The Trade Effects of Tariffs and Non-Tariff Changes of Preferential Trade Agreements

Juyoung Cheong,* Do Won Kwak,† and Kam Ki Tang‡

July 13, 2017

Abstract

The recent literature on preferential trade agreements (PTAs) emphasizes on the distinction between the extensive and intensive margins. What has been missing is the distinction between tariff and non-tariff changes under PTAs. Tariff reduction is a quintessential feature of PTAs. But member countries of a PTA often pursue deeper integration through agreements on non-tariff matters as well. Some member countries, however, may want to use non-tariff barriers (NTBs) to compensate for tariff cut. The current study isolates the effects of tariff and non-tariff changes under PTAs. It involves the construction of a new dataset of bilateral tariff rates for 90 importing and 149 exporting countries over 1996-2010, covering Harmonized System 2-digit level of product varieties. Given the complexity of non-tariff arrangements, we allow for heterogeneity across three different types of PTAs, namely custom unions (CUs), free trade agreements (FTAs), and partial scope agreements (PSAs). We further consider heterogeneity within each of these three PTAs regarding respond time, partner type, income level, and product type. The key findings are: (i) non-tariff changes under PTAs on average increase both the intensive and extensive margin of trades; (ii) PSAs do not have discernible trade impacts unlike FTAs and CUs; (iii) CUs have a stronger trade impact than FTAs; (iv) the impact of CUs come mostly from non-tariff changes, while that of FTAs comes from both tariff and non-tariff changes; (v) CUs have lower tariff rates than FTAs, those in turn are lower than PSAs', (vi) non-tariff changes associated with CUs have a strong trade effect than those associated with FTAs, which in turn are stronger than those associated with PSAs; (vii) it takes longer time for non-tariff changes to effect on the intensive margin as compared to tariff changes; (viii)

*Corresponding author; Department of Economics, Kyung Hee University, Korea; e-mail: jcheong@khu.ac.kr

†Asiatic Research Institute, Korea University, Seoul, Korea; e-mail: dwkwak@korea.ac.kr

‡School of Economics, University of Queensland, QLD 4072, Australia; e-mail: kk.tang@uq.edu.au.

non-tariff changes under FTAs and CUs between industrial and developing countries increase the exports from the former to the latter more than the other way round; and (viii) there is substantial heterogeneity across sectors in their response to trade liberalization.

JEL Code: F15
Keywords: Preferential Trade Agreements, Tariff, Non-tariff Measure, Gravity Model

1 Introduction

Preferential trade agreements (PTAs) have dramatically proliferated since the mid-1990s, prompting numerous studies on their effects. Most studies, including Baier and Bergstrand (2007, 2009), Magee (2003, 2008), Eicher *et al.* (2012) and Ghosh and Yamarik (2004), find the effects on trade volume between PTA signatures to be significant and positive, with Ghosh and Yamarik (2004) being an exception. The recent literature goes beyond trade volume and emphasizes on the distinction between the intensive and extensive margins of trade (Eaton and Kortum, 2002; Melitz, 2003; Chaney, 2008). Dutt *et al.* (2013) show that the growth in trade since the 1980s has been largely driven by trade in new products (the extensive margin) instead of by the growth in old products (the intensive margin). Some studies find that product variety is an important source of gains from trade (Broda and Weinstein, 2006), but some others suggest otherwise (Arkolakis *et al.*, 2012).

Studying the extensive margin of trade requires disaggregate data at the firm, industry or product level, as seen in Trefler (2004), Bernard *et al.* (2009) and Kehoe and Ruhl (2013). Because these studies focus on a few selective countries, their findings cannot be generalized to others. Dutt *et al.* (2013) cover a large number of countries over a long period, but their focus is on the World Trade Organization (WTO) membership instead of PTAs. Foster *et al.* (2011) and Baier *et al.* (2014) are two exceptions, investigating the PTA effects on the product margins covering a substantial number of countries.

What has been missing in the aforementioned studies is the distinction between tariff and non-tariff changes under PTAs. Tariff reduction is a quintessential feature of PTAs as member countries aim to gain better access to each other's market. However, member countries often pursue "deeper integration" through agreements on non-tariff matters as well. Non-tariff arrangements (NTAs) typically cover competition policies, product standards, regulatory regimes, investment codes, environmental policies, labor standards and so on.[1] *Ex ante* the trade effect of NTAs can be either positive or negative. On the one hand, legally binding agreements can reduce uncertainty to traders arisen from unilateral policy interventions (Bagwell and Staiger, 2002). On the other hand, some

[1] See pp. 78 of Baier and Bergstrand (2007) for the related literature.

member countries may use NTAs to protect import-competing industries, especially those with strong lobbying power. Under the General Agreement on Tariffs and Trade (GATT), PTAs are allowed as an exception to the clause of Most Favored Nation (MFN) only if all duties are eliminated on "substantially all" trade between the member countries within a "reasonable length of time". As such, countries wanting to protect specific industries can only resort to non-tariff barriers (NTBs) disguised as GATT-complying NTAs. Ray (1981) provides empirical evidence that NTBs have been utilized in part to compensate for internationally agreed-upon tariff reductions, and Limao and Tovar (2011) show that tariff commitments in trade agreements increase the likelihood and restrictiveness of NTBs.

In fact, NTBs have risen during the mid-1990s to 2000 and then again after the Global Financial Crisis (WTO, 2012). And there has been a steady increase in sanitary and phytosanitary (SPS) measures and technical barriers to trade (TBTs) notifications by WTO members since 1995 (Bacchetta and Beverelli, 2012). Because the GATT and WTO have already reduced tariffs substantially, as evident in the merely five percent average duty worldwide, tariff reduction arising from future PTAs will be moderate; consequently, NTAs may become increasingly important in determining the impact of PTAs.

Against this background, the objective of this paper is to examine the effects of tariff and NTA changes under PTAs on trade flows and product margins of trade. If NTA changes are found to have positive effects on trade, then it implies that countries' liberalization is beyond what the GATT initially aimed to accomplish through tariff reduction; if the effects are negative, it is the other way around. In the scenario that both tariff and non-tariff changes has positive trade effects, it is useful to compare their quantitative differences. This is because the negotiation for a PTA usually takes years to conclude, and NTAs are often the most time-consuming items, therefore, it is important to know how those efforts on NTA negotiation pay off regarding trade gain. Non-tariff barriers are one but not all sources of NTA changes associated with PTAs. Preferential trade agreements could be a form of commitment to more stable and predictable policies, making firms more likely to incur the fixed costs of selling in the market. Signatory governments of a PTA may also implement some economic reform policies to complement a PTA.

The empirical strategy adopted in this paper is able to separate the effects of NTAs associated with PTAs from the effects of potential complementary policy changes using import-country fixed effects (FEs). Using this strategy, we first estimate the effects of PTAs as a composite effects, and then decompose these effects into two distinct components: the effect from tariff-cut and the effect from other remaining policy (i.e. NTA) changes associated with the adoption of PTAs, respectively. We focus on the heterogeneity in NTA changes by distinguishing three types of PTAs, namely partial scope agreements (PSAs), free trade agreements (FTAs), and custom unions

(CUs). In our framework, the estimated effect from tariff-cut is common to all PTAs while that from other remaining policy changes is the average effect from various NTA changes for each type of PTAs. We test, regarding the degree of economic integration, whether CUs dominates FTAs which in turns dominate PSAs. Baier *et al.* (2014) find that CUs, which are the deepest form of economic integration among three, have the largest effects on bilateral trade. However, it is not entirely clear whether the results are due to CUs entailing the deepest tariff cut or the deepest non-tariff changes or both. It is also not clear, regarding the quantitative effects on trade, how the three types of PTAs fare relative to each other. Equally unknown is the relative importance of tariff and non-tariff changes associated with each type of PTAs and across different types of partners, e.g. industrial-industrial countries versus industrial-developing countries. In this paper, we aim to provide answers to these questions.

To our knowledge, this paper is one of the first studies to isolate the trade effects of tariff and non-tariff changes associated with PTAs in a gravity equation framework and to differentiate PTAs amongst and between developing countries and industrial countries. Such differentiations are important if there is uneven bargaining power between them. For instance, Bergsten (1997) asserts that in the North America Free Trade Agreement (NAFTA) negotiation, Mexico "accepted virtually every demand placed upon it" and "made virtually all the concessions." In addition, we consider the lagged effects of trade integration, because NTAs tend to more complex as well as heterogeneous than tariffs, countries may take longer time to respond to non-tariff changes than to tariff cut. Lastly, we also consider the time factor and sectoral heterogeneity in countries' responses to trade liberalization.

To accomplish our objective, we have constructed a comprehensive bilateral tariff dataset covering 90 importing and 149 exporting countries over the period of 1996 to 2010 at the Harmonized System 2-digit (HS2) level. The dataset allows us to compute the average tariff rates on goods between any two WTO member countries. This dataset also allows us to contribute to the recent trade literature on the fixed and variable trade costs (Melitz, 2003; Chaney, 2008). Baier *et al.* (2014) show that the elasticity of variable costs is larger for the intensive margin than for the extensive margin. And Dutt *et al.* (2013) show that while the extensive margin increases with a drop in either the fixed costs or the variable costs, the intensive margin decreases with a drop in the fixed costs, but its response to a drop in the variable costs is ambiguous. Inferring from their empirical findings, they argue that the WTO membership incurs a reduction in the fixed costs for developing countries and a reduction in the variable costs for industrial countries. However, when merely a dummy variable for PTAs (or WTO memberships for that matter) is used in the gravity equation to capture changes in trade costs, it is not clear if it is capturing the fixed costs or the variable costs or both. In other words, the effects of fixed and variable costs as identified in the current literature are

mostly based on *deduction* instead of *detection*. Our contribution here is that, by separating tariff from NTAs, we can explicitly examine the trade effects of changes in the variable costs because of tariff reduction.[2]

Our key findings are: (i) non-tariff changes under PTAs on average increase both the intensive and extensive margin of trade; (ii) PSAs do not have discernible trade impacts unlike FTAs and CUs; (iii) CUs have a stronger trade impact than FTAs; (iv) the impact of CUs come mostly from non-tariff changes, while that of FTAs comes from both tariff and non-tariff changes; (v) CUs have lower tariff rates than FTAs, which in turn are lower than PSAs; (vi) non-tariff changes associated with CUs have a strong trade effect than those associated with FTAs, which in turn are stronger than those associated with PSAs; (vii) it takes a longer time for non-tariff changes to effect on the intensive margin as compared to tariff changes; (viii) non-tariff changes under FTAs and CUs between industrial and developing countries increase the exports from the former to the latter more than the other way round; and (ix) there is substantial heterogeneity across sectors in their response to trade liberalization.

The rest of the paper is organized as follow. Section 2 explains the methodology. Section 3 describes the dataset. Section 4 reports the empirical findings. The last section concludes.

2 Methodology

2.1 Gravity Model

Our empirical analysis is based on extending the standard, three-dimensional (importer, exporter, time) gravity equation to incorporate the fourth dimension (product):

$$\begin{aligned} lnT_{ijkt} &= \beta + \gamma_1 ln(1 + Tariff_{ijkt}) + \gamma_2 PSA_{ijt} + \gamma_3 FTA_{ijt} \\ &\quad + \gamma_4 CU_{ijt} + u_{it} + v_{jt} + w_{ij} + x_{kt} + \epsilon_{ijkt} \end{aligned} \tag{1}$$

where T_{ijkt} is the imports of product k at the HS2 level by country i from country j in year t; PSA_{ijt} is a dummy taking a value of one if i and j are part of at least one PSA in year t and zero otherwise, and likewise for FTA_{ijt} and CU_{ijt};[3] $Tariff_{ijkt}$ is the average tariff of all product

[2]We cannot explicitly examine the trade effects of changes in the fixed costs using NTA measures, because non-tariff changes could affect either the fixed costs or the variable costs or both. For instance, compiling with pre-shipment inspection or rule of origin incurs fixed administrative costs, but alternating product material or design to meet higher health or environmental standards could incur both fixed and variable costs.

[3]If the two countries are part of more than one PSA in year t, we only count it as one because any extra PSA is redundant as far as the same two countries are concerned. Likewise for FTAs and CUs.

varieties at the HS2 level (details of its construction are in the following subsection); u_{it}, v_{jt}, w_{ij}, x_{kt} are the importer-time, exporter-time, pair, and product-time FEs; and ϵ_{ijkt} is the error term.

In eq.(1), lnT_{ijkt} is a measure of the intensive margin. The estimation of eq.(1) uses only observations of positive trade flows. We supplement the analysis by using the extensive margin as the second trade flow variable. The extensive margin is measured by a dummy variable that is equal to one if $T_{ijkt} > 0$ and zero otherwise. That is, for the extensive margin, we estimate a linear probability model and use observations of positive positive and zero trade flows. We prefer linear probability model estimation over logit and probit because it is hard to account for unobserved factors $u_{it}, v_{jt}, w_{ij}, x_{kt}$ with logit and probit specification due to incidental parameters problem Neyman and Scott (1948) as well as convergence issue with many dummy variables. On top of that, as long as our main interest is the effect for the conditional mean model, the approximation of the linear probability model is quite robust to distributional misspecification on the error term Angrist and Pischke 2009; Wooldridge 2002.

The first three FEs, u_{it}, v_{jt}, and w_{ij}, subsume all standard country level explanatory variables in gravity equations. More importantly, u_{it} and v_{jt}, supplemented with x_{kt}, are used to capture the multilateral resistance terms (MRTs) (see (Anderson and van Wincoop, 2003; Magee, 2008; Eicher *et al.*, 2012; Dutt *et al.*, 2013; Baier *et al.*, 2014), and among others).

As mentioned in the Introduction, there is a possibility that a country signing a PTA will implement other complementary policy reforms. To the extent that those reforms are not controlled for, the PTA variables in eq.(1) will overstate the true impact of NTAs of the PTA. However, if those complementary policies are non-discriminatory, they should impact on the country's trade with its PTA partner countries as well as its trade with non-partner countries. If that is the case, then the country-time FEs will be sufficient to control for any unilateral policy changes, leaving the PTA variables to capture the effects of bilateral NTAs. Only in the scenario that the policy changes are complementary uniquely to the PTA, trade with partner countries is likely to benefit more. However, in that (rather unusual) scenario, those policy changes are effectively NTAs of the PTA.

It is worth noting that $Tariff_{ijkt}$ in (1) includes not only preferential tariffs through PTAs and other preferential agreements on tariffs, but also MFN tariffs for pairs with no preferential tariffs. However, γ_1 captures only the effects of preferential tariffs, because MFN tariffs, which are importer-time varying, are controlled for by the importer-time fixed effects, u_{it}.

It should be noticed that the coefficient on $ln(1+Tariff_{ijkt})$ is not the marginal effect of tariff changes on trade flows. That is, a 1% increase in tariffs is not expected to increase trade flows by γ_1 percents. To see that, consider the following simple case. The price of import k in destination i at time t, P_{ijkt}, can be represented as

$$P_{ijkt} = P_{kt} \times E_{it} \times (1 + Tariff_{ijkt})$$

where P_{kt} is the international price of product k expressed in the USD; E_{it} is the value of the USD in terms of the currency of country i; and $Tariff_{ijkt}$ is expressed in decimal points.

It is reasonable to assume T_{ijkt} to be a function of P_{ijkt} and thus lnT_{ijkt} to be a function of lnP_{kt}, lnE_{it}, and $ln(1 + Tariff_{ijkt})$. In (1), the FE terms u_{it} and x_{kt} subsume lnE_{it} and lnP_{kt}. Therefore, γ_1 is the marginal effect of 1% increase in the domestic price of product k in destination i at time t as a result of certain amount of tariff increase on the product.

3 Data

Our dataset has bilateral trade data for 90 importing and 149 exporting countries spanning from 1996 to 2010. The full list of the countries is reported in Table 9. This sample is chosen based on tariff data availability after the WTO establishment. The country coverage is limited to WTO members because in principle MFN tariff data are applicable only when both importing and exporting countries are the WTO members.

Bilateral trade flows and applied bilateral tariffs at the HS-6 digit level, which is the most disaggregate product level in the international standard, are first constructed using the data from the World Integrated Trade Solution (WITS), which are originally sourced from the UNCTAD Trade Analysis Information System (TRAINS), and WTO's Integrated Data Base (IDB) and Consolidated Tariff Schedules (CTS) data base. Once we construct the trade and tariff data at HS-6 digit, we obtain the simple average of them at the HS-2 digit level for our analysis.

Bilateral trade flows are not observable for more than 70% in our observations at the HS-2 digit level. If positive trade flows are not reported, we impute trade flows as zero.

Most Favored Nation (MFN) tariffs and preferential tariffs are separately constructed. For MFN tariffs they are available at the unilateral level while we need bilateral tariffs. To obtain bilateral tariff data, for each year we apply an importing country's MFN tariffs to all its trading partner countries in our sample. This procedure is justifiable as our sample includes the WTO members only. For countries engaged in a CU, tariff schedules are available also at the union level, not the country level. We, therefore, use these CU tariff data to generate MFN tariff data for each of member countries of a CU. Also, for some countries, MFN tariffs are not reported for certain years. In those cases, we use the data from the closest previous available year as a substitute.

Preferential tariffs are collected separately for applicable country-pairs for each year. For most country-pairs preferential tariffs are not equal to zero for many products unless they belong to the same CU. If preferential tariffs on certain products imposed by an importing country are applied to

multiple exporting countries simultaneously, data are observed at the group level only. To identify which countries belong to a specific group, we use the Preference Beneficiaries data from TRAINS and then generate preferential tariff data for each country-pair. Like MFN tariffs, for the countries engaged in a CU, we only observe the preferential external tariff schedules at the union level. Therefore, we generate an individual member country's bilateral tariff data using the CU tariff data. Preferential tariffs are also not always reported for all years for many countries, so we use the data from the closest previous available year as a substitute for an unavailable year.

For given country-pair, product and year, if data for both MFN and preferential tariffs are available, the latter is lower with only a few exceptions. So, we use the preferential tariffs if they exist. Otherwise, MFN tariffs are used. [4]

Preferential trade agreements data are constructed from the Regional Trade Agreements Information System (RTA-IS) of the WTO. Data on nominal GDP and GDP per capita are drawn from the Penn World Table (PWT) 7.0. Data on distance, common language, common colony, common border, common legal origin, and country-pair combined land area are drawn from CEPII. For the country classification for income level, we follow Subramanian and Wei (2007).

Table 1 provides the summary statistics for the key variables. The statistics show that, for our dataset, on average any two countries trade about 29% of HS2 sectors. The average tariff rate is about 9% while the median is only 5%. It is due to some exceptionally high tariffs imposed on a specific sector by few countries. For instance, the Egypt's tariff level on spirits (HS2)[5] is 1,686% while even a few advanced countries including Canada and USA impose higher than 100% tariff on some agricultural products. FTAs and PSAs, are more common than CUs. The list of sample countries is provided in the Appendix.

Figure 1 shows the time trends of the mean values of tariffs, MFN tariffs and preferential tariffs of our sample. MFN tariffs are relatively much higher in 1996 compared to average preferential tariffs and have been substantially reduced by 2010. The rapid decline in MFN tariffs is the reason why the average tariff for the whole sample also reduces at roughly the same rate.

Figure 2 shows the distribution of tariffs in 1996 and 2010, respectively, for sectors at the HS2 level. While tariffs are lower in 2010 on average, tariffs are evenly declined across sectors. One of few exceptions is sector 22 (HS2). It is because of Egypt, which has exceptionally high tariff rates, entering the dataset in 2006.

Figure 3 shows the distribution of tariffs in 1996 and 2010, respectively, for several country-pair groupings. Tariffs imposed by industrial countries on each other or developing countries are

[4] Alternatively, we have also used preferential tariffs whenever they are available, otherwise use MFN tariffs. The difference it makes to the tariff variable after averaging over all products is negligible.

[5] "Spirits" is coded 22 under Section IV of the HS 2-digit classification. In Table 7 of this paper, it is grouped under "Prepared Foodstuffs".

relatively small even in 1996 and remain so in 2010. Tariffs imposed by developing countries on each other or industrial countries, on the contrary, are much higher in 1996 and, despite substantial reduction over time, are still substantial in 2010. These figures suggest that it might be important to differentiate country-pairs based on whether the importing or exporting countries are developing or industrial countries.

Table 2 shows the summary statistics of the tariff rates among PTA partner countries one year prior, one year after, and five years after the formation of a PTA. The average tariff rate among PSA members only drops by about one percentage point one year before and after the agreement and by another 2.8 percentage points after five years. The average tariff rate among FTAs drops by a similar amount: 1.5 percentage points and 0.65 percentage points. However, the mean tariff rate hides the fact that tariffs among FTA member countries are much more skewed by the maximum tariff rate in our sample, which is 10 times higher for FTAs than for PSAs. Typically agricultural products attract the highest tariff rates. However, in our dataset, the most prohibitive tariff rate (1,686%) is imposed on alcohol – by a Muslim country, Egypt. The 0.5 quantile (median) and 0.75 quantile figures show that tariff rates on most of the products traded among FTA member countries are much lower than their PSA counterparts, as well as reduce faster as a result of the trade agreement.

The tariff rates among CU member countries, as expected, are lowest amongst the three types of PTAs. The figures show that half of the products traded among the members are effectively not taxed (median tariff = 0.07%) even before the formation of the CUs and at least 75% of the goods traded are not taxed one year afterwards. But the statistics also show that, even though CU members are supposed to impose zero tariffs on each others' exports, exemptions do exist in reality. Notwithstanding, overall the findings confirm that, as far as tariff rates are concerned, CUs are a deeper form of economic integration than FTAs, which in turn are a deeper than PSAs. The remaining question is whether for NTAs the three types of PTAs exhibit the same order of economic integration. We will answer this question in the following empirical section.

4 Results

4.1 Preferential Trade Agreement Effects on Trade

Table 3 shows the first set of OLS and FE regression results. Here we include only the three PTA variables and therefore they capture the effects of both tariff and non-tariff changes from the PTAs. The intensive margin of trade is the dependent variable in the first three columns, and likewise for the extensive margin in the last three columns.

Starting with the intensive margin, column (1) reports the OLS regression results. Standard gravity equation variables including log GDP (lgdp1 & lgdp2), log GDP per capita variables (lgdppc1 & lgdppc2), contiguity (contig), common coloniser (comcol), common legal origin (comleg), and log distance (ldist) are all significant at the 1% level and have the expected signs. Both the quantitative and qualitative results from the OLS regression are comparable with the findings of some previous studies with more controls, e.g. Baier and Bergstrand (2009) and Egger and Pfaffermayr (2003). These findings on the standard gravity variables suggest that there is no evidence of abnormality about our dataset. As regarding the key PTA variables, PSA is significant at the 5% level but of a negative sign, while both FTA and CU are significant at the 1% level and of the expected positive sign. The results suggest that forming a PSA can reduce bilateral trade flows by nearly 10% between member countries, while an FTA and a CU can lift their trade flows by nearly 22%($= exp(0.198) - 1$) and 92%($= exp(0.65 - 1)$), respectively. It should be noted that the effects of the PTA variables on the intensive margin are not equal to their regression coefficients. This is because both variables are dummy variables and their value can change only from zero or one. Because the intensive margin is measured on the logarithmic scale, the trade effect of a PTA variable is equal to the exponential value of its coefficient minus one. However, if the coefficient is small, e.g. less than 0.1, its value will change little by the exponential transformation. The same argument applies to other intensive margin regressions in this paper but, as explained later, not to the extensive margin regressions.

Column (2) incorporates pair (ij), importer-time (it) and exporter-time (jt) FEs. These FEs subsume not only all the observed gravity variables in column (1), but also unobserved ones such as economic uncertainty. Furthermore, the country-time FEs provide a simple mean to account for MRTs at the aggregate level. Withe the three FEs, the PSA variable becomes insignificant. Both FTA and CU remain significant at the 1% level. While the magnitude of the trade effect for FTA has dropped substantially to only 5.5%, that on CU has reduced moderately to about 80%.[6]

Column (3) further incorporate product-time (kt) FEs to account for any unobserved factors at the product-time level such as world prices. However, the results are largely the same as column (2), indicating that, at least for our HS2 data, controlling for product-time heterogeneity does not add much once pair and country-time heterogeneity have been accounted for. The results in column (3) suggest that forming an FTA could raise bilateral trade flows among member countries by about merely 6%, but a CU could increase them by 79%, close to 13 times as big.

Why does the gain from FTA drop so much (from 22% to 6%) once we have controlled for a

[6]In column (2), the FE model is estimated using within transformation. So the R^2 statistics only indicates the extent to which the explanatory variables explain the within variations of the dependent variable. In column (3), the additional kt FEs are included in the estimation using dummy variables, that is why the R^2 is much larger than in column (2).

few FEs? One possible explanation is endogeneity due to reverse causality. Countries that are natural trading partners more likely tend to form PTAs (e.g. see Cheong *et al.* (2015); Magee (2003)) . In other words, those trading partners that have unobserved fundamental factors leading to more benefit from forming an FTA are also more likely to do so. To the extent that standard observable gravity variables in column (1) do not fully capture all the 'fundamental factors' underlying bilateral trade potentials, the FTA variable works as a proxy for the unobserved fundamental factors. Therefore, the results in column (1) overstate the real impact FTA on bilateral trade. As the FEs in column (2) provide a more comprehensive control over those factors, the estimated trade effect of FTA has substantially reduced. The same mechanism can also work for CU although the magnitude of the change in coefficients can be different. Indeed, as for the CU variable, controlling for the same set of FEs only diminishes its coefficient slightly (from 0.65 to 0.58). This finding suggests that the formation of CUs among some of our sample countries tend to be more often than what the member countries' fundamental factors implied. In other words, the decision to form a CU is not that strongly related to unobserved fundamental factors, as compared to FTAs.

Now turn to the extensive margin. It should be aware that here we use a simple, linear probability model and therefore the dependent variable is not expressed in the logarithmic scale anymore. As a result, a coefficient can be interpreted directly as the marginal effect of the corresponding variable on the average probability of products being traded, regardless if the variable is a PTA variable. For instance, according to the OLS regression results in column (4), a 1% increase in the distance between two countries is expected to reduce their chance of trading a product by about 0.08%. Again, all the standard gravity variables have their expected sign if there is one. As for the PTA variables, PSA, FTA, and CU are all significant at the 1% level, but PSA once again has an unexpected negative sign. However, once FEs are included as in columns (5) and (6), PSA becomes insignificant, the FTA variable becomes significant at the 5% level only, while the CU variable remains significant at the 1% level. The inclusion of the kt FEs in column (6) does not change the estimation results at all as compared to column (5). The FE estimation results suggest that forming an FTA is expected to increase the chance of trading a product between member countries by a negligible 0.6%, while the marginal effect of a CU is 1.2%. Although the marginal effect of CUs is twice as big as that of FTAs, it is still very small in absolute terms.

One distinct result from Table 3 is that for both margins of trade and in all model specifications considered, the impact of CUs is larger than that of FTAs, which in turn larger than that of PSAs. Among the three types of PTAs, PSA represents the reduction or elimination of tariffs or NTBs on certain products between member countries. In comparison, FTA is a deeper form of integration because in principle it should involve elimination of tariffs on "substantially all" products among the members. Custom union constitutes an even greater economic integration than FTA as it in-

volves, in addition to zero tariffs among the members, a single customs territory, free movement of services, and sometimes a single market with free movement of labor and capital (e.g. the Single European Act of the EU). In other words, we know as a matter of fact that, the non-tariff changes of CUs entail a bigger cut in trade costs than the non-tariff changes of FTAs. The statistics in Table 2 also demonstrate that it is the case for tariffs. The results in Table 3 are also consistent with these facts.

Another noticeable result from Table 3 is that, the effect of PTAs on the extensive margin is rather small, even for CUs. This finding suggests that the intensive margin is the main channel to reap the gains from trade integration, similar to the finding in Baier *et al.* (2014).

4.2 Effects of Tariff and Non-Tariff Changes

In this section, we separate the effects of tariff and non-tariff changes from PTAs by including a measure of tariffs in the estimations. The results are shown in Table 4. Except for the new tariff variable, $ln(1 + Tariff_{ijkt})$, the specification of each column is the same as its counterpart in Table 3. In this estimation, the tariff variable captures the effects of variable trade costs associated with tariffs, leaving the PTA variables to capture the effects of NTAs.

For the intensive margin, columns (1) to (3) show that the tariff variable is significant at the 1% level across the OLS and two FE estimations, and has the expected negative sign. According to column (3), which has the most comprehensive set of FEs, a 1% increase in import prices due to tariff hikes is expected to reduce bilateral trade flows by about 2.3%. For the three PTA variables, since now they capture only the effects of non-tariff changes, which can have either positive or negative to trade flows, their expected signs are ambiguous. The PSA variable retains its negative sign as before but is not significant in all three estimations. The FTA variable is significant at the 1% in column (1) but the significance level comes down once FEs are included. In column (3), the variable is significant at the 5% level. The CU variable is the only PTA variable that remains significant at the 1% level when we have controlled for FEs.

Comparing with the results in Table 3, once we have accounted for tariff changes and all FEs, the coefficient on the FTA variable has reduced by slightly less than half to 0.035, while that on the CU variable is largely the same at 0.54. These findings seem to suggest that, for FTAs, both tariff and non-tariff changes are important mechanisms of impacting on the intensive margin, while for CUs, non-tariff changes are the main mechanism. However, to compare the effects of tariff and non-tariff changes precisely, we need to make use of the information in Table 2 regarding the average tariff cut under each type of PTAs. Table 2 indicate that, for our dataset, the average tariff rate among FTA member countries fall by 1.1 percentage points one year after the FTA formation as compared to one year before, and that for CU member countries are 3.2 percentage

points. Multiplying these figures with the coefficient on the tariff variable (i.e. 2.34), we reach that, on average, the tariff changes associated with the formation of FTAs and CUs will increase the bilateral trade between their member countries by 3.4% and 7.5%, respectively.[7] In comparison, non-tariff changes under FTAs and CUs are expected to boost trade flows among member countries by about 3.6% and 71%, respectively. These figures confirm that for the intensive margin, the impact of FTAs is derived equally from tariff and non-tariff changes, while that of CUs is derived mostly from non-tariff changes.

As for the extensive margin, the results are largely in line with expectations. Consider the results in column (6), which has the most comprehensive set of FEs, a 1% increase in import prices due to tariff hikes is expected to reduce the chance of two countries trading a product by 0.12% on average. Non-tariff changes from PSAs has not significant impact, statistically or otherwise, on the extensive margin. On the contrary, the coefficient on the FTA and CU variables are significant at the 10% and 1% level, respectively. Again, to compare the effects of tariff and non-tariff changes associated with FTAs and CUs, we make use of the information in Table 2. It can be imputed that, on average, the tariff changes associated with FTAs and CUs are expected to increase the chance of member countries trading a product by 0.18% and 0.39%, respectively. In comparison, non-tariff changes associated with FTAs and CUs are expected to increase the chance of trading a product by about 0.4% and 1%, respectively. Therefore, for FTAs, the effect derived from tariff reduction is about twice as big as that from non-tariff changes, while for CUs, it is about 2.5 times as big.

The finding of non-tariff changes being the dominant driver of CUs' impacts on both intensive and extensive margins is consistent with expectations. This is because, as shown Table 2, countries that are about to form a CU would have already eliminated most of the tariffs among the members before taking the final step of integration. Therefore, for CU member countries, it is the non-tariff changes that matter most.

Another clear finding from this section is that, reflected from the responses of the two trade margins, CUs are found to involve a deeper reduction in NTBs than FTAs, which in turns involve a deeper reduction in NTBs than PSAs. In fact, the findings suggest that the trade impact of PSAs, if any, would come entirely from tariff reduction. Moreover, the non-tariff changes associated with CUs and FTAs are, on average, trade promoting. On the contrary, there is no such evidence for PSAs, as the coefficients on its variable are negative albeit insignificant. It is also worth mentioning that, if a particular type of PTA on average involves a fall (rise) in NTBs, it should increase (decrease) both the intensive and extensive margins, provided that the coefficients are significant at the first place. The results in Table 3 are consistent with this expectation. In fact, as we will see later, the same is true for almost all estimations reported in this paper.

[7] If we use the median tariff rates instead, the trade flow gains will be 2.7% for FTAs and 0.16% for CUs.

4.3 Lag Effects

In the previous section, some PTA variables are found to be insignificant in the presence of FEs. However, firms may take multiple years to respond to tariff and non-tariff changes. Furthermore, some non-tariff arrangements under a PTA phrase in gradually over a number of years after the PTA's launch. Allowing these possibilities but, at the same time, considering the length of the dataset (17 years), in Table 5 we add a three-year lag term for the tariff and PTA variables, respectively. To generate the lag terms, we take the data of every-three-year starting from the year 1998, which gives us five-year data points: 1998, 2001, 2004, 2007 and 2010. That is why the number of observations is only about one-third that in the previous tables. As a result, one should be cautious about comparing the results of Table 5 with others. For brevity, we only report the results for the tariff and PTA variables.

For the intensive margin, consider column (3), which has incorporated the most comprehensive set of FEs. Similar to the findings in Table 4, the contemporaneous terms of tariff, FTA, and CU are significant at the 5% level, but not that of PSA. Similar, only the lag terms of tariff, FTA, and CU are significant, although that of FTA is significant only at 10% level. The coefficient on the contemporaneous term of tariffs is about 2.4 times that on its lag. A 1% decrease in import price due to tariff reduction is expected to boost bilateral trade by 1.7% in the first year of implementation and continue to increase trade by another additional 0.7% three years later. The finding suggests that, although firms and consumers can adjust to tariff changes immediately within a year, some adjustments still take place three years later. In comparison, non-tariff changes of FTAs are expected to increase bilateral trade flows by 4.2% in the first year, and an additional 2.9% three years later. In other words, countries take a longer time to adjust to non-tariff changes associated with FTAs compared to tariff reduction. However, the adjustment to non-tariff changes under a CU takes a longer time still: bilateral trade is expected to increase by 42% in the first year of a new CU, and continue to increase by another 32% three years later. The difference in the relative strength of the lag terms between tariff, FTA, and CU may come from the timing of firms' acknowledgement and accessibility of information. Although firms can easily get access to the complete information on tariffs even before the tariff changes, it may take a longer time for firms to get full information on non-tariff changes and make adequate responses to them. Furthermore, as CUs are a deeper form of integration and therefore may involve a wider range of non-tariff changes, the adjustment is more prolonged. Another possible explanation is that some non-tariff arrangements under CUs take longer time to phrse in than their counterparts under FTAs.

The results of the extensive margin appear to be somewhat incoherent. Given that an increase in the intensive margin requires firms to scale up production while an increase in the extensive margin require firms to export new products, one would expect the latter to be more time consuming than

the former. The results in column (6) suggest that that is true in the case of tariffs. The coefficient on the lag tariff variable is 3.2 times that of its contemporaneous counterpart, as compared to 2.4 times in the case the intensive margin. The results for the PSA variable are also in line with this expectation in that, its contemporaneous term is not significant while that of its lag term is significant at the 10% level. On the contrary, the contemporaneous term of the CU variable is significant at the 1% level while its lag term is not significant at all. For the FTA variable, both the contemporaneous and lag terms are not significant at the standard level. One possible explanation for the unexpected results for CUs is that when a firm export a new product to a market, the product itself is not new, the firm may have sold it in the domestic market or other foreign markets for sometimes. If that is the case, firms can quickly respond to non-tariff changes by exporting a small amount of the new product to test the market and, if proven successful, then to scale up the volume in subsequent years. The expansion in subsequent year is reflected in the results for the intensive margin. Furthermore, as shown in Table 4, the effects of non-tariff changes associated with PTAs on the extensive margin, in general, are weak statistically and economically. As a result, the estimated effects are likely to be more sensitive to different samples. Thereby, one should interpret the extensive margin results with caution.

4.4 Heterogeneity by Development Status

In this section, we explore if the effects of tariff and non-tariff changes differ across various groups of country-pair. We divide countries into developing (DEV) and industrial (IND) following Subramanian and Wei (2007). Negotiation outcomes of NTBs are probably to be affected by the relative bargaining power of the signatories. Being the politically and economically weaker partner, developing countries could be pressured by industrial countries to accept stringent provisions on matters such as intellectual property right, environment and labor standards that are in favor of the latter. Perroni and Whalley (2000) compare concessions made by trading partners in various recent PTAs and show that notably more concessions are made by the smaller partners. The results are reported in Table 6. For instance, in columns (1) and (2), the dependent variable is the imports by industrial countries from industrial countries ("IND from IND"), and so forth. For brevity, we only present the results for the estimations with the four sets of FEs. There are no results for the PSA variable for three groups because their country pairs did not form any PSAs during the sample period.

At first glance, there are a lot of similarity across the results of various pair groups results. First of all, tariff reduction is found to have a positive and statistically significant impact on both trade margins for all groups. Also, non-tariff changes associated with FTAs and CUs, as long as they are statistically significant, are found to have positive impacts on both trade margins for all groups. The magnitudes of corresponding coefficients are mostly of the same scale across all groups.

But there are also differences across groups. The trade among developing countries ("DEV from "DEV") as in columns (3) and (4), stand out from the others. It is the only group where PSAs are formed in our sample, meaning that it is behind all the PSA results in this paper. Consistently with the findings in the previous sections, the PSA variable is not significant. This group is also the only one for which non-tariff changes – with FTAs or CUs – have statistically significant effects on the extensive margin. Furthermore, the "IND from IND" is the only group for which non-tariff changes associated with FTAs have no significant and positive effect on the intensive margin. Indeed, imports by developing countries tend to respond more strongly to non-tariff changes than imports by industrial countries. In particular, non-tariff changes associated with CUs are expected to increase trade flows by developing member countries by 105% (column 5) to 129% (column 3), but to increase trade flows by industrial countries by 31% (column 7) to 38% (column 1) only.

Regarding the hypothesis that developing countries may be disadvantaged in negotiation with industrial countries, we find some evidence to support it. In particular, for the intensive margin estimations, the coefficients on the FTA and CU variables are smaller for the "IND from DEV" subsample than for the "DEV from IND" subsample. This result may indicate that industrial country members are able to gain better access to the markets of their developing country counterparts than the other way round under the trade agreements. However, we should also be cautious that differences in the trade flows outcome between the two groups of countries could attribute to other factors unrelated to negotiation power, such as differences in consumer preferences.

Furthermore, the effect of tariff changes is highest for IND-IND trade for both the intensive and extensive margins, as compared to IND-DEV or DEV-DEV trade. At the same time, as shown in Figure 3, the average tariff rate is lowest for IND-IND trade. That is, there seems to be an inverse relationship between the average tariff rate and the effect of tariff changes.[8] One possible explanation is the following. In industrial countries, where the average tariff is lower and most products are not protected by tariffs as compared to developing countries. The remaining protected industries are typically the most vulnerable ones such as the agricultural sector, and they are particularly sensitive to trade liberalisation in the form of tariff reduction.

Overall, there is some evidence of heterogeneity across various pair groups, but the degree of heterogeneity is limited for our sample.

4.5 Sectoral Heterogeneity

Although we use HS2 level data for our analysis, the results presented thus far are average over all products and therefore silent on any potential heterogeneity across sectors. In principal, we

[8] We are thankful to the reviewer for pointing out this pattern in the findings to us.

can estimate the effects of tariff and non-tariff changes for each of the 99 HS2 sectors (known as 'chapters'). However, it is burdensome to comprehend the results for all 99 chapters. Thereby, we aggregate the 99 chapters in 11 groups as defined in Table 7, and then do group-by-group estimations.

The estimation results for the intensive margin for each of these 11 groups are presented in Table 8. In all estimations, we have controlled for ij, it, jt and kt FEs.[9] We can control for kt FEs because the group estimations are still conducted using HS2 level data. The corresponding results for all groups combined are already reported in column (3) of Table 4. For the ease of comparison, we repeat the results for all groups in Table 8. It can be seen that there is huge heterogeneity across groups. The tariff variable is significant and of a negative sign for G3, G4, G6, G8, G10 and G11, and the coefficients for the tariff variable range from -1.59 (G6) to -6.4 (G8), compared to -2.78 for the average effect for all groups combined. The variable is also significant at the 10% level for G2, but has an unexpected positive sign; the group covers "prepared foodstuffs". As for the PSA variable, it is only significant for G2 and G11. Its coefficient is negative for G2, and the opposite is true for G11. The FTA variable is significant only for G6 at the 10% level and G10 at the 1% level. However, the coefficients on the variable are negative in both cases, implying a rise of NTBs. Regarding the CU variable, it is significant for all groups except for G9 and G11, and only G10 registers a negative coefficient. It can be noticed that the coefficients on the PTA variables are sizable for many groups, implying that non-tariff changes can have an economically large impact on trade flows between member countries for those groups. For instance, PSAs are expected to increase trade flows for G11 by 366%; and CUs are expected to have a similar level of impact for G2 (344%), G5 (340%), G6 (443%) and G10 (-313%), and an even higher level of impact for G3 (1195%).

The estimations results for the extensive margin are reported in Table 9. Once again, there is large heterogeneity across the groups. The tariff variable is significant and of a negative sign for G5, 6 and 8 only. It is also significant for G2, but its sign is unexpectedly positive like the case of the intensive margin.

The PSA variable is not significant at the standard levels for any group. The FTA variable is significant only for G5 at the 10% level and G8 and 10 at the 1% level. The coefficients on the variable are negative in all three cases and their magnitudes are comparable to that for all group combined. As for the CU variable, it is significant for all groups except for G9 and G11, and among them only G8 and G10 register a negative coefficient. Regarding the magnitude, G2, G4 and G6 are of the largest coefficients in absolute terms. In particular, the formation of a CU is

[9]The only exception of G8, which does not include kt FEs. G8 has only two HS2 sectors and thus the inclusion of kt FE will wipeout all the variables of interest.

expected to increase the chance of trading "chemical products, plastic, rubber" products (G4) by 20%, "prepared foodstuffs" (G2) by 16%, and "textile and footwears" (G6) by 17%.

It is worth mentioning that, the results for Tables 8 and 9 are fairly consistently with each other. As long as a variable is significant at the standard level, it has the same sign for both trade margins for the same group. For instance, the FTA variable is significant at the 1% level for G10 in both tables, implying that, on average, FTAs involve a rise of NTBs for this group. The only case of inconsistency is the results for the CU variable, which is significant in both tables but of the opposite signs.

Overall, we observe vast differences in sectoral responses to trade liberalization. What drives the differences between those responses could be of interests to both policymakers and industry stakeholders and therefore an important research question for the future.

5 Conclusion

The GATT allows countries to provide a preferential treatment to a specific trading partner in the form of a CU or an FTA, provided that all tariffs are eliminated on all trade between the member countries within a reasonable time frame. A quintessential feature of PTAs is tariff reduction between member countries abiding by the GATT. However, countries often pursue further economic integration through agreements on non-tariff matters. NTAs can either complement tariffs cut to intensify trade liberalization or substitute tariff cuts to abate it. The relative effects of tariff and non-tariff changes under PTAs on bilateral trade have hitherto not been studied much, probably due to the limitation on bilateral tariff data. This paper aims to fill this gap by disentangling the effects of tariff and non-tariff changes under PTAs, using a new dataset on bilateral tariff rates. The dataset covers HS 2-digit level products for 90 importing and 149 exporting countries between 1996 and 2010. The dataset incorporates both MFN and preferential tariffs.

Our results show that PTAs, in general, increase both the extensive margin (measured in the probability of trading a product) and the intensive margin (measured in percentage changes of trade flows) between member countries, and both tariff and non-tariff changes contribute to such increases. The finding indicates that that countries' liberalization through PTAs is beyond what the GATT initially aimed to accomplish through tariff eliminations. The finding also implies that, on average, non-tariff changes under PTAs do not lead to higher NTBs. We also find that the impact of non-tariff changes, as expected, increases with the level of trade integration. For our dataset, non-tariff changes of PSAs do not have any discernible effects on trade margins, the impact of non-tariff changes under FTAs is statistical discernible but economically modest, and that of CUs is the only one that is significant in both statistical and economic terms. The trade impact of FTAs

is derived from both tariff and non-tariff changes. On the contrary, the trade effects of CUs steam mostly from non-tariff changes, because their member countries have eliminated most if not all tariffs within the club prior to the formation of a CU. Furthermore, we find the intensive margin responds to tariff changes faster than non-tariff changes under FTAs, which in turns faster than non-tariff changes under CUs. We obtain some tentative evidence to support the argument that, in PTA negotiations between industrial and developing countries, the former tend to be a more powerful position and come out with a better deal than the latter. We also find large heterogeneity across sectors.

Our results are largely in line with Baier *et al.* (2014), who show that PTAs have significant, positive effects on trade flows and both trade margins. Of course, one should be cautious about comparing our results with others' because of large differences of the samples, especially regarding time and countries coverage. In particular, our sample is restricted to WTO member countries while others' typically consist of both WTO member and non-member countries. As shown in Handley (2012), WTO memberships can help reduce uncertainty in international trading environment faced by member countries, and this may affect the response of a country toward further trade liberalization changes.

References

ANDERSON, J. E. and VAN WINCOOP, E. (2003). Gravity with Gravitas: A Solution to the Border Puzzle. *American Economic Review*, **93** (1), 170–192.

ANGRIST, D. and PISCHKE, J.-S. (2009). Mostly harmless econometrics princeton. *Princeton University*.

ARKOLAKIS, C., COSTINOT, A. and RODRIGUEZ-CLARE, A. (2012). New Trade Models, Same Old Gains? *American Economic Review*, **102** (1), 94–130.

BACCHETTA, M. and BEVERELLI, C. (2012). Non-tariff measures and the wto.

BAGWELL, K. and STAIGER, R. W. (2002). *The Economics of the World Trading System*. Cambridge, MA and London, UK: MIT Press.

BAIER, S. L. and BERGSTRAND, J. H. (2007). Do free trade agreements actually increase members' international trade? *Journal of International Economics*, **71** (1), 72–95.

— and — (2009). Estimating the effects of free trade agreements on international trade flows using matching econometrics. *Journal of International Economics*, **77** (1), 63–76.

—, — and FENG, M. (2014). Economic integration agreements and the margins of international trade. *Journal of International Economics*, **93** (2), 339–350.

BERGSTEN, F. (1997). American politics, global trade. *Economist*, pp. 23–26.

BERNARD, A., JENSEN, J. B., REDDING, S. J. and SCHOTT, P. K. (2009). The margins of us trade. *American Economic Review*, **99** (2), 487–493.

BRODA, C. and WEINSTEIN, D. E. (2006). Globalization and the Gains from Variety. *TheQuarterly Journal of Economics*, **121** (2), 541–585.

CHANEY, T. (2008). Distorted Gravity: The Intensive and Extensive Margins of International Trade. *American Economic Review*, **98** (4), 1707–1721.

CHEONG, J., KWAK, D. W. and TANG, K. K. (2015). Heterogeneous effects of preferential trade agreements: How does partner similarity matter? *World Development*, **66**, 222–236.

DUTT, P., MIHOV, I. and VAN ZANDT, T. (2013). The effect of WTO on the extensive and the intensive margins of trade. *Journal of International Economics forthcoming*, **91** (2), 204–219.

EATON, J. and KORTUM, S. (2002). Technology, geography, and trade. *Econometrica*, **70** (5), 1441–1479.

EGGER, P. and PFAFFERMAYR, M. (2003). The proper panel econometric specification of the gravity equation: A three-way model with bilateral interaction effects. *Empirical Economics*, **28** (3), 571–580.

EICHER, T. S., HENN, C. and PAPAGEORGIOU, C. (2012). Trade creation and diversion revisited: Accounting for model uncertainty and natural trading partner effects. *Journal of Applied Econometrics*, **27** (June 2010), 296–321.

FOSTER, N., POESCHL, J. and STEHRER, R. (2011). The impact of Preferential Trade Agreements on the margins of international trade. *Economic Systems*, **35** (1), 84–97.

GHOSH, S. and YAMARIK, S. (2004). Are regional trading arrangements trade creating? An application of extreme bounds analysis. *Journal of International Economics*, **63** (2), 369–395.

HANDLEY, K. (2012). *Exporting under trade policy uncertainty: theory and evidence*. Tech. rep., Standford University.

KEHOE, T. J. and RUHL, K. J. (2013). American Economic Review. *Journal of Political Economy*, **121** (2), 358–392.

LIMAO, N. and TOVAR, P. (2011). Policy choice: Theory and evidence from commitment via international trade agreements. *Journal of International Economics*, **85** (2), 186–205.

MAGEE, C. S. (2003). Endogenous preferential trade agreements: an empirical analysis. *Contributions to Economic Analysis and Policy*, **21** (2), Article 15.

MAGEE, C. S. P. (2008). New measures of trade creation and trade diversion. *Journal of International Economics*, **75** (2), 349–362.

MELITZ, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, **71** (6), 1695–1725.

NEYMAN, J. and SCOTT, E. L. (1948). Consistent estimates based on partially consistent observations. *Econometrica: Journal of the Econometric Society*, pp. 1–32.

PERRONI, C. and WHALLEY, J. (2000). The new regionalism: trade liberalization or insurance? *Canadian Journal of Economics*, **33** (1), 1–24.

RAY, E. J. (1981). The determinants of tariff and nontariff trade restrictions in the united states. *Journal of Political Economy*, **89** (1), 105–121.

SUBRAMANIAN, A. and WEI, S. J. (2007). The WTO promotes trade, strongly but unevenly. *Journal of International Economics*, **72** (3), 151–175.

TREFLER, D. (2004). The long and short of the canada-u. s. free trade agreement. *American Economic Review*, **94** (4), 870–895.

WOOLDRIDGE, M. (2002). *Economietric analysis of cross section and panel data*. Cambridge, MA, US: MIT Press.

WTO (2012). *World trade report-trade and public policies: a closer look at non-tariff measures in the 21st century*. Tech. rep., World Trade Organzsation, Geneva, Switzerland.

Figure 1: Tariff (Simple Average)

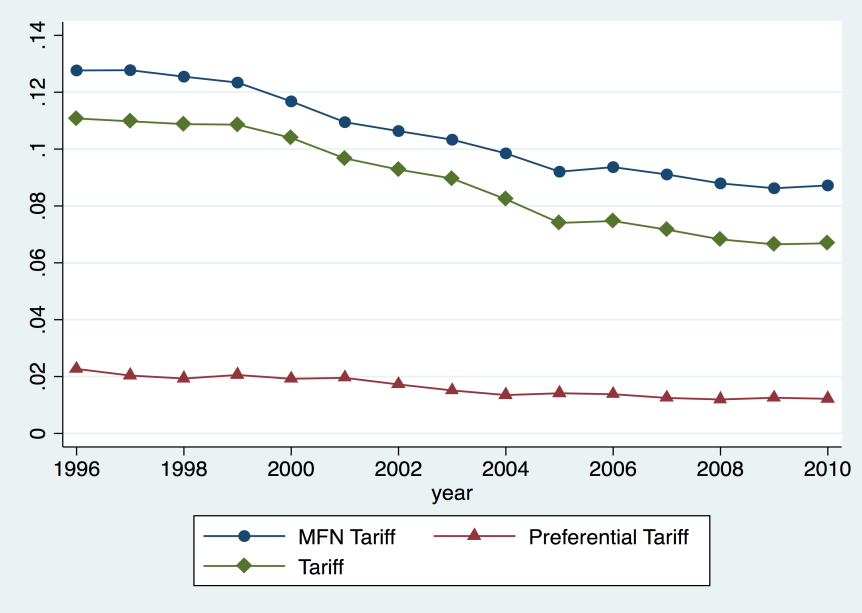
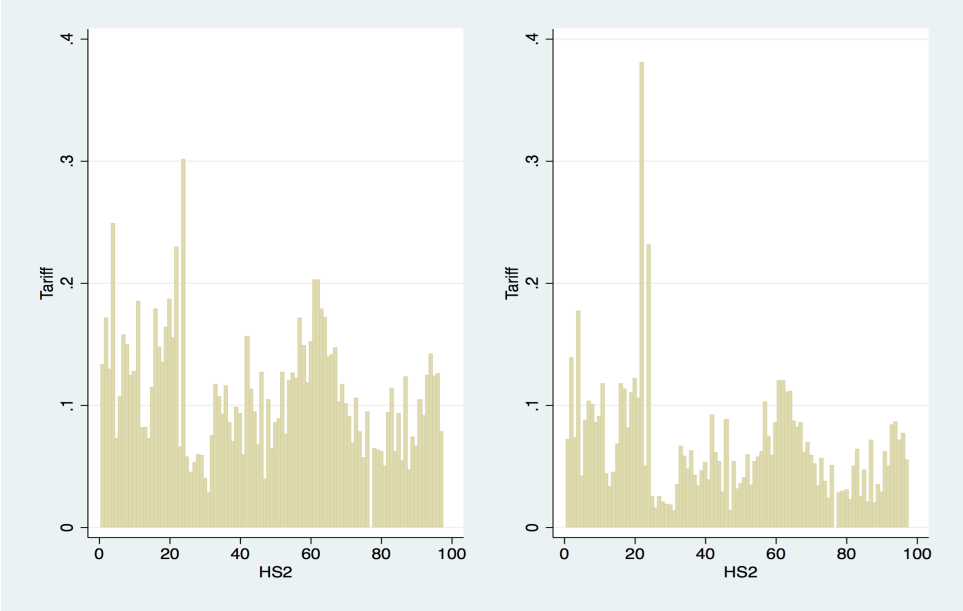
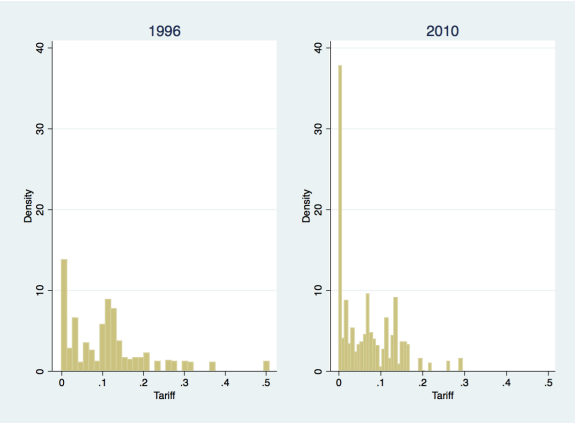


Figure 2: Tariff across sectors: Year 1996 and Year 2010

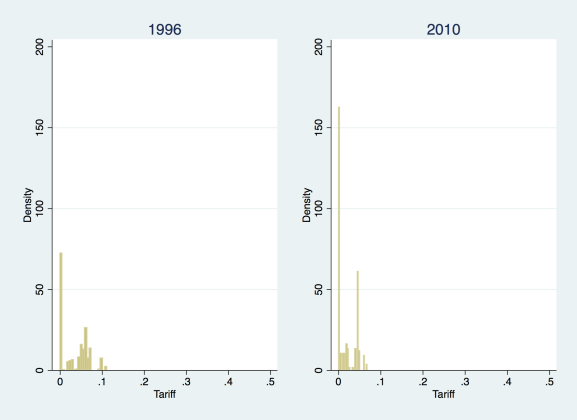


*Note: The higher tariff level on HS2 sector 22 in 2010 is due to the new entry of Egypt in year 2006 into our dataset , where its tariff level on sector 22 (e.g. spirits) is 1, 686% .

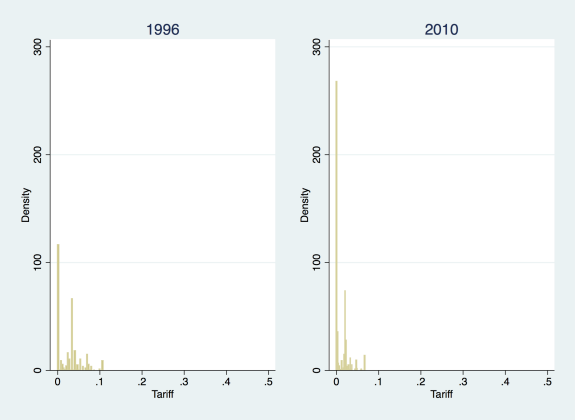
Figure 3: Distribution of Tariff: Year 1996 and Year 2010



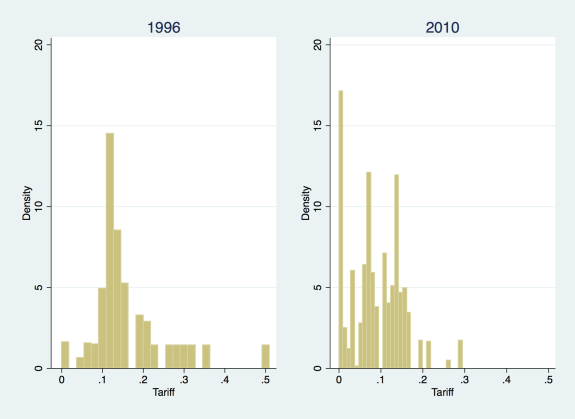
(a) All samples



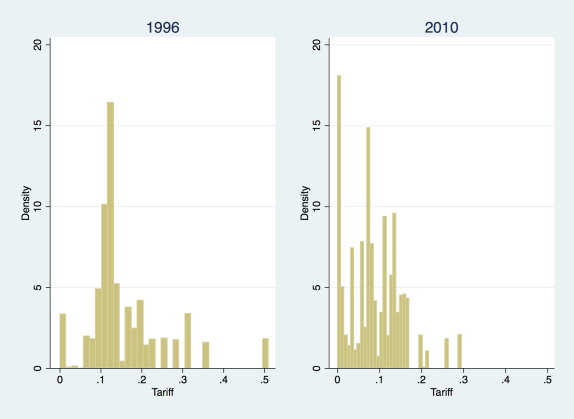
(b) Industrial against Industrial



(c) Industrial against Developing



(d) Developing against Industrial



(e) Developing against Developing

Table 1: Summary Statistics

Variable	Median	Mean	Std.Dev	Min	Max
Log Trade Flows	4.89	4.85	3.64	-6.91	18.54
Extensive Margin	0.00	0.29	0.46	0	1
Tariff (HS2)	0.05	0.09	0.17	0.00	16.86
MFN Tariff (HS2)	0.07	0.10	0.18	0.00	16.86
FTA Tariff (HS2)	0.00	0.02	0.05	0.00	6.75
PSA	0.00	0.08	0.28	0	1
FTA	0.00	0.08	0.28	0	1
CU	0.00	0.05	0.22	0	1

Table 2: Tariff Rate (%) Among Trade Agreements Partner Countries

	# obs.	Mean	S.D.	Min	0.25 quantile	0.5 quantile	0.75 quantile	Max
PSA(-1)	1056	17.54	13.22	0.00	8.73	13.62	24.16	165.62
PSA(+1)	1056	16.44	15.16	0.00	8.00	12.16	21.36	220.27
PSA(+5)	768	13.60	14.44	0.00	7.10	10.85	16.48	210.50
FTA(-1)	132,682	7.07	17.45	0.00	0.00	1.34	9.36	1686.36
FTA(+1)	128,265	5.60	16.72	0.00	0.00	0.17	6.05	1685.50
FTA(+5)	61,048	4.95	13.30	0.00	0.00	0.11	3.44	418.06
CU(-1)	51,552	3.65	8.94	0.00	0.00	0.07	4.00	169.33
CU(+1)	51,552	0.43	2.02	0.00	0.00	0.00	0.00	83.96
CU(+5)	41,184	0.10	1.13	0.00	0.00	0.00	0.00	83.96

Note: (-1), (+1), and (+5) denote one year before, one year after, and five years after the formation of a PTA. The number of observations for FTA(+1) is smaller than that for FTA(-1) because there are some FTAs formed in the last sample year, 2010, for which there are no observations for FTA(+1) and FTA(+5).

Table 3: Preferential Trade Agreement Effects

	Intensive margin			Extensive margin		
	(1)	(2)	(3)	(4)	(5)	(6)
PSA	-0.097**	-0.053	-0.054	-0.044***	-0.011	-0.011
	(0.047)	(0.04)	(0.042)	(0.006)	(0.012)	(0.012)
FTA	0.198***	0.054***	0.060***	0.094***	0.006**	0.006**
	(0.039)	(0.016)	(0.016)	(0.005)	(0.002)	(0.002)
CU	0.650***	0.585***	0.582***	0.140***	0.012***	0.012***
	(0.046)	(0.028)	(0.028)	(0.007)	(0.004)	(0.004)
lgdp1	0.683***			0.047***		
	(0.009)			(0.001)		
lgdp2	0.817***			0.100***		
	(0.008)			(0.001)		
lgdppc1	0.127***			0.020***		
	(0.015)			(0.001)		
lgdppc2	0.116***			0.019***		
	(0.013)			(0.001)		
contig	0.889***			0.101***		
	(0.076)			(0.014)		
comcol	0.540***			0.038***		
	(0.075)			(0.006)		
comleg	0.376***			0.026***		
	(0.03)			(0.003)		
ldist	-0.772***			-0.077***		
	-0.019			(0.002)		
Constant	-9.713***			-1.027***		
	-0.265			(0.027)		
Fixed effects	None	ij, it, jt	ij, it, jt, kt	None	ij, it, jt	ij, it, jt, kt
N	4,524,919	4,524,919	4,524,919	15,349,068	15,349,068	15,349,068
R-sq	0.297	0.015	0.231	0.358	0.038	0.153

Note: *, **, *** significant at the 10, 5, and 1 percent level, respectively; robust standard errors clustered by country-pair.

Table 4: Effects of Tariff and Non-tariff Changes

	Intensive margin			Extensive margin		
	(1)	(2)	(3)	(4)	(5)	(6)
Tariff	-1.731***	-2.602***	-2.340***	-0.107***	-0.029***	-0.122***
	(0.098)	(0.088)	(0.089)	(0.008)	(0.004)	(0.004)
PSA	-0.048	-0.032	-0.036	-0.042***	-0.010	-0.009
	(0.047)	(0.039)	(0.041)	(0.006)	(0.012)	(0.012)
FTA	0.165***	0.026*	0.035**	0.092***	0.005**	0.004*
	(0.038)	(0.016)	(0.015)	(0.005)	(0.002)	(0.002)
CU	0.565***	0.535***	0.535***	0.134***	0.012***	0.010***
	(0.046)	(0.028)	(0.028)	(0.007)	(0.004)	(0.004)
lgdp1	0.685***			0.047***		
	(0.009)			(0.001)		
lgdp2	0.820***			0.100***		
	(0.008)			(0.001)		
lgdppc1	0.062***			0.016***		
	(0.015)			(0.001)		
lgdppc2	0.126***			0.019***		
	(0.013)			(0.001)		
contig	0.867***			0.098***		
	(0.076)			(0.014)		
comcol	0.567***			0.040***		
	(0.075)			(0.006)		
comleg	0.372***			0.026***		
	(0.030)			(0.003)		
ldist	-0.770***			-0.077***		
	(0.019)			(0.002)		
Constant	-9.167***			-0.986***		
	(0.264)			(0.028)		
Fixed effects	None	ij,it,jt	ij,it,jt,kt	None	ij,it,jt	ij,it,jt,kt
N	4,524,919	4,524,919	4,524,919	15,349,068	15,349,068	15,349,068
R-sq	0.299	0.018	0.233	0.359	0.038	0.154

Note: * significant at the 10 percent level; **significant at the 1 percent level; robust standard errors clustered by country-pair.

Table 5: Lagged Effects

	Intensive margin			Extensive margin		
	(1)	(2)	(3)	(4)	(5)	(6)
Tariff	-2.314***	-2.272***	-1.720***	-0.046***	-0.084***	-0.100***
	(0.158)	(0.124)	(0.117)	(0.015)	(0.007)	(0.006)
lag_Tariff	0.231	-0.552***	-0.723***	-0.034**	0.060***	-0.031***
	(0.144)	(0.103)	(0.103)	(0.016)	(0.006)	(0.006)
PSA	0.174	-0.059	-0.037	-0.023	0.006	0.007
	(0.148)	(0.056)	(0.056)	(0.024)	(0.015)	(0.015)
lag_PSA	-0.195	-0.036	-0.053	-0.020	-0.028*	-0.028*
	(0.146)	(0.052)	(0.053)	(0.024)	(0.014)	(0.014)
FTA	0.227***	0.032	0.041**	0.060***	0.002	0.002
	(0.039)	(0.021)	(0.020)	(0.005)	(0.003)	(0.003)
lag_FTA	0.032	0.029	0.029*	0.050***	-0.001	-0.002
	(0.041)	(0.018)	(0.017)	(0.006)	(0.003)	(0.003)
CU	0.485***	0.346***	0.352***	0.142***	0.014***	0.014***
	(0.050)	(0.044)	(0.043)	(0.008)	(0.005)	(0.005)
lag_CU	0.206***	0.293***	0.281***	0.005	-0.000	-0.002
	(0.049)	(0.030)	(0.030)	(0.007)	(0.004)	(0.004)
Fixed effects	None	ij, it, jt	ij, it, jt, kt	None	ij, it, jt	ij, it, jt, kt
N	1,272,135	1,272,135	1,272,135	4,020,295	4,020,295	4,020,295
R-sq	0.315	0.013	0.234	0.367	0.016	0.147

Note: *, **, *** significant at the 10, 5, and 1 percent level, respectively; robust standard errors clustered by country-pair.

Table 6: Heterogeneity by Development Status

	IND from IND		DEV from DEV		DEV from IND		IND from DEV	
	Intensive	Extensive	Intensive	Extensive	Intensive	Extensive	Intensive	Extensive
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tariff	-2.412***	-0.121***	-1.784***	-0.083***	-2.044***	-0.130***	-2.184***	-0.056***
	(0.267)	(0.025)	(0.121)	(0.005)	(0.156)	(0.013)	(0.288)	(0.013)
PSA			0.030	0.005				
			(0.051)	(0.013)				
FTA	-0.010	0.004	0.077**	0.015***	0.095***	-0.008	0.072***	0.002
	(0.054)	(0.012)	(0.035)	(0.004)	(0.027)	(0.006)	(0.026)	(0.003)
CU	0.324***	-0.003	0.827***	0.030***	0.717***	-0.017	0.267***	-0.002
	(0.109)	(0.015)	(0.058)	(0.008)	(0.060)	(0.011)	(0.052)	(0.008)
N	646,536	801,404	1,591,991	8,674,767	1,064,529	1,888,761	1,221,863	3,984,136
R-sq	0.467	0.262	0.201	0.136	0.409	0.289	0.200	0.170

Note: *, **, *** significant at the 10, 5, and 1 percent level, respectively; robust standard errors clustered by country-pair . All estimations include and FEs.

Table 7: HS Classification by Section

Group	HS Sections	HS2 Codes	Simple Descriptions
1	Sections I, II and III	01-15	Live Animals, Vegetable Products
2	Section IV	16-24	Prepared Foodstuffs
3	Section V	25-27	Mineral Products
4	Sections VI, VII	28-40	Chemical Products, Plastic, Rubber
5	Sections VIII, IX, X	41-49	Skins, Leather, Wood
6	Section XI	50-67	Textile and Footwear
7	Sections XIII, XIV, XV	68-83	Plaster, Glass, Base Metals
8	Section XVI	84-85	Machinery, Appliances
9	Section XVII	86-89	Vehicles
10	Section XVIII	90-92	Optical, Watches
11	Section XX	94-96	Furniture, Toys

Table 8: Intensive Margin Estimations by Sector

	All	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11
Tariff	-2.340***	-0.649	1.988*	-3.580**	-2.168**	0.794	-1.586***	-1.424	-6.403***	1.362	-3.748**	-2.852*
	(0.089)	(0.808)	(1.165)	(1.644)	(0.877)	(0.743)	(0.292)	(0.964)	(0.364)	(1.169)	(1.558)	(1.517)
PSA	-0.036	0.268	-0.978***	-0.245	-0.365	0.219	-0.401	0.452	0.082	0.179	-0.379	1.539***
	(0.041)	(0.305)	(0.373)	(0.540)	(0.263)	(0.321)	(0.258)	(0.376)	(0.102)	(0.579)	(0.488)	(0.481)
FTA	0.035**	-0.137	-0.094	0.154	-0.115	0.043	-0.217*	-0.168	0.044	-0.093	-0.545***	0.075
	(0.015)	(0.103)	(0.187)	(0.307)	(0.104)	(0.150)	(0.112)	(0.110)	(0.032)	(0.172)	(0.203)	(0.120)
CU	0.535***	0.490***	1.490***	2.561***	0.740***	1.481***	1.489***	0.468**	0.127**	-0.150	-1.418***	0.637
	(0.028)	(0.185)	(0.292)	(0.605)	(0.167)	(0.315)	(0.191)	(0.202)	(0.057)	(0.351)	(0.473)	(0.549)
N	4,524,919	30,433	12,331	5,837	36,454	26,441	42,094	35,573	195,936	11,799	6,840	8,082
R-sq	0.233	0.199	0.266	0.209	0.386	0.456	0.316	0.333	0.142	0.146	0.482	0.160

Note: *, **, *** significant at the 10, 5, and 1 percent level, respectively; robust standard errors clustered by country-pair. All estimations include and FEs, the only exception is G8, those estimation include , and FEs only, because the group has only two HS2 sectors and so the inclusion of FEs will wipeout all the variables of interests.

Table 9: Extensive Margin Estimations by Sector

	All	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11
Tariff	-0.122***	-0.051	0.236***	-0.231	0.038	-0.116**	-0.092***	0.028	-0.188***	-0.119	-0.099	-0.134
	(0.004)	(0.066)	(0.064)	(0.203)	(0.054)	(0.053)	(0.014)	(0.052)	(0.032)	(0.117)	(0.109)	(0.111)
PSA	-0.009	-0.006	0.089	0.061	0.026	0.049	-0.025	-0.016	-0.016	-0.008	-0.070	0.364
	(0.012)	(0.028)	(0.066)	(0.057)	(0.036)	(0.046)	(0.031)	(0.030)	(0.017)	(0.066)	(0.061)	(0.244)
FTA	0.004*	0.009	0.004	-0.024	-0.004	-0.021*	0.013	-0.006	-0.033***	-0.014	-0.070***	-0.007
	(0.002)	(0.007)	(0.011)	(0.025)	(0.009)	(0.012)	(0.008)	(0.008)	(0.005)	(0.010)	(0.016)	(0.024)
CU	0.010***	-0.016	0.163***	0.105**	0.204***	0.067***	0.167***	0.086***	-0.105***	0.018	-0.101***	-0.021
	(0.004)	(0.013)	(0.022)	(0.045)	(0.017)	(0.024)	(0.015)	(0.015)	(0.010)	(0.044)	(0.035)	(0.034)
N	15,349,068	160,039	85,632	36,864	135,351	93,451	191,010	171,555	320,148	49,726	27,014	29,010
R-sq	0.154	0.078	0.067	0.053	0.222	0.273	0.120	0.123	0.184	0.062	0.163	0.040

Note: *, **, *** significant at the 10, 5, and 1 percent level, respectively; robust standard errors clustered by country-pair. All estimations include and FEs, the only exception is G8, those estimation include , and FEs only, because the group has only two HS2 sectors and so the inclusion of FEs will wipeout all the variables of interests.

Appendix

Table 10: Countries in the sample

Argentina	Armenia	Australia	Austria	Bangladesh
Belgium	Bolivia	Brazil	Bulgaria	Cameroon
Canada	Chile	China	Colombia	Costa Rica
Croatia	Cuba	Czech Republic	Denmark	Dominican Republic
Ecuador	Egypt Arab Rep.	El Salvador	Estonia	Fiji
Finland	France	Germany	Greece	Guatemala
Honduras	Hungary	Iceland	India	Indonesia
Ireland	Israel	Italy	Jamaica	Japan
Jordan	Kenya	Korea Rep.	Kuwait	Latvia
Lithuania	Luxembourg	Macedonia FYR	Malaysia	Maldives
Malta	Mauritius	Mexico	Morocco	Namibia
Netherlands	New Zealand	Nicaragua	Niger	Norway
Oman	Pakistan	Peru	Philippines	Poland
Portugal	Qatar	Romania	Saudi Arabia	Senegal
Singapore	Slovak Republic	Slovenia	South Africa	Spain
Sri Lanka	Sweden	Switzerland	Thailand	Trinidad and Tobago
Tunisia	Turkey	Uganda	Ukraine	United Arab Emirates
United Kingdom	United States	Uruguay	Venezuela	Zambia
Albania	Angola	Antigua and Barbuda	Bahrain	Barbados
Belize	Benin	Botswana	Brunei	Burkina Faso
Burundi	Cambodia	Cape Verde	CAR	Chad
Congo Dem.	Congo Rep.	Cote d'Ivoire	Cyprus	Djibouti
Dominica	Gabon	Gambia	Georgia	Ghana
Grenada	Guinea	Guinea-Bissau	Guyana	Haiti
Hong Kong	Kyrgyz Republic	Lesotho	Macao	Malawi
Mali	Mauritania	Moldova	Mongolia	Mozambique
Myanmar	Nepal	Nigeria	Panama	Papua New Guinea
Paraguay	Rwanda	Sierra Leone	Solomon Islands	St. Kitts and Nevis
St. Lucia	St. Vincent and the Grenadines	Suriname	Swaziland	Tanzania
Togo	Tonga	Vietnam	Zimbabwe	

*Notes: CAR is Central African Republic. 90 countries in the upper panel are included as both importing and exporting countries. 59 countries in the lower panel are included as exporting countries only.