

The Trade Effects of Preferential Trade Agreements: Extensive and Intensive Margins

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Research Question: Trade liberalization and its effects

- ▶ One of the main policy sources of trade-cost changes is the formation of an economic integration agreement (EIA) – WTO, PTA, CU
- ▶ Numerous studies exist to study the impact of these policies on an importing country's welfare
- ▶ Gravity model has been used widely to measure the impact of these policies on bilateral trade flows

Research Question: The EIA's effect on the intensive and the extensive margins

- ▶ Until very recently, positive estimates for the effect of EIA were **interpreted** as increasing in the intensive margin (Krugman models) (i.e. EIA increasing trade flows of existing homogeneous firms). Among EIAs, we focus on PTA in this paper.
- ▶ Consideration of zeros in bilateral trade, fixed export costs, and firm heterogeneity have led researchers to examine **extensive** margin of trade.
- ▶ We focus on the **product** margin of trade. Hummels and Klenow (2005) introduced this notion by examining zeros in bilateral trade flows at highly disaggregated product-category levels.

Previous studies - Empirical studies

- ▶ Previous literature on studying the effects of PTA: focus on the impact on trade volumes.
 - ▶ Trefler [1993], Lee and Swagel [1997], Baier and Bergstrand [2007, 2009], Eicher et al. [2012], Magee [2003, 2008], Foster et al. [2011], Anderson and Yotov [2011]
 - ▶ Positive effects on trade flows are reported.
 - ▶ Recently large positive effects on trade flows are reported after controlling for **endogeneity** due to self-selection.

Previous studies - Theoretical studies

- ▶ Recent theoretical literature: emphasize the role of the firm heterogeneity
 - ▶ Trade liberalization may affect both intensive margins (trade in products already traded between a country-pair) and extensive margins (new trade in products not previously traded between a country-pair). (Bernard et al. [2003], Melitz [2003], Chaney [2008], and among others).
 - ▶ The impact on these margins would be **different** depending on whether the effects of EIA come from the reduction of the fixed or variable costs of trade (Eaton and Kortum [2002], Melitz [2003], Bernard et al. [2003], Chaney [2008]).

Theoretical prediction: Main contribution of this paper is quantify the impacts on these two distinct margins according to two distinct sources of trade-costs changes.

- ▶ A reduction in either fixed or variable costs leads to more entry into an export market and thus increases the **extensive** margins.
- ▶ A reduction in fixed cost leads to decrease in the **intensive** margins.
- ▶ A reduction in variable costs has **uncertain** effects on the **intensive** margins.

- ▶ A reduction in fixed cost has uncertain effects since the increase in entrant firms which leads to a dilution of the market shares of the incumbent firms. The average exports per firm is brought down even further as the entrants are less productive.
 - ▶ When productivities and hence revenues follow a Pareto distribution (of productivities – Chaney [2008], Helpman et al. [2008]), as incumbent firms see their revenues rise but entrant firms are with lower productivity and lower revenues, the average sales does not change. Lawless [2010] shows that the intensive margin is unaffected by a changes in fixed costs.

Contribution of this empirical study

- ▶ Decomposition of the impacts on trade flows into two components: **intensive margins** and **extensive margins**.
 - ▶ Various measures for intensive and extensive margins are proposed. We focus on three measures in the literature.
- ▶ Decomposition of the sources of trade-cost changes into two components: **tariffs** and **PTA dummy variable**.
 - ▶ The changes in tariffs are proxy for the change in variable trade-cost.
 - ▶ The change in non-tariffs factors captured by PTA dummy variable is a proxy for the change in fixed trade-cost.

Contribution of this empirical study

- ▶ Decomposing the sources of trade-costs change can be important since GATT/WTO reduce tariffs substantially already while tariffs reduction might be moderate through PTAs.
 - ▶ The main GATT rounds reduced worldwide tariffs around 11 percentage points on manufacturing goods. Yi [2003]'s calculations show that such tariff reductions are too moderate to explain the large increases in trade.
 - ▶ Yi [2003] shows that the standard models cannot explain the growth of trade without assuming large elasticities of substitution between goods. Tariff declines are much larger prior to the mid 1980s than after, and yet, trade growth was smaller in the earlier period than in the later period. Other channels of trade-costs changes can be more important especially for PTAs.

Measure construction: the intensive and the extensive margins

- ▶ Conventional (unweighted measure): the average volume per product (intensive), the number of products (extensive)
- ▶ Hummels and Klenow (2005)(HK hereafter): Foster, Poeschl, and Stehrer (2011), Baier, Bergstrand, and Feng (2013); our benchmark
- ▶ Feenstra et al. (2005): Dutt et al.(2013)
- ▶ An unweighted average, which would be simply the fraction of all products exported from country j to i . However, HK, as well as researchers since then, use the weighted average. A weighted average seems more appropriate since cars and pencils do not have the same values in trade.

HK measure

- ▶ The extensive margin is referred to as growth in trade in newly traded goods whereas the intensive margin is growth in trade of already traded goods.
- ▶ In empirical studies, these margins are not defined as growth terms but rather as snapshots: the extensive margin being the number of goods traded and hence capturing trade goods variety, whereas the intensive margin is the average exports per product.
- ▶ In our benchmark specification, we use (export volume) weighted measures in Hummels and Klenow [2005] for which microfoundations for the construction of these indices are provided by Feenstra [1994] and Feenstra and Kee [2004].

The extensive margin of exports

- ▶ The extensive margin of exports from county j to county i at year t is: $EM_{ijt} = \frac{\sum_{p \in \mathbf{P}_{ijt}} T_{iWt}(p)}{\sum_{p \in \mathbf{P}_{iWt}} T_{iWt}(p)}$ where p is product index; $\mathbf{P}_{ijt}$ is a set of products that county j exports to county i at time t ; $\mathbf{P}_{iWt}$ is a set of products that all counties in the World W exports to county i at year t ; $T_{iWt}(p)$ is export flows for a product p from all counties in the World W to country i at time t .

$$EM_{ijt} = \frac{\sum_{p \in P_{ijt}} T_{iWt}(p)}{\sum_{p \in P_{iWt}} T_{iWt}(p)}$$

- ▶ The numerator is product varieties obtained by the sum of volume-weighted products that country j exports to country i . (weight for each product p is World's exports)
- ▶ The denominator is product varieties obtained by the sum of volume-weighted products that all countries in the World W exports to country i . It can be interpreted as the share of world export volume weighted products variety from j to i .
- ▶ This measure is supposed to capture **products-diversification**.

The intensive margin of exports

- ▶ The intensive margin of exports from country j to country i at year t is: $IM_{ijt} = \frac{\sum_{p \in P_{ijt}} T_{ijt}(p)}{\sum_{p \in P_{ijt}} T_{iWt}(p)}$ where $T_{ij}(p)$ is export flows for a product p from country j to country i at time t .
- ▶ The intensive margin of exports is j 's exports to country i relative to World's exports to country i for **the sum of products** that country j exports to country i at year t .
- ▶ It measures **the overall market share** of country i 's imports **within the set of products** in which country j exports to country i .

The product of the two margins

- ▶ The product of the two margins is:

$$EM_{ijt} \cdot IM_{ijt} = \frac{\sum_{p \in P_{ijt}} T_{ijt}(p)}{\sum_{p \in P_{iWt}} T_{iWt}(p)} = \frac{T_{ijt}}{\sum_{\forall j} T_{ijt}} \text{ where } T_{ijt} \text{ is}$$

aggregate exports from country j to country i .

- ▶ $EM_{ijt} \cdot IM_{ijt}$ equals total bilateral exports from j to i in year t as the overall market share of country i 's imports for all products that World exports to country i .

Alternative measures

- ▶ HK (2005) applied their methodology to only a cross section. Subsequent studies applied HK measure to a time series of cross sections.
- ▶ We are also applying it to a time series of cross sections. Consequently, the trade weights used in constructing EX_{ijt} and IM_{ijt} will likely vary from year to year. To address this, we consider in a sensitivity analysis fixed-year trade-share weights and also a chain-weighting technique.

Alternative I, Baier et al. [2013]

- ▶ The first alternative measure of the extensive margin, denoted EM_{ijt} , uses values for T_{iW1995} set to a **base year**; we choose 1995 following Baier et al. [2013].
- ▶ EM_{ijt} is defined as: $EM_{ijt} = \frac{\sum_{p \in P_{ijt}} T_{iW1995}(p)}{\sum_{p \in P_{iWt}} T_{iW1995}(p)}$. Note that weights do not change over time.
- ▶ IM_{ijt} is defined as: $IM_{ijt} = \frac{\sum_{p \in P_{ijt}} T_{ijt}(p)}{\sum_{p \in P_{ijt}} T_{iW1995}(p)}$.
- ▶ One problem with the fixed-year trade weights is that the particular year chosen may bias the results.

Alternative II

- ▶ The second alternative measure of the extensive margin, denoted EM_{ijt} , uses values for T_{iWt-1} set to a **base year**.

- ▶ EM_{ijt} is defined as:
$$EM_{ijt} = \frac{\sum_{p \in P_{ijt}} T_{iWt}(p)}{\sum_{p \in P_{iWt-1}} T_{iWt-1}(p)}.$$

- ▶ IM_{ijt} is defined as:
$$IM_{ijt} = \frac{\sum_{p \in P_{ijt}} T_{ijt}(p)}{\sum_{p \in P_{ijt-1}} T_{iWt-1}(p)}.$$

- ▶
$$\begin{aligned} EM_{ijt} \cdot IM_{ijt} &= \frac{\sum_{p \in P_{ijt}} T_{iWt}(p)}{\sum_{p \in P_{iWt-1}} T_{iWt-1}(p)} \cdot \frac{\sum_{p \in P_{ijt}} T_{ijt}(p)}{\sum_{p \in P_{ijt-1}} T_{iWt-1}(p)} \\ &= \frac{\sum_{p \in P_{ijt}} T_{iWt}(p)}{\sum_{p \in P_{iWt}} T_{iWt}(p)} \cdot (1 + gEX_{iWt}) \cdot \frac{\sum_{p \in P_{ijt}} T_{ijt}(p)}{\sum_{p \in P_{ijt}} T_{iWt}(p)} \cdot (1 + gIM_{ijt}) \end{aligned}$$

Data I

- ▶ Five main data-sets: Bilateral Exports, Bilateral Tariffs, EIA variables, Gravity variables and GDP
- ▶ 1. Bilateral Exports: Annual bilateral trade flows for 1988-2011 are from UN-Comtrade data. The data are organized by Harmonized System (HS) 6-digit classification code; this yielded 5,017 products categories. The numbers of import and export countries are 175 and 253 respectively. The choice was made to have the longest time series dimension for HS data and the finest disaggregation possible to capture as best as possible diversification in products traded.

Data II

- ▶ 2. Bilateral Tariffs: Annual bilateral tariffs for 1988-2009 are from UNCTAD TRAINS data. MFN data is available for 173 reporting countries and PTA and GSP tariffs data are available for 250 countries. The data are organized by Harmonized System (HS) 6-digit classification code.
- ▶ 3. EIA Variables (WTO membership, PTA, CU) are collected from WTO website, Tomz, et al (2007), Magee (2010) and Liu(2009)
- ▶ 4. Other Gravity variables: CIA fact book, UN publication, CEPII bilateral distance database (www.cepii.fr), Magee (2010) and Liu(2009)
- ▶ 5. GDP and population: PWT6.1, PTW5.6, WDI2003, Maddison Historical Statistics, the IMF International Financial Statistics (IFS) and the United Nations Statistical Yearbooks (UNSYB)

Gravity Model

- ▶ Following AvW(2003)

$$\begin{aligned} \ln(T_{ijt}) = & \alpha_0 + \alpha_1 \ln Y_{it} + \alpha_2 \ln Y_{jt} + \alpha_3 \ln y_{it} + \alpha_4 \ln y_{jt} \\ & + \mathbf{X}_{ijt} \cdot \beta + \gamma_1 \text{Tariffs}_{ijt} + \gamma_2 \text{PTA}_{ijt} \\ & + \mu_t + \underbrace{\omega_{ij} - \ln P_{it}^{1-\sigma} - \ln P_{jt}^{1-\sigma}}_{\text{MRTs}} + \epsilon_{ijt} \end{aligned}$$

subject to the N nonlinear market-equilibrium conditions

$$\ln P_{it}^{1-\sigma} = \sum_{k=1}^N \ln P_{kt}^{1-\sigma} (Y_{kt} / Y_{Wt}) e^{\mathbf{X}_{ikt} \cdot \beta + \gamma_1 \text{Tariffs}_{ikt} + \gamma_2 \text{PTA}_{ikt}}, i = 1, \dots, N$$

Gravity models that control for MRTs and other unobserved effects

- ▶ AvW(2003), Feenstra (2004) and BB (2009) suggest to use **country-time fixed effects** (CTFEs):

$$\ln(T_{ijt}) = \mathbf{X}_{ijt} \cdot \beta + \gamma_1 Tariffs_{ijt} + \gamma_2 PTA_{ijt} \\ + \omega_{ij} + u_{it} + v_{jt} + \epsilon_{ijt}$$

- ▶ Baier, Bergstrand and Feng (2013) employed an alternative specification using first-differencing based on Wooldridge (2000) which suggests a random growth first-difference (RGFD) model. Unobservable pair-specific changes over time can be partially accounted for by including pair-specific ij fixed effects, suggesting specification:

$$\begin{aligned}\Delta \ln(T_{ijt}) &= \Delta \mathbf{X}_{ijt} \cdot \beta + \gamma_1 \Delta Tariffs_{ijt} + \gamma_2 \Delta PTA_{ijt} \\ &\quad + \omega_{ij} + u_{it} + v_{jt} + \Delta \epsilon_{ijt}\end{aligned}$$

- ▶ Consequently, if unobservable declines in bilateral variable and fixed trade costs (say, due to technological improvements) evolve smoothly over time, the ω_{ij} 's will account for these influences.

Preliminary Results: PTA's combined effects on Export Share ($EM * IM$)

Table : PTA and Export Share

		(1)	(2)	(3)	(4)
PTA	Coefficient	0.528***	0.079**	0.473***	0.104***
	Robust SE	0.051	0.037	0.051	0.040
No of obs		55,761	55,761	55,884	55,884
Year FEs		yes	yes	yes	yes
CPFEs		no	yes	no	yes
CTFEs		no	no	yes	yes

** : significant at 5%, *** : significant at 1%

Table : Tariffs and Export Share

		(1)	(2)	(3)	(4)
Tariffs	coefficient	-0.72***	-0.49***	-9.99***	-1.50**
	Robust SE	0.197	0.139	0.998	0.803
	No of obs	55,761	55,761	55,884	55,884
	Year FE	yes	yes	yes	yes
	CPFE	no	yes	no	yes
	CTFEs	no	no	yes	yes

** : significant at 5%, *** : significant at 1%

Table : PTA, Tariffs and Export Share

		(1)	(2)	(3)	(4)
PTA	coefficient	0.522***	0.076 **	0.465 ***	0.097**
	Robust SE	0.051	0.037	0.051	0.040
Tariffs	coefficient	-0.647***	-0.482***	-9.783 ***	-1.300
	Robust SE	0.197	0.139	0.014	0.808
	No of obs	55,761	55,761	55,884	55,884
	Year FEs	yes	yes	yes	yes
	CPFEs	no	yes	no	yes
	CTFEs	no	no	yes	yes

** : significant at 5%, *** : significant at 1%

Table : PTA and Product Margins

		(1)	(2)	(3)	(4)
IM					
PTA	coefficient	0.373***	0.110***	0.484***	0.157***
	Robust SE	0.034	0.036	0.033	0.040
EX					
PTA	coefficient	0.154***	-0.031	-0.012	-0.053
	Robust SE	0.040	0.037	0.043	0.040
	No of obs	55,761	55,761	55,884	55,884
	Year FEs	yes	yes	yes	yes
	CPFEs	no	yes	no	yes
	CTFEs	no	no	yes	yes

:significant at 5%, *:significant at 1%

Table : Tariffs and Product Margins

		(1)	(2)	(3)	(4)
IM					
Tariffs	coefficient	0.649***	-0.102	3.296***	-3.103***
	Robust SE	0.141	0.138	0.784	0.798
EM					
Tariffs	coefficient	-1.366***	-0.388***	-13.3***	1.600**
	Robust SE	0.169	0.139	0.968	0.797
	No of obs	55,761	55,761	55,884	55,884
	Year FEs	yes	yes	yes	yes
	CPFEs	no	yes	no	yes
	CTFEs	no	no	yes	yes

:significant at 5%, *:significant at 1%

		(1)	(2)	(3)	(4)
IM					
PTA	coefficient	0.380***	0.109***	0.487***	0.142***
	Robust SE	0.034	0.036	0.033	0.040
Tariffs	coefficient	0.700 ***	-0.091	3.511***	-2.792***
	Robust SE	0.141	0.138	0.751	0.802
EM					
PTA	coefficient	0.142***	-0.033	-0.022	-0.044
	Robust SE	0.040	0.037	0.043	0.040
Tariffs	coefficient	-1.35***	-0.39***	-13.23***	1.500
	Robust SE	0.169	0.139	0.966	0.802
	No of obs	55,761	55,761	55,884	55,884
	Year FE	yes	yes	yes	yes
	CPFE	no	yes	no	yes
	CTFEs	no	no	yes	yes

** : significant at 5%, *** : significant at 1%

Result Summary

- ▶ Our findings confirms that PTA has positive trade effects: 11%
- ▶ A decrease in Tariffs leads to positive trade effects: 7.8% (17.9%) when tariffs decrease is 5%(11%)
- ▶ Both channels (through PTA and decrease in tariffs) have positive trade effects: 10.2% by PTA and 6.7% (15.3%) when tariffs decrease is 5% (11%)
- ▶ Both channels (through PTA and decrease in tariffs) have positive trade effects on intensive margins: 15.3% by PTA and 15.0% (36.1%) when tariffs decrease is 5% (11%)
- ▶ Both channels (through PTA and decrease in tariffs) has no effects on extensive margins. This result is in contrast to the results (Baier et al. [2013]) in previous studies.

No effect on extensive margins

- ▶ Our dataset is more refined and more recent compared to Baier et al. [2013].
 - ▶ Data-span: 1988-2009 vs 1962-2000
 - ▶ HS-6 digits (5013 products categories) vs SITC-4 digits (969 products categories in 1962 and 1,289 in 2000)
- ▶ Potential reasons for getting no effect on extensive margins
 - ▶ Effects on extensive margins may takes some time while effects on intensive margins may instantaneous.
 - ▶ Theoretical literature of firm heterogeneity emphasized EIA's effects on products diversification but specialization as well as diversification takes place after EIAs at least in the short-run.

Sensitivity Analysis

- ▶ Our benchmark is fixed effects models using every three-year data with HK measure.
- ▶ Regression analysis with alternative measures of intensive and extensive margins (unweighted and chain-weighted) provide the same qualitative results.
- ▶ The estimation results from the RGFD (Random growth first-differencing) model also provides the same qualitative results.
- ▶ Every three-year data, every four-year data, and annual data provide the same qualitative results.