on total exports - i.e. on both the intensive and the extensive margins (where the extensive margin refers to new products being exported by a given country at some point during our time period to the EU, where previously that product was not being exported by that country to the EU) and, therefore, also on the scope for countries to diversify into new exports.

However, accommodating zero flows in our dataset is non-trivial since we are looking at product data rather than aggregate flows. One complication arises because the dataset has a large number of products that appear and disappear during

the years. Filling our dataset with zeros along the year dimension is problematic due to the fact that imports from specific products on a given year may cease because the product line no longer exists. In order to address this, product lines that are not defined for the entire period of the sample are removed. This ensures that we do not artificially fill with zeros a product that was not defined in the tariff book for a given year.[17],[18] This reduced dataset has around 9,000 product lines. For each product year, all exporters to the EU in that year are potential exporters.[19]

There is a growing econometric literature exploring the implications of estimating a log linear gravity equation in the presence of many zero trade flows (see Santos Silva and Tenreyro (2006), Linders and de Groot (2006), Martin and Pham (2008) or Burger et al. (2009)).

With regard to the former the recent literature has focussed on the bias introduced by the log-linear transformation of the gravity equation through the heteroskedaticity of the errors and the presence of zero-valued trade flows. Santos Silva and Tenreyro (2006) show how the log-linearisation introduces heteroskedasticity of the error term and changes its properties in such a way that the pattern of this heteroskedasticity affects the consistency of the OLS estimator for the β coefficients rather than just its efficiency. Moreover the log-linear form of the model does not deal with zero trade flows: the log of zero is undefined and these observations are dropped from the sample. Estimating the gravity equation by using only positive trade flows introduces an additional source of bias if the zero flows are not distributed at random but are instead the outcome of an endogenous selection. Following Santos Silva and Tenreyro (2006), we use the Poisson Pseudo Maximum Likelihood (PPML) estimator. The main advantages of the Poisson specification in its multiplicative form with fixed effects are three: it permits controlling for country-product heterogeneity with fixed effects, it avoids the heteroskedasticity introduced by the log-linearisation and it includes some of the zero flows in the estimation.[20]

Burger et al. (2009) note how the Poisson suffers from overdispersion, that is when the conditional variance exceeds the conditional mean, which quite likely comes from unobserved heterogeneity. Not correcting for overdispersion leads to consistent but inefficient estimates. One way to correct for this is to use a Negative Binomial (NB) regression model, a modified Poisson model which has an extra parameter (the dispersion parameter) that models overdispersion. Another

[17] In practical terms we restrict the sample to products with imports in 2002 and 2008, 2003 and 2008 or 2002 and 2007.

[18] While we are aware of the recent literature on the survival of trade flows (Besedes and Prusa, 2006) and the fact that many trade relationships may not survive more than five years, we expect that the number of simultaneous product dropouts for all exporters in the world to the EU in a specific year to be minimal. Therefore, the risk of eliminating products not exported to the EU in one specific year is low.

[19] The criterion is that a country should have exported at least one product to the EU in the same year. We look at each separately in order to guarantee that Eastern European EU countries enter the sample in the first period as exporters and after joining the EU are considered members and not exporters.

[20] Only groups for which the value of trade is different from zero in at least one period are considered.

Table 3 Percentage of non-zero flows by year.

	2002	2003	2004	2005	2006	2007	2008
GSP countries	0.035	0.038	0.036	0.034	0.038	0.038	0.030
EBA countries	0.004	0.004	0.005	0.005	0.005	0.005	0.007
All countries	0.119	0.120	0.119	0.108	0.113	0.109	0.109
Countries in Top quartile of GDP	0.361	0.365	0.353	0.333	0.331	0.332	0.351

Authors' own calculation. The table shows the percentages of non-zero flows for GSP and EBA countries between 2002 and 2008. It then compares them with those of all countries and of the richest countries, defined as the ones in the top quartile of the distribution of GDP.

problem that affects the Poisson model is the existence of an excessive number of zeros in the data, that is more zeros then the model would actually predict. Some of these excess zeros could be originated by another statistical process. In this case a zero inflated model could be used. These models are two parts models where one part models the zeros and the other models the positive trade flows. Zero inflated Poisson (ZIP) and Zero Inflated Negative Binomial (ZINB) are two feasible alternatives for the Poisson model with excess zeros. However, while we recognise the limitations of the Poisson model, the alternatives discussed above do not handle a very high number of observations with many fixed effects - which is what is needed here for consistency with the theoretical literature. In this paper, therefore, together with the standard log-linear model with country-product fixed effects we focus on the PPML with the same fixed effects.

Data on EU imports at the 10-digit level was supplied by EU Commission services. In most specifications we follow French (2012) and use country i's total exports in sector s to the world minus EU, defined at the two-digit level. This data comes from United Nations sources, the COMTRADE database for trade. Information on distance is taken from the CEPII database whereas data on GDPs come from the World Bank's World Development Indicators.

5 Results

In this section we present the results of three sets of regressions. We are dealing with highly detailed trade data for a large number of countries where there is a large number of zero trade flows. It is therefore important to correctly deal with both the intensive (trade in existing products) and extensive (trade in new products) margins of trade. We do this by first considering standard OLS estimates from regressions that aim to explain the intensive margin of trade and then with a linear probability model (LPM) which considers the determinants of the probability of trading (extensive margin) and therefore includes all possible observations. Then we move to our final and preferred estimates, the ones produced by the PPML estimator proposed by Santos-Silva and Tenreyro (2006). All of the estimations include exporter-product fixed effects. The role of preferences is best understood by considering each of these sets of results together.

5.1 The impact of preferences on the intensive margin of trade

Table 4 shows the results of estimating equation (7) with exporter-product fixed effects for positive flows only - which therefore capture the intensive margin of trade. In column (1) we show the results where, in addition to the *log of HS2exports* as activity variable and the multi-lateral resistance variable MRI, we include the actual tariff paid by each export flow *(log of (1+Tariff))*.

Each of the variables has the expected sign and is statistically significant at the 99% confidence level. As expected, total product exports as a measure of supply capacity increases the level of bilateral exports. The MRI is a GDP-weighted distance measure (Carrere, 2008; Carrere et.al., 2009; Eicher et.al 2010) where one would expect that more remote countries would trade less and hence we would expect a negative coefficient. This is the case in all the regressions. With regard to our main variable of interest, tariffs, - we see that tariff reductions unambiguously increase export flows to the EU. In these regressions we are picking up both temporal variation in tariffs, and cross-country variation. As we are working with the power of the tariff a 1 percentage point reduction in tariffs would increase trade by $b/(1 + tariff)$, where b is the coefficient, so in principle the marginal effect depends on the level of the tariff. However, in practice the coefficient gives a reasonable first order approximation to the marginal effect. In column 1, of Table 2 the coefficient is -4.09, which suggests that a one percentage point reduction in $(1 + tariff)$ is associated with a 4.09% increase in trade.

It is also worth noting that these results are substantially different from those obtained by working with aggregate trade flows. In Appendix B we show the results for the same specifications as in table 4 but where we have aggregated the trade flows such that we are dealing with total bilateral trade between each of the countries and the EU. As found by previous authors, at the aggregate level there is no discernible effect of tariffs on trade flows. This serves to emphasise the importance of working with trade flows and tariffs at the product level.

In column (2) of the table we include the preference dummy variables. The inclusion of the preference indices results in a substantial decline in the size of the tariff coefficient which is no longer statistically significant. This is interesting. The tariff coefficient is likely to be picking up both the direct and indirect effects associated with preference regimes; and this specification is designed to see if, in addition to any tariff effects, there is any evidence that the preference regimes might increase bilateral trade. All the flows with lower tariffs enter under some form of preference scheme, and as the dummies appear to be capturing all the effects from those lower tariffs, there is no evidence here of any additional effects. The column also gives some indication of the difference in the effect across the preference regimes. The results suggest that the biggest impact compared to MFN flows is with regard to countries that either have some form of FTA arrangement with the EU, with a similar sized impact for the GSP+ regimes, followed by the EBA regime. The smallest positive additional impact is for the GSP regime. The coefficient on the Cotonou Agreement is negative.[21] This may be driven by is-

[21] EPA regime since 2008.

sues such as the product coverage, or the underlying rules of origin. Other things constant, the effect of shifting exports from MFN to an FTA is of the order of 160%.

Columns (3) to (6) decompose the impact of preferential regimes by the tariff paid and the preference margin. This gives us the average impact attributable to tariffs and the average impact effect given by the size of the preferential margin. Depending on the margin used the coefficient on the tariffs is now reduced, and the preferential margin effect varies between 2.28 and 0.12, suggesting a positive impact of preferential margins on exports to the EU in addition to the direct tariff effect. The size of the additional impact depends on how the margin is calculated. The weighted tariff and the largest exporter margins probably captures best the extent to which a given country is de facto getting preferential access, and these suggest that there may be a more modest additional positive impact on trade than when the MFN or average tariff margin specifications are used. Hence the impact of preference margins on exports is reduced when we account for the degree of competition within each product category.

In columns 7-10 we provide specifications which include all of the preceding. Hence, we decompose the regime impact according to the tariff paid, the preferential margin enjoyed and regime specific factors proxied by the preference dummies. We obtain a pattern of results which is highly consistent with the preceding: with the preference dummies the tariff is no longer significant, and there is little evidence of the role of the preference margins. This is because the dummies absorb all of the effects. The preference dummies once again suggest that the larger impact on exports arise from FTA preferences, followed by the GSP+ and EBA regimes, and a negative impact associated with the Cotonou regime.

In conclusion, the results suggest that preferential regimes have increased exports to the EU at the intensive margin, via lower tariffs. There is also some evidence from the regressions with the preference margins that there may be additional regime specific factors. The largest effect is associated with FTA regimes. A potential explanation for this is that FTAs, which provide reciprocal preferences and therefore are negotiated product by product, offer margins in products which are more attractive for exporters or better match their export basket. Additional reasons could be because of the greater certainty associated with FTAs, as well as the treatment of behind the border, non-tariff measures, which is an increasing feature in many of the EU's agreements. With regard to the greater impact of GSP+ and EBA, this is likely to reflect the fact that these schemes offer higher preference margins than GSP, and provide additional evidence of the positive impact of these schemes on trade. The negative Cotonou coefficient echoes previous results in the literature (Aiello, 2010; Gamberoni, 2007), and may be driven by the greater administrative difficulties faced by these countries in taking advantage of these preferences. It is probably less likely to be driven by product composition effects as in principle EBA and Cotonou preferences are offered on almost all products.

Table 4 Gravity model at the product level-tariff regime.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log of (1+Tariff)	-4.0924***	0.1016	-2.5176***	-3.7925***	-4.0566***	-2.8515***	-0.3888*	-0.0092	0.0323	0.1346
	(0.126)	(0.108)	(0.239)	(0.161)	(0.138)	(0.177)	(0.157)	(0.133)	(0.117)	(0.147)
MRI	-31.2150***	-31.8210***	-31.2583***	-31.1331***	-31.1807***	-31.0496***	-31.7823***	-31.8567***	-31.8511***	-31.8280***
	(1.279)	(1.274)	(1.280)	(1.279)	(1.279)	(1.278)	(1.276)	(1.274)	(1.274)	(1.274)
Log of HS2exports	0.3340***	0.3478***	0.3331***	0.3347***	0.3345***	0.3353***	0.3469***	0.3476***	0.3478***	0.3478***
	(0.006)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)
FTA		0.9561***					0.9703***	0.9580***	0.9576***	0.9565***
		(0.011)					(0.011)	(0.011)	(0.011)	(0.011)
EBA		0.8444***					0.8527***	0.8481***	0.8473***	0.8449***
		(0.035)					(0.035)	(0.035)	(0.035)	(0.035)
Cotonou		-0.1305***					-0.1306***	-0.1291***	-0.1294***	-0.1304***
		(0.032)					(0.032)	(0.032)	(0.032)	(0.032)
GSP+		0.9295***					0.9396***	0.9324***	0.9317***	0.9300***
		(0.037)					(0.037)	(0.037)	(0.037)	(0.037)
GSP		0.7099***					0.7161***	0.7108***	0.7106***	0.7100***
		(0.010)					(0.010)	(0.010)	(0.010)	(0.010)
Margin 1 (MFN)			2.2854***				-0.6207***			
			(0.298)				(0.146)			
Margin 2 (weighted tariff)				0.3956***				-0.1585		
				(0.114)				(0.081)		
Margin 3 (largest export)					0.1224*				-0.1058*	
					(0.053)				(0.050)	
Margin 4 (average tariff)						1.6540***				0.0234
						(0.182)				(0.119)
Constant	58.8854***	59.3763***	58.8911***	58.7169***	58.8153***	58.5279***	59.3435***	59.4465***	59.4327***	59.3880***
	(2.393)	(2.384)	(2.395)	(2.393)	(2.393)	(2.392)	(2.387)	(2.384)	(2.384)	(2.384)
Observations	1,225,809	1,225,809	1,225,809	1,225,809	1,225,809	1,225,809	1,225,809	1,225,809	1,225,809	1,225,809
R-squared	0.0302	0.0579	0.0309	0.0302	0.0302	0.0305	0.0579	0.0579	0.0579	0.0579
Number of fixed effects	440,919	440,919	440,919	440,919	440,919	440,919	440,919	440,919	440,919	440,919
R2 within	0.0302	0.0579	0.0309	0.0302	0.0302	0.0305	0.0579	0.0579	0.0579	0.0579
R2 between	0.158	0.176	0.158	0.158	0.158	0.158	0.177	0.176	0.176	0.176
R2 overall	0.141	0.161	0.141	0.141	0.141	0.141	0.161	0.161	0.161	0.161
ll	-1.610e+06	-1.592e+06	-1.610e+06	-1.610e+06	-1.610e+06	-1.610e+06	-1.592e+06	-1.592e+06	-1.592e+06	-1.592e+06

OLS estimates, Intensive margin. All specifications include exporter-product fixed effects and year dummies. Robust standard errors in parentheses *** p¡0.01, **p¡0.05 and * p¡0.1.

Table 5 Gravity model at the product level-tariff regime. LPM estimates, extensive margin.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log of (1+Tariff)	0.4251***	0.3685***	0.3278***	0.4006***	0.4247***	0.4231***	0.2968***	0.3493***	0.3690***	0.3674***
	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
MRI	0.0660***	-0.0616***	0.0661***	0.0660***	0.0660***	0.0659***	-0.0615***	-0.0617***	-0.0616***	-0.0617***
	(0.011)	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)
Log of HS2exports	0.0016***	0.0015***	0.0016***	0.0015***	0.0016***	0.0015***	0.0015***	0.0015***	0.0015***	0.0015***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
EBA		-0.9024***					-0.9013***	-0.9022***	-0.9024***	-0.9024***
		(0.002)					(0.002)	(0.002)	(0.002)	(0.002)
GSP		-0.3389***					-0.3387***	-0.3389***	-0.3389***	-0.3388***
		(0.001)					(0.001)	(0.001)	(0.001)	(0.001)
Margin 1 (MFN)			-0.1521***				-0.1121***			
			(0.004)				(0.003)			
Margin 2 (weighted tariff)				-0.0305***				-0.0238***		
				(0.002)				(0.001)		
Margin 3 (largest export)					-0.0004***				0.0005***	
					(0.000)				(0.000)	
Margin 4 (average tariff)						-0.0016***				-0.0009***
						(0.000)				(0.000)
Constant	-0.0356	0.5550***	-0.0294	-0.0348	-0.0356	-0.0352	0.5591***	0.5556***	0.5550***	0.5552***
	(0.021)	(0.018)	(0.021)	(0.021)	(0.021)	(0.021)	(0.018)	(0.018)	(0.018)	(0.018)
Observations	10,771,994	10,771,994	10,771,994	10,771,994	10,771,994	10,771,994	10,771,994	10,771,994	10,771,994	10,771,994
R-squared	0.0048	0.1731	0.0054	0.0049	0.0048	0.0048	0.1734	0.1732	0.1731	0.1731
Number of fixed effects	1,877,465	1,877,465	1,877,465	1,877,465	1,877,465	1,877,465	1,877,465	1,877,465	1,877,465	1,877,465
R2 within	0.00480	0.173	0.00537	0.00486	0.00480	0.00483	0.173	0.173	0.173	0.173
R2 between	0.0149	0.144	0.0223	0.0157	0.0150	0.0152	0.145	0.144	0.144	0.144
R2 overall	0.0127	0.0997	0.0165	0.0131	0.0127	0.0129	0.0999	0.0997	0.0997	0.0997
ll	5.420e+06	6.418e+06	5.423e+06	5.420e+06	5.420e+06	5.420e+06	6.420e+06	6.418e+06	6.418e+06	6.418e+06

All specifications include exporter-product fixed effects and year dummies. Robust standard errors in parentheses *** p¡0.01, **p¡0.05 and * p¡0.1.

5.2 The impact on all trade, the intensive and extensive margin of trade

In the previous section the estimations were based only on the positive trade flows in our data-set. In so doing, the regressions focused on the impact of preference margins on the intensive margin of trade. However, as pointed out in section **??**, omitting all zero flows between exporters and the EU can result in biased coefficient estimates. As discussed earlier, product lines that are not likely to be defined for the entire period of our sample are removed to avoid artificially filling with zeroes a product that was not defined in the tariff book for a given year, and that otherwise would be considered as not exported rather than not defined. As a result of including the large number of zero observations, and focussing just on the intensive margin, we might expect that the coefficients on tariffs and on the secondary preference effects (be this the preference dummies, or the preference margins) to be smaller. This is because there are now a large number of cases where there is no observed trade. However, at the same time, the inclusion of the zeros also allows for changes in trade at the extensive margin.

Tables 5 presents the results for the LPM with country-product fixed effects. The LPM models the probability of exporting to the EU and all the explanatory variables, except for the preference dummies, are in natural logarithms. Table 6 reports the estimates obtained with the PPML estimator as proposed by Santos Silva and Tenreyro (2006): here equation (7) is estimated in its level-log form, with export levels to include zero flows, and includes country-product fixed effects.

If we turn first to table 5 we see that in all the specifications we consistently have a positive and statistically significant coefficient on tariffs and total 2-digit exports, negative and statistically significant EBA and GSP coefficients, and typically a negative statistically significant coefficient with regard to the preference margins. In the PPML regressions the sign is reversed for the tariff coefficient, and typically for the preference margin coefficients. The EBA preference margin remains negative as does the GSP coefficient (thought the latter is not significant). This is again informative. With regard to tariffs, although the sign of the observed effects remains the same, the magnitude of the PPML estimates differs considerably from the OLS estimates with fixed effects. In particular the elasticities for tariffs are much higher than the one found with OLS estimation.

If we take the LPM and consider the first column, the coefficient on tariffs indicates that the higher the tariff the greater the probability of exporting, and this is true across all the specifications. This suggests that in the EU tariffs tend to be higher in those sectors which countries are most likely to export, which is therefore consistent with political economy considerations with the EU protecting those sectors where it faces more competition (eg agriculture and textiles to give two examples).[22] For specification (2) we include dummy variables only for the

[22] Of course this raises issues of endogeneity which we acknowledge. However, as is well known, dealing with endogeneity in gravity models is difficult. In a recent paper Egger et.al (2011) instrument for preferential trading agreements in a two part model. In our case, there is potential endogeneity between tariffs and exports, but applying the two-part model is not possible because of the lack of appropriate instruments at the country-product-year level. While we recognise the possibility of endogeneity, we feel our methodology is the best suited given the nature of our dataset.

GSP and EBA preference regimes. We cannot include an FTA dummy, as for the zero trade flows we have no way of knowing whether the individual products would have had preferential access since we do not have access to all the FTA tariff schedules for all the countries with the EU. This would require looking at the exclusion lists of every FTA signed with the EU. In addition, all the product coverage of Cotonou is included in EBA and partially in GSP, so for most Cotonou eligible flows not exported, countries could also export using the GSP/EBA regime. Since we do not have any information about what regime would be used if the country could export that specific product we are constrained to use only the GSP/EBA regime, hence these results should now be seen as being relative to the FTA (and MFN) regimes.

In the second column of table 5 we see the negative coefficients on the EBA and GSP preference margins. This indicates that, controlling for tariffs, the additional probability of exporting is lower where the trade flow for any given product uses EBA preferences. An alternative way of putting this is that there is a higher additional probability of exporting with other preference regimes, than with EBA or GSP preferences. This result also holds with the PPML results (table 6, second column) however, the coefficient on tariffs is negative. These differences on the tariff coefficients arise because the LPM takes into account all possible flows including when a given country never exports a given product to the EU. Hence for the LPM estimations we have around 10 million observations. The PPML estimator, in contrast takes into account all the products that were exported at least once in the period to the EU by the country, since country-products with all zero flows are collinear and dropped from the estimations, and then takes into account the zeros for all other years.

This explains the difference between the results. There is a wide range of products which the EBA and GSP eligible countries never export - hence the probability of exporting is negative (LP model). However, conditional on the fact that the product was at least exported once by the given country (Poisson model), then once again we see the positive effect of tariff reductions on trade flows. The difference in the EBA and GSP coefficients when comparing the intensive margin results and where we take into account zero trade flows is interesting. If we just consider the intensive margin we see evidence that the EBA and GSP preference regimes may have an additional impact on trade beyond that provided by the tariff preference. The LP and PPML results suggest that relative to FTA or MFN preferences, if we include zero trade flows, this is no longer the case. Of course, it is possible that relative to MFN trade flow the coefficients could be positive, however, as it is not possible for us to distinguish between the MFN and FTA preferences this cannot be identified.

Column 3-6 in both tables then consider the role of the preference margins. In the LP model we see that the coefficient is negative in all cases; and it is positive in all cases in the PPML results (except when using the simple average tariff). The explanation here is analogous to that given earlier. The high margins tend to be on products which are not exported by a lot of countries, hence there are a lot of zero trade flows in the LP model associated with high margin products leading to the negative coefficient. However, once we control for the fact that a

given product has a positive flow by the given country in at least one period, then we see some evidence that preference margins do appear to have a positive additional impact on trade, even when tariffs are controlled for; and also when we include the preference dummies. This is always the case for one of our two preferred margin specifications, the weighted average tariff; whereas the margin based on the tariff of the largest exporter is not significant. When using the simple average the coefficient is also not statistically significant. This result is likely to be driven by the fact that the EBA and GSP countries tend to have very narrow export baskets and, therefore, very large shares in zero flows. This implies that preference margins using the simple average tariff will tend to be zero or even negative, since the average tariff will be close to zero when including all zero flows for EBA countries. As was the case for the intensive margin estimates the size of the coefficients on margins drops when the degree of competition in the market is considered.

In specifications (7) to (10) we include both the preference dummies for EBA and GSP as well as the preference margins. These confirm the negative additional impact of the EBA and GSP regimes on exports at the intensive and the extensive margins relative to FTA and MFN flows. Note that as discussed above, given the lack of information on the FTA or Cotonou regime use for zero flows, we impose on the data that the zero flows use the GSP/EBA regime and not the Cotonou or FTA regime and this could also result in overestimating the impact of the GSP/EBA regime.

Table 6 Gravity model at product level-tariff regime. PPML estimates, Intensive and extensive margin

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log of (1+Tariff)	-2.1300***	-2.1803***	-1.6683***	-1.8108***	-2.1022***	-2.2006***	-1.6995***	-1.8465***	-2.1467***	-2.2465***
	(0.338)	(0.347)	(0.365)	(0.358)	(0.360)	(0.349)	(0.372)	(0.366)	(0.369)	(0.357)
MRI	-0.6679	-0.6235	-0.6370	-0.6529	-0.6668	-0.6716	-0.5892	-0.6069	-0.6221	-0.6278
	(1.091)	(1.092)	(1.091)	(1.093)	(1.091)	(1.091)	(1.092)	(1.095)	(1.093)	(1.093)
Log of HS2exports	0.7425***	0.7390***	0.7428***	0.7446***	0.7427***	0.7417***	0.7390***	0.7410***	0.7392***	0.7384***
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
EBA		-0.7754***					-0.7777***	-0.7823***	-0.7764***	-0.7752***
		(0.167)					(0.168)	(0.168)	(0.167)	(0.167)
GSP		-0.0304					-0.0377	-0.0334	-0.0305	-0.0272
		(0.043)					(0.043)	(0.043)	(0.043)	(0.043)
Margin 1 (MFN)			0.9414*				0.9981**			
			(0.367)				(0.373)			
Margin 2 (weighted tariff)				0.8724**				0.9216**		
				(0.335)				(0.335)		
Margin 3 (largest export)					0.0753				0.0914	
					(0.166)				(0.166)	
Margin 4 (average tariff)						-0.0922*				-0.0912*
						(0.043)				(0.043)
Observations	1,981,255	1,981,255	1,981,255	1,981,255	1,981,255	1,981,255	1,981,255	1,981,255	1,981,255	1,981,255
Number of fixed effects	364,215	364,215	364,215	364,215	364,215	364,215	364,215	364,215	364,215	364,215
Chi2	1360	1394	1372	1399	1385	1364	1409	1445	1435	1397
N. groups	364215	364215	364215	364215	364215	364215	364215	364215	364215	364215
ll	-7.610e+08	-7.590e+08	-7.600e+08	-7.600e+08	-7.610e+08	-7.600e+08	-7.590e+08	-7.590e+08	-7.590e+08	-7.590e+08

All specifications include exporter-product fixed effects and year dummies. Robust standard errors in parentheses *** p<0.01, **p<0.05 and * p<0.1.

Finally, we have also explored whether there is any evidence of the impact of preferential regimes directly on the extensive margin of trade. To do this we estimate an additional specification that uses as the dependent variable the measure of the extensive margin proposed by Feenstra & Kee (2004). The measure is given for each country i by the share of its export basket in world exports. In our case since we are working with bilateral exports to the EU, the variety index reflects for each country i, the share of world exports to the EU using country i export basket.

Appendix C shows the results for the extensive margin only estimates. Here we see that there is no evidence that tariffs, or preference regimes have impacted on the diversification of trade. Interestingly, it is only the GDP and the MRI variables which appear to increase the number of varieties exported. As the MRI is a GDP-weighted distance measure, both these results suggest that changes in trade at the extensive margins are correlated with higher levels of GDP.

6 Conclusions

Unilateral preferences have been one of the most important instruments offered by developed to developing countries in the last four decades to increase exports. The existing literature provides a mixed picture regarding the effectiveness of GSP schemes in fostering those exports. This paper provides an evaluation of the impact of trade preferences in the EU, based on a unique dataset that links each flow with the tariff paid and preferential regime of entry. This element is critical in order to attribute causality between the trade policy regime and the level of export flows.

The most important finding of the paper is that we find a positive impact of preferential regimes on exports to the EU. We find evidence that the positive impact is transmitted directly via lower tariffs and therefore larger preferential margins, and some evidence of additional indirect effects linked to these regimes. Indirect regime effects appear to be larger for FTAs and then for the GSP and EBA regimes at the intensive margin. This would suggest that the greater the depth and range of preferences on offer the greater might be the indirect effects on trade. The size of the preferential margin also depends on how the preference advantage is calculated, and we show the importance of taking account of the degree of competition from other export markets, when considering these additional indirect effects.

The results regarding tariffs and margins are robust to the inclusion of both the intensive and extensive margin in our estimations. In the OLS estimates the largest additional impact once tariffs are controlled for was with respect to FTA preferences; and similarly in the PPML estimates, which include both the intensive and extensive margins we see that relative to FTA, Cotonou or MFN preferences, there is a smaller additional effect associated with EBA and GSP flows. Consistent with this, when we directly estimate the impact of trade on the extensive margin using the Feenstra and Kee measure in Appendix C we do not find evidence of a positive impact of either tariffs or margins.

Finally it is instructive to compare our detailed results with the comparable regression run on aggregate trade flows in Appendix B. The aggregate regressions fail to identify the direct role of tariffs as well as the indirect effects associated with preference regimes via the preference dummies, and to a limited extent via the inclusion of the preference margins. This serves to highlight the importance of assessing preferences at the most detailed level possible if one wants to correctly identify the role of tariffs, as well as further effects.

More work is required in order to understand the diverse impact of different preferential regimes. It is possible that this is due to the different product coverage of each regime, and the possibility that especially FTAs offer preferences in key export products where margins play a more important role. Other potential explanations are the role of rules of origin, other non-tariff barriers; or investment effects linked to the trade regimes.

Appendix A: Methodology for the zero flows dataset

The main challenges when calculating the zero flows dataset are:

- differentiating products that disappear due to changes in classification;
- inferring tariffs for trade flows that do not occur.

Selecting products that occur all the period
We select only those product lines that are exported most of the period. This implies selecting those exported in 2002 and 2008, those in 2003 and 2008, and those exported in 2002 and 2007. In total we select 9,068 (over 19,259 products defined in some year) product lines that represent 73.31% of value and 71.50% of flows. **Inference of tariffs for no flows**

For all the zero flows, we use the following procedure. We use the complete tariff book and paste tariffs in the following order.

- First we attach country specific duties, which are the result of FTAs or specific situations
- We set tariffs to 0, when MFN rates are 0.
- We use zero tariffs for all EBA countries
- We use GSP plus tariffs for GSP+ countries
- With countries with double membership GSP and Cotonou, and in 2008 GSP and EPA, we use the minimum tariff. When both are the same we group the country with the GSP regime.
- Remaining tariffs are set to MFN rates

We create a dummy variable which indicates whether the tariff applied belongs to the GSP/EBA regime. Since in the case of multiple preferential regimes we do not know what regime would be utilised for zero flows, the results of the coefficient on the margin decomposition needs to be interpreted with caution.

Appendix B: Gravity model based on aggregate trade flows

Table 7 Gravity model for aggregate trade flows. OLS estimates.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log of (1+Tariff)	-1.8655	-1.4891	-1.4106	-0.9801	-1.4586	-0.1168	-1.5625	-0.8843	-1.2602	-0.1661
	(1.105)	(1.1405)	(1.0868)	(1.1866)	(1.138)	(1.1873)	(1.1236)	(1.2116)	(1.1683)	(1.208)
Margin 1 (MFN)			4.6497***				4.4998***			
			(0.7732)				(0.8401)			
Margin 2 (weighted tariff)				3.2220*				2.3907		
				(1.5913)				(1.6244)		
Margin 3 (largest export)					1.926				1.1976	
					(1.3017)				(1.3226)	
Margin 4 (average tariff)						5.2182***				4.5008**
						(1.3574)				(1.409)
GSP		-0.6758					-0.8830*	-0.7223	-0.6954	-0.7723
		(0.4222)					(0.4177)	(0.4231)	(0.4228)	(0.4212)
EBA		0.7805*					0.3332	0.7111	0.7396	0.5955
		(0.3769)					(0.3805)	(0.3796)	(0.3796)	(0.3794)
Other FTAs		0.3604					0.0289	0.2879	0.3302	0.177
		(0.6724)					(0.6652)	(0.6737)	(0.6732)	(0.6714)
Cotonou		0.4156					0.1877	0.4078	0.4	0.3712
		(0.7177)					(0.7082)	(0.7172)	(0.7179)	(0.7142)
GSP+		-0.4872					-1.076	-0.4783	-0.4653	-0.6141
		(0.9486)					(0.9409)	(0.9481)	(0.9491)	(0.9447)
Log of GDP	2.4646***	2.3469***	2.5143***	2.4509***	2.4513***	2.4715***	2.4346***	2.3417***	2.3420***	2.3680***
	(0.3812)	(0.3815)	(0.3741)	(0.3806)	(0.381)	(0.3783)	(0.3761)	(0.3813)	(0.3816)	(0.3796)
Log of Population	-0.8922	-1.1221	-0.7257	-0.7942	-0.8404	-0.7382	-1.0002	-1.047	-1.0858	-0.9945
	(1.0674)	(1.0683)	(1.0477)	(1.0667)	(1.0673)	(1.0602)	(1.0526)	(1.0689)	(1.0692)	(1.0637)
MRI	39.57	45.8761	49.392	40.7184	40.034	45.2246	51.2150*	46.0703	45.7856	49.0036
	(26.4162)	(26.3941)	(25.971)	(26.3774)	(26.4008)	(26.2595)	(26.018)	(26.3774)	(26.3969)	(26.279)
Constant	-61.5847	-72.9879	-80.6779	-63.9067	-62.5276	-72.6157	-83.4567	-73.4596	-72.8608	-79.155
	(50.1936)	(50.143)	(49.3523)	(50.1214)	(50.1649)	(49.9001)	(49.4309)	(50.1117)	(50.1482)	(49.927)
Observations	1088	1088	1088	1088	1088	1088	1088	1088	1088	1088
R-squared	0.668	0.601	0.68	0.68	0.675	0.683	0.629	0.62	0.611	0.628
Number of fixed effects	169	169	169	169	169	169	169	169	169	169
R2 within	0.104	0.118	0.138	0.108	0.106	0.118	0.145	0.12	0.119	0.128
R2 between	0.683	0.612	0.694	0.696	0.69	0.698	0.64	0.632	0.622	0.641

All specifications include exporter and importer fixed effects and year dummies. Robust standard errors in parentheses *** p<0.01, **p<0.05 and * p<0.1.

Appendix C: Impact on the extensive margin - OLS estimates using the Feenstra & Kee variety index

Table 8 Gravity model for aggregate trade flows. OLS estimates.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log of (1+Tariff)	0.0511	0.0172	0.0480	0.0382	0.0397	0.0254	0.0173	0.0101	0.0088	0.0012
	(0.0493)	(0.0511)	(0.0494)	(0.0531)	(0.0508)	(0.0534)	(0.0511)	(0.0543)	(0.0523)	(0.0544)
Margin 1 (MFN)			-0.0308				-0.0073			
			(0.0352)				(0.0382)			
Margin 2 (weighted tariff)				-0.0466				-0.0281		
				(0.0712)				(0.0728)		
Margin 3 (largest export)					-0.0538				-0.0439	
					(0.0581)				(0.0592)	
Margin 4 (average tariff)						-0.0767				-0.0544
						(0.0610)				(0.0634)
GSP		-0.0182					-0.0178	-0.0176	-0.0175	-0.0170
		(0.0189)					(0.0190)	(0.0190)	(0.0189)	(0.0190)
EBA		-0.0252					-0.0245	-0.0244	-0.0237	-0.0230
		(0.0169)					(0.0173)	(0.0170)	(0.0170)	(0.0171)
Other FTAs		-0.0170					-0.0165	-0.0162	-0.0159	-0.0148
		(0.0301)					(0.0303)	(0.0302)	(0.0302)	(0.0302)
Cotonou		0.0058					0.0062	0.0059	0.0064	0.0064
		(0.0321)					(0.0322)	(0.0322)	(0.0322)	(0.0322)
GSP+		-0.0975*					-0.0965*	-0.0976*	-0.0983*	-0.0959*
		(0.0425)					(0.0428)	(0.0425)	(0.0425)	(0.0425)
Log of GDP	0.0888***	0.0905***	0.0884***	0.0890***	0.0891***	0.0887***	0.0904***	0.0906***	0.0907***	0.0903***
	(0.0170)	(0.0171)	(0.0170)	(0.0170)	(0.0170)	(0.0170)	(0.0171)	(0.0171)	(0.0171)	(0.0171)
Log of Population	0.0973*	0.0876	0.0962*	0.0959*	0.0959*	0.0950*	0.0874	0.0868	0.0863	0.0861
	(0.0476)	(0.0479)	(0.0477)	(0.0477)	(0.0477)	(0.0477)	(0.0479)	(0.0479)	(0.0479)	(0.0479)
MRI	5.7800***	5.6128***	5.7150***	5.7634***	5.7671***	5.6969***	5.6041***	5.6105***	5.6161***	5.5750***
	(1.1789)	(1.1822)	(1.1814)	(1.1796)	(1.1791)	(1.1804)	(1.1837)	(1.1828)	(1.1825)	(1.1832)
Constant	-11.0068***	-10.6709***	-10.8803***	-10.9732***	-10.9805***	-10.8447***	-10.6538***	-10.6653***	-10.6755***	-10.5963***
	(2.2401)	(2.2459)	(2.2450)	(2.2414)	(2.2404)	(2.2431)	(2.2489)	(2.2470)	(2.2465)	(2.2479)
Observations	1088	1088	1088	1088	1088	1088	1088	1088	1088	1088
R-squared	0.395	0.409	0.398	0.397	0.397	0.399	0.409	0.410	0.409	0.410
Number of fixed effects	169	169	169	169	169	169	169	169	169	169
R2 within	0.0610	0.0695	0.0618	0.0614	0.0619	0.0626	0.0695	0.0696	0.0700	0.0702
R2 between	0.365	0.377	0.367	0.366	0.366	0.368	0.377	0.378	0.378	0.379

All specifications include exporter fixed effects and year dummies. Robust standard errors in parentheses *** p<0.01, **p<0.05 and * p<0.1

Appendix D: Additional regressions using total trade at the 6-digit level and GDP as activity variables

Table 9 Gravity model at the product level-tariff regime with total trade at 6 the digits level. OLS estimates, Intensive margin.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log of (1+Tariff)	-3.9620***	0.1013	-2.1872***	-3.4967***	-3.8802***	-2.6870***	-0.2778	-0.0661	-0.0027	0.0143
	(0.126)	(0.109)	(0.246)	(0.161)	(0.138)	(0.179)	(0.158)	(0.136)	(0.117)	(0.149)
MRI	-25.2877***	-25.9705***	-25.3392***	-25.1619***	-25.2604***	-25.1223***	-25.9573***	-26.0177***	-26.0064***	-25.9823***
	(1.232)	(1.226)	(1.231)	(1.231)	(1.232)	(1.231)	(1.226)	(1.227)	(1.226)	(1.226)
Log of HS6export	0.5300***	0.5257***	0.5299***	0.5302***	0.5300***	0.5303***	0.5257***	0.5256***	0.5257***	0.5257***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Other FTAs		0.9261***					0.9338***	0.9279***	0.9270***	0.9274***
		(0.011)					(0.011)	(0.011)	(0.011)	(0.011)
EBA		0.7787***					0.7897***	0.7825***	0.7807***	0.7810***
		(0.033)					(0.033)	(0.033)	(0.033)	(0.033)
Cotonou		-0.1617***					-0.1592***	-0.1602***	-0.1609***	-0.1608***
		(0.031)					(0.031)	(0.031)	(0.031)	(0.031)
GSP+		0.8651***					0.8750***	0.8680***	0.8665***	0.8671***
		(0.037)					(0.037)	(0.037)	(0.037)	(0.037)
GSP		0.6871***					0.6910***	0.6881***	0.6876***	0.6878***
		(0.010)					(0.010)	(0.010)	(0.010)	(0.010)
Margin 1 (MFN)			2.3787***				-0.5538***			
			(0.313)				(0.147)			
Margin 2 (weighted tariff)				0.5557***				-0.2104*		
				(0.113)				(0.097)		
Margin 3 (largest export)					0.0938				-0.1242*	
					(0.053)				(0.050)	
Margin 4 (average tariff)						1.6672***				-0.1216
						(0.181)				(0.128)
Constant	47.9008***	48.7498***	47.8994***	47.6539***	47.8477***	47.5552***	48.7444***	48.8417***	48.8191***	48.7738***
	(2.303)	(2.292)	(2.301)	(2.302)	(2.302)	(2.302)	(2.292)	(2.293)	(2.293)	(2.293)
Observations	1,137,124	1,137,124	1,137,124	1,137,124	1,137,124	1,137,124	1,137,124	1,137,124	1,137,124	1,137,124
R-squared	0.1082	0.1342	0.1089	0.1083	0.1082	0.1086	0.1342	0.1342	0.1342	0.1342
Number of fixed effects	400,004	400,004	400,004	400,004	400,004	400,004	400,004	400,004	400,004	400,004
R2 within	0.108	0.134	0.109	0.108	0.108	0.109	0.134	0.134	0.134	0.134
R2 between	0.341	0.354	0.340	0.341	0.341	0.341	0.356	0.355	0.354	0.355
R2 overall	0.336	0.355	0.337	0.337	0.336	0.337	0.356	0.355	0.355	0.355
ll	-1.450e+06	-1.434e+06	-1.450e+06	-1.450e+06	-1.450e+06	-1.450e+06	-1.434e+06	-1.434e+06	-1.434e+06	-1.434e+06

All specifications include exporter-product fixed effects and year dummies. Robust standard errors in parentheses *** p<0.01, **p<0.05 and * p<0.1.

Table 10 Gravity model at the product level-tariff regime with total trade at the 6-digit level. LPM estimates, Extensive margin.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log of (1+Tariff)	0.7501***	0.5043***	0.5549***	0.7071***	0.7489***	0.7444***	0.3934***	0.4789***	0.5049***	0.5013***
	(0.010)	(0.007)	(0.010)	(0.010)	(0.010)	(0.010)	(0.007)	(0.007)	(0.007)	(0.007)
MRI	0.1248***	-0.0850***	0.1230***	0.1244***	0.1248***	0.1238***	-0.0858***	-0.0852***	-0.0850***	-0.0856***
	(0.027)	(0.023)	(0.027)	(0.027)	(0.027)	(0.027)	(0.023)	(0.023)	(0.023)	(0.023)
Log of HS6export	0.0113***	0.0087***	0.0113***	0.0113***	0.0113***	0.0113***	0.0087***	0.0087***	0.0087***	0.0087***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
EBA		-0.8793***					-0.8775***	-0.8791***	-0.8793***	-0.8793***
		(0.003)					(0.003)	(0.003)	(0.003)	(0.003)
GSP		-0.5711***					-0.5706***	-0.5711***	-0.5711***	-0.5711***
		(0.001)					(0.001)	(0.001)	(0.001)	(0.001)
Margin 1 (MFN)			-0.3025***				-0.1724***			
			(0.011)				(0.007)			
Margin 2 (weighted tariff)				-0.0522***				-0.0309***		
				(0.004)				(0.003)		
Margin 3 (largest export)					-0.0011***				0.0005*	
					(0.000)				(0.000)	
Margin 4 (average tariff)						-0.0045***				-0.0024***
						(0.000)				(0.000)
Constant	-0.1290*	0.6223***	-0.1125*	-0.1271*	-0.1290*	-0.1268*	0.6309***	0.6234***	0.6223***	0.6235***
	(0.051)	(0.043)	(0.051)	(0.051)	(0.051)	(0.051)	(0.043)	(0.043)	(0.043)	(0.043)
Observations	4,425,632	4,425,632	4,425,632	4,425,632	4,425,632	4,425,632	4,425,632	4,425,632	4,425,632	4,425,632
R-squared	0.0116	0.2469	0.0127	0.0117	0.0116	0.0117	0.2472	0.2469	0.2469	0.2469
Number of fixed effects	1,016,232	1,016,232	1,016,232	1,016,232	1,016,232	1,016,232	1,016,232	1,016,232	1,016,232	1,016,232
R2 within	0.0116	0.247	0.0127	0.0117	0.0116	0.0117	0.247	0.247	0.247	0.247
R2 between	0.0622	0.143	0.0745	0.0637	0.0623	0.0631	0.143	0.143	0.143	0.143
R2 overall	0.0478	0.153	0.0572	0.0488	0.0479	0.0484	0.154	0.153	0.153	0.153
ll	557421	1.159e+06	559899	557614	557424	557595	1.160e+06	1.159e+06	1.159e+06	1.159e+06

All specifications include exporter-product fixed effects and year dummies. Robust standard errors in parentheses *** p<0.01, **p<0.05 and * p<0.1.

Table 11 Gravity model at the product level-tariff regime with total trade at the 6-digit level. PPML estimates, Extensive and Intensive margin.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log of (1+Tariff)	-2.0631***	-2.1115***	-1.7810***	-1.6455***	-1.9680***	-2.1423***	-1.8101***	-1.6802***	-2.0108***	-2.1853***
	(0.316)	(0.320)	(0.329)	(0.305)	(0.321)	(0.328)	(0.335)	(0.311)	(0.326)	(0.333)
MRI	-1.1445	-1.0861	-1.1291	-1.1200	-1.1412	-1.1509	-1.0673	-1.0585	-1.0824	-1.0943
	(1.420)	(1.421)	(1.419)	(1.425)	(1.421)	(1.421)	(1.420)	(1.427)	(1.422)	(1.421)
Log of HS6export	0.8289***	0.8267***	0.8287***	0.8303***	0.8291***	0.8287***	0.8264***	0.8281***	0.8270***	0.8266***
	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)
EBA		-0.8200***					-0.8218***	-0.8311***	-0.8236***	-0.8198***
		(0.207)					(0.207)	(0.208)	(0.207)	(0.207)
GSP		-0.0336					-0.0386	-0.0378	-0.0338	-0.0291
		(0.052)					(0.052)	(0.051)	(0.052)	(0.051)
Margin 1 (MFN)			0.5873				0.6384			
			(0.327)				(0.327)			
Margin 2 (weighted tariff)				1.1901***				1.2404***		
				(0.330)				(0.326)		
Margin 3 (largest export)					0.2705				0.2877	
					(0.166)				(0.168)	
Margin 4 (average tariff)						-0.1017*				-0.1007*
						(0.049)				(0.048)
Observations	1,485,869	1,485,869	1,485,869	1,485,869	1,485,869	1,485,869	1,485,869	1,485,869	1,485,869	1,485,869
Number of fixed effects	248,485	248,485	248,485	248,485	248,485	248,485	248,485	248,485	248,485	248,485
Chi2	2982	3023	2994	3029	3013	2994	3042	3110	3076	3030
N. groups	248485	248485	248485	248485	248485	248485	248485	248485	248485	248485
ll	-4.680e+08	-4.660e+08	-4.670e+08	-4.670e+08	-4.680e+08	-4.670e+08	-4.660e+08	-4.660e+08	-4.660e+08	-4.660e+08

All specifications include exporter-product fixed effects and year dummies. Robust standard errors in parentheses *** p<0.01, **p<0.05 and * p<0.1.

Table 12 Gravity model at the product level-tariff regime with GDP. OLS estimates, Intensive margin.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log of (1+Tariff)	-3.9620***	0.1013	-2.1872***	-3.4967***	-3.8802***	-2.6870***	-0.2778	-0.0661	-0.0027	0.0143
	(0.126)	(0.109)	(0.246)	(0.161)	(0.138)	(0.179)	(0.158)	(0.136)	(0.117)	(0.149)
MRI	-25.2877***	-25.9705***	-25.3392***	-25.1619***	-25.2604***	-25.1223***	-25.9573***	-26.0177***	-26.0064***	-25.9823***
	(1.232)	(1.226)	(1.231)	(1.231)	(1.232)	(1.231)	(1.226)	(1.227)	(1.226)	(1.226)
Log of HS6export	0.5300***	0.5257***	0.5299***	0.5302***	0.5300***	0.5303***	0.5257***	0.5256***	0.5257***	0.5257***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Other FTAs		0.9261***					0.9338***	0.9279***	0.9270***	0.9274***
		(0.011)					(0.011)	(0.011)	(0.011)	(0.011)
EBA		0.7787***					0.7897***	0.7825***	0.7807***	0.7810***
		(0.033)					(0.033)	(0.033)	(0.033)	(0.033)
Cotonou		-0.1617***					-0.1592***	-0.1602***	-0.1609***	-0.1608***
		(0.031)					(0.031)	(0.031)	(0.031)	(0.031)
GSP+		0.8651***					0.8750***	0.8680***	0.8665***	0.8671***
		(0.037)					(0.037)	(0.037)	(0.037)	(0.037)
GSP		0.6871***					0.6910***	0.6881***	0.6876***	0.6878***
		(0.010)					(0.010)	(0.010)	(0.010)	(0.010)
Margin 1 (MFN)			2.3787***				-0.5538***			
			(0.313)				(0.147)			
Margin 2 (weighted tariff)				0.5557***				-0.2104*		
				(0.113)				(0.097)		
Margin 3 (largest export)					0.0938				-0.1242*	
					(0.053)				(0.050)	
Margin 4 (average tariff)						1.6672***				-0.1216
						(0.181)				(0.128)
Constant	47.9008***	48.7498***	47.8994***	47.6539***	47.8477***	47.5552***	48.7444***	48.8417***	48.8191***	48.7738***
	(2.303)	(2.292)	(2.301)	(2.302)	(2.302)	(2.302)	(2.292)	(2.293)	(2.293)	(2.293)
Observations	1,137,124	1,137,124	1,137,124	1,137,124	1,137,124	1,137,124	1,137,124	1,137,124	1,137,124	1,137,124
R-squared	0.1082	0.1342	0.1089	0.1083	0.1082	0.1086	0.1342	0.1342	0.1342	0.1342
Number of fixed effects	400,004	400,004	400,004	400,004	400,004	400,004	400,004	400,004	400,004	400,004
R2 within	0.108	0.134	0.109	0.108	0.108	0.109	0.134	0.134	0.134	0.134
R2 between	0.341	0.354	0.340	0.341	0.341	0.341	0.356	0.355	0.354	0.355
R2 overall	0.336	0.355	0.337	0.337	0.336	0.337	0.356	0.355	0.355	0.355
ll	-1.450e+06	-1.434e+06	-1.450e+06	-1.450e+06	-1.450e+06	-1.450e+06	-1.434e+06	-1.434e+06	-1.434e+06	-1.434e+06

All specifications include exporter-product fixed effects and year dummies. Robust standard errors in parentheses *** p<0.01, **p<0.05 and * p<0.1.

Table 13 Gravity model at the product level-tariff regime with GDP. LPM estimates, Extensive margin.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log of (1+Tariff)	0.4509***	0.3925***	0.3483***	0.4251***	0.4503***	0.4486***	0.3159***	0.3718***	0.3929***	0.3913***
	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
MRI	0.0673***	-0.0351**	0.0695***	0.0677***	0.0673***	0.0671***	-0.0334**	-0.0348**	-0.0351**	-0.0352**
	(0.013)	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)	(0.012)	(0.012)	(0.012)	(0.012)
Log of GDP	0.0140***	-0.0629***	0.0136***	0.0140***	0.0140***	0.0140***	-0.0631***	-0.0629***	-0.0629***	-0.0629***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
EBA		-0.8991***					-0.8979***	-0.8989***	-0.8991***	-0.8991***
		(0.002)					(0.002)	(0.002)	(0.002)	(0.002)
GSP		-0.3608***					-0.3606***	-0.3608***	-0.3608***	-0.3608***
		(0.001)					(0.001)	(0.001)	(0.001)	(0.001)
Margin 1 (MFN)			-0.1600***				-0.1196***			
			(0.004)				(0.003)			
Margin 2 (weighted tariff)				-0.0319***				-0.0257***		
				(0.002)				(0.002)		
Margin 3 (largest export)					-0.0005***				0.0004***	
					(0.000)				(0.000)	
Margin 4 (average tariff)						-0.0018***				-0.0010***
						(0.000)				(0.000)
Constant	-0.0438	0.6846***	-0.0401	-0.0436	-0.0438	-0.0433	0.6870***	0.6848***	0.6846***	0.6849***
	(0.024)	(0.022)	(0.024)	(0.024)	(0.024)	(0.024)	(0.022)	(0.022)	(0.022)	(0.022)
Observations	9,213,693	9,213,693	9,213,693	9,213,693	9,213,693	9,213,693	9,213,693	9,213,693	9,213,693	9,213,693
R-squared	0.0050	0.1742	0.0055	0.0050	0.0050	0.0050	0.1745	0.1742	0.1742	0.1742
Number of fixed effects	1,636,715	1,636,715	1,636,715	1,636,715	1,636,715	1,636,715	1,636,715	1,636,715	1,636,715	1,636,715
R2 within	0.00496	0.174	0.00554	0.00502	0.00496	0.00499	0.174	0.174	0.174	0.174
R2 between	0.128	0.0393	0.138	0.130	0.129	0.129	0.0393	0.0393	0.0393	0.0393
R2 overall	0.0929	0.0317	0.0973	0.0936	0.0929	0.0934	0.0317	0.0317	0.0317	0.0317
ll	4.110e+06	4.969e+06	4.113e+06	4.110e+06	4.110e+06	4.110e+06	4.971e+06	4.969e+06	4.969e+06	4.969e+06

All specifications include exporter-product fixed effects and year dummies. Robust standard errors in parentheses *** p<0.01, **p<0.05 and * p<0.1.

Table 14 Gravity model at product level-tariff regime with GDP. PPML estimates Intensive and extensive margin.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log of (1+Tariff)	-2.0698***	-2.1075***	-1.5223**	-2.0762***	-2.1521***	-2.1655***	-1.5473**	-2.0958***	-2.1826***	-2.1963***
	(0.435)	(0.442)	(0.501)	(0.537)	(0.487)	(0.450)	(0.507)	(0.542)	(0.495)	(0.456)
MRI	-1.8851	-1.8362	-1.8531	-1.8855	-1.8890	-1.8900	-1.7992	-1.8355	-1.8399	-1.8436
	(1.401)	(1.400)	(1.399)	(1.401)	(1.400)	(1.402)	(1.399)	(1.400)	(1.399)	(1.401)
Log of GDP	1.6704***	1.6622***	1.6776***	1.6704***	1.6719***	1.6762***	1.6672***	1.6620***	1.6637***	1.6698***
	(0.172)	(0.175)	(0.172)	(0.172)	(0.172)	(0.172)	(0.175)	(0.176)	(0.175)	(0.175)
EBA		-0.9365***					-0.9397***	-0.9367***	-0.9343***	-0.9361***
		(0.165)					(0.166)	(0.165)	(0.165)	(0.165)
GSP		-0.0194					-0.0278	-0.0195	-0.0192	-0.0137
		(0.047)					(0.046)	(0.047)	(0.047)	(0.046)
Margin 1 (MFN)			1.1218**				1.1665**			
			(0.421)				(0.422)			
Margin 2 (weighted tariff)				-0.0164				0.0299		
				(0.411)				(0.408)		
Margin 3 (largest export)					-0.1973				-0.1797	
					(0.194)				(0.193)	
Margin 4 (average tariff)						-0.1177*				-0.1170*
						(0.053)				(0.053)
Observations	1,909,467	1,909,467	1,909,467	1,909,467	1,909,467	1,909,467	1,909,467	1,909,467	1,909,467	1,909,467
Number of fixed effects	354,279	354,279	354,279	354,279	354,279	354,279	354,279	354,279	354,279	354,279
Chi2	776.5	809.5	784.6	826.3	802	788.2	819	870.5	842.1	820
N. groups	354279	354279	354279	354279	354279	354279	354279	354279	354279	354279
ll	-7.960e+08	-7.940e+08	-7.950e+08	-7.960e+08	-7.960e+08	-7.950e+08	-7.930e+08	-7.940e+08	-7.940e+08	-7.930e+08

All specifications include exporter-product fixed effects and year dummies. Robust standard errors in parentheses *** p<0.01, **p<0.05 and * p<0.1.

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