



# Essays on the Economics of Trade Agreements

Arevik Mkrtchyan

Thesis submitted for assessment with a view to obtaining the degree  
of Doctor of Economics of the European University Institute

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European University Institute  
**Department of Economics**

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To my family



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# Abstract

The world trading system is governed through an ever-expanding web of *trade agreements*, which subtly but powerfully determine the terms of market competition and how rents are distributed between countries, firms and consumers. This thesis studies two such agreements: firstly, Customs Unions – regional agreements with a wide coverage of goods and a common external tariff – and secondly the Information Technology Agreement, a plurilateral agreement to eliminate import tariffs on a narrow range of goods.

*The Silent Success of Customs Unions*, the first chapter, joint work with Hinnerk Gnutzmann, studies theoretically the incentives of governments – which may be subject to lobbying – to form bilateral trade agreements, considering both “exceptions” to the MFN principle permitted under GATT/WTO rules: namely, the Free Trade Area, where partner countries liberalise internal tariffs to zero but retain independent in their external policy, and a Customs Union, which goes beyond FTA by requiring the countries to adopt a harmonised common external tariff. We show that it is always a political equilibrium to implement CU. Crucially, while CUs may be formed because of lobbying, we show that they improve the welfare of member countries as long as trade with the rest of the world remains positive. In line with these results, we show empirically that CUs are much more important to world trade – in terms trade volume and membership scope – than so far acknowledged in the literature.

Surprisingly little is known empirically about the effect of Customs Unions on tariff policy. In my second chapter, *Determining the Common External Tariff in a Customs Union: Evidence from the Eurasian Customs Union*, I seek to fill the void. Using a large panel data set from the Eurasian Customs Union (ECU), established from 2010 between Russia, Belarus and Kazakhstan, I demonstrate the importance of *mutual protectionism*: member states use their bargaining power to spill over to CU partners high tariffs for those goods which were previously strongly protected nationally. There is little evidence of the reverse

effect, i.e. tariffs being negotiated down for lines that were previously handled liberally in national tariff policy. This effect is demonstrated using three methodologies: analysis of variance using unique explanatory power of each variable, determining Shapley value from analysis of variance and OLS regression. The chapter also develops a simple model to rationalise the effect.

Trade facilitation, the reduction of administrative and other barriers, has become a key policy priority. Customs Unions may eliminate internal border controls. But how strongly can such measures benefit trade? In the ECU, the elimination of borders proceeded in two stages, which allows me to study the *Trade Impact of Non-Tariff Trade Costs* in chapter 3. I control for tariff changes and other factors to show that the growth in internal trade between the ECU member countries can be attributed to reduced trade costs, rather than trade diversion due to tariff increases. The natural experiment of border removal thus allows more precise estimates of trade costs than approaches that capture non-tariff costs merely as a residual.

Finally, *The Layers of the Information Technology Agreement Impact* – joint work with Christian Henn – turns to plurilateral agreements. We show how the WTO’s Information Technology Agreement (ITA) affected trade flows and value chain participation in the IT sector. We show that this agreement did not only lead to increased imports, but – by reducing the cost of intermediate goods – ITA members were also able to increase their exports of final goods. Our estimation strategy is based on the plausibly exogenous entry of late signatories to the agreement, who ratified the ITA as part of a broader policy objective. Using product-level data, we are able to take into account the various *layers* of ITA impact, dissecting the impact of tariff reduction, tariff elimination to zero, and over and above tariff reductions, including through firm relocation via intermediate goods channel. We find that having zero tariffs is associated with more imports of intermediate than final goods, and with participation in global value chains. This finding also supports the line of thought that trade policy certainty attracts investment.

# Chapter 1

## The Silent Success of Customs Unions

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### Abstract

Customs Unions are the silent success story of regional integration, now surpassing Free Trade Areas in trade volumes and prevalence among neighbouring countries, the quintessential natural trading partners. Yet their importance has often been concealed from the literature because CUs are few in number compared to other agreements. We show that the standard regionalism model implies that CUs dominate all other PTAs in political viability even with asymmetric production - hence FTAs may turn into CUs with higher tariffs, challenging the view that endogenous trade agreements necessarily benefit third countries. Moreover, Customs Unions can be an engine for development: even when governments are politically biased, we demonstrate that CU maximises social welfare in member states among the alternative agreements as long as trade with the rest of the world does not cease entirely.

### 1.1 Introduction

Customs Unions (CUs), regional trade agreements committing members to zero internal tariffs and a common external tariff (CET), are few in number compared to the sprawling of Free Trade Areas (FTAs), accounting for less than 10% of trade agreements (Facchini *et al.*, 2013). But this statistic conceals the fundamental importance CUs now play in the

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world trade system: we show that natural trading partners form Customs Unions rather than Free Trade Areas, leading CUs to carry more trade than FTAs! Since CUs have more protectionist tariff policies than FTAs when tariffs are set endogenously, this observation potentially has important implications for our understanding of the welfare effects of regionalism. For example, [Goyal and Joshi \(2006\)](#) envision an ever-growing network of bilateral FTAs eventually leading to free trade, while [Ornelas \(2005b\)](#) studies a model with lobbying and shows that politically viable FTAs lead to lower tariffs and hence improve welfare of all countries globally. But these papers do not consider CUs, the issue taken up in this paper. As we show, CUs are more politically viable than FTAs, and FTAs can be turned into CUs; this reduces global welfare, because tariffs rise for third countries. But we also show that Customs Unions can be an engine for development: even when governments are politically biased, social welfare in member states is highest under CU as long as trade with the rest of the world does not cease.

We employ the canonical regionalism model with imperfect competition<sup>3</sup>, augmented to allow for lobbying of governments by domestic firms and endogenous tariff setting as in [Ornelas \(2005b\)](#). We show that a Customs Union maximizes the political objective of each potential member government among all possible bilateral agreements, including those not feasible under GATT principles. While it is well known that formation of a Free Trade Area is sometimes politically viable when countries previously engaged trade under MFN ([Ornelas, 2005a,b](#)), analysis shows them to be inefficient agreements – they lead to tariffs that are “too low”, both from a political and member social welfare perspective. Turning an FTA into a CU is therefore politically viable, but leads to excessively high external tariffs from a welfare perspective if the government is biased. However, there are limits to the adverse effects of Customs Unions: as long as trade with the rest of the world remains positive, member social welfare under a CU is higher than under FTA.

These results help to understand the rapid proliferation of Customs Unions in recent decades. Figure 1.1(b) provides a global view of the prevalence of Customs Unions today. The European Union Customs Union, which now includes also Turkey to form the world’s largest CU in economic terms, accounts for 25% of world trade alone [WTO \(2011\)](#). Since 2010, this CU is bordered eastwards by the Eurasian Customs Union – one can now travel from Porto to Almaty, passing eleven countries but only encountering a single customs point. With the exception of Chile, Latin America divides into three customs unions, the Andean Community, Mercosur and CARICOM. Various Customs Unions are active in Africa and the

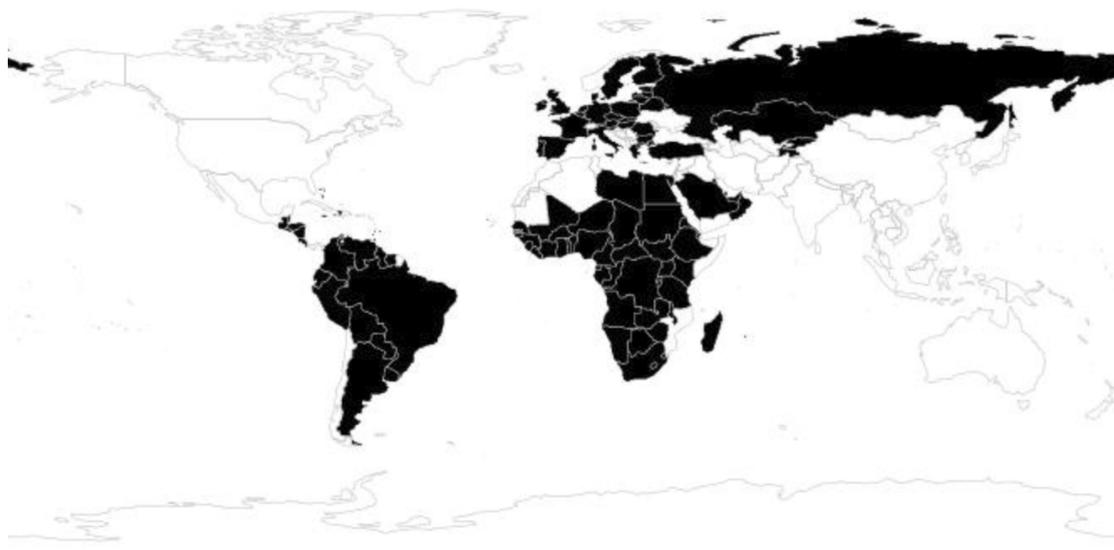
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<sup>3</sup>See [Krishna \(1998\)](#), [Freund \(2000\)](#), [Ornelas \(2005b\)](#), [Saggi \(2006\)](#), [Goyal and Joshi \(2006\)](#), and [Zissimos \(2011\)](#)

Middle East, too. Compare this to part (a) of the same figure, which shows CUs in effect after the end of the Cold War in 1992. In contrast, all FTAs combined account for only 15% of world trade (Carpenter and Lendle, 2010) *combined*. It is clear that countries choose to manage their most important trade links through the institution of a Customs Union.



(a) 1992



(b) 2012

Figure 1.1: Proliferation of Customs Unions, 1992–2012<sup>4</sup>

We contribute to the literature in three ways. First, we show empirically how strongly

Customs Unions – and not FTAs – have proliferated between “natural” trading partners over the past 20 years. Second, a number of very interesting theoretical studies have emphasized benign consequences of Free Trade Areas, showing that even tariffs on non-members may endogenously fall (Richardson, 1993), that politically viable FTAs must be globally welfare improving (Ornelas, 2005b) and can pave the path towards multilateral liberalization (Goyal and Joshi, 2006, Saggi and Yildiz, 2010). We show that it is politically feasible to turn any bilateral trade relation, including FTA and MFN, into CUs, and that the stricter equilibrium tariff policy under CU quite profoundly alters welfare conclusions. Finally, we provide a sufficient – and easily observable – condition for a Customs Union to improve social welfare of members in a political economy setting: as long as trade with non-member states remains positive, CU improves member social welfare.

We proceed by giving more evidence on the “silent success” of CUs in section 1.2. Section 1.3 then introduces the model; the tariff setting stage is solved in the following section. Section 1.5 then turns to central results of political viability and welfare. Subsequently, the next section develops extensions regarding border effects and asymmetric production structures. Finally, section 3.6 concludes.

## 1.2 Silent Success: Neighbours form Customs Unions

Figure 1.1 shows graphically how CUs proliferated across the globe. This section more formally confirms that natural trading partners turn to Customs Unions.

*Data:* We study a large cross-section bilateral trade relations of 207 countries. For each country pair, we observe membership in an FTA or CU in 2012 and 1992 using data from the WTO’s *Trade Agreements Database*. Additionally, geographical data were obtained from Mayer and Zignago (2011). 2012 was the last year available in the dataset; we chose 1992 as the comparison year since it was the first year when the independent states of the former Soviet Union appear in the statistics.

Neighbouring countries have quickly turned to forming CUs in the past decades. Table 1.1 summarises bilateral trade relations. By 2012, 10% of country pairs in the sample engage in an FTA, while less than half - 4.5% - are in a Customs Union. Since CUs tend to have more members than FTAs, the discrepancy is much less striking than when counting the number of agreements. However, turning to *neighbouring* countries – those – which share a common land border, reverses the pattern. 45% of pairs engaged in a Customs Union in

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<sup>4</sup>Based on the Customs Unions notified to the WTO, sourced from the WTO Trade Agreements Database, see section 1.2.

PTA	<i>All Country Pairs</i>		<i>Neighbouring Pairs</i>	
	1992	2012	1992	2012
None	96%	85%	79%	27%
FTA	2%	10%	9%	28%
CU	1%	4%	12%	45%

Table 1.1: Share of Trade Agreements by Country Pairs

Dep.Var	CU membership in 2012	
	(1)	(2)
Estimation	OLS	Probit
(Intercept)	0.03***	-1.92***
	(0.00)	(0.01)
Common Border	0.30***	1.48***
	(0.01)	(0.06)
FTA in 1992	0.13***	0.88***
	(0.01)	(0.05)
CU in 1992	0.87***	3.34***
	(0.01)	(0.09)
R <sup>2</sup>	0.28	
McFadden R <sup>2</sup>	0.26	
Num. obs.	38612	

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$

Table 1.2: Probability that a country pair is in CU (2012)

2012! This high number – and its rapid increase since 1992 – is driven by the popularity of CUs in Europe, Africa and Latin America. In contrast, FTAs rank a distant second with 28%. As the gravity model suggests, neighbouring countries are natural trading partners; and neighbours are prone to turning to CU.

Regression analysis shows that FTAs may “graduate” to becoming a Customs Union. Table 1.2 presents regression estimates for the probability of a country pair being in a CU in 2012, as a function of whether the countries share a common border and dummies indicating common FTA or CU membership in 1992. The linear probability model is presented in

Coefficient	Marginal Effect
Common Border	0.106*** (0.005)
FTA in 1992	0.063*** (0.004)
CU in 1992	0.238*** (0.007)

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$

Table 1.3: Probit Model: Marginal Effects at Sample Mean

equation (1), with probit estimation taking into account the limited dependent variable in equation (2). Marginal effects of the probit model are in table 1.3; both models yield consistent results: a common border and CU membership in 1992 are strongly positively correlated with CU membership in 2012. Furthermore, FTA membership in 1992 raises the probability of being in CU by 2012 by 6% at the sample mean. In this sense, one may expect more of the current FTAs, which are still young, to eventually turn into Customs Unions.

CUs are distinctively “regional”, especially in contrast to free trade agreements. Partly this may be explained by the fact that a country cannot be member of two CUs. But CUs also allow the closure of internal customs points; this is especially valuable for geographically contiguous areas. We augment the model to allow for border effects below.

### 1.3 Model

Our set-up closely follows the standard regionalism model under imperfect competition with segmented markets as in Brander and Krugman (1983). As in Ornelas (2005b), governments take an active role – endogenously setting their external tariff policy and choosing preferential trade agreements to optimally meet their objectives. The main departure from previous papers is that we model Customs Unions as a potential trade agreement in addition to FTA and MFN (i.e., absence of agreement). Thus, our analysis covers all “exceptions” to GATT XXIV in a unified setting.

*Countries and Markets:* Our world economy consists of two potential partner countries in a trade agreement - indexed  $X$  and  $Y$  respectively - and the rest of the world,  $Z$ . Each country

has  $n$  firms producing a homogeneous good under constant returns to scale with marginal cost normalised to zero (called “imperfectly competitive good”). Markets are nationally segmented and have Cournot competition; thus, each firm in country  $i$  sets a vector of quantities  $\{q_{ij}\}$  for all  $j = X, Y, Z$  determining its output in a given market  $j$ . Furthermore, there is one numeraire good produced competitively.

There is a representative consumer in each country, whose utility is linear in the competitive good and quadratic in the imperfectly competitive good. Hence, the utility function of a consumer in country  $i$  is given by  $u(Q_i) = \Gamma Q_i - (Q_i^2/2)$ , where  $Q_i = \sum_{k \in \{X, Y, Z\}} q_{ik}$  is the total output available in the country. *Government Objective*: In each country, the government maximises a political objective function, which is a weighted combination of producer and consumer surplus:

$$G_i(\mathbf{t}_i; \mathbf{t}_{-i}) = CS_i(\mathbf{t}_i; \mathbf{t}_{-i}) + TR_i(\mathbf{t}_i) + (1 + \alpha)PS_i(\mathbf{t}_i; \mathbf{t}_{-i}) \quad (1.3.1)$$

where  $CS_i$  and  $PS_i$  are consumer and producer surplus respectively, and  $TR_i$  denotes the tariff revenue.  $\alpha \geq 0$  represents the *political bias*, through which producer interests are overweighted when policy is determined. Due to the segmented markets assumption of the model, a government’s first order condition for tariff setting does not depend on tariffs of other countries; hence we drop the arguments  $\mathbf{t}_{-i}$  henceforth to simplify the notation. This objective function arises, for example, from the bargaining game between government and lobbies of Maggi and Rodriguez-Clare (1998).

*Trade Agreements and External Tariffs*: We model all three permissible trade regimes under article XXIV. In a Customs Union (CU), the external tariff is set cooperatively; in practice, an intergovernmental body is often created that determines the external tariff policy. In line with the literature, we assume that the external tariff is chosen to maximise the joint welfare of the partner countries. Two important constraints apply: first, internal tariff barriers must be eliminated as in an FTA. But additionally, the external tariffs imposed by each partner country X and Y on the rest of the world must Z must be equal:

$$\begin{aligned} \mathbf{t}^{CU} = \operatorname{argmax}_{\mathbf{t}_X, \mathbf{t}_Y} \quad & G_X(\mathbf{t}) + G_Y(\mathbf{t}) \\ \text{s.t.} \quad & t_{XY} = 0, t_{YX} = 0 \\ & t_{XZ} = t_{YZ} \end{aligned} \quad (1.3.2)$$

In a free trade area (FTA), the member government is committed to a zero internal tariff with its partner; it remains to impose, non-cooperatively, the politically optimal tariff on  $l$ .

This yields the problem

$$\begin{aligned} \mathbf{t}_i^{FTA} = \operatorname{argmax}_{\mathbf{t}_i} \quad & G_i(\mathbf{t}) \\ \text{s.t.} \quad & t_{ik} = 0, \quad i \in \{X, Y\} \end{aligned} \quad (1.3.3)$$

for each member state.

When no agreements are in place – so tariffs are set merely according to the most favoured nation principle (MFN) – the government of country  $i$  imposes equal tariffs on *both* other countries  $k$  and  $l$  in the world of our model. Hence, each government’s problem is

$$\begin{aligned} \mathbf{t}_i^{MFN} = \operatorname{argmax}_{\mathbf{t}_i} \quad & G_i(\mathbf{t}) \\ \text{s.t.} \quad & t_{ik} = t_{il}, \quad i, k, l \in \{X, Y, Z\} \end{aligned} \quad (1.3.4)$$

*Ratification and Timing:* In the first period (“ratification stage”), countries  $X$  and  $Y$  simultaneously announce a trade agreement they would be willing to enter with the other country,  $\phi_i \in \{FTA, CU, MFN\}$ . If countries make the same announcement, the agreement is implemented; otherwise, MFN obtains. Then follows the “tariff-setting stage”, in which the governments or Commission of the Customs Union determines external tariff so as to maximise the objective functions just described. Finally, firms produce and consumers consume in the “market outcome stage”.

*Solution Method:* Given the sequential, perfect information structure of the game, the solution concept is Subgame Perfect Nash Equilibrium and we proceed by backwards induction. Since solution of the last stage – market outcomes – is standard, we relegate the relevant calculations to the appendix.

## 1.4 Trade Agreements and Tariff Policy

It is a “safe bet” (Freund and Ornelas, 2010) that preferential trade agreements profoundly alter the incentives of governments to set external tariffs, and the tariff channel is the fundamental reason why FTA and CU affect world trade differently. Hence this section establishes a comparative view of external tariff policy, first comparing the two types of preferential trade agreement, and then a discussion of CU vis-à-vis MFN.

*Customs Union vs FTA:* In a free trade area, each partner country unilaterally solves problem 1.3.3, while a single supranational institution determines the joint external tariff for *both* members under CU, solving problem 1.3.2. While in principle, FTA members could

charge different tariffs, it is an *equilibrium outcome* that their external tariffs are identical; hence one may compare the FTA and CU tariff levels directly:

**Proposition 1.1.** *External Tariffs: Customs Union vs FTA*

1. A Free Trade Area imposes a strictly lower external tariff than a Customs Union,  $t_{iz}^{FTA} < t_{iz}^{CU}$
2. The stronger the political bias, the more CU external tariff exceeds FTA

*Proof.* i. Under FTA, policy solves the first order condition of problem 1.3.3

$$\frac{dG_i}{dt_{iz}^{FTA}} = \frac{dCS_i(\mathbf{t}_i^{FTA})}{dt_{iz}^{FTA}} + \frac{dTR_i(\mathbf{t}_i^{FTA})}{dt_{iz}^{FTA}} + (1 + \alpha) \frac{dPS_{ii}(\mathbf{t}_i^{FTA})}{dt_{iz}^{FTA}} = 0 \quad (1.4.1)$$

Under a CU, the first order condition of problem 1.3.2 is given by

$$\frac{dG_i}{dt_{iz}} = \frac{dCS_i(\mathbf{t}_i)}{dt_{iz}} + \frac{dTR_i(\mathbf{t}_i)}{dt_{iz}} + (1 + \alpha) \left( \frac{dPS_{ii}(\mathbf{t}_i)}{dt_{iz}} + \frac{dPS_{ji}(\mathbf{t}_i)}{dt_{iz}} \right) = 0 \quad (1.4.2)$$

Evaluating the latter condition at the FTA tariff yields

$$\left. \frac{dG_i}{dt_{iz}} \right|_{t_{iz}=t_{iz}^{FTA}} = 0 + (1 + \alpha) \frac{dPS_{ji}(\mathbf{t}_i)}{dt_{iz}} > 0 \quad (1.4.3)$$

Note that whenever the bias is not too high and the tariff is not prohibitive and we have interior solution, the objective of the government must be concave (second-order polynomial). Due to the concavity of  $G_i(\mathbf{t})$ , the tariff that solves the CU problem must be higher than the FTA level.

- ii. Using the implicit function theorem on the first order conditions 1.4.1 and 1.4.2,

$$\begin{aligned} \frac{dt_{iz}^{FTA}}{d\alpha} &= - \frac{PS_{ii}(\mathbf{t}_i^{FTA})}{d^2G_i(\mathbf{t}_i^{FTA})/dt_{iz}^{FTA}} \\ \frac{dt_{iz}^{CU}}{d\alpha} &= - \frac{PS_{ii}(\mathbf{t}_i^{CU}) + PS_{ji}(\mathbf{t}_i^{CU})}{d^2G_i(\mathbf{t}_i^{CU})/dt_{iz}^{CU}} \end{aligned}$$

Combining,

$$\frac{d(t_{iz}^{CU} - t_{iz}^{FTA})}{d\alpha} = - \frac{(PS_{ii}(\mathbf{t}_i^{CU}) - PS_{ii}(\mathbf{t}_i^{FTA})) + PS_{ji}(\mathbf{t}_i^{CU})}{d^2G_i(\mathbf{t}_i^{CU})/dt_{iz}^{CU}} > 0 \quad (1.4.4)$$

Since the external tariff under CU is higher, producer surplus  $PS_{ii}$  is also higher under CU than under FTA. Second,  $PS_{ji}(\mathbf{t}_i^{CU}) \geq 0$ , so the numerator is positive. Since the denominator is negative by concavity of the government objective  $G_i(\mathbf{t})$ , the overall product is positive, as required.  $\square$

As [Saggi \(2006\)](#) and [Ornelas \(2007\)](#) emphasise, centralised tariff setting in a Customs Union leads to consideration of profits arising from cross-border trade; hence, tariffs are higher. While a stronger political bias leads to higher tariffs both under FTA and CU, the effect in a CU is even stronger – because the marginal political returns to higher tariffs are larger in CU than FTA. This is due to absence of “leakage”, in the terminology of [Freund and Ornelas \(2010\)](#): a higher tariff always benefits also the partner country, and only under CU are those gains internalised in endogenous tariff setting. However [Bohara et al. \(2004\)](#) find some evidence for the tariff complementarity in the formation process of MERCOSUR in Argentina’s tariffs - as the average tariff went up to be closer aligned with the Brazilian tariff and the internal tariff was going down, the tariffs in the sectors most affected by the trade diversion saw a decrease.

[Estevadeordal et al. \(2005\)](#) study the impact of the RTAs of 10 Latin American countries on the non-member tariffs. Consistently with theory, they find that moving from an FTA to a CU (cases of MERCOSUR and Andean Community) leads to an increase in the tariffs towards non-members.

*Customs Union vs Most Favoured Nation:* MFN tariffs are higher than CU ones, but the effects are complex. In an MFN regime, tariff revenue and domestic profits are higher than under CU, calling also for higher tariffs at the margin. On the other hand, consumer surplus is lower, and would call for a lower tariff. In principle, the comparison could thus go either way. In [Ornelas \(2007\)](#), for example, the potential partners each have a single firm while the number of firms in the rest of the world is a parameter. In this environment, the CU tariff is higher than MFN when the number of firms abroad is sufficiently large and otherwise below. In contrast, the present model has an arbitrary, but symmetric, number of firms in each country, allowing a definitive comparison of the tariffs:

**Proposition 1.2.** *External Tariffs: Customs Union vs MFN*

- i. The stronger the political bias, the larger the tariff decrease from MFN to CU*
- ii. The stronger the political bias, the more MFN tariffs exceed CU external tariffs*

*Proof.* i. The government’s first order condition under MFN is

$$\frac{dG_i}{dt_{iz}^{MFN}} = \frac{dCS_i(\mathbf{t}_i^{MFN})}{dt_{iz}^{MFN}} + \frac{dTR_i(\mathbf{t}_i^{MFN})}{dt_{iz}^{MFN}} + (1 + \alpha) \frac{dPS_{ii}(\mathbf{t}_i^{MFN})}{dt_{iz}^{MFN}} = 0 \quad (1.4.5)$$

Substituting into the FOC of a customs union, [1.4.2](#), we obtain after some algebra

$$\left. \frac{dG_i}{dt_{iz}} \right|_{\mathbf{t}=\mathbf{t}^{MFN}} = \frac{n^2(8\alpha^2n^2 + \alpha(16n^2 - 6n - 4) + 8n^2 - 1)}{2(n + 1)^2((1 - 2\alpha)n^2 + 3n + 1)} < 0 \quad (1.4.6)$$

Similarly to the previous case, whenever the solution is interior,  $G_i(\mathbf{t})$  is concave in tariffs, the external tariff in CU must be lower than in MFN.

- ii. Using the implicit function theorem on the first order conditions 1.4.5 and 1.4.2,

$$\begin{aligned}\frac{dt_{iz}^{MFN}}{d\alpha} &= -\frac{PS_{ii}(\mathbf{t}_i^{MFN})}{d^2G_i(\mathbf{t}_i^{MFN})/dt_{iz}^{MFN}} \\ \frac{dt_{iz}^{CU}}{d\alpha} &= -\frac{PS_{ii}(\mathbf{t}_i^{CU}) + PS_{ji}(\mathbf{t}_i^{CU})}{d^2G_i(\mathbf{t}_i^{CU})/dt_{iz}^{CU}}\end{aligned}$$

Substituting the required expressions,

$$\frac{dt_X^{MFN}}{d\alpha} - \frac{dt^{CU}}{d\alpha} = \frac{4n(\Gamma + 2nt^{MFN})}{2(1+n)^2 + (1-2\alpha n)2n} - \frac{4n(\Gamma + nt^{CU})}{2(1+2n)^2 + (1-4\alpha n)n} > 0$$

Both the nominator and denominator are positive as  $t^{MFN} > t^{CU}$  and  $\alpha < 1/4n$

□

Magee and Lee (2001) show that the European Economic Community, created from an MFN basis, led to a mild decrease (0.9%) in the average tariffs, similar to the theoretical prediction.

## 1.5 Political Viability and Welfare

Given the political tariffs determined in the previous section, we now study which agreements are politically viable. We show that the Customs Union dominates all other PTAs in this regard, and hence that formation of a CU can always occur in equilibrium; however, an example demonstrates that this does not rule that the possibility that an FTA may be formed. We then turn a careful welfare analysis, and provide the central result: a CU also leads to the highest social welfare in member countries as long as trade with the rest of the world does not cease. This holds in spite of excessively high tariffs due to lobbying. One may thus say that political viability and member welfare go hand in hand.

*The Politically Optimal Agreement:* Consider first the agreement that two governments would optimally like to conclude if the restrictions of GATT XXIV did not apply, i.e. there would be no requirement to eliminate internal tariffs on “substantially all trade” and the external tariff need not be a “common” one. As the following proposition shows, the partner countries optimal bilateral agreement would still satisfy these constraints – they are not binding in the benchmark model – and implement the customs union policy:

**Proposition 1.3.** *Among all possible bilateral agreements, the Customs Union yields highest political payoff, for each member individually and collectively. In the absence of political bias, the Customs Union tariffs implement the bilaterally social welfare maximizing policy.*

*Proof.* See Appendix □

The intuition for this result is two-fold. First, tariffs on internal trade are a transfer from producers in the partner country and domestic consumers to the government purse; especially if producer lobbying is politically important, governments thus want to eliminate internal tariffs - even if they were not forced to do so - when forming an optimal bilateral agreement. In fact, if import subsidies were allowed, they would be called for both to further boost profits and reduce underproduction implied by imperfect competition. Second, due to the symmetry of the model, there is no reason for the partner countries to want to charge different tariffs; hence this constraint is also non-binding. As we show in section 1.6.2, the result is robust to having asymmetric production structures. Finally, when there is no political bias, the governments problem coincides with the social planner's; in this case, CU tariffs are set at the bilaterally welfare maximizing level.

*Politically Viable Agreements:* Since Customs Unions are so successful in raising government welfare, it is a corollary that forming such a trade agreement is always an equilibrium of the ratification subgame:

**Corollary 1.1.** *There is always an equilibrium where a Customs Union is formed*

*Proof.* By proposition 1.3, the government is maximised under CU among all possible bilateral agreements. This implies that there is no profitable deviation to another PTA when both countries propose CU, and hence formation of CU is always an equilibrium. □

However, this equilibrium need not be unique. As Ornelas (2005b) has shown, there are cases when a Free Trade Area can be ratified from the “status quo” of a Most Favoured Nation trade regime. Thus, for some parameter constellations – in particular, when the number of firms is not too large – there are cases when formation of an FTA can also arise in equilibrium. However, if such an agreement were to be formed, it would be due to coordination failure – from the perspective of member states, the agreements are Pareto ranked. Likewise, if country X were to expect that country Y would propose MFN, it is also in X's best response to propose MFN. One may speculate that such coordination failures are especially likely to arise if potential partners are not politically aligned – and indeed, evidence shows that both CU and FTA are more likely to be formed among political allies rather than rivals. Crawford and Fiorentino (2005), Fiorentino et al. (2007) discuss the importance of political alliances

in forming of the RTAs and hurdles to creating them in the presence of political differences) while [Whalley \(1998\)](#) highlight the importance of political alliance in deepening the trade agreements.

Customs Unions may also be hampered by institutional challenges. Our analysis presupposes that a supranational organization is formed that sets the external tariff to maximize joint member welfare. As [Facchini et al. \(2013\)](#) demonstrate, a Customs Union that suffers from strategic delegation may yield poor outcomes: the median voter in each country is tempted to strategically delegate a highly protectionist representative to the CU commission; but this then causes the CU to set extraordinarily high tariffs. In their setting, a CU may fail to be formed for some parameter cases. As our analysis shows, if such issues can be overcome, the political case for formation of a CU becomes rather compelling.

*Welfare Trade-Offs Among PTAs:* When governments are politically biased, they will not implement optimal policies from a social welfare perspective. Interestingly, in an FTA, the government's political bias actually promotes social welfare. This is because profits in the partner countries, while important to welfare, are neglected when tariffs are set unilaterally. As bias increases, although driven by concern for domestic producers, the external tariffs in an FTA rises; hence it moves in the "right direction" from a member social welfare perspective. For a CU, external tariffs are set the welfare maximizing level when no bias is present; they continue to rise as bias is strengthened, hence reducing welfare. Summarizing, we have

**Proposition 1.4.** *As political bias increases, the welfare gain from CU over FTA increases less.*

*Proof.* The welfare change as the government bias changes in CU is given by

$$\frac{dW_i^{CU}}{d\alpha} = -\alpha \frac{d\Pi_i^{CU}}{d\alpha} = -\alpha \frac{d\Pi_i^{CU}}{dt} \frac{dt^{CU}}{d\alpha}$$

and in FTA is

$$\frac{dW_i^{FTA}}{d\alpha} = -\alpha \frac{d\Pi_{ii}^{FTA}}{d\alpha} + \frac{d\Pi_{ji}^{FTA}}{d\alpha} = \left( -\alpha \frac{d\Pi_{ii}^{FTA}}{dt} + \frac{d\Pi_{ji}^{FTA}}{dt} \right) \frac{dt^{FTA}}{d\alpha}$$

We know from proposition 3.1  $\frac{dt^{CU}}{d\alpha} > \frac{dt^{FTA}}{d\alpha}$ . Also note that

$$-\alpha \frac{d\Pi_i^{CU}}{dt} - \left( -\alpha \frac{dP_{ii}^{FTA}}{dt} + \frac{dP_{ji}^{FTA}}{dt} \right) = \frac{2\alpha n(\Gamma + nt^{FTA})}{(3n+1)^2} - \frac{4\alpha n(nt^{CU} + \Gamma)}{(3n+1)^2} - \frac{2n(\Gamma + nt^{FTA})}{(3n+1)^2} < 0$$

Combining the two results we have verified that  $\frac{dW^{CU}}{d\alpha} - \frac{dW^{FTA}}{d\alpha} < 0$  □

With  $\alpha > 0$ , politically optimal tariffs under CU will always exceed the member welfare-maximising level. Given assumption 1, i.e. that political bias is not so strong as to lead countries into autarky under any trade regime, it turns out that the equilibrium tariff under FTA is always below what welfare maximization would require – as profits in the partner country are neglected when the external tariff is set. The question then becomes, in view of the linear-quadratic structure of the model: which regime is further away from the welfare optimum? A simple, observable condition ensures that CU is better for member welfare:

**Proposition 1.5.** *Given that trade with the rest of the world does not cease, member social welfare is higher under CU than FTA*

*Proof.* Consider first the case where  $\alpha = 0$ . By proposition 1.3, in this case the CU implements member welfare maximising tariffs, which obviously dominates the (lower) FTA tariffs.

Now consider the case where trade with the rest of the world is about to cease, i.e.  $\alpha = \frac{1}{4n}$ . In this case, the distance of the political CU tariff to the welfare maximising tariff is

$$\|t^{CU} - t^W\| = \frac{\Gamma}{1+2n} - \frac{4n\Gamma}{2(1+2n)^2+n} \quad (1.5.1)$$

Similarly, the distance between FTA and welfare maximising tariff is

$$\|t^{FTA} - t^W\| = \frac{4n\Gamma}{2(1+2n)^2+n} - \frac{\Gamma(2n+\frac{3}{2})}{(\frac{1}{2}+2n)n+2(1+2n)^2} \quad (1.5.2)$$

Then,

$$\|t^{FTA} - t^W\| - \|t^{CU} - t^W\| = \frac{\Gamma(3n+1)(32n^3+4n^2-17n-6)}{(2n+1)(8n^2+9n+2)(20n^2+17n+4)} > 0$$

The inequality follows because  $n \geq 1$ , and hence each bracket is of positive sign. Thus, member social welfare under CU is higher at  $\alpha = \frac{1}{4n}$ .

It remains to check the intermediate values of  $\alpha$ . From proposition 1.4, we know that the welfare gain of CU vs FTA is monotone decreasing in  $\alpha$ ; but since welfare under CU is still larger at  $\alpha = \frac{1}{4n}$ , this means welfare must also be higher under CU in the intermediate range ( $\alpha \in (0, \frac{1}{4n})$ ).  $\square$

This result shows that social welfare and political viability go hand-in-hand for the transition from FTA to CU. The intuition behind this rather surprising result is as follows: governments want to maximise social welfare; we already showed that CU is viable, so member social welfare must be higher than under FTA. As the political bias increases, we have the following forces:

1. CU becomes worse for member social welfare. This is because the external tariff rises and moves further away from the social-welfare maximising level.
2. FTA member welfare improves when the political bias rises. This part was quite surprising to us, but the intuition is clear: an FTA does not internalise cross-border externalises, causing the external tariff to be inefficiently low. As political bias gets stronger, the external tariff of the FTA goes up, and moves closer to the welfare-maximising level. So the political bias is good for welfare under FTA!

One can indeed find examples with strong political bias, where the CU already ceased external trade, but the FTA is actually quite close to implementing the member-welfare maximising tariff. What the proposition shows is that trade with the rest of the world being positive under CU is a sufficient condition to ensure that member welfare is also higher under CU than FTA. The link to the non-members positive exports is also intuitive: the bias, while affecting the members, also has a strong negative impact on non-member exports. We think this particular bound is interesting because it's a very conservative requirement and can easily be observed empirically.

Customs Unions also imply greater member welfare than under MFN. As the preceding discussion showed, the MFN regime implies by far the highest “tariff wall”. Implementation of a CU improves market access in the partner country – benefiting producer profits – and reduces the prices consumers face, as tariffs are either eliminated (with respect to the partner country), or reduced (vis-a-vis the rest of the world). Formally, we have

**Proposition 1.6.** *Given that trade with the rest of the world does not cease, member social welfare is higher under CU than MFN. The stronger the political bias, the larger the welfare gain under CU*

This result may hold in a setting with non-linear demand. [Saggi and Yildiz \(2005\)](#) extend the standard model in this direction and confirm that a lot of properties found in the baseline fully symmetric linear demand case extend to the non-linear demand. In particular, even though the tariff complementarity of the bilateral agreements cannot be guaranteed, the welfare domination of the bilateral agreement over the MFN is found up to the tariff level  $t^{bilateral} \leq 2t^{MFN}$ . If we move to comparing the FTA and CU, the fundamental advantage of the CU that it internalises the cross-border effects remains. Thus one can conclude that for welfare-maximising governments even under more general demand functions the CU is expected to deliver the highest welfare. One can also expect that introducing the political concerns, similar to the linear demand case, will erode the welfare advantages of the CU over

FTA. What will remain is the upper limit on this erosion set by non-negative production of the rest of the world. It is unclear which of the thresholds would be reached first under non-linear demand function, one can expect that for the government objective close to the welfare-maximising the result will still hold. Extending the model for non-linear demands is a promising direction for future research.

*Impact on Outsiders and Global Welfare:* Yi (1996) shows that the formation of a customs union with benevolent governments reduces the welfare of non-members compared to the MFN setting. And the position of the non-members is worsening as the number of countries in a customs union increases. The presence of the political motivations of the governments only makes negative impact stronger. At the same time, the global welfare is higher under a customs union. Indeed, the positive tariffs increase the distortions of the imperfect competition by reducing the total production. Thus, as the customs union has lower tariffs than the MFN world, aggregate welfare increases.

## 1.6 Extensions

### 1.6.1 Trade Costs and Border Effects

As discussed in the World Bank's *Trading Across Borders* reports, trade costs are often administrative: the need to prepare documents, waiting time for customs clearance, etc. The question then becomes how the *external* tariff in a customs union responds to a reduction in *internal* non-tariff trade costs, e.g. because border controls were abolished or documents harmonised.

We now augmented the model to allow for real trade costs. Let  $tc_{ij}$  be the non-tariff cost, per unit, incurred when trading from country  $i$  to country  $j$ . A reduction in trade cost  $t_{XY}$  then leads to a *fall* in the external tariff of a CU:

**Proposition 1.7.** *The larger the reduction in internal trade costs in a CU, the more the external tariff falls*

*Proof.* After augmenting the model with trade costs  $tc_{ij} \geq 0$  for each bilateral pair, and solving for external tariff analogously to the procedure in section 3 above<sup>5</sup>, one finds that:

$$\frac{dt_{CU}^*}{dtc_{XY}} = \frac{n(2\alpha n + 5n + 2)}{8n^2 + (9 - 4\alpha n)n + 2} \quad (1.6.1)$$

Since  $\alpha < \frac{1}{4n}$  by assumption 1, the expression is positive. Hence a reduction in internal trade costs leads to a lower external tariff, as claimed.  $\square$

<sup>5</sup>Detailed calculations are available upon request from the authors

Reduction in trade costs provide a further rationale for CU formation, which also attenuates adverse effects on non-member countries. Aside from the direct positive welfare effect of a reduction in trade costs, tariff complementarity forces also lead to a reduction in the external tariff once internal borders are eliminated. This may offset some of the tariff increase expected when a CU is formed. Empirical evidence from both MERCOSUR and the Eurasian Customs Union showed typically mild tariff increases after CU formation, consistent with the effect of reduced trade costs.

### 1.6.2 Asymmetric Production

We now extend the baseline model to incorporate asymmetric production structures. As in [Facchini et al. \(2013\)](#), we now consider the case of two imperfectly competitive goods; each of the potential partner countries has  $n$  firms, but produces only one of the goods. In the rest of the world, both goods are produced by  $n$  firms each. Letting  $x$  denote the good produced in country X, and  $y$  the good produced in country Y, we have the following production structure:

$$\begin{bmatrix} n & 0 & n \\ 0 & n & n \end{bmatrix}$$

The utility function is linear-quadratic in each good, directly generalising from the baseline above. All other elements of the model remain unchanged. It follows that the best response functions of each firm remains the same. The government, however, now sets two tariff lines: one for the good produced domestically, and one for the imported good. This yields the following optimal external tariffs:

**Proposition 1.8.** *External Tariffs under Asymmetric Production*

*i. The external tariff for the domestically produced good  $a$  is invariant to the trade regime:*

$$t_{i,a}^{MFN} = t_{i,a}^{FTA} = t_{i,a}^{CU}$$

*ii. The external tariff on the non-produced good  $b$  is lowest in FTA, intermediate in MFN and highest under CU:  $t_{i,b}^{FTA} < t_{i,b}^{MFN} < t_{i,b}^{CU}$ .*

In the asymmetric production setting, CU is now the most protectionist trade regime. For the domestically produced good, government incentives for tariff setting do not change when a PTA is formed with the partner country: there is, by construction, no competition from firms in the partner country when an FTA is formed – hence removing the tariff complementarity effect. When forming a CU, due to symmetric utility functions, the CU

objective for setting of the external tariff simply becomes a monotonic transformation of the original problem; this also leaves tariffs unchanged. Regarding the non-produced good, tariffs are lowest under FTA – due to tariff complementarity, since the country already committed to a zero internal tariff with the partner – and highest under CU, because profit effects are fully internalised. In contrast to the symmetric setting, tariffs under MFN are now *lower* than under CU.

These differences in tariff structures do not affect results on political viability and member welfare of CU compared to the baseline setting. In the CU the tariff on the good that is not produced domestically is matched to the level of the partner country tariff. Thus it is clear that the consumer surplus and tariff revenue for the only-import good in the CU is lower than under the MFN and FTA, – the country engages in extra protection the good it has no firms in. However the upside comes from gaining similar protection in the domestically produced good in the partner country. The home country extends fully its level of protection to the partner. The trade-off between the losses in the only-import good and gains in the home-produced good define the overall outcome. Hence,

**Proposition 1.9.** *i. There is always an equilibrium where a CU is formed*

*ii. Member social welfare is maximised under CU, as long as trade with the rest of the world does not cease.*

Intuitions from the symmetric model carry over to the asymmetric extension. In particular, political viability of CU is promoted by the fact that cross-border profit externalities are internalised under CU; this benefits lobbies, in particular when  $\alpha$  is large and hence the external tariff is high. However, member social welfare is still promoted by the CU: the tariff on the non-produced good is inefficiently low, and by “trading protection”, the countries achieve a welfare improvement. As long as trade with the rest of the world does not cease in either product, the member welfare improvement in fact dominates the inefficiency brought by excessively high political tariffs under CU.

## 1.7 Conclusion

Customs Unions have rapidly proliferated in recent decades. Among neighbouring countries, the most natural trading partners, CUs are now much more widespread than FTAs. Probit analysis confirmed the statistically and economically significant role played by common borders in CU formation; moreover, we showed that past FTA membership of a country pair increases the probability of a trade link “graduating” to become a customs union. These

results are consistent with the political and welfare advantages of a CU regime over both FTA and MFN.

These empirical facts are explained by our model. We show that Customs Unions dominate all other bilateral agreements, including those not permitted under GATT XXIV, from a political objective perspective. This dominance is driven by improved management of cross-border elasticities as well as greater scope for protection of profits, especially important when governments are subject to lobbying pressures. But we also show that CUs improve the social welfare of member states, so long as trade with the rest of the world does not cease entirely. Thus, Customs Unions can be an engine for development.

These results highlight the importance of Customs Unions to our understanding of preferential trade and its consequences. In particular, the static gains from FTAs to third countries – due to tariff complementarity – may not last long if FTAs then turn into CUs. On the other hand, CUs can bring welfare benefits to member countries, and may lead to a reduction in trade costs that could not be achieved under FTA.

## 1.8 Appendix

### 1.8.1 Market Outcomes

The problem of any of the  $n$  firms in, say, country  $X$  is given by

$$\begin{aligned} \max_{\{q_{xx}, q_{yx}, q_{zx}\}} &= P(\bar{Q}_x, q_{xx})q_{xx} + (P(\bar{Q}_y, q_{yx}) - t_{yx})q_{yx} \\ &+ (P(\bar{Q}_z, q_{zx}) - t_{zx})q_{zx} \end{aligned} \quad (1.8.1)$$

where  $\bar{Q}_j$  denotes the total quantity produced in the market by all other firms, and  $Q_j$  denotes the market output.

And similarly for firms in the other countries,  $Y$  and  $Z$ . To find the equilibrium in country  $j$ , sum the  $3n$  first-order conditions for  $q_{xx}, q_{xy}, q_{xz}$  respectively to find the equilibrium output for given tariffs:

$$\begin{aligned} 0 &= 3n(\Gamma - Q_x) - Q_x - nt_{ji} - nt_{jk} \\ Q_j^*(t_{ji}, t_{jk}) &= \frac{3n\Gamma - n(t_{ji} + t_{jk})}{3n + 1} \end{aligned}$$

and, again, symmetrically for the other countries. The output of the representative firm in

each country is then given by

$$q_{jj}^* = \frac{\Gamma + n(t_{ji} + t_{jk})}{3n + 1} \quad (1.8.2)$$

$$q_{ji}^* = \frac{\Gamma - (1 - 2n)t_{ji} + nt_{jk}}{3n + 1} \quad (1.8.3)$$

$$q_{jk}^* = \frac{\Gamma + nt_{ji} - (1 + 2n)t_{jk}}{3n + 1} \quad (1.8.4)$$

## 1.8.2 Proofs of Propositions

*Proof of Proposition 1.3:* First, consider the problem of maximising the government objective of country X, subject only to tariffs being non-negative, i.e.

$$\begin{aligned} \max_{\substack{t_{XY} \geq 0 \\ t_{XZ} \geq 0}} G_X(\mathbf{t}) &= \max_{\substack{t_{XY} \geq 0 \\ t_{XZ} \geq 0}} CS_X(\mathbf{t}) + TR(\mathbf{t}) + (1 + \alpha)(PS_{XX}(\mathbf{t}) + PS_{YX}(\mathbf{t})) \quad (1.8.5) \\ &= \max_{\substack{t_{XY} \geq 0 \\ t_{XZ} \geq 0}} \frac{Q_X^2(\mathbf{t})}{2} + n\mathbf{q}_X(\mathbf{t})\mathbf{t}^T + (1 + \alpha)nq_{XX}^2(\mathbf{t}) + (1 + \alpha)nq_{YX}^2(\mathbf{t}) \end{aligned}$$

*Remark:* In any solution,  $t_{XY}^* \leq t_{XZ}^*$ . Indeed, assume the opposite were true, and there was a solution where  $t_{XZ}^* < t_{XY}^*$ . That implies  $G_X(t_{XY}^*, t_{XZ}^*) \geq G_X(t_{XZ}^*, t_{XY}^*)$ .  $G_X^H(\mathbf{t}) = CS_X(\mathbf{t}) + TR(\mathbf{t}) + (1 + \alpha)PS_{XX}(\mathbf{t})$  is a symmetric polynomial in  $(t_{XY}, t_{XZ})$  and thus has the same value for permutations. However  $(1 + \alpha)PS_{YX}(\mathbf{t})$  is decreasing in  $t_{XY}$  and increasing in  $t_{XZ}$  and thus  $PS_{YX}(t_{XY}^*, t_{XZ}^*) < PS_{YX}(t_{XZ}^*, t_{XY}^*)$  as  $t_{XZ}^* < t_{XY}^*$ . It follows that  $G_X(t_{XY}^*, t_{XZ}^*) < G_X(t_{XZ}^*, t_{XY}^*)$  - contradiction to the assumption that  $(t_{XY}^*, t_{XZ}^*)$  was a solution.

Now, suppose first first were an interior solution with no constraint binding. By the first order conditions:

$$\begin{aligned} t_{XY}^* &= -\frac{(2\alpha+1)\Gamma}{n+\alpha(2n^2\alpha-4n^2-5n-2)} \\ t_{XZ}^* &= -\frac{\Gamma\alpha(2(\alpha+1)n+1)}{n+\alpha(2n^2\alpha-4n^2-5n-2)} \end{aligned}$$

Testing the second order condition: For a maximum, the function should be concave. This requires  $|H| > 0$  and  $H(1, 1) > 0$ , where

$$H = \begin{bmatrix} n \frac{-2n^2 - n + 2\alpha(5n^2 + 4n + 1)}{(3n+1)^2} & n^2 \frac{4n+1-2\alpha(n+1)}{(3n+1)^2} \\ n^2 \frac{4n+1-2\alpha(n+1)}{(3n+1)^2} & n \frac{-8n^2 - 9n - 2 + 4\alpha n^2}{(3n+1)^2} \end{bmatrix}$$

is the Hessian matrix of second order derivatives.

The  $|H| = \frac{n+\alpha(2n^2\alpha-4n^2-5n-2)}{(3n+1)^2}$

It follows that  $n + \alpha(2n^2\alpha - 4n^2 - 5n - 2) > 0$  is a necessary and sufficient condition for the concavity of the function and the local extremum being the global maximum.

However the extremum is outside of the feasible set wherever the function is concave, the internal tariff found with the FOC  $t_{XY} < 0$ .

Wherever the function is concave, i.e.  $n + \alpha(2n^2\alpha - 4n^2 - 5n - 2) > 0$ , the function is monotone and decreasing on the right of the extremum and, hence, the constraint on non-negative tariffs is binding. The Remark implies then that  $t_{XY} = 0$  and  $t_{XZ} \geq 0$ . The problem thus converges to that of the customs union.

When the function is not concave, i.e.  $n + \alpha(2n^2\alpha - 4n^2 - 5n - 2) \leq 0$ , the borders of the feasible set and the prohibitive tariffs have to be considered. The Remark implies that either  $t^*_{XY} = 0$  or  $t^*_{XZ} = \overline{t_{XZ}}$  is true in any solution.

Thus we are comparing the candidates of the form  $(t^*_{XY}, t^*_{XZ}) = (0, t_{XZ})$  to the candidates of the form  $(t^*_{XY}, t^*_{XZ}) = (t_{XY}, \overline{t_{XZ}})$ .

Remember that  $G(0, t_{XZ})$  is concave and maximised at  $(t^*_{XY}, t^*_{XZ}) = (0, t_{XZ}^{CU})$  for  $\alpha \leq 1/(4n)$

Moreover, the function

$$G(t_{XY}, \overline{t_{XZ}}) = \frac{(\Gamma 2n - t_{XY})^2}{2(2n+1)^2} - \frac{nt_{XY}(\Gamma - n(1+t_{XY}))}{2n+1} + \frac{(1+\alpha)n(\Gamma + nt_{XY})^2}{(2n+1)^2} \\ + \frac{(1+\alpha)n + (\Gamma - n(1+t_{XY}))^2}{(2n+1)^2}$$

is concave if the second order derivative  $\frac{\partial^2 G(t_{XY}, \overline{t_{XZ}})}{\partial t_{XY}^2} = n \frac{-n+\alpha(4n^2+4n+2)}{(2n+1)^2}$

Thus wherever  $\alpha < \frac{n}{4n^2+4n+2}$ , the function is concave and the extremum is found at:

$$t_{XY} = \frac{(2\alpha + 1)\Gamma}{-n + \alpha(4n^2 + 4n + 2)}$$

As the extremal point is negative when the function is concave, the function is maximized at  $t_{XY} = 0$  and the candidates of the form  $(t_{XY}, \overline{t_{XZ}})$  collapse to  $(0, \overline{t_{XZ}})$ . And we know that for any  $\alpha \leq 1/(4n)$   $(0, t_{XZ}^{CU})$  is the solution of the function  $G(0, t_{XZ})$ .

Instead, if  $\alpha \geq \frac{n}{4n^2+4n+2}$ , the function  $G(t_{XY}, \overline{t_{XZ}})$  is not concave. Thus the function reaches its highest point at either  $t_{XY} = 0$  or  $t_{XY} = \overline{t_{XY}}$ .

$$G(0, \overline{t_{XZ}}) = \frac{2\Gamma^2 n(n+\alpha+1)}{(2n+1)^2}$$

$$G(\overline{t_{XY}}, \overline{t_{XZ}}) = \frac{\Gamma^2 n(n+2\alpha+2)}{2(n+1)^2}$$

$$G(0, \overline{t_{XZ}}) - G(\overline{t_{XY}}, \overline{t_{XZ}}) = \frac{\Gamma^2 n(3n+2+2\alpha(1-2n^2))}{2(n+1)^2(2n+1)^2} > 0 \text{ for } \alpha \leq 1/(4n)$$

Thus,  $G(\overline{t_{XY}}, \overline{t_{XZ}}) < G(0, \overline{t_{XZ}}) < G(0, t^{CU})$ .

*Proof of Proposition 1.8:*

i. The problem in the MFN for good a is, as before,

$$\begin{aligned} t_{i,a}^{MFN} &= \underset{t_{i,a}}{\operatorname{argmax}} G_i(\mathbf{t}) \\ \text{s.t. } & t_{ik,a} = t_{il,a} \end{aligned}$$

while in the FTA the problem for good a is

$$\begin{aligned} t_{i,a}^{FTA} &= \underset{t_{i,a}}{\operatorname{argmax}} G_i(\mathbf{t}) \\ \text{s.t. } & t_{ik,a} = 0 \end{aligned}$$

However as there are no firms producing good a in the partner country the change in the constraint from  $t_{ik,a} = t_{il,a}$  in MFN to  $t_{ik,a} = 0$  in FTA has no impact on the government objective - in both cases the government only sets the tariff  $t_{il,a}$ .

$$t^{CU} = \underset{t_X, t_Y}{\operatorname{argmax}} G_X(t) + G_Y(t)$$

$$\text{s.t. } t_{XY} = 0, t_{YX} = 0, t_{XZ} = t_{YZ}$$

$CS_{X,a} + TR_{X,a} + PS_{XX,a} + CS_{Y,a} + TR_{Y,a} + PS_{XY,a}$  because  $PS_{XX,a} = PS_{XY,a}$  and  $CS_{X,a} + TR_{X,a} = CS_{Y,a} + TR_{Y,a}$  by construction

the CU problem is equivalent to  $CS_{X,a} + TR_{X,a} + PS_{XX,a}$  which is the MFN problem.

ii. The tariff on the only-import good in MFN and FTA is determined by the consumer surplus and tariff revenue considerations. The arguments behind the tariff complementarity make the comparison straightforward.

The increase in the tariff paid by the rest of the world in the CU compared to the other two trade regimes is presented in part i. It follows that once the country has to match the tariff level to the partner level where the producer interests are being protected, its tariff would be higher than when no producer interests are involved. Indeed, following a similar approach to the symmetric case in derivations, the customs union tariff of the welfare maximising government is:

$$t^{CU,b} = \frac{\Gamma(2n+1)}{2n^2 + 5n + 2}$$

Meanwhile the MFN tariff in the good that the country does not produce does not depend on the political bias and is:

$$t^{MFN,b} = \frac{\Gamma}{2(n+1)}$$

It follows that the difference between CU and MFN tariff is positive when  $\alpha = 0$ , a difference that will only grow as  $\alpha$  increases:

$$\frac{\Gamma n}{2(n+1)(n+2)} > 0$$

*Proof of Proposition 1.9:*

- i. The consumer surplus and tariff revenue in the only-import good in the CU and in the FTA has the following form:

$$CS_{X,b} + TR_{X,b} = \frac{(2\Gamma n - nt_{XZ,b})^2}{2(2n+1)^2} + \frac{nt_{XZ,b}(\Gamma(-n-1)t_{XZ,b})}{2n+1}$$

While the profits in the partner country have the following form:

$$PS_{XY,a} = n \frac{(nt_{YZ,a} + \Gamma)^2}{(2n+1)^2}$$

Note that as the countries are a mirror image of each other,  $t_{XZ,b} = t_{YZ,a}$

The comparison of the government payoffs in each trade agreement regime leads to the following outcome:

$$G_i^{*CU} - G_i^{*FTA} = \frac{8(\alpha+1)^2 \Gamma^2 n^3 (n+1)^2}{(4n^2 + 5n + 2)^2 (2n^2 + 5n + 2 - 2\alpha n^2)} > 0$$

for all  $\alpha < 1/(2n)$

$$G_i^{*CU} - G_i^{*MFN} = \frac{\Gamma^2 n (2\alpha^2 n^2 + 4\alpha n^2 + 2n^2 + 7\alpha n + 5n + 6\alpha + 4)}{4(n+1)^2 (2n^2 + 5n + 2 - 2\alpha n^2)} > 0$$

- ii. The difference in social welfare between CU and FTA is given by:

$$W_i^{*CU} - W_i^{*FTA} = \frac{8(\alpha+1)\Gamma^2 n^3 (n+1)^2 (2n^2 + 5n + 2 - 6\alpha n^2 - 5\alpha n - 2\alpha)}{(4n^2 + 5n + 2)^2 (2n^2 + 5n + 2 - 2\alpha n^2)^2} > 0$$

as at  $\alpha = 1/(2n)$

$$W_i^{*CU} - W_i^{*FTA} = \frac{\Gamma^2 n (2n + 1) (4n^3 + 4n^2 - n - 2)}{2(n + 1)^2 (4n^2 + 5n + 2)^2} > 0$$

for all  $\alpha < 1/(2n)$

$$W_i^{*CU} - W_i^{*MFN} = \frac{\Gamma^2 n (2\alpha^2 n^2 + 4\alpha n^2 + 2n^2 + 7\alpha n + 5n + 6\alpha + 4)}{4(n + 1)^2 (2n^2 + 5n + 2 - 2\alpha n^2)} > 0$$

The welfare advantage of the CU over the MFN follows from the welfare advantage of FTA over MFN.

## Chapter 2

# Determining the Common External Tariff in a Customs Union: Evidence from the Eurasian Customs Union

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### Abstract

How do member states determine the Common External Tariff (CET) in a Customs Union? While a large theoretical literature studies the incentives faced by governments when negotiating the CET, empirical evidence is so far scant. This paper studies a large panel data set of tariff data from the Eurasian Customs Union and demonstrates the importance of *mutual protectionism*: member states bargain to expand to their partners the protection of goods that were protected nationally. Moreover, there is almost no evidence of exercising bargaining power to keep the CET down for goods where one of the member states would see large tariff increases. Thus countries bargain for mutual protection, rather than mutual liberalisation concessions. I show that the mutual protectionism finding emerges using three methodologies: analysis of variance using unique explanatory power of each variable, determining the Shapley value from analysis of variance and finally OLS regression. Furthermore, I develop a simple model to explain the mutual protectionism effect.

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## 2.1 Introduction

Regional trade agreements, in particular FTAs but also CUs have been studied comprehensively in the literature<sup>2</sup>. The general theme of this literature is that a Customs Union allows member countries to internalise cross-border externalities, e.g. relating to profits arising from trade or terms of trade effects, that are ignored by policy-makers under MFN or FTA tariff setting. As a result of extending the tariff protection to partners, tariffs in a Customs Union tend to be higher than in a free trade area. When decision-makers are biased towards the interests of producers, this effect is particularly strong.

Much less is known about trade policy in a Customs Union empirically and performance of the theory in practice. This study makes its contribution by providing insights on these two areas for the case of the Customs Union of Russia, Belarus and Kazakhstan. This Customs Union is ideal to study how national tariffs are translated into a common external tariff of the CU for several reasons. First, the countries were all linked through FTAs before forming the CU with zero internal tariffs; and thus all the external tariff changes are attributed to the CU. Second, there is a high level of compliance with CU tariff and quick implementation of the common external tariff, so it is a “genuine” Customs Union. Third, the three members have rather similar GDP per capita, allowing to apply a theoretical model with symmetric consumer preferences.

I develop a theoretical model showing how pre-CU national tariff lines are related to post-CU CET lines through political economy factors and market structure. Theoretical considerations imply that the individual tariffs of the CU members prior to the agreement are determinants of the common external tariff in the CU. Indeed, all the forces that would impact the CU tariff are already behind the individual country tariff. These forces can be amplified or diminished in the CU due to changes in the market power or internalisation of cross-border effects. This may be reflected in the weight of one country’s tariff lines in the determination of CET. Following this line of reasoning, this paper examines the CET of the Customs Union after its creation at the 6-digit level as an affine function of the national tariff profiles of the members prior to the CU.

Theoretical derivations of the common external tariff in a CU exhibit internalisation of cross-border profits, that is spillover of the domestic tariff protection to the CU partners. If the production profiles are different among members, then the country with the highest protection will push for the protection of its goods of interest. Thus empirically we should expect to observe a similar phenomenon, coined as mutual protectionism.

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<sup>2</sup>e.g. [Freund and Ornelas \(2010\)](#) provide a survey

The analysis of the creation of the common external tariff (CET) and impacts each member had is done both on aggregate and specific sector types. Findings support qualitatively the theory in determining the weights of each national tariff in the CET. Most of the specifications attribute a lower weight to the Russian tariff than it is predicted by theory due its significantly larger economy. This suggests that Russia could have offered tariff concessions in negotiations in exchange for concessions non-tariff issues.

Interestingly, 40% of the tariff lines (HS 6 level) were identical prior to the Customs Union for all members and more lines have similar tariffs. In order to account for this, multiple regression analysis of variance is employed. In this regard two approaches of determining the relative weight of the variable is used. The first one hinges on analysing the difference between the full model and the model without the variable of interest. The second determines the relative weight of the variable by calculating the Shapley value of each variable in the common external tariff.

The main finding of the paper is the strong support for the phenomenon of mutual protectionism, - countries successfully extend their domestic protection of goods to the members. This result is found using the techniques of analysis of variance described above by looking at the groups of goods protected by each CU member.

There is relatively little empirical research on tariff setting in a Customs Union and its determinants. The world's largest Customs Union, the European Union, was established in 1958 and then referred to as European Economic Community; data availability is thus very limited. According to [Magee and Lee \(2001\)](#), the initial external tariff was set as a simple average of the previous national tariffs and was slightly decreased over the following 15 years. But little is known about the ex ante structure of national tariffs. The tariff policy in the Mercosur area has been studied more extensively (e.g [Olarreaga and Soloaga \(1998\)](#), [Bohara et al. \(2004\)](#),[Roett \(1999\)](#)). Compliance to to the common external tariff in Mercosur is limited, around 30% of tariffs are exempted, and similarly some goods are exempt from internal free trade ([Esteradeordal et al., 2001](#)).

Most closely related to this paper, [Olarreaga et al. \(1999\)](#) study the Mercosur external tariff. Using a cross section of industries – at both the HS6 and ISIC4 levels – they estimate a Tobit model of the CET. Using the bloc's market share in world imports as a proxy for export elasticity and various proxies for labour and capital lobbying respectively, they seek to disentangle terms of trade and political economy motivations in Mercosur tariff determination. Terms of trade motives are found to account for up to 28% of the variation in tariffs according to their estimates, lending some support to an efficiency rationale for customs unions. However, seeking to explain the determinants of tariffs - particularly at

the fine level of disaggregation provided by HS6 - is a daunting task. An advantage of the present study is our ability to use previous years of national tariffs. Since these tariffs were presumably optimally set, they should contain all the relevant information driving *domestic* policy - be it lobbying or efficiency. This lets us focus on the more tractable problem how the formation of a Customs Union specifically influences tariff policy.

[Estevadeordal et al. \(2008\)](#) conduct an empirical study of preferential tariff liberalisation on MFN tariffs for Latin American countries. The authors regress the current MFN tariff on the preferential tariff for the same line in the previous year and on some control variables. Their main finding is that tariff complementarity of preferential tariff liberalisation is empirically supported for FTA, but not when the preferential tariff is granted in a Customs Union where no such effect rises. This kind of analysis, unfortunately, is not possible to do for the Customs Union of Russia, Belarus and Kazakhstan as prior to the Customs Union the countries were in an FTA with zero internal tariffs on practically all goods. Hence, virtually, no extra tariff preference was given since the creation of the CU.

The paper is organised in a following manner. It continues by providing an overview of key facts about the Customs Union in Section 2. The following Section 3 presents the data and summary statistics. Next, the paper continues with the theoretical model for the estimation strategy in Section 4. Section 5 turns to the empirical analysis of common tariff determinants and mutually protected sectors. Finally, the conclusion follows in Section 6.

## 2.2 The Customs Union at a Glance

Just 2 years prior to joining WTO, Russia formed the Eurasian Customs Union (ECU) with Belarus and Kazakhstan – pointing to a more regionally oriented trade approach. Since the Customs Union between Russia, Belarus and Kazakhstan (RBKCU) was ratified in November 2009, regional integration within this institution has proceeded at a rapid pace. A common external tariff was implemented in January 2010. Internal customs controls in the union were abolished in July 2010 (between Russia and Belarus) and July 2011 (between Russia and Kazakhstan). The Customs Union developed in May 2014 into the “Eurasian Economic Union”, modeled after early European integration policies. There are current attempts to extend the membership of the Customs Union to other CIS countries, complicated by possible associated revision of WTO bound tariffs for the WTO members.

Membership: Current Customs Union members Russia, Belarus and Kazakhstan have an annual GDP exceeding \$2trn. In PPP terms, Russia accounts for 86% of the block’s GDP and 84% of its population. Kazakhstan accounts for 8% of GDP and 10% of population,

while the Belorussian economy and population both amount to approximately 5% of the total.

Volume of Internal Trade: In the years prior to formation of the Customs Union, internal trade between the three countries amounted to \$44bn., about 16% of total imports by the three countries. The bilateral flows are highly uneven: in 2009, Russian exports to Belarus and Kazakhstan respectively accounted for 46% and 24% respectively of the total. Belorussian exports to Russia made up another 18%, and Kazakh exports to the same destination 10%. Belorussian-Kazakh trade, at just over 1% of the total, was almost insignificant. This asymmetric trade pattern prompted concerns of trade diversion towards Russia (Tarr, 2012) as a result of the CU. Isakova and Plekhanov (2012) provide evidence for small CU impact on trade promotion and some evidence of trade diversion for the case of Kazakhstan. Similarly, Isakova et al. (2013) extends the analysis to include Russia and Belarus and find tariff increases lead to small positive impact on imports from Russia, and anticipating larger benefits to members could come from reduced internal trade costs.

Goods Traded Internally: The importance of energy exploitation in the region is reflected in its trade patterns. Petroleum and natural gas alone accounted for \$11bn, or a third of internal trade, in 2009, largely driven by Russian transit exports to Belarus.

By 2011 trade in these two key resources had further grown - to \$15.5bn - but, due to the overall increase in internal trade, their share had diminished to a quarter. Other sectors with large absolute increases were vehicles, iron, machinery and other equipment as well as dairy products. Some of this growth was due to new product lines being internally traded, which in the two Customs Union years rose approximately 10% to 4473.

Internal Tariffs: Even before the formation of the Eurasian Customs Union, internal tariffs between the members were largely eliminated. Data set records just 8 lines where Russia imposed tariffs on its partners - involving sugar, alcohol and tobacco - in the immediate pre-CU years. For Kazakhstan, there are 36 positive lines covering similar products and additionally some rice varieties. Our data set has no record of positive internal tariffs imposed by Belarus. From 2010 onwards, internal tariffs had been fully eliminated.

Most-Favoured Nation Tariffs: Even prior to the Customs Union, Russia and Belarus had similar tariff regimes - with average rates around 12%. By 2009, close to 80% of MFN tariff lines by the two countries already agreed. In contrast, Kazakhstan pursued a relatively liberal policy, imposing on average just a 6.5% tariff in 2009 (reflecting a period of liberalisation after 2007 that is apparent in the sample).

Common External Tariff: In 2010, the overwhelming majority of MFN tariffs - 4360 lines or 86% - were harmonised into the Common External Tariff, with many exceptions found

in textiles. The CET mean a large tariff increase for Kazakhstan - to 10.29%, or nearly a 60% increase. But Russian tariffs fell to 10.7%, nearly a 20% cut, and Belorussian tariffs by 10%<sup>3</sup>. [Shepotylo \(2011\)](#) calculates the tariff changes of trade-weighted tariffs for Kazakhstan and finds an increase from 5.3% to 9.5%.

Other Trade Agreements and commitments: Existing bilateral free trade agreements between CIS countries are in place, notably with Ukraine. Russia's WTO accession negotiation is an important background part of the Customs Union's creation. The accession has been negotiated for many years, and the slow pace of the process could have contributed to Russia's interest in the regional integration. One has to also note the immediate impact of the Customs Union on the speeding up of Kazakhstan's accession to the WTO. [Dragneva and Wolczuk \(2012\)](#) discuss the impact of the Customs Union on the EU's relationship with eastern neighbours, in particular, Ukraine. The paper also mentions that EU has become associated with modernization and rules-based governance, promoting Russia to adopt similar approach for its regional policy.

[Coronel et al. \(2010\)](#) briefly review the CU experience of Kazakhstan in the context of an IMF country report, noting increase in tariff revenue of government, a result of higher tariffs. The paper argues that some trade diversion may arise towards CU partners away from non-member neighbouring countries, especially Central Asian countries, but do not expect a strong impact on imports from China. [Krotov \(2011\)](#) presents a detailed discussion of the Customs Union's administration system, customs legislation and clearance. He finds that the CU is functional and the necessary institutions and legislation for Customs Union's work are at place. [Carneiro \(2013\)](#) is a good survey of the perspectives on ECU.

## 2.3 Data and Summary Statistics

Tariff Data: The tariff data was obtained from the ITC MacMap platform as it provides high-quality tariff data at various classification levels, including the ad valorem equivalents of specific tariffs. We were able to obtain applied tariffs at HS2007 6-digit level for Russia and Kazakhstan for 2007-2012 and for Belarus for 2009-2012.

Other Data: We also collected data on GDP and population from the IMF World Economic Outlook.

Descriptive Statistics: The members of the Customs Union, prior to its creation, had 40% of the tariff lines (HS 6 lines) harmonised, and in November 2009 they agreed on the Common

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<sup>3</sup>Table 3.2 in the following chapter provides more detailed data on the evolution of MFN tariffs in the ECU region.

External Tariff (CET). The CET was harmonising around 86% of the tariff lines.

Table 2.1 summarises the tariff averages of the members and the number of product lines with zero tariff. The tariff means are calculated as simple averages of the tariff lines of the HS6 disaggregation level. Russia and Belarus had similar tariff averages prior to the ECU while Kazakhstan had noticeably lower average tariff. The tariff harmonisation in the CU led to 1.5% and 1.2% decrease in mean MFN tariff for Russia and Belarus, respectively and 3.8% increase in mean MFN tariff for Kazakhstan.

Table 2.1: Trends in MFN Tariffs

Year	All goods	Goods with zero MFN tariff			Mean MFN tariff (simple)		
		Russia	Belarus	Kazakhstan	Russia	Belarus	Kazakhstan
2007	5052	369	-	914	12.12	-	8.26
2008	5052	420	-	1154	12.12	-	6.59
2009	5052	445	373	1164	12.18	11.81	6.49
2010	5052	554	554	712	10.67	10.60	10.30
2011	5015	547	547	655	11.07	10.99	10.82
2012	5205	550	550	641	10.94	10.87	10.74

The differences in the pre-CU trade policy of Russia and Belarus on one side and Kazakhstan on the other side is seen also through the number of 6-digit goods with zero tariff. In Kazakhstan 1164 product lines were subject to free trade prior to the ECU, almost three times more than in the partner countries. Furthermore, Kazakhstan negotiated a transition period to reduce that number over the course of several years.

## 2.4 Theoretical Background of Empirical Strategy

This section develops a model of trade under imperfect competition that gives rise and explains the mutual protectionism in the formation of customs unions. The model makes several predictions that will be addressed below. The model suggests that the level of political influence of a sector will transfer into the protection through a higher tariff. This will translate into a larger weight during common tariff bargaining. Thus, the most protected sectors will be mutually protected by the partners.

We follow the standard oligopoly model that is often employed in studies of regional agreements. Two countries,  $X$  and  $Y$ , will be the potential trade agreement partners while rest of the world is denoted as  $Z$ . Each country produces two homogeneous goods under

constant returns to scale and with marginal cost normalised to zero. The first good,  $A$ , set to balance the trade accounts, is traded in perfectly competitive markets, and each country has an arbitrary number of firms producing this good. The remaining  $L$  goods are produced and sold in imperfectly competitive markets (firms compete a-la Cournot). National markets are segmented: a firm in country  $i$  sets the output of good  $l$  to sell to country  $j$ ,  $q_{ij}^l$ , separately from the output it sells in country  $k$ ,  $q_{ik}^l$ .

In general, each country has  $n_i^l \geq 0$  firms producing good  $l$ . The representative consumer's utility is linear in the competitive good  $A$ , and linear-quadratic in imperfectly produced goods:  $u(Q_i^l) = \Gamma Q_i^l - (Q_i^l)^2/2$  and associated inverse demand function  $p_i^l = \Gamma - Q_i^l$  where  $Q_i^l$  is the total output of good  $l$  in country  $i$ .

Countries may have different number of consumers.

Each country  $i$  may impose a per unit tariff on country  $j$ 's exports of good  $l$ , denoted by  $t_{ij}^l$ . Tariffs are set endogenously to maximise the objective function of the government.

**Governments.** In each country, government policies regarding trade are chosen to maximise a weighed sum of consumer surplus, tariff revenues and producer surplus -  $CS_i^l$ ,  $TR_i^l$  and  $PS_i^l$ , respectively, and its objective is denoted as  $G_i^l$ . In particular, due to lobbying or other contributions, the government may be subject to a political bias,  $\alpha_i^l \geq 0$ , which overweights producer interests in its objective:

$$G_i^l = CS_i^l + TR_i^l + (1 + \alpha_i^l)PS_i^l \quad (2.4.1)$$

There are three possible trade regimes: Most Favoured Nation setting where no trade agreement is in place, and each country is bound to set a non-discriminatory tariff  $t_{ij} = t_{ik}$ ; a Free Trade Area setting where the members of the FTA  $i$  and  $j$  trade freely between themselves,  $t_{ij} = 0$  and set independently their external tariff on the rest of the world; a Customs Union, or a cooperative setting, where the members trade freely between each other and have to set a common tariff on the rest of the world  $t_{ij} = 0, t_{ik} = t_{jk}$ .

The model is being solved backwards by first finding the market outcomes given the tariff and trade regime and then determining the optimal tariffs. The market outcomes stage is standard and is presented in the Appendix. The governments take as given the market response function of the last stage in their tariff setting.

**Tariff Setting.** In MFN the countries set up the trade policy non-cooperatively with the only restriction to apply non-discriminatory tariffs. If the two countries make a FTA, then they are constrained to have zero tariffs for internal trade. In FTA the members set tariffs applied to the rest of the world non-cooperatively, like in MFN.

Finally, if the two countries form a CU, they not only have to keep the internal zero tariffs but also set cooperatively the common external tariff. One way the two countries

might set the cooperative tariff is through maximising the total government welfare (social welfare plus the bias component) as it is typically done in the literature.

The government objectives are as in equation (1) given the firm responses from the market outcomes stage. The optimal tariffs are found with the standard first and second order conditions. Below the optimal unit tariffs in each trade regime are presented. Note that the product superscripts are omitted for expositional clarity:

$$\begin{aligned}
t_{ij}^{MFN} = t_{ik}^{MFN} &= \Gamma \frac{1 + 2(1 + \alpha_i)n_i}{(1 - 2\alpha_i n_i)(n_j + n_k) + 2(1 + n_i)^2} \\
t_{ij}^{FTA} = 0, \quad t_{ik}^{FTA} &= \Gamma \frac{1 + 2(1 + \alpha_i)n_i}{(1 - 2\alpha_i n_i + 2n_j)n_k + 2(1 + n_i + n_k)^2} \\
t_{ij}^{FTA} = 0, \quad t_{ik}^{CU} &= \Gamma \frac{1 + 2(1 + \alpha_i)n_i + (1 + \alpha_j)n_j}{(1 - 2\alpha_j n_j - 2\alpha_i n_i)n_k + 2(1 + n_i + n_j)^2}
\end{aligned} \tag{2.4.2}$$

If the CU members  $i$  and  $j$  have different sizes  $a$  and  $b$ , respectively, then the CU objective becomes  $aG_i + bG_j$  and the common external tariff is:

$$t_{ij}^{FTA} = 0, \quad t_{ik}^{CU} = \Gamma \frac{a + b + 4bn_j(\alpha_j + 1) + 4an_i(\alpha_i + 1)}{(a + b - (4b\alpha_j + 2b - 2a)n_j - (4a\alpha_i + 2a - 2b)n_i)n_k + 2(1 + n_i + n_j)^2(b + a)}$$

The governments charge unit tariffs in the model while the dataset presents all tariffs, including unit tariffs in their ad valorem equivalents. So the optimal unit tariffs have to be converted into ad valorem, i.e. percentages. The ad valorem equivalent (AVE) tariff is the tax share of the price found as the ratio of the unit tariff to the equilibrium price:

$$\tau = \frac{t}{p}$$

Substituting in the formula of the ad valorem tariffs the equilibrium tariffs and price in each trade regimes gives equilibrium ad valorem equivalent tariffs:

$$\begin{aligned}
\tau^{MFN} &= \frac{1 + 2n_i(1 + \alpha)}{2(n_i + 1)} \\
\tau^{FTA} &= \frac{1 + 2n_i(1 + \alpha)}{2(n_i + n_j + 1)} \\
\tau^{CU} &= \frac{1 + 2n_i(1 + \alpha) + 2n_j(1 + \alpha)}{2(n_i + n_j + 1)} \\
\tau^{CU} &= \frac{a(1 + 4n_i(1 + \alpha_i)) + b(1 + 4n_j(1 + \alpha_j))}{(a + b)2(n_i + n_j + 1)}
\end{aligned} \tag{2.4.3}$$

Note that  $\tau^{FTA} < \tau^{MFN} < \tau^{CU}$ . The AVE tariffs are easy to interpret - being the share of the price that is being taxed, they allow to determine trivially the prohibitive tariff - it is the level of bias  $\alpha$  such that  $\tau = 1$ , i.e. the effective tariff rate is 100%.

Importantly for the empirical analysis, notice that the Customs Union tariff can be presented as an affine combination of either national MFN or FTA tariffs of the CU members. Below is the representation for countries of equal size:

$$\begin{aligned}\tau^{CU} &= \tau_i^{MFN} \frac{1}{2} \frac{(n_i + n_j + 1)(1 + 4n_i(1 + \alpha_i))}{(n_i + 1)(1 + 2n_i(1 + \alpha_i))} + \tau_j^{MFN} \frac{1}{2} \frac{(n_i + n_j + 1)(1 + 4n_j(1 + \alpha_j))}{(n_j + 1)(1 + 2n_j(1 + \alpha_j))} \\ \tau^{CU} &= \tau_i^{FTA} \frac{1}{2} \frac{1 + 4n_i(1 + \alpha_i)}{1 + 2n_i(1 + \alpha_i)} + \tau_j^{FTA} \frac{1}{2} \frac{1 + 4n_j(1 + \alpha_j)}{1 + 2n_j(1 + \alpha_j)}\end{aligned}\quad (2.4.4)$$

If instead the countries have different number of consumers, in particular, country  $i$  has  $a$  consumers and country  $j$  -  $b$  consumers, the affine combination becomes:

$$\begin{aligned}\tau^{CU} &= \tau_i^{MFN} \frac{a}{a+b} \frac{(n_i + n_j + 1)(1 + 4n_i(1 + \alpha_i))}{(n_i + 1)(1 + 2n_i(1 + \alpha_i))} + \tau_j^{MFN} \frac{b}{a+b} \frac{(n_i + n_j + 1)(1 + 4n_j(1 + \alpha_j))}{(n_j + 1)(1 + 2n_j(1 + \alpha_j))} \\ \tau^{CU} &= \tau_i^{FTA} \frac{a}{a+b} \frac{1 + 4n_i(1 + \alpha_i)}{1 + 2n_i(1 + \alpha_i)} + \tau_j^{FTA} \frac{b}{a+b} \frac{1 + 4n_j(1 + \alpha_j)}{1 + 2n_j(1 + \alpha_j)}\end{aligned}\quad (2.4.5)$$

The number of consumers, whenever a representative consumer exists, does not affect the non-cooperatively set tariff. However it is not the case for a cooperatively set tariff. Indeed, if the number of consumers is normalised to 1 or is equal in each country then the maximisation objective in the Customs Union is simply the sum of each consumer's problem corrected for governments' biases.

## 2.5 Empirical Analysis of Common External Tariff

The theoretical model above makes a number of predictions regarding the formation of the CET. There are several properties of this CU tariff as a function of individual FTA tariffs that can be tested empirically.

Testable hypotheses:

- (a) The CET is well-represented as an affine combination of the national tariffs.
- (b) Country  $i$ 's weight is proportional to  $a/(a+b)$  while country  $j$ 's weight is lower and proportional to  $b/(a+b)$ . Everything else same, the larger country is expected to have

Table 2.2: Macroeconomic indicators: 2009

Indicator	Share %		
	Russia	Belarus	Kazakhstan
GDP <sub>pc</sub> PPP	38.3	32.7	29
GDP PPP	87.5	5	7.5
Population	84.7	5.7	9.6

higher weight. Note that this theoretical outcome comes from the assumption of equal  $\Gamma$  across countries, an analog of the GDP per capita. The CU members are a really good fit for that as they have very close GDP per capita. As a result we can compare the empirically obtained weights with either GDP or population share, as they are very close.

Country size ratio: Using data on population and GDP from the IMF's *World Economic Outlook*, the model would predict the CET formation function to give a weight ratio for GDP and population as in Table 2.2, controlling for sectoral variation.

- (c) Country's weight in the CU tariff is higher for goods that are protected by this country in FTA more than in partner country. This hypothesis is mutual protectionism.
- (d) The sum of weights of individual tariffs should be higher than one, - CU is more protectionist than the FTA. In the remaining part we are conducting regression analysis based on several estimating strategies in order to explain the determination of the Customs Union tariff that later we will put together with the model's predictions.

### 2.5.1 Regression Results

As a starting point of empirical analysis of the common external tariff, we look at the harmonised tariffs in 2012 as a linear function of national tariffs in 2009 prior to Customs Union formation:

$$t_{ECU2012i} = \alpha + \beta_1 t_{RU2009i} + \beta_2 t_{BY2009i} + \beta_3 t_{KZ2009i} + e_i \quad (2.5.1)$$

The results are presented in column (1) in Table 2.3. This simple regression provides an adjusted R-squared of 95%, explaining very well the tariff variation. This exploratory regression is pooling the sectors, thus ignoring sectoral variation. The country coefficients

correspond to the country weights obtained by averaging across all sectors. The sum of coefficients is 0.95, i.e. very close to 1, a property that will be observed in almost all of the specifications.

Russian tariffs enter with the coefficient 0.615 which corresponds to 65% of sum of the coefficients, a very large number but well below its 84.7% population share and 87.5% of total GDP share. Both Belarus and Kazakhstan thus have greater weights than their population or GDP shares would suggest, particularly the latter with 19.5%. Kazakhstan's tariff policy is significantly different from the policy of the other two members and the average tariff was much lower. Kazakhstan's share is higher in overall CU; even if we pull together Belarus and Russia due to their similarities prior to the CU, the result stands. As the more elaborate analysis below will show, this regression result probably comes from Kazakhstan being successful in achieving tariff spillover in the partner countries for goods it protects.

Table 2.3: CET in 2012 and national tariffs in 2009

Dep. Variable Model	$t_{2012}$				
	(1)	(2)	(3)	(4)	(5)
$t_{RU2009}$	0.615*** (39.54)	0.616*** (30.72)	0.518*** (27.29)	0.633*** (43.40)	0.563*** (31.54)
$t_{BY2009}$	0.146*** (9.09)	0.128*** (6.06)	0.0596** (3.17)	0.196*** (12.79)	0.127*** (6.85)
$t_{KZ2009}$	0.187*** (19.35)	0.198*** (14.50)	0.158*** (15.67)	0.0758*** (6.63)	0.0565*** (4.81)
$t_{max2009}$			0.191*** (8.77)		0.146*** (6.69)
Constant	0.603*** (8.47)	0.952*** (7.20)	0.568*** (8.04)	0.570*** (8.37)	0.525*** (7.70)
Coef. sum <sup>4</sup>	0.95	0.94	0.93	0.90	0.89
Fixed effects				HS2 groups	HS2 groups
Observations	4318	2447	4318	4318	4318
Adjusted $R^2$	0.914	0.908	0.916	0.934	0.935

$t$  statistics in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

The next specification, presented in column (2) of Table 2.3, considers the sub-sample of product lines for which the tariffs were not harmonised in 2009. As more than 40% of all tariffs were equal already in 2009, this specification excludes the lines that were equal as we are interested to assess the weights of individual country tariffs in determining the tariffs that actually had to be harmonised:

$$t_{ECU2012i} = \alpha + \beta_1 t_{RU2009NH_i} + \beta_2 t_{BY2009NH_i} + \beta_3 t_{KZ2009NH_i} + e_i \quad (2.5.2)$$

The results are very similar to the first specification.

The specification in column (3) is aiming to capture the spillovers of protectionism from national level to partners in the CU. The tariffs in 2012 are regressed on national tariffs, like in the first specification, and on a variable  $t_{max}$ . The latter variable equals to the highest tariff in 2009 among the three members for each product line. As theory predicts, the country will have a higher weight in the CU tariff for goods that it protected more than its partners in the FTA. The null hypothesis that the country receives no extra weight in goods that it protects more than the partners, would lead to an insignificant coefficient. However if the CET determination exhibits mutual protectionism effect – that is, spillover to partners, then the coefficient of variable  $t_{max}$  is expected to be positive and significant.

$$t_{ECU2012i} = \alpha + \beta_1 t_{RU2009i} + \beta_2 t_{BY2009i} + \beta_3 t_{KZ2009i} + \beta_4 t_{max2009} + e_i \quad (2.5.3)$$

The column (3) in Table 2.3 summarises the estimation results; the  $t_{max}$  coefficient is 0.19. This implies that on average the weight of each country is 20% higher for goods that it protects more than the partners, and these will be protected by all members in the Customs Union. The highest tariff charged by any member country enters with an additional effect: a 1% increase in the maximum tariff raises the common tariff by 0.2% on top of national tariff weight.

Interestingly, the inclusion of the maximum tariff decreases the weight of Belarus to 6.4%. Note that Russia and Belarus had very similar tariffs already prior to the CU which can be attributed to Belarus having extra weight in the pooled regression.

The specifications presented in columns (4) and (5) of Table 2.3 are analogous to (1) and (3), respectively, with the only difference that they control for the sectoral fixed effects at the 2 digit level:

$$t_{ECU2012i} = \alpha_j + \beta_1 t_{RU2009i} + \beta_2 t_{BY2009i} + \beta_3 t_{KZ2009i} + e_i \quad (2.5.4)$$

The results remain of the same magnitude with the sector dummies for Russia but are much lower for Kazakhstan. This specification gives the we country weights, controlling for

differences in products, and thus is best fit to test the hypothesis b). Indeed, still well below the population and GDP share of Russia, its weight goes up to 70% while Kazakhstan's share decreases to 10%, much closer to its population and GDP share. Moreover, the number for Russia can be biased downward as its tariff is very similar to the one of Belarus and thus the regression can wrongly attribute to Belarus part of Russia's weight. To account for this, the next part is analysing the sample variance.

## 2.5.2 Mutually Protected Sectors

Table 2.4 presents the tariff averages prior and after the creation of the Customs Union for several groups of products for each member. The first row presents the means for all products, showing that in the process of harmonisation tariffs of Belarus and Russia went slightly down while Kazakhstan's tariffs increased.

The following rows show the changes for the groups of protected goods. Following theory, goods protected in FTA more in one country, will be protected by all members of the CU. To test this hypothesis, let us look at goods that we protected in each country prior to the CU. For empirical purposes, a good is considered protected in country  $i$  if the pre-CU tariff in this country is at least 1% higher than in the partner countries<sup>5</sup>.

Across all protected goods, the picture is similar to that of mean all goods - noticeable decrease for Russia and Belarus and even more significant increase for Kazakhstan.

However the picture is very different for the last three rows where the protected goods are grouped by countries that protected these goods pre-CU in 2009. Although Kazakhstan saw a 65% increase in mean tariff (from 6.5% to 10.7%), it actually decreased tariffs for the goods the goods it protected more than the partners. And just the opposite is true for Belarus and Russia: the two countries had to decrease their tariffs on average (tariff down from around 12% to around 11%) and in the goods they protected, but in goods protected by Kazakhstan were 4% higher post-CU.

Similarly, Kazakhstan saw the mean tariff up by 65% but for the goods protected by partners, Russia and Belarus, - by 98% and 72%, respectively.

These findings confirm the hypothesis that the tariff determination in a CU is not only driven by the economic weights of its members but is an outcome of a process where each side is willing to concede to protect the partners' goods in exchange for similar protection. Some example sectors. Closer look at the sectors with largest spillovers of protection from

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<sup>5</sup>The minimum margin of 1% was chosen to avoid arbitrary cases where all countries have same specific tariffs but when these are converted into ad valorem tariffs as they appear in the dataset, they might be slightly different.

Table 2.4: Tariff changes by product groups

	No	Russia		Belarus		Kazakhstan	
		$t_{2009}$	$t_{2012}$	$t_{2009}$	$t_{2012}$	$t_{2009}$	$t_{2012}$
All goods	5052	12.18	10.94 ↓	11.81	10.87 ↓	6.49	10.74 ↑
Protected goods	901	24.42	19.74 ↓	22.20	19.35 ↓	12.61	19.82 ↑
Protected by Russia	405	40.86	29.53 ↓	30.84	28.74 ↓	14.97	29.71 ↑
Protected by Belarus	309	11.12	10.35 ↓	18.26	10.30 ↓	5.79	9.94 ↑
Protected by Kazakhstan	187	10.77	14.40 ↑	10.01	14.32 ↑	18.79	15.11 ↓

one member to partners reveals the following observations. Sector 4(Dairy products, eggs and etc) was one of the most protected sectors in Kazakhstan with tariff 25,78%, significantly higher than in Russia and Belarus, and the adopted average tariffs in 2010 in that sector are between 23-24% for these countries.

Instead, Russia was very successful in pushing up tariff for sector 02(Meat and edible meat offal). The meats sector was well-protected in all members prior to the CU, but way below Russia's 45% average tariff, however in 2010, all three countries adopted mean tariff rates 46% for meat. Other sectors where Russia and Belarus had very high tariffs in 2009 while Kazakhstan - moderate ones but then the protection was spilled over to Kazakhstan are: 44(Wood and etc), 48 (Paper and etc), 71(Pearls, precious stones, metals, coins, etc), 88(Aircrafts and etc).

We also note that there are many more sectors with mutual protectionism effect than sectors that saw liberalisation over the weighed average during CET determination. The most prominent liberalised sector is 22 (Beverages, spirits and vinegar), which had lines at HS 6 of more than 300% tariff. We believe that the extremely high tariffs for these few lines explain the outlier behaviour of that sector.

### 2.5.3 Analysis of Variance

The previous two subsections gave already a lot of insight into the CU tariff determination. However the relatively high level of tariff harmonisation of 40% prior to the CU gives an opportunity for biased weight estimators. The linear model can bias towards more equal weights. To determine the country weights, in particular for the protected goods, this subsection analyses the variance of multiple regression models. The basic idea of such analysis is comparing the explanatory power of the model with and without the variable of interest.

There are three explanatory variables in the full model under consideration: the three national tariffs in 2009. The unique explanatory power of each variable is then determined by

Table 2.5: Analysis of Variance based on Exclusion Test

2012 MFN tariff	Obs	$aR^2$	Relative Importance		
			$t_{RU2009}$	$t_{BY2009}$	$t_{KZ2009}$
All goods					
$t_{RU2012}$	4876	92%	0.73	0.05	0.21
$t_{BY2012}$	4876	89%	0.68	0.07	0.25
$t_{KZ2012}$	4876	87%	0.67	0.02	0.31
Harmonised goods					
$t_{harm2012}$	4239	92%	0.83	0.03	0.14
$t_{harm2012}$	4318	91%	0.77	0.04	0.19
Protected by Russia					
$t_{RU2012}$	393	94%	0.96	0.03	0.01
$t_{BY2012}$	393	93%	0.96	0.03	0.02
$t_{KZ2012}$	393	91%	0.98	0.01	0.01
Protected by Belarus					
$t_{RU2012}$	306	84%	0.67	0.19	0.15
$t_{BY2012}$	306	86%	0.57	0.31	0.12
$t_{KZ2012}$	306	84%	0.49	0.29	0.22
Protected by Kazakhstan					
$t_{RU2012}$	183	85%	0.10	0.14	0.77
$t_{BY2012}$	183	85%	0.11	0.00	0.89
$t_{KZ2012}$	183	89%	0.17	0.05	0.79

exclusion test, that is, by looking at the difference of the explanatory power of the full model and without the variable in question. If such exclusion test is done for all three variables, the unique explanatory power of all variables will be found. The weight of each national tariff is then found as the ratio of its unique explanatory power to the sum of unique explanatory power of the three variables.

Table 2.5 presents the results of the analysis for the 2012 tariffs as functions of national 2009 tariffs. Note that the 2012 tariffs were highly harmonised but still below 100%. To avoid possible differences depending on which of the 2012 tariffs is used as depending variable, the results are shown for all three countries. As expected, for almost all cases the results are not too sensitive to that choice, with qualitative findings being intact.

Each country has a tremendous increase in its weight in the 2012 tariffs for the goods it protects. Russian tariffs' weight is 0.96 – 0.98, for Belarus the weight is 0.19 – 0.31 and for Kazakhstan 0.77 – 0.79 for the groups protected by respective country.

For the full sample and for harmonised goods the country weights go closer to the economic size ratios. Kazakhstan's weight remains significantly higher than its economic size which is explained by its ability to extend the protection in the CU of goods it protected before the CU. Note that there are two samples of harmonised tariffs: fully harmonised and

those were there is still difference but lower than 1%.

The analysis of unique explanatory of each variable is very useful in the case in hand where the explanatory variables had a lot in common. It allows to pick the extra bit added by each variable specifically.

It is useful, however, to determine the overall value added by each variable. [Lipovetsky and Conklin \(2001\)](#) demonstrate the advantages and consistency of using the Shapley value for identifying the relative importance of regressors in the presence of multicollinearity. To calculate a Shapley value of a regressor, all possible combinations of explanatory variables should be considered. How much each variable is able to explain on its own, how much it adds when added to either of the other two and how much explanatory power it adds to both other two variables. For this task of finding the extra explanatory power of each variable in all possible combinations Shapley value for each variable is calculated. The Shapley value of explanatory variable  $i$ ,  $\phi_i(v)$ , is ([Shapley \(1953\)](#)):

$$\phi_i(v) = \sum_{S \subseteq N \setminus \{i\}} \frac{|S|! (n - |S| - 1)!}{n!} (v(S \cup \{i\}) - v(S)) \quad (2.5.5)$$

where  $n$  is the number of explanatory variables in the full model (3 in this case),  $N$  is the set of variables of full model,  $S$  is set of variables included in a regression model and  $v$  is the regression sum of squares.

Note that the Shapley value takes into account the extra explanatory power of the variable for each possible combination, including the empty set. And as each variable alone is able to predict the CU tariff rather well, the Shapley value will suggest less unequal weights than the analysis of variance by unique explanatory power of each variable.

The results are presented in [Table 2.6](#).

Indeed, the weights determined by the Shapley values are close to each other. At the same the results point to the spillover of protectionism within the CU. In particular, the weight for Kazakhstan goes up to 37-38% for goods it protected in the FTA from 26-27% for all goods or all harmonised goods. Similarly, Belarus' weight reaches its peak of 37-39% in the common CU tariff of goods it protected in the FTA.

Note that Russia's tariff weight does not see such a spike in its weight for sample of goods it protects. Instead, Kazakhstan's tariff weight is slightly higher than for the sample of all goods and harmonised goods. This case is the only slight evidence of Kazakhstan's attempts to negotiate down the CET for the goods where it would have to make the most significant increases.

Table 2.6: Analysis of Variance based on Shapley Value

2012 MFN tariff	Obs	Shapley Value: Relative Importance		
		$t_{RU2009}$	$t_{BY2009}$	$t_{KZ2009}$
All products	4876	0.39-0.40	0.33-0.35	0.26-0.27
$t_{harm2012}$	4239	0.39	0.35	0.26
$t_{harm2012}$	4318	0.39	0.35	0.26
Protected by Russia	393	0.39	0.32	0.29
Protected by Belarus	306	0.41-0.43	<b>0.37-0.39</b>	0.19-0.21
Protected by Kazakhstan	183	0.32	0.30-0.29	<b>0.37-0.38</b>

## 2.5.4 Discussion

All the specifications are very simple and yet explain around 93-94% of variation in common external tariff. All estimations highlight the large role of Russian tariffs in 2009 in determining the common external tariff. However compared to the theoretical prediction where tariffs are driven by population (or GDP) share, the Russian weight is considerably lower (70% vs 87% ) and especially Kazakh influence is stronger (20% vs 8%). Thus the theoretical model that is used for structural support of the estimation strategy has a lot of embodied structure but still captures important patterns of common tariff determination in a Customs Union. The Customs Union brought on average only a very modest increase of the tariffs above the weighted average but on sectoral level there is evidence of mutual protectionism.

We also found that there are large differences in the determination of common external tariffs among the two subgroups of ad valorem and specific tariffs. The former are on average much lower for all the three countries and for these lines Russia had a very strong, decisive, impact on common tariff. The latter tariffs are on average several times larger than ad valorem tariffs. In these lines Kazakhstan had on average much lower tariffs than Russia and Belarus prior to the CU, but also for these lines we found the strongest impact of Kazakh tariffs and, weaker than for ad valorem tariffs, impact of Russian tariff policy. The lower than predicted share of the coefficient of the Russian tariffs in the sum of all coefficients can be seen as evidence that Russia entered into compromises on the external tariff. This appears as a natural conclusion given that Kazakhstan in any case experienced large adjustments and increase in tariffs and in order to make the Customs Union participation incentive compatible for Kazakhstan, certain room for negotiation above the weight based on population size was

available. Belorussian tariffs had the lowest impact on the determination of the CET, and that can be also potentially explained through transfers. Indeed, Belarus is located between the EU countries and Russia and thus a large part of the imports from the EU enter through Belarus. Positive externalities from transit could be a possible explanation why Belarus seems to have been the least active in tariff determination.

## 2.6 Conclusion

Customs Unions are perhaps among the most far-reaching preferential trade agreements, which naturally have consequences on external tariff policy. While extensive theoretical results are available, which largely predict Customs Unions to be more protectionist than Free Trade Areas, surprisingly little is known about the effects of CUs empirically. This paper seeks to fill the void through a detailed study of tariff policy in the newly-formed Eurasian Customs Union using a large panel data set.

Using three different methodologies, I show that mutual protectionism powerfully shapes tariff structure in a Customs Union. If a member state strongly protected an industry before the formation of the CU, this state is able to assure protection for the same industry after CU formation too - but extended also the partner countries. There is little evidence of a mutual liberalisation effect, where countries would bargain to keep previously low tariffs at similar levels after CU formation. These findings are consistent with a simple model of tariff formation in an imperfectly competitive setting.

Given the asymmetry of the members of the Eurasian Customs Union, it is of some interest to estimate the relative decision weights to given to each country in the determination of the CET. One of the most immediately noticed impacts of the Customs Union of Russia, Belarus and Kazakhstan was the rise of the import tariffs in Kazakhstan. Furthermore, suggestions were made that the common external tariff (CET) was dictated by Russia. We discuss in this work that as a larger market, Russia could be theoretically expected to have a large influence in the common tariff, even in the absence of any “power abuse”. However I find that Russia had much lower impact in tariff determination than GDP-weighted bargaining would suggest. Depending on specification, Russian role varies roughly between 53-64%, even if we only look at the tariffs that were not harmonised prior to the Customs Union. As the 40% percent of tariff lines were identical for all three members prior to the Customs Union, counting the share of the lines of the CET that were equal to the Russian ones in 2009 overestimates Russia’s influence. Having said that, Russia and Belarus both had more highly protected sectors than Kazakhstan. In the CET for most of these highly protected

sectors we observe mutual protectionism - the sectors that were not protected before in partner markets, become protected.

Our tariff data includes years 2011 and 2012 and shows continuing harmonisation between members and the fall of CET. And although Russia joining the WTO only towards the end of 2012, the decrease in the CET could either be explained by further moderation of Russian and Belorussian tariffs with Kazakhstan's 2009 tariffs or requirements imposed by WTO accession protocol. Determining which of the two caused mild decreases of the CET in 2011 and 2012, though an interesting challenge, is left out of scope of this project.

## 2.7 Appendix

### 2.7.1 Market Outcomes

In the following superscript  $l$  is omitted for expositional purpose. The problem of any of the  $n_i$  firms in country  $i$  is given by

$$\begin{aligned} \max_{\{q_{ii}, q_{ji}, q_{ki}\}} &= P(\bar{Q}_i, q_{ii})q_{ii} + (P(\bar{Q}_j, q_{ji}) - t_{ji}) q_{ji} \\ &+ (P(\bar{Q}_k, q_{ki}) - t_{ki}) q_{ki} \end{aligned} \quad (2.7.1)$$

where  $\bar{Q}_j$  denotes the total quantity produced in the market by all other firms, and  $Q_j$  denotes the market output.

And similarly for firms in the other countries,  $j$  and  $k$ . To find the equilibrium in country  $j$ , sum the  $3n$  first-order conditions for  $q_{ii}, q_{ij}, q_{ik}$  respectively to find the equilibrium output for given tariffs:

$$\begin{aligned} 0 &= 3n(\Gamma - Q_i) - Q_i - nt_{ji} - nt_{jk} \\ Q_j^*(t_{ji}, t_{jk}) &= \frac{3n\Gamma - n(t_{ji} + t_{jk})}{3n + 1} \end{aligned}$$

and, again, symmetrically for the other countries. The output of the representative firm in each country is then given by

$$q_{jj}^* = \frac{\Gamma + n(t_{ji} + t_{jk})}{3n + 1} \quad (2.7.2)$$

$$q_{ji}^* = \frac{\Gamma - (1 - 2n)t_{ji} + nt_{jk}}{3n + 1} \quad (2.7.3)$$

$$q_{jk}^* = \frac{\Gamma + nt_{ji} - (1 + 2n)t_{jk}}{3n + 1} \quad (2.7.4)$$

## Chapter 3

# Trade impact of non-tariff trade costs: An Assessment of the Customs Union of Russia, Belarus and Kazakhstan

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### Abstract

Trade facilitation, the reduction of administrative and other non-tariff barriers, has become a key policy priority. But how strongly can such measures benefit trade? This paper studies the most comprehensive trade facilitation measure possible – complete elimination of customs points – using a rich panel data set incorporating the staged border removal in the recently established Eurasian Customs Union. The Customs Union abolished the customs controls between the members in two stages. This allows to estimate the effect of border elimination which is particularly strong for intra-CU trade. Controlling for tariff changes and other factors, trade growth can be attributed to reduced trade costs, that is, not driven by trade diversion due to tariff changes. The time differences of removing the internal customs controls allows to estimate the border effects directly, instead of inferring them indirectly from the difference between intra-country and inter-country trade as it is typically done in the literature.

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## 3.1 Introduction

Since the Customs Union between Russia, Belarus and Kazakhstan (RBKCU) was ratified in November 2009, regional integration within this institution has proceeded at a rapid pace. A common external tariff was implemented in January 2010. None of the CU members was a WTO member by the time the Customs Union was created. The unexpected announcement and rapid implementation suggest the Customs Union appeared as an exogenous shock.

Internal customs controls between the three members were successfully abolished. The elimination of the internal customs controls can potentially have an important non-tariff impact on trade patterns. [Freund and Pierola \(2012\)](#) find that border crossing times and variations in time can strong impact on trade; similarly, findings from [Martincus et al. \(2013\)](#) suggest that customs delays have a significant negative impact on exports. That is particularly true in the case of Russia, Belarus and Kazakhstan: [UNECE \(2012\)](#), [UNECE \(2013\)](#) and [Vinokurov \(2013\)](#) found very large man-made costs at the border crossings of the CU countries. Among those are complex customs procedures at border crossing points that increase waiting times for vehicles and rolling stock. The CU creates an opportunity to reduce these costs, for example, the goods that belong to the “Single List of Products Imported to the CU, subject to a mandatory conformity assessment in the CU framework with issuance of the uniform documents” need to be certified only once when they enter the CU. This change brought by the CU should lower the trade costs of exporting to the CU countries.

The members of the ECU rank near the bottom of World Bank’s *Trading Across Borders* index, hinting at large trade costs on top of formal tariffs. The removal of the last internal customs posts – effective from July 2011 – may thus bring gains, creating the potential for integrated supply chains in the ECU area – and going beyond what could be achieved multilaterally. Foreign exporters may also benefit from reduced trade costs, somewhat offsetting adverse tariff effects: since rules of origin ([Krueger, 1997](#)) are no longer in effect, they can import to the ECU market through either of its members. In time, this may lead to competitive pressure on the member countries to improve the efficiency of their borders.

Just 2 years prior to joining WTO, Russia formed the Eurasian Customs Union (ECU) with Belarus and Kazakhstan – pointing to a more regionally oriented approach. There are far-reaching plans to further develop the Customs Union into a “Common Economic Space” modeled after early European integration policies. There are current attempts to extend the membership of the Customs Union to other CIS countries, in particular Armenia and Kyrgyzstan and possible associated revision of bound tariffs for these countries. Russia’s WTO

accession negotiation is an important background part of the Customs Union's creation. The accession has been negotiated for many years, and the slow pace of the process could have contributed to Russia's interest in the regional integration.

The timing of the elimination of borders gave rise to a natural experiment setting that this paper explores. The elimination of internal customs controls happened in two stages: in July 2010 (between Russia and Belarus) and July 2011 (between Russia and Kazakhstan). The table below demonstrates that. The two-stage process allows to distinguish the overall effect of the Customs Union that came into force in 2010 from the impact of the border elimination and thus assess the importance of border barriers. This method also allows to estimate the effect of the borders directly rather than inferring it from the difference between the intra-country and inter-country trade as previous studies did (starting with [McCallum \(1995\)](#)). These studies attribute to the border effect (after controlling for a variety of factors) the differences between the pairs of regions within the countries and across the countries. That approach attributes to the border effects many unobserved differences between the countries that could persist even if the borders would be eliminated. Instead the approach based on the analysis of the trade flows before and after the removal of internal customs checks allows for a more specific assessment of the border effects.

This study uses highly disaggregated bilateral trade within the CU and with main trade partners of the CU members from 2007 to 2012 to disentangle the tariff and non-tariff impact. [Clausing \(2001\)](#) demonstrates that using product-level data allows to capture trade effects that are blurred in the pooled data while [Anderson and Yotov \(2010b\)](#) and [Anderson and Yotov \(2010a\)](#) show the estimation bias of aggregation. The disaggregation level of 6-digit HS2007 classification and significant tariff changes brought by the CET give the necessary variation in the observed data of about 600000 observations across four dimensions: importer, exporter, product and period. The empirical strategy involves estimations with country-pair fixed effect and country-time fixed effects controlled for, as well as with those where major macroeconomic variables (GDP, exchange rate) are used.

The results point to a positive and strong impact of the removal of borders on trade flows across several specifications. The effect is estimated to be the strongest for the intra-CU trade. That is rather intuitive as the CU partners enjoy the unique environment of trading across borders without customs checks. There are several economic mechanisms that stand behind the result. First, the checks at the borders can significantly increase the trade costs if the trucks have to stop for long periods for the documents and goods checks. Second, the lack of internal borders and the associated reduction in trade costs induces the firms to look at the CU members as a common market. That, in turn, may attract investment

and increase in trade for the smaller members of the CU as they now provide access to the whole of the CU. First examples of improved investment attractiveness in peripheral members due to ECU are available. [Anishenko \(2014\)](#) reports that China, a major investor, is focusing intensively on Belarus due to its relatively investment and doing business friendly environment and the access to Russia through Customs Union.

More generally, the removal of customs controls offers equal gains from access to a larger market to everyone. However as the barriers for entering the CU remain in place, we see smaller impact on the non-members. Second channel for the positive impact of the non-tariff changes on the trade with non-members could be that the increase in the intra-CU trade leads also requires increased use of intermediate inputs from external partners that are world export leaders. This is intuitive as plants of foreign multinationals use intermediate inputs imported from other countries ([Frost and Davies \(2014\)](#))

While Russia is a prime import partner of Belarus and Kazakhstan, the reverse is not true. This pattern prompted concerns of trade diversion towards Russia ([Tarr, 2012](#)) as a result of the CU; supporting evidence for this is provided by [Isakova and Plekhanov \(2012\)](#) for the case of Kazakhstan.

The common external tariff introduced in the Customs Union brought many changes to the applied tariffs of the members. These changes create sufficient variation to estimate precisely tariff elasticity of bilateral trade flows. As expected, the relationship is strong and negative (elasticity between -0.5 and -1). But, crucially, the creation of the Customs Union can have trade effects that go well beyond the tariffs. Specifically, the elimination of internal customs controls in the CU creates a potential for common economic market and has significant positive impact trade. The results suggest that firms from member countries benefit the most, doubling their exports; but also non-members gain, exporting 50% more due to lack of intra-CU borders. These numbers are in line with the findings of the seminal work by [Anderson and Van Wincoop \(2003\)](#). They find that borders reduce trade between the US and Canada by about 44% and by 30% between other industrialised countries. This paper uses a more direct assessment of borders, i.e. a more narrow definition close to actual border crossing costs, thus everything else the same, the impact should be slightly lower. However the analysis is done for countries with border-related costs that are much higher than for average country, and that implies that the impact is expected to be higher as indeed the results suggest.

Overall, the effect of the Customs Union is a composite of tariff changes and alleviated trade costs. With moderate tariff increases, CU has, although asymmetric with respect to members and non-members, trade creation effect.

The paper proceeds by discussing the relevant literature in Section 2. Section 3 presents the data and descriptive statistics. The following Section 4 turns to the empirical strategy, while Section 5 presents the results. Section 5 presents results, whose robustness is examined in section 6. Section 7 concludes the paper.

## 3.2 Related Literature

Theory: PTAs, in particular FTAs but also CUs have been studied comprehensively in the regionalism literature (e.g. [Freund and Ornelas \(2010\)](#) provide a survey). The general theme of this literature is that a Customs Union allows member countries to internalise cross-border externalities, e.g. relating to profits arising from trade or terms of trade effects, that are ignored by policy-makers under MFN or FTA tariff setting. As a result, tariffs in a Customs Union tend to be higher than in a free trade area; and through higher tariffs, imports from the rest of the world are diverted towards the partner country. When decision-makers are biased towards the interests of producers, this effect is particularly strong. Hence, CUs are often seen negatively by multilateralists; however, in related theoretical work (see Chapter 1), we show that even in the presence of political bias, CUs can be welfare-enhancing for members. In practice, it is important to understand to what extent Customs Unions have tariff effects, and whether they lead to trade diversion empirically.

Trade effects of PTAs have been extensively studied, particularly for the case of NAFTA ([Clausing, 2001](#), [Trefler, 2001](#)). Of particular interest is the work of [Romalis \(2007\)](#), who identifies trade effects of NAFTA using differences in differences vis-à-vis Europe as an identification strategy. In his estimation, NAFTA had a substantial effect on trade volumes, particularly in protected sectors, but only moderate price and welfare effects. [Clausing \(2001\)](#) assesses the impact of Canada-US FTA tariff changes on disaggregated bilateral trade flows in a panel setting. The paper provides trade theory motivation for the estimation strategy employed which is very similar to our basic approach. The goal of the present section is to decompose the changes in trade patterns that occurred under CU into those that can be attributed to tariff changes and those due to non-tariff factors. The regression analysis decomposes the trade changes into tariff and non-tariff factors. The structure of the panel has three cross-sectional dimensions - importer, exporter and product and one time dimension - year.

Empirical estimations of border effects as the difference between intra-national and across the border trade start with the gravity estimation of Canada and U.S. trade by [McCallum \(1995\)](#). [Anderson and Van Wincoop \(2001\)](#) pointed to the overestimation of the border effects

by [McCallum \(1995\)](#) due to omitted variable bias - country-specific price index. Further, [Feenstra \(2002\)](#) suggests the use of importer-exporter fixed effects over the computational method of [Anderson and Van Wincoop \(2001\)](#) of controlling for price index as fixed effects provide consistent estimates, control for other possible country-specific omitted variables and are simple to apply. [Olper and Raimondi \(2008\)](#) follow [Feenstra \(2002\)](#) in their gravity estimation of border effects follow and for OECD countries. [Requena and Llano \(2010\)](#) and [Emlinger et al. \(2008\)](#) use sectoral data and include the country- and industry-fixed effects. Similar to this paper [Chen and Novy \(2011\)](#) apply a gravity model of bilateral trade for disaggregate panel data.

These studies rely on the theoretical model behind the gravity equation as in [Anderson and Van Wincoop \(2004\)](#).

Analysis of the CU of Russia, Belarus and Kazakhstan: [Isakova and Plekhanov \(2012\)](#) investigate the impact of the Customs Union on the structure of imports in Kazakhstan. They note that Kazakh–Russian trade fell before the Customs Union became effective, creating the possible problem that increases in bilateral trade could be due to a natural recovery – which would have happened even in the absence of a CU being formed – rather than causal. Using ITC Trade Map time series data from 2006–2010 disaggregated at the 10–digit level and statutory tariffs the authors then estimate a panel of the form

$$\Delta IM_{j,t} = \alpha \Delta d_{j,t} + \beta IM_{j,t-1} + \lambda Z_{j,t} + \epsilon_{j,t} \quad (3.2.1)$$

with  $IM$  being the (log) import flows,  $d$  the change in the tariff, and  $Z$  a vector of controls, which include lagged import changes (to account for possible natural recovery effects). Their parameter of interest is  $\alpha$  - captures change in trade due to change in tariffs, and the model is separately estimated by trading partner. In addition, there are fixed effects at the product group (i.e. 2 digit) level. Estimated for the Customs Union partners, their model yields a positive and significant estimate of  $\alpha$ . A 1% increase in tariffs would promote intra–CU by 0.8%. For other trading partners – they consider China, European Union, CIS and Rest of the World, the estimate of  $\alpha$  is negative, but small and not significant at the 5% level. They conclude that the Customs Union had a small impact on trade promotion and some evidence of trade diversion.

Using similar strategy, [Isakova et al. \(2013\)](#) extends the previous work to include Russia and Belarus. The study explains the change in the trade between 2009 and 2010 through tariff changes. They find some trade creation for Russia with the rest of the world due to tariff falls in that country. They find positive impact of tariff increases on imports from Russia. The authors note that the magnitude is however small and they anticipate that the larger benefits

could come from reduced internal trade costs. [Tarr \(2012\)](#) argues that previous attempts for deep regional integration projects of Russia were failing as they involved transfers from potential members to Russia, and in this respect the current Customs Union aims to reduce internal trade costs in which case other members will also benefit. The author also suggests that Russia's WTO accession will be a step in the direction of reducing non-tariff barriers to trade.

[Krotov \(2011\)](#) presents a detailed discussion of the Customs Union's administration system, customs legislation and clearance. He finds that the Customs Union is functional and, although the rules are yet to be fully formed, the necessary institutions and legislation for Customs Union's work are at place.

[Dragneva and Wolczuk \(2012\)](#) discuss the impact of the Customs Union on the EU's relationship with eastern neighbours, in particular, Ukraine. The paper also mentions that EU has become associated with modernization and rules-based governance, promoting Russia to adopt similar approach for its regional policy, specifically, by highlighting the economic gains and rules-based functioning of the Customs Union for potential members.

### 3.3 Data and Descriptive Statistics

#### 3.3.1 Trade Flows

Bilateral trade flows were obtained from the TradeMap platform of the *International Trade Center* (ITC) (original source UN COMTRADE) and have a panel structure. The study requires bilateral trade flow data disaggregated at the goods level. For each cross-section, the data set contains the trade flows (exports) from the main trading partners – China, Ukraine, the European Union and United States – to the ECU member countries, Russia, Belarus and Kazakhstan, as well as internal trade flows. The trade flows are disaggregated at the HS-6 level for 2007-2012.

The data is inaccurate for some bilateral intra-CU trade flows in 2010. Whenever possible, the mirror data was used. However in the case of exports of Russia to Kazakhstan in 2010 the mirror data did not resolve the problem, and this trade flow will be controlled for by a dummy in the regressions.

In the years prior to formation of the Customs Union, internal trade between the three countries amounted to \$44bn., about 16% of total imports by the three countries. The bilateral flows are highly uneven: in 2009, Russian exports to Belarus and Kazakhstan respectively accounted for 46% and 24% respectively of the total. Belarussian exports to

Table 3.1: Intra-CU bilateral trade exports

Exporter	Importer	2008, USD mln	2011, USD mln	Growth, %
RU	BY	23 500	24 700	0.05
RU	KZ	12 900	163 00	0.26
BY	RU	10 600	14 400	0.36
BY	KZ	365	668	0.83
KZ	RU	6 227	7 514	0.21
KZ	BY	171	104	-0.39

Russia made up another 18%, and Kazakh exports to the same destination 10%. Belarussian-Kazakh trade, at just over 1% of the total, was almost insignificant.

The table 3.1 summarises the changes in intra-CU export flows for a pre-crisis year 2008 before the creation of the CU and for 2011, by which year intra-CU borders were removed. By 2011 some changes were already apparent. Internal trade grew by about 19% from pre-crisis level of 2008 to \$63.7bn, faster than the 10% growth of overall trade. Thus, the intra-CU trade share rose from 20.8% to 22.4%. Exports from both Belarus and Kazakhstan to the Russian market increased significantly, overall by 30% compared to 2008. Exports from Belarus to Kazakhstan grow by 83%, making these bilateral trade flows the fastest growing. However Kazakhstan's exports to Belarus went down 40%. Russia increased its exports to the CU partners as well, very slightly to Belarus and by 26% to Kazakhstan.

The Figure 3.1 presents the trend in exports to the CU member countries using the exports in 2007 as index. The trends suggest a noticeable increase in export flows after 2010. Figure 3.3 in Appendix shows the export to the Customs Union countries as shares to total exports, year 2007 is again a base year.

### 3.3.2 Tariff Data

The tariff data was also obtained from the ITC through the MacMap platform as it provides high-quality tariff data at various classification levels. The data on applied tariffs HS 6 level was available for 2007-2012 for Russia and Kazakhstan for 2007-2012, and for 2009-2012 for Belarus. For each good, country pair and year, we have matched the tariff that is actually applied – taking into account regional agreements and the Generalised System of Preferences. Table 3.2 summarises the tariff averages of the members and the number of product lines where no tariff was levied in each year. The tariff means are calculated as simple averages

Figure 3.1: Trends in Exports

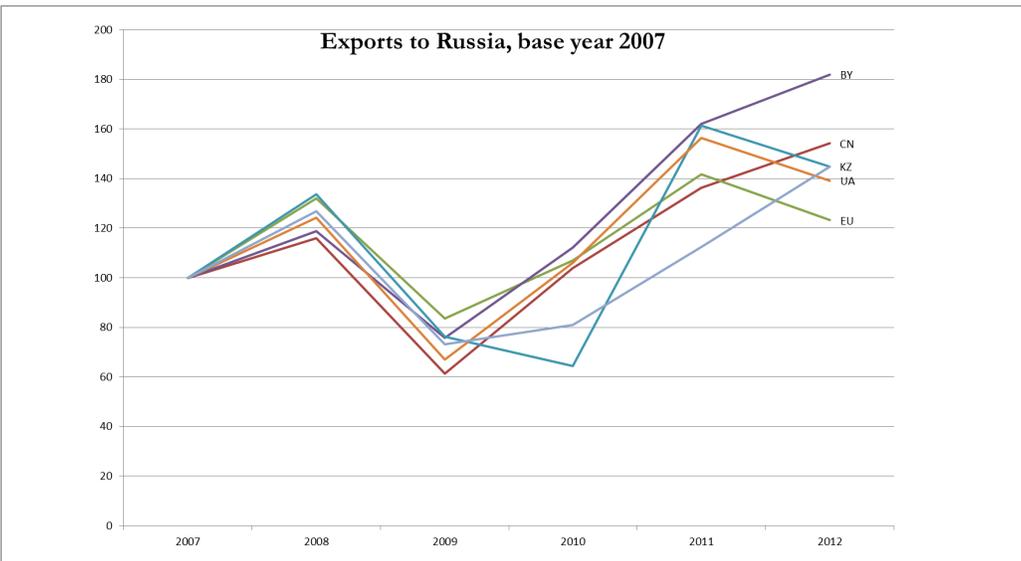
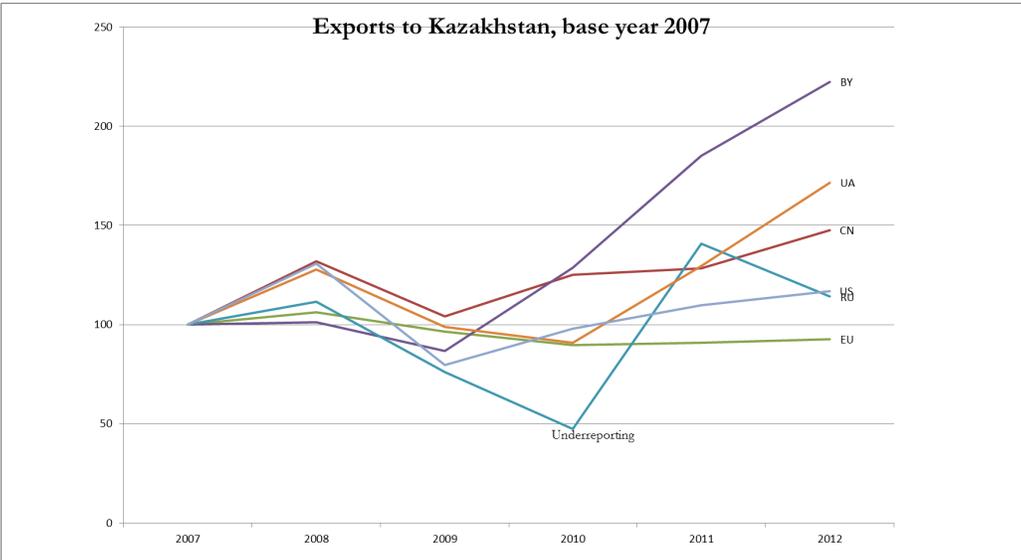
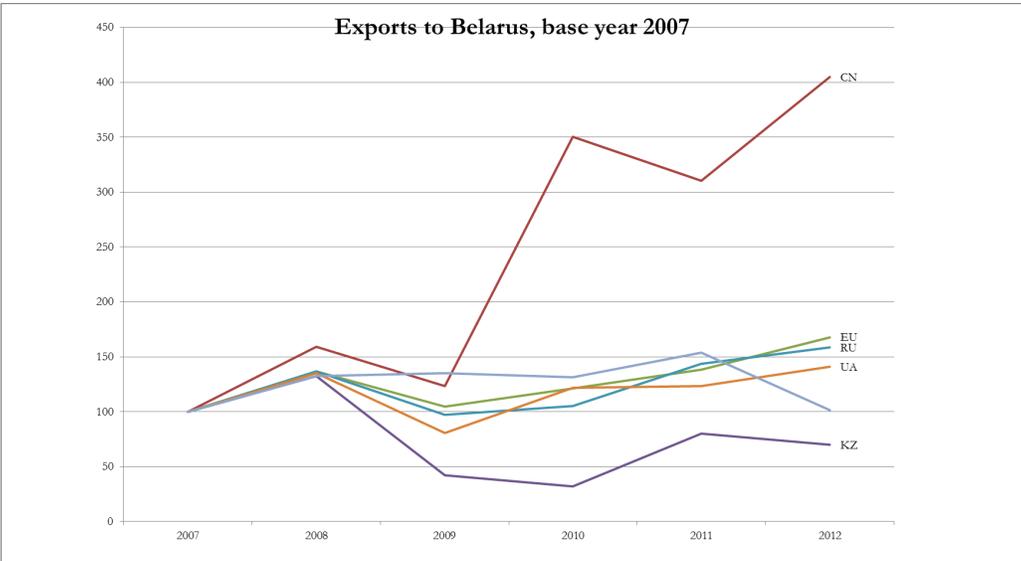


Table 3.2: Trends in MFN Tariffs

Year	N of rows	N of rows with zero tariff			Mean MFN tariff		
		Russia	Belarus	Kazakhstan	Russia	Belarus	Kazakhstan
2007	5052	369	-	914	12.12	-	8.26
2008	5052	420	-	1154	12.12	-	6.59
2009	5052	445	373	1164	12.18	11.81	6.49
2010	5052	554	554	712	10.67	10.60	10.30
2011	5015	547	547	655	11.07	10.99	10.82
2012	5205	550	550	641	10.94	10.87	10.74

of the tariff lines of the HS6 disaggregation level.

Internal Tariffs: Already before the formation of the Eurasian Customs Union, internal tariffs between the members were largely eliminated. Our data set records just 8 lines where Russia imposed tariffs on its partners - involving sugar, alcohol and tobacco - in the immediate pre-CU years. For Kazakhstan, there are 36 positive lines covering similar products and additionally some rice varieties. Our data set has no record of positive internal tariffs imposed by Belarus. From 2010 onwards, internal tariffs had been fully eliminated.

Most-Favoured Nation Tariffs: Even prior to the Customs Union, Russia and Belarus had similar tariff regimes - with average rates around 12%. By 2009, close to 80% of MFN tariff lines by the two countries already agreed. In contrast, Kazakhstan pursued a relatively liberal policy, imposing on average just a 6.5% tariff in 2009 (reflecting a period of liberalisation after 2007 that is apparent in the sample).

Common External Tariff: In 2010, the overwhelming majority of MFN tariffs - 4360 lines or 86% - were harmonised into the Common External Tariff, with many exceptions found in textiles. The CET mean a large tariff increase for Kazakhstan - to 10.29%, or nearly a 60% increase. But Russian tariffs fell to 10.7%, nearly a 20% cut, and Belarussian tariffs by 10%. Table 3.2 provides more detailed data on the evolution of MFN tariffs in the ECU region.

The members of the Customs Union prior to its creation had 40% of the tariff lines (HS 6 lines) harmonised, and in November 2009 they agreed on the Common External Tariff (CET). The CET was harmonising around 86% of the tariff lines.

Table 3.2 shows that Russia and Belarus had similar tariff averages prior to the ECU while Kazakhstan had noticeably lower tariff average. The creation of the Customs Union and tariff harmonisation led to 1,5% and 1,2% decrease in mean MFN tariff for Russia and Belarus, respectively and 3,8% increase in mean MFN tariff for Kazakhstan. The MFN tariff is applied among important trade partners, in particular, to the EU and US.

The differences in the trade policy of Russia and Belarus on one side and Kazakhstan on the other side prior to the creation of the Customs Union is seen also through the number of tariff lines where no tariff is levied. In Kazakhstan 1164 product lines were subject to free trade prior to the ECU, almost three times more than in the partner countries, and Kazakhstan got a transition period to reduce that number over the course of several years.

All three members of the ECU applied various tariff regimes besides the MFN regime. Moreover, some of the most important trade partners were benefiting from the special tariff regimes. In particular, China had access to the General System of Preferences (GSP). The GSP does not apply to all the tariff lines and, wherever it applies, it typically offers 25% discount of the MFN tariff. Interesting observation here is that Russia and Belarus were including significantly more lines in the GSP than Kazakhstan prior to the ECU. That difference is somewhat compensating the MFN tariff differences before 2010 for the developing countries. In particular, if we look at Russia, the average tariff paid by the countries in the GSP in 2009 (that is, where the preference margin was positive) was 10.89% while the corresponding MFN tariff mean for these products was 14.26%.

### 3.3.3 Other Controls

The data on GDP and population was collected from the IMF World Economic Outlook. With an annual GDP exceeding \$2trn. in PPP terms, Russia accounts for 86% of the block's GDP and 84% of its population. Kazakhstan accounts for 8% of GDP and 10% of population, while the Belarussian economy and population both amount to approximately 5% of the total.

## 3.4 Empirical Strategy

The paper follows the basic structural model of gravity equation developed by [Anderson and Van Wincoop \(2003\)](#) for cross-sectional aggregate trade flows. However in adopting the panel approach and varying trade costs across goods, the structural model and estimation specification have to be adjusted.

Already [Anderson and Van Wincoop \(2004\)](#) discuss the advantages of using the disaggregate data to account for varying trade costs and elasticities across goods as this study does. The basic model adapted for the industry level analysis is following.

$$x_{ij}^k = \frac{y_i^k x_j^k}{y^k} \left( \frac{T_{ij}^k}{\Pi_i^k P_j^k} \right)^{1-\sigma_k} \quad (3.4.1)$$

where  $x_{ij}^k$  denote import of country  $j$  from country  $i$  of good  $k$ ,  $y_i^k$  - total production of good  $k$  by firms from country  $i$ ,  $x_j^k$  - total expenditure for good  $k$  in country  $j$ . Further,  $T_{ij}^k$  stands for bilateral trade costs,  $\Pi_i^k$  is outward trade barriers of country  $i$  and  $P_j^k$  are inward trade barriers of country  $j$ . The latter two terms comprise the multilateral resistance and lead to higher bilateral trade.

The bilateral trade costs  $T_{ij}^k$  consist of tariff and non-tariff costs. In particular,  $T_{ij}^k = (1 + t_{ij}^k)b_{ij}$  where  $t_{ij}^k$  is the bilateral import tariff on good  $k$  and  $b_{ij}$  is the bilateral border barrier. If there is no border between two countries then  $b_{ij} = 1$  and otherwise it is one plus the tariff equivalent of the border barrier.

The model presented in logarithms becomes linear:

$$\ln x_{ij}^k = (1 - \sigma_k) \ln(1 + t_{ij}^k) + (1 - \sigma_k) \ln b_{ij} + \ln y_i^k (\Pi_i^k)^{1-\sigma_k} + \ln x_j^k (P_j^k)^{1-\sigma_k} - \ln y^k \quad (3.4.2)$$

The unobservable terms  $y_i^k (\Pi_i^k)^{1-\sigma_k}$  and  $x_j^k (P_j^k)^{1-\sigma_k}$  are estimated with the exporter- and importer-product fixed effects, thus leading to the structural model based gravity equation (world production of the good  $k$  omitted):

$$\ln x_{ij}^k = (1 - \sigma_k) \ln(1 + t_{ij}^k) + (1 - \sigma_k) \ln b_{ij} + \alpha_i^k + \beta_j^k + \epsilon_{ij}^k \quad (3.4.3)$$

The traditional structural gravity model is not adapted for the panel data. [Baldwin and Taglioni \(2006\)](#) argue that the gravity equation with time-invariant controls developed for cross-sectional data cannot be used for panel data. To account for changing multilateral trade resistance, the authors recommend to use pair fixed effects and country-time fixed effects. [Olivero and Yotov \(2012\)](#) develop a dynamic version of the structural gravity model that leads to the estimation equation for panel dataset. The estimation equation for the panel dataset then becomes:

$$\ln x_{ijt}^k = (1 - \sigma_k) \ln(1 + t_{ijt}^k) + (1 - \sigma_k) \ln b_{ijt} + \alpha_{it}^k + \beta_{jt}^k + \epsilon_{ijt}^k \quad (3.4.4)$$

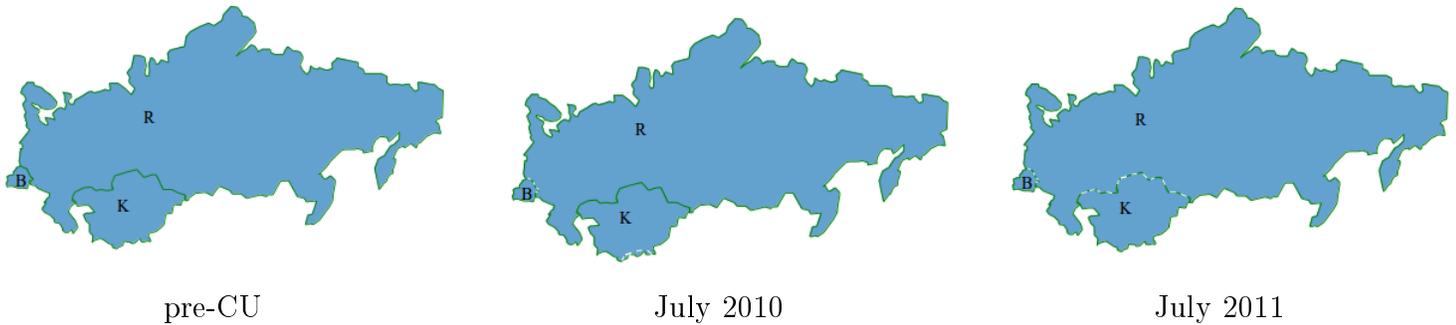
Further, to account for bilateral unobserved trade-related effects (e.g. unobserved trade costs), estimation with the country-pair fixed effects will be included.

### 3.4.1 Border Removal

In particular case of the Customs Union, the bilateral cost  $T_{ij}^k$  was changing both due to tariffs and non-tariff costs, - the changing number of borders to be crossed when exporting.

Figure 3.2 visualises the order in which the internal customs checks in the CU were removed. As the time-line of the CU indicates, the borders were removed in two stages: first, in 2010 between Russia and Belarus and only in 2011 between Russia and Kazakhstan.

Figure 3.2: Stages of Border Removal in the CU



There are several implications from the border removals. First, there are fewer administrative obstacles to trade within the CU. All import and export within the CU can happen without any customs check crossing leading to savings in customs waiting times, document checks, possible bribes and etc. Second, similar effect extends to the non-CU partners. Indeed, once the goods go through the customs clearance at the borders of the CU, they can be easier transported to all the CU members.

Further, the lack of internal customs controls creates a base for the common economic market, in particular from the investment perspective. In the common economic market the firms can invest in either of the CU members and sell the products in all the CU countries. At the same time foreign investment is often associated with imports of equipment and materials from rest of the world. There are already examples of investment and production decisions oriented to the common market, e.g. China's investment in Belarus with the focus on potential exports to Russia ([Anishenko \(2014\)](#)).

Finally, the international fragmentation of production of recent decades has been well established. This means that, mainly apart from agricultural products, any trade creation in the intra-CU trade will necessarily imply increase in demand in imports from non-members. As an example, among the automotive companies with local plants in Russia, Renault-Nissan is the leader with 70% sourcing locally, while others are much lower: Volkswagen and Hyundai with 50% and Ford, General Motors and Toyota around 10-30% ([Frost and Davies \(2014\)](#)).

The presence of various impacts of border removal, primarily, that firms from the CU do not have to cross customs controls while non-members do, the bilateral border costs  $b_{ijt}$  could

have changed differently for members and non-members. Furthermore, one could expect the border removal to have different effect on trade partners that pay MFN tariff or enjoy free trade due to multiplier effects. To control for this difference, the three border costs dummies are used:

$$lnb_{ijt} = \begin{cases} noborder_{ijt} = 1 & \text{if } j = (RU, BY), t = 2010 - 2012 \\ noborder_{ijt} = 1 & \text{if } j = (RU, BY, KZ), t = 2011, 2012 * \\ noborder_{ijt} = 0 & \text{otherwise} \end{cases} * \begin{cases} members = 1 & \text{if } i = \text{CU member (RU, BY, KZ)} \\ fta = 1 & \text{if } i = \text{FTA partner (UA)} \\ external = 1 & \text{if } i = \text{No Agreement (CN, EU, US)} \end{cases}$$

The first dummy is one if the importer is Russia or Belarus in 2010-2012 and Kazakhstan in 2011 and 2012 while the exporter is a CU member. The other two bilateral costs are defined similarly with the exporter being an FTA partner and MFN-based trade partner (no trade agreement), respectively. This differentiation also accounts for indirect effects across different exporters - decrease in trade cost for some exporters has negative impact on the remaining exporters.

Later the impact will be further differentiated among individual exporters.

### 3.4.2 Bilateral Tariffs

The indirect channel of impact of a cost-amending policy could be present not only for border removals but also for tariff changes. Indeed, higher tariff imposed on one partner, puts the unaffected partner in a better position, and vice versa. In the case of the Customs Union of Russia, Belarus and Kazakhstan, this argument is very relevant. As it has been shown above, although the internal tariffs were zero already before the CU, the MFN tariffs saw significant changes. These changes have a clear expected effect on intra-CU trade: increase in MFN tariff should be positively associated with the intra-CU trade.

The augmented gravity estimation that accounts for differentiated border and tariff effects for various exporters becomes:

$$\begin{aligned} ln x_{ijt}^k &= \alpha \ln(1 + t_{ijt}^k) + \beta \ln(1 + t_{MFNijt}^k) * partner + \gamma_1 noborder * member_{ijt} + \\ &+ \gamma_2 noborder * fta_{ijt} + \gamma_3 noborder * external_{ijt} + \alpha_{it}^k + \beta_{jt}^k + \epsilon_{ijt}^k \end{aligned} \quad (3.4.5)$$

where  $t_{ijt}^k$  is the applied tariff for each bilateral trade flow; it is zero for the FTA and CU exporters, and MFN or GSP tariff for the other exporters. Similarly,  $t_{ijt}^k$  is the MFN tariff applied to the exporters that are not in an FTA or CU with the importers. The coefficient of this variable interacted with the dummy that equals to one for FTA and CU partners, is expected to be positive: when the MFN tariff rises, flows that enjoy preferences of zero tariffs are expected to increase, other things being equal, due to trade diversion.

Zero trade flows are included in all OLS estimations. To avoid taking a logarithm of zero, an infinitesimal number is added. However this approach does not address the possible bias of the OLD estimations in the presence of zero trade flows, non-linear model of gravity equation using the Poisson estimator is applied. In order to have standard elasticity interpretation, the trade flows enter as levels while the regressors enter in logs (Silva and Tenreyro (2006)).

### 3.5 Results

Table 3.3 summarizes the results of the OLS and Poisson estimations (column 7).

Results point to a strong impact of border removal on trade flows across various approaches and estimations. The CU members appear to be the main beneficiaries of the border removal: the most conservative estimate suggests a 52% increase in bilateral flows associated with no internal borders. That is rather intuitive as the CU partners enjoy the unique environment of trading across borders without customs checks. Most comprehensive fixed effects OLS estimation model suggests more than 130% increase while the Poisson estimator of the same model is more conservative, although still very high at 61%. The divergence of the OLS and Poisson estimators speaks about the importance of controlling for zero trade flows in the dataset.

Although smaller in magnitude, all exporters appear to have benefited from the border removal. The OLS regressions with the most comprehensive sets of fixed effects imply that having access to a larger market with no internal borders increases trade by around 85% for FTA partners and 60% for exporters that are not in a regional trade agreement with export destination. Again, although significant and positive, the Poisson estimator reduces the magnitude of the impact both for FTA partner and external trade partners. The increase in bilateral trade is 35% and 3.5%, respectively.

As expected, the increase in the applied tariff has negative impact on the trade flows. The elasticity of bilateral trade flows to tariffs is close to 1 in regressions (1) to (4). However the elasticity drops down to 0.2 when the country-pair-product fixed effects are introduced. This is intuitive as the latter fixed effects eliminate the variation between bilateral tariffs in different products and leave only the time variation. This means that elasticity can be very large for some products but, once we account for that difference, the average elasticity is lower.

Increases in MFN tariff paid by the external (not in a trade agreement) exporters in general have a positive impact on the exporters that do not pay a tariff. Similar to the applied tariffs, the elasticity is between 1 and 1.2 in the regressions (1)-(4) and decreases

Table 3.3: Impact of Border Removal in a Customs Union

	OLS	OLS	OLS	OLS	OLS	OLS	Poisson
Ln(1+t)	-0.933*** (-8.35)	-1.095*** (-6.65)	-1.095*** (-6.65)	-1.363*** (-8.44)	-0.153 (-0.98)	-0.484*** (-3.65)	-0.218*** (-245.97)
Ln(1+t_mfn)*partner	1.201*** (10.41)	1.215*** (7.46)	1.215*** (7.46)	0.996*** (6.23)	-0.0283 (-0.16)	0.500*** (3.44)	0.468*** (260.95)
noborder*members	0.789*** (7.44)	1.267*** (11.63)	1.167*** (12.52)	0.515*** (18.08)	1.363*** (19.79)	1.408*** (20.44)	0.610*** (700.08)
noborder*fta	0.406*** (3.59)	0.866*** (6.95)	0.835*** (6.76)	0.113*** (3.36)	0.874*** (11.08)	0.843*** (10.69)	0.355*** (247.89)
noborder*external	0.121 (1.61)	0.577*** (5.47)	0.546*** (5.25)	0.0966*** (4.10)	0.684*** (10.20)	0.592*** (8.84)	0.0347*** (32.09)
cu_underrep	0.167 (1.71)	0.137 (1.77)		-0.681*** (-14.20)	0.0769 (1.57)	0.136** (2.79)	
LnExchange rate				-0.0139 (-0.55)			
LnGDPexporter				0.364*** (7.53)			
LnGDPimporter				0.857*** (15.91)			
Fixed effects	ij it jt	ij it jt p	ij it jt p	ij p	ijp it jt	it jt	ijp it jt
Random effects						ijp	
Observations	534422	534422	534422	534422	534422	534422	323487

*t* statistics in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

when the pair-product effects are introduced to 0.5. The random effects (6) and fixed effects Poisson estimator (7) are insignificant for the OLS fixed effects model (5).

Table 3.4: Impact of Border Removal in a Customs Union: by Exporters

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	BY	KZ	RU	UA	CN	EU	US
Ln(1+t)	-0.873 (-1.79)	-1.343* (-2.17)	-0.445 (-0.57)	0.911 (1.04)	0.110 (0.33)	-0.429 (-1.49)	-0.228 (-0.71)
Ln(1+t_mfn)*partner	1.284*** (3.78)	-3.268*** (-8.15)	0.249 (0.68)	0.882** (2.72)			
noborder	1.020*** (19.03)	0.0563 (1.17)	1.456*** (25.55)	0.328*** (5.77)	1.049*** (18.83)	1.078*** (20.90)	0.375*** (6.74)
cu_underrep		0.668*** (9.86)	-0.0901 (-1.12)				
Fixed effects	ijp jt	ijp jt	ijp jt	ijp jt	ijp jt	ijp jt	ijp jt
Observations	58432	59094	58924	87595	90516	88493	91368

*t* statistics in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Table 3.4 presents the impact of the CU for each export country separately, allowing a look at the export dimension of the CU impact. The findings are very revealing regards the results from the Table 3.3. First, note that there is very little variation of the applied tariff for the CU members and Ukraine as prior to the CU they were in FTAs with only few products with positive tariffs. Hence, the insignificant coefficients for these countries.

The indirect impact of MFN tariff on exports of countries that enjoy paying no tariffs has expected positive sign for all countries except Kazakhstan – increases in MFN tariffs of partner countries applied to the external countries had negative impact on Kazakhstan’s exports.

Interestingly, the border effects are also heterogeneous within the types of exporters. Indeed, Russia and Belarus have benefited from the border removal by doubling their exports, while the impact is negligible for Kazakhstan. The latter result can be due to the short period after the Russia-Kazakhstan border removal, and that the effect is fully observed only over a longer period.

Highly disaggregated data such as the one used in this paper typically has a lot of product lines that are not traded or the small trade values are not recorded. It is thus possible that the policy change that decreases trade costs might increase the number of products traded, e.g. by increasing the volume of trade to a sufficient level for being recorded. That is the impact of a policy on the extensive margin of trade. The extensive margin of trade flows is typically analysed using a probit model (e.g. [Debaere and Mostashari \(2010\)](#)). This paper differs in analysing the number of goods bilaterally traded in each year. Similar to the trade values, the log-linear gravity model with trade costs would determine the number of goods traded between the countries. Table 3.5 summarises the results for three estimation models of extensive margin of trade. The last column reports the Poisson maximum likelihood estimator of the regression with the dependent variable in levels and explanatory variables in logs.

The results point to the same direction as the regressions on the intensive margin of trade. It is noteworthy that on the extensive margin the impact of border removal is practically identical for CU, FTA partners and external trade partners.

Table 3.5: Impact of Border Removal: Extensive Margin

	OLS	OLS	Poisson
$\ln(1+t)$	-0.0865*** (-4.44)		-0.0706*** (-7.66)
$\ln(1+t\_mfn)*partner$	0.120*** (4.83)		
$noborder*members$	0.408*** (58.08)	0.409*** (58.31)	0.460*** (83.00)
$noborder*fta$	0.403*** (43.31)	0.403*** (43.48)	0.422*** (62.07)
$noborder*external$	0.352*** (44.59)	0.358*** (45.66)	0.379*** (62.91)
Fixed effects	ijp it jt	ijp it jt	ijp it jt
$N$	10368	10476	10368

$t$  statistics in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

### 3.6 Conclusion

This paper showed that much of the trade increase in the Eurasian Customs Union can be attributed to the removal in internal borders. We benefited from the natural experiment of CU establishment, which allowed a direct measurement of the effect of border removal. The trade promoting effect of border removal applies most strongly to internal trade – where producers already benefited from zero tariffs for almost all goods before the formation of the CU – but were held back by high trade costs. Furthermore, external trade partners also benefited from the border removal, as reduced trade costs through easier transit had benign effects on their trade volume.

The overall positive non-tariff impact of the CU on non-CU exports can be explained through two channels. First, the removal of customs controls offers equal gains from access to a larger market to everyone. However as the barriers for entering the CU remain in place, we see a smaller impact on the non-members. The second channel for the positive impact of non-tariff changes on the trade with non-members could be that the increase in the intra-CU trade leads also requires increased use of intermediate inputs from external partners.

More generally, these findings highlight the practical importance of trade facilitation measures. Indeed, the Eurasian countries were known to have problematic borders – as reflected in their low *Trading Across Borders* ranking. In these environments, it appears that a Customs Union can go far in promoting trade.

## 3.7 Appendix

### 3.7.1 Timeline of CU Implementation

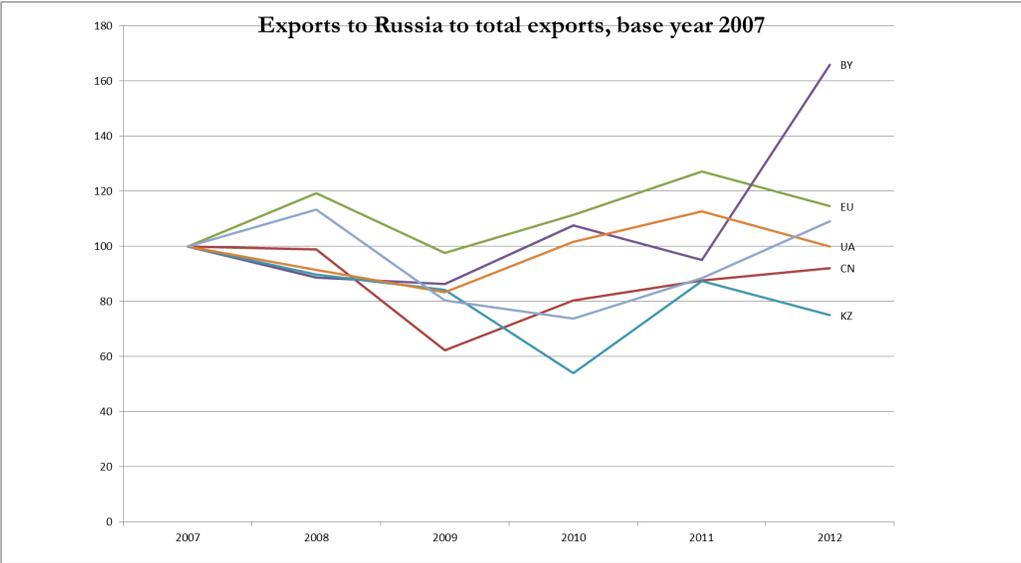
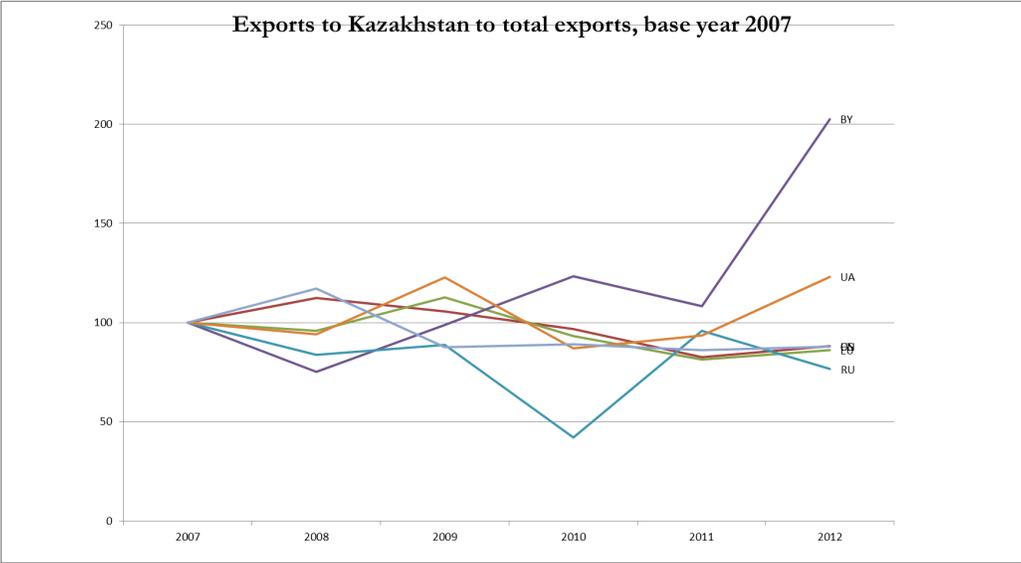
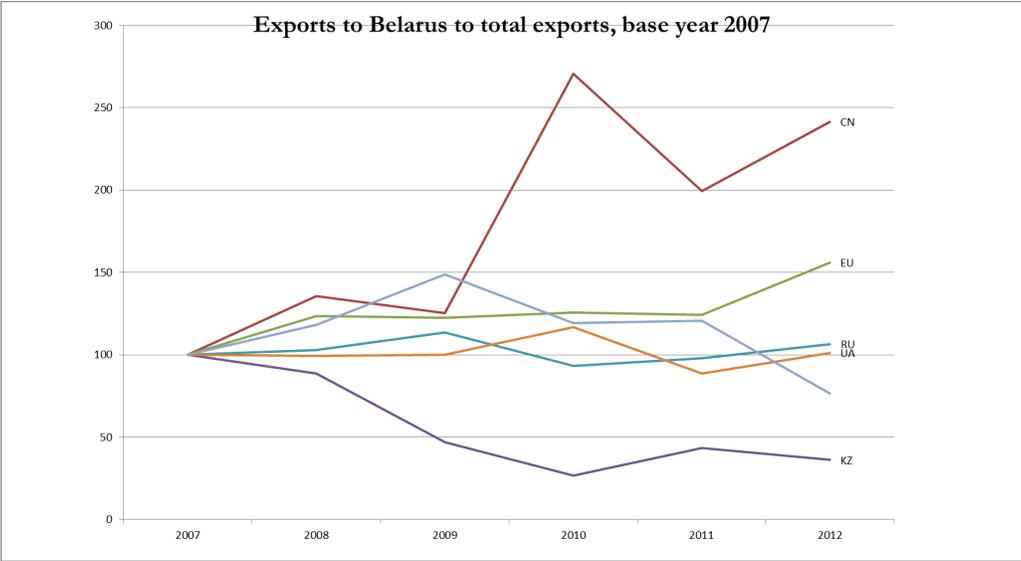
Key Events in the formation of RBKCU were<sup>2</sup>

- In 2009 heads of states of Russia, Belarus and Kazakhstan have signed and ratified international agreements that formed the basis of Customs Union.
- In November of the same 2009 the decision to create a common customs space with common external tariff on the territory of the three countries from January, 1st 2010 was taken.
- January, 1st 2010, the common external tariff became effective.
- From July 2010 the Customs Code of the Customs Union became effective.
- From July, 1st 2011 the customs control was removed from between the CU countries. The control was moved to the external borders of the CU.
- In October 2011 it was announced that Kyrgyzstan would join the Customs Union
- In the same month the Commission of the CU has brought to accordance the norms of the Customs Union to the norms of the WTO. Moreover, in case of accession to the WTO, the norms of that organisation would have priority over the norms of the Customs Union.

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<sup>2</sup>Based on <http://www.rfca.gov.kz/7377>, <http://www.tsouz.ru> (Official website of the Customs Union), “Nezavisimaya Gazeta”, 12.10.2011

Figure 3.3: Trends in Export Shares to total Exports





# Chapter 4

## The Layers of the Information Technology Agreement Impact

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### Abstract

The signatories of the WTO's Information Technology Agreement eliminated import tariffs for a wide range of IT goods, not just among each other but on an MFN basis. We show that this agreement did not only lead to increased imports, but – by reducing the cost of intermediate goods – ITA members were also able to increase their exports of final goods. Our estimation strategy is based on the plausibly exogenous entry of late signatories to the agreement, who ratified the ITA as part of a broader policy objective. Using product-level data, we are able to take into account the various *layers* of ITA impact, dissecting the impact of tariff reduction, tariff elimination to zero, and over and above tariff reductions, including through firm relocation via intermediate goods channel, rather than just a single ITA dummy as in the previous literature. Our results suggest that the positive trade and value chain effects of the ITA are driven entirely by tariff-related effects. In particular, having zero tariffs is associated with more imports of intermediate than final goods, and with participation in global value chains. This finding also supports the line of thought that trade policy certainty attracts investment. Moreover, while China stands out among exogenous joiners, we show that results are not driven just by this country. Our results are robust to estimation not only with OLS, but also using Poisson estimation to correct for zero trade flows, as well as adding multilateral resistance terms. <sup>3</sup>

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<sup>3</sup>Our study of the disaggregate imports and exports required substantive preparatory work to take care of some of the issues related to product coverage and membership of the ITA that was possible with the kind

## 4.1 Introduction

Among the WTO's plurilateral agreements, the ITA stands out as being probably the most wide-ranging, reducing to zero tariffs on many information technology products. This makes it the paramount case for study of the effects zero-for-zero agreements may have on trade flows. The question becomes particularly policy relevant for two reasons. First, an ITA 2 agreement is currently being debated, which could amplify the product coverage of the original ITA agreement considerably further. Second, zero-for-zero agreements in other sectors are often floated as proposals, mainly by developed countries, with the aim of bringing the Doha Round to conclusion.

Yet, the literature examining the trade impact of the ITA is surprisingly scarce. To our knowledge, only few studies have addressed this topic so far. [Bora and Liu \(2006\)](#) is the only econometric analysis of ITA imports for members and non-members. The paper focusses on the impact of the ITA for imports only. They use data up to 2003 on aggregate ITA imports and thus mainly covers original participants, finds that ITA signatories were on average importing more ITA goods than non-signatories.

A more recent study by [Anderson and Mohs \(2010\)](#) presents a mainly descriptive review of ITA experience while going further in time coverage. In their assessment of main trends in trade of ITA products the paper outlines the rapid increase in exports of developing countries that is associated with joining ITA, in particular a shift to Asia and emerging role of China. The authors attribute this effect to the lower cost of intermediate goods due to ITA. Complementarily, [World Trade Organization \(2012\)](#) provides a comprehensive analysis of the formation, membership and coverage overview of the ITA.<sup>4</sup>

[Joseph and Parayil \(2006\)](#) analyse early ITA trade – until 2003 – and note that some non-ITA members have outperformed the ITA members (China joined the ITA only in 2003 but was already a fast-growing country in IT goods trade). Further, the paper argues that in agreements like the ITA the developing countries have been passive adopters. In order to reap the benefits of liberalization, as the authors argue, developing countries should create a South–South framework in the IT sector; thus late joiners to the ITA may have anticipated lower gains.

[Portugal-Perez et al. \(2010\)](#) focus on non-tariff costs. Their results indirectly suggest that the impact of a sectoral agreement like the ITA may have further-reaching impacts if it leads to harmonisation standards. Analysing the impact of ITA on EU15 imports, the paper

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help from the WTO secretariat.

<sup>4</sup>[Dreyer and Hindley \(2008\)](#) discuss that the partial and complex coverage of the ITA have led to a WTO dispute on compliance between two ITA signatories.

finds a positive trade impact when EU standards are aligned with international norms.

The Global Value Chains literature ([Gawande et al. \(2011\)](#), [Milberg and Winkler \(2010\)](#)) suggests that membership in an agreement like ITA may also promote exports. The transmission mechanism here is that lower import tariffs in intermediate goods help exporters be more competitive, thus increasing their presence on the world market. In line with this, [Feenstra \(2008\)](#) presents evidence of strongly magnified effect on prices from tariff cuts in ITA products because of highly fragmented production and off-shoring. And indeed, one may wonder if China would be the same IT export hub if it had not eliminated tariffs on the inputs required for this success. Using the Sturgeon classification ([Sturgeon and Memedovic, 2010](#)) for intermediate goods<sup>5</sup> we thus explore the impact of the ITA on trade of intermediate goods.

Some countries joined the ITA when ratifying a larger agreement, such as China upon accession to the WTO. These countries can be plausibly argued to have joined for exogenous reasons, helping us to overcome identification problems. Economic theory suggests that the decision to join an agreement is typically endogenous ([Ornelas, 2005](#)), which has important implications for empirical analysis ([Baier and Bergstrand \(2007\)](#) pioneered the econometric methods for this case). Furthermore, higher income countries may have adopted products covered by the ITA faster, increasing their incentive to join the agreement. But a significant number of countries became ITA signatories while pursuing other goals: since the EU joined the ITA in 1997, future members automatically became ITA parties too. Some new WTO members made a commitment to join ITA as part of their accession protocol. Finally, the US was actively promoting ITA participation as a precondition for FTAs.

Using product-level data allows us quantify ITA benefits more precisely than the previous literature, which relied on aggregates. We disentangle ITA benefits into three components: firstly, the direct effect of a reduced tariff; this effect is very well understood in the literature. Second, the elimination of tariffs reduces transaction costs of crossing borders. While small positive tariffs do not generate significant revenue for the government, they have a fixed cost for exporters through the effort required for compliance. And finally, since the ITA also sets the bound tariff rate for covered products to zero, it removes uncertainty about future tariff increases. This may influence the location decisions of MNEs through reduced policy risk.

This paper proceeds by giving a brief overview of the ITA agreement and its impact in Section 2. Section 3 then turns to a description of the data; the next section turns to the empirical strategy. Section 5 presents results, whose robustness is examined in section 6. Finally, we conclude in Section 7.

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<sup>5</sup>The classification will become part of a revised BEC classification

## 4.2 The ITA and a first glance at its impact

The ITA is a plurilateral agreement under the WTO, which institutes import tariff concessions by its members on certain IT-related goods. The concessions are offered on MFN basis, meaning that even WTO members that were not join the agreement enjoy duty-free (applied and bound) exports to the ITA members. The agreement was initiated by 43 countries in March 1997 and managed to increase its membership to 74 countries by March 2012. In order to be implemented within the WTO, the initial members had to cover at least 90% of world trade in IT products. The agreement is solely about tariff elimination on certain products and does not include provisions on non-tariff issues. The ITA requires the members to apply concessions to all WTO members by adjusting the MFN applied and bound tariffs. The agreement has a complex coverage of goods. In particular, there are in total 154 product lines of 6-digit HS classification affected, with 95 product lines being covered fully. The rest are covered only partially thus creating an issue for empirical analysis of the trade in ITA goods; we address these issues in more detail in the data section below.

The products covered by the ITA can be roughly classified into 7 groups of products ([World Trade Organization, 2012](#)) :

1. Computers
2. Instruments and apparatus
3. Semiconductors
4. Semiconductor manufacturing equipment
5. Data-storage media and software
6. Telecommunications equipment
7. Parts and accessories

Computers, semiconductors and parts and accessories are the most traded products, making up around 80% of trade flows.

Table 4.1 below shows the commitment effect of the ITA as its members continue to reduce average tariffs on ITA goods. Note that the average tariff rate of the ITA participants is slightly above zero as its recently joined members receive an implementation schedule spanning several years during which they gradually reduce the tariffs.

As noted earlier, the ITA membership has been expanding over time, and almost doubling the membership by 2012. This process was happening largely through three channels. First,

Table 4.1: Tariffs: ITA Members and Nonmembers

Country group	Tariff (%)
<b>1997</b>	
ITA Participants	2.47
Non-participants	9.19
<b>2011</b>	
ITA Participants	0.047
Non-participants	5.15

some countries that were acceding to the WTO after 1997 members had the commitment to join the ITA in their accession protocol as a result of accession negotiations. Second, all recent members of the European Union (EU) had to adopt the trade policy of the EU upon accession or in the preparatory process and hence join the ITA, unless they had done it earlier. Third, the US was one of the initiators of the ITA and was actively encouraging during negotiations with potential FTA partners to join the ITA. This paper is determining the extent of the impact of the ITA on global trade, as well as on the development of IT value chains. Methodologically, we distinguish the countries by the circumstances at which they were joining the ITA. It follows that from this perspective we can identify two groups among current members. One group is referred to “individual joiners” and includes all the initial members and later joiners whose accession was not associated with or tied to any larger agreement package. The other group, referred to as “exogenous joiners”, consists of the ITA members that can be considered to have joined the ITA through a package of a larger agreement, mainly as a by-product of a broader policy objective (three channels outlined above).

It is particularly insightful then to look at the impact on these countries that joined the ITA as a pre-condition for another agreement rather than due to their national decision. Clearly, by offering duty-free exports on MFN basis, the consumers in these countries would most likely gain from lower prices of imported IT goods. But were these countries also able to boost their IT industries and manage to export more than the non-members?

Table 4.2 below presents the lists of individual and exogenous joiners as well as the year of joining the ITA. The majority of the exogenous joiners of the ITA became signatories via WTO accession, in total 13 countries. Chinese Taipei and Estonia have the ITA membership in their WTO accession protocols as well but these two countries were among the initial ITA signatories before the WTO accession and thus are classified as individual joiners. Another

Table 4.2: List of ITA members categorized by motivation driving their ITA accession

“Individual” ITA joiners, including all founding members <sup>1</sup>		
Australia	Hong Kong, China	New Zealand
Austria	Iceland	Norway
Belgium	India	Philippines
Canada	Indonesia	Poland
Chinese Taipei <sup>2</sup>	Ireland	Portugal
Costa Rica	Israel	Romania
Czech Republic	Italy	Singapore
Denmark	Japan	Slovak Republic
Egypt (2003)	Korea, Republic of	Spain
El Salvador	Kuwait (2010)	Sweden
Estonia <sup>2</sup>	Liechtenstein	Switzerland
European Union	Luxembourg	Thailand
Finland	Macao, China	Turkey
France	Malaysia	United Arab Emirates (2007)
Germany	Mauritius (1999)	United Kingdom
Greece	Netherlands	United States of America
“Exogenous” ITA joiners, whose ITA accession was likely significantly motivated by...		
WTO accession	EU accession	US FTA
Albania (1999) <sup>3</sup>	Bulgaria (2002)	Bahrain, Kingdom of (2003)
China (2003)	Cyprus (2000)	Colombia (2012)
Croatia (1999) <sup>3</sup>	Hungary (2004)	Dominican Republic (2006)
Georgia (1999) <sup>3</sup>	Malta (2004)	Guatemala (2005)
Jordan (1999) <sup>3</sup>	Slovenia (2000)	Honduras (2005)
Kyrgyz Republic (1999)		Morocco (2003)
Latvia (1999)		Nicaragua (2005)
Lithuania (1999) <sup>3</sup>		Panama (1998)
Moldova, Republic of (2001)		Peru (2008)
Oman (2000)		
Saudi Arabia, Kingdom of (2005)		
Ukraine (2008)		
Viet Nam (2006) <sup>3</sup>		

Sources: Authors' compilation based on WTO (2012) and information obtained through interviews of various WTO Secretariat staff.

<sup>1</sup> ITA founding members joined in 1997. Accession year for all non-founding members is given in parentheses.

<sup>2</sup> Among ITA founding members, Chinese Taipei and Estonia were the only ones which only joined the WTO subsequently (in 2002 and 1999, respectively).

<sup>3</sup> These countries already joined the ITA during their WTO accession process in the calendar year before WTO accession (only Lithuania acceded the WTO two calendar years later, in 2001).

15 countries were classified as exogenous joiners because of their ITA accession was related to negotiating an FTA with the US or EU accession. One can see from table 4.2 that exogenous joiners entered the agreement in various years.

Trade in ITA goods has evolved in rather different ways for the two groups of members. The Figures 4.1 and 4.2 below present the world import and export shares of ITA individual and exogenous members and non-members for 1996 and 2012. Note that the countries are grouped as members or non-members both in 1996 and 2012 based on their ITA membership status in 2012. This is done in order to avoid shifting shares coming from changing combination of various groups in 1996 and 2012. The world trade in IT products has seen an enormous growth of China’s importance, an exogenous ITA member. Thus there is a potential concern that a large part of our results could be driven by this increase in trade with China. To account for that, for all our later regression specifications we look at the effects on the whole sample and on the sample without China.

Figure 4.1: World Import Market Shares in ITA products, 1996 and 2012

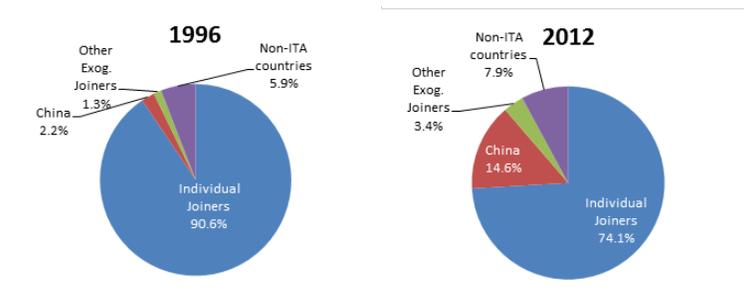
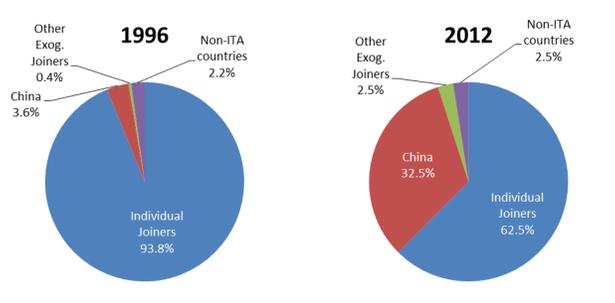
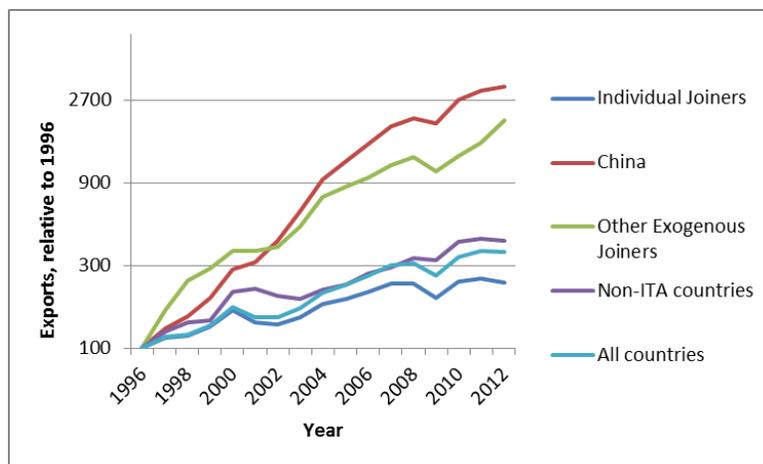


Figure 4.2: World Export Market Shares in ITA products, 1996 and 2012



Similarly, other exogenous ITA members also experienced a large increase in their trade share. The rising importance of exogenous ITA members displaced individual ITA members with regards to world IT market share, while the non-members largely retained their small

Figure 4.3: Exports of ITA products: Market Shares (index, 1996=100)

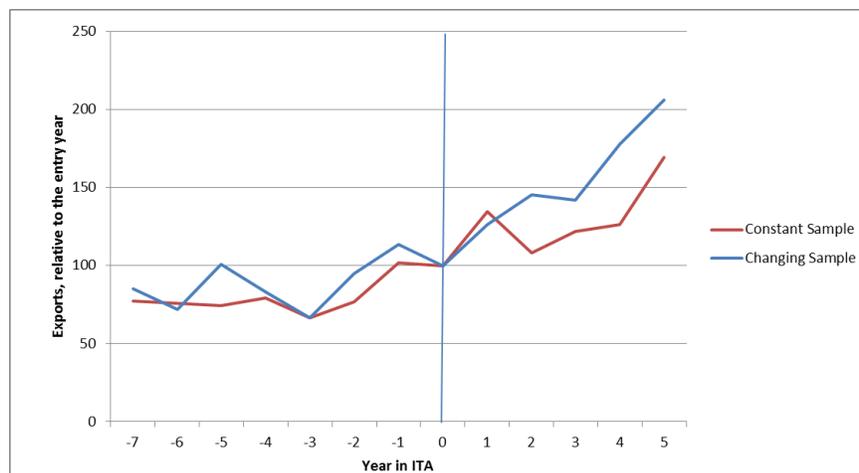


world market share. Notably both for China and other exogenous ITA members the increase in market share is more impressive for exports than imports. On the flip side, the individual joiners lost more of their importance in exports than imports. One may therefore hypothesise that the demand for ITA goods is relatively stable over time. In contrast, the geographical origin of products changed significantly in the last decades, driven by location decisions of MNEs.

Figure 4.3 presents the nominal export value of ITA products by country groups with 1996 values indexed at 100. Exports of all groups have seen an increase and exports of individual ITA members and non-ITA members exports as well as the total world trade show a similar pattern. Exogenous ITA members instead have a much steeper slope. Given that they generally acceded to the ITA a few years after 1997, this graph does not allow to identify whether this impressive pattern is related to ITA accession alone.

Indeed, exogenous joiners were not in ITA yet in earlier years. To obtain a first notion of whether ITA accession may have boosted exports of exogenous joiners, we therefore look at how their exports have evolved prior to ITA accession. To eliminate influences of global fluctuations in ITA trade, we again look at market shares, which we rescale to 100 in the entry year to allow simple averaging across countries. To retain a sufficient number of countries in the sample, we focus only on the 7 years before the ITA entry year and 5 years after. Figure 4.4 presents the results. Twelve exogenous joiners can be observed for such a length of time. In the Figure 4.4 they are referred to as the “Constant Sample”. To check the robustness of the ITA exports pattern over time across larger set of exogenous joiners, we look at all exogenous joiners (“Changing Sample”) during this 12 year period. Both for the constant

Figure 4.4: Exports of ITA products (index, entry year=100)



and changing sample of countries, the increase in export market share is visibly steeper after joining the ITA.

### 4.3 Data

Coverage of the ITA by codes: The empirical analysis of the ITA has been complicated by the issues related to its product coverage, as also noted by [Anderson and Mohs \(2010\)](#). The ITA was initially signed in HS1996, however some of the lines were considered to be covered only partially. In cases when it was considered that the ITA covers a small share of the products in 6-digit line, the line was dropped. As the definitions of the product lines were changing in different HS classifications, the coverage had to be reassessed instead of being simply mapped. For instance, Line C may have covered a lot of ITA products (relative to non-ITA products) in 1996 and therefore was considered an ITA product line. However, in 2002, this line may not be considered an ITA tariff line any more, due to (i) changing trade structure with now more non-ITA products being traded or (ii) because the ITA products became technologically obsolete. The lines that are covered by the ITA vary for each of the vintages. With this procedure in place, we obtained the product lines covered by the ITA in HS1996, HS2002 and HS2007 classifications, respectively.

Data on Trade values: The bilateral trade flows data was obtained from UN Comtrade. Using the three coverage sets we obtained three datasets for, respectively, 1996-2001 in HS1996, 2001-2006 in HS2002, 2007-2012 in HS2007. The lines were then mapped into HS1996 using the correspondence tables.

Not all products are present in all three sets mapped into HS1996, and this has the drawback that some products will not be observed in all years and therefore any product fixed effects may be less reliable for some products.

We use the import flow data and complement with mirror data whenever possible. We apply the mirror data whenever a certain import-reporter didn't report in the particular year at all. We restrict the mirror data to such cases only because if a country reports in the particular year the bilateral trade but doesn't specify some line or it is zero while it is present in the mirror data, then it is not actually a lack of reporting issue but a difference in methodology of classifying products.

Our data cover 234 countries and 106 HS1996 6-digit ITA products over the period 1996-2012.

Data on Tariffs: Data on tariffs for ITA lines was downloaded from Trains database from WITS in HSCombined for years 1996-2012. Using the sets of ITA coverage for HS1996, HS2002, HS2007, only the lines covered in each time frame were left. Next, using the correspondence tables, the lines from HS2002 and HS2007 were converted into HS1996. Note that the coverage in HS1996 in this manner implies that different lines in HS1996 were covered in different periods. Further, we had to take into account that the EU is presented as one country in TRAINS so we had to append the dataset to include all individual members in various years to have time-consistency.

Sturgeon data on intermediate/final: [Sturgeon and Memedovic \(2010\)](#) emphasizes the importance of intermediate goods to understanding global value chains. They develop a novel classification scheme, dividing goods into final and intermediate categories. Improving on the UN's Broad Economic Categories (BEC) scheme, they group capital and consumption goods as final; others are considered intermediate. The data were kindly provided by the authors, and are used in the estimation section to investigate how ITA affects GVC.

Other RHS variables: Furthermore, we collect any standard gravity variables, which vary across time within any country or country-pair.<sup>6</sup> GDP and GDP per capita were taken from Penn World Table Version 8.0. RTA and currency union membership data are taken from [De Sousa \(2012\)](#).<sup>7</sup> A remoteness measure was computed analogue to those commonly used

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<sup>6</sup>Non-time variant variables such as distance are controlled for by country-pair fixed effects in all our specifications.

<sup>7</sup>[De Sousa \(2012\)](#) data only cover currency union relationships up to 2009. To extend the data, we added Estonia joining the Euro in 2011. As we are not aware of any other countries joining or exiting a currency union after 2009 and before 2013, we assume that no further changes in currency union membership occurred after this time. Like the [Glick and Rose \(2002\)](#) currency union definition, ours is also transitive, i.e. if country-pairs  $x$ - $y$ , and  $x$ - $z$  are in currency unions, then  $y$ - $z$  is a currency union. Therefore with both

in the literature.<sup>8</sup> WTO membership data was collected from the WTO website.

## 4.4 Empirical Strategy

### 4.4.1 Gravity Model of Trade

The paper follows the basic structural model of gravity equation developed by [Anderson and Van Wincoop \(2003\)](#) for cross-sectional aggregate trade flows. However in adopting the panel approach and varying trade costs across goods, the structural model and estimation specification have to be adjusted.

Already [Anderson and Van Wincoop \(2004\)](#) discuss the advantages of using the disaggregate data to account for varying trade costs and elasticities across goods as this study does. The basic model adapted for the industry level analysis is as follows:

$$x_{ij}^k = \frac{y_i^k x_j^k}{y^k} \left( \frac{T_{ij}^k}{\Pi_i^k P_j^k} \right)^{1-\sigma_k} \quad (4.4.1)$$

where  $x_{ij}^k$  denote import of country  $j$  from country  $i$  of good  $k$ ,  $y_i^k$  - total production of good  $k$  by firms from country  $i$ ,  $x_j^k$  - total expenditure for good  $k$  in country  $j$ . Further,  $T_{ij}^k$  stands for bilateral trade costs,  $\Pi_i^k$  is outward trade barriers of country  $i$  and  $P_j^k$  are inward trade barriers of country  $j$ . The latter two terms comprise the multilateral resistance and lead to higher bilateral trade.

The traditional structural gravity model is not adapted for the panel data. [Baldwin and Taglioni \(2006\)](#) argue that the gravity equation with time-invariant controls developed for cross-sectional data cannot be used for panel data. To account for changing multilateral trade resistance, the authors recommend to use pair fixed effects and country-time fixed effects. [Olivero and Yotov \(2012\)](#) develop a dynamic version of the structural gravity model that leads to the estimation equation for panel dataset. We follow their approach by using appropriate fixed effects.

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El Salvador and Ecuador having adopted the U.S. Dollar, they would both be considered to be in a currency union with the United States as well as each other.

<sup>8</sup>Our remoteness measure is computed for importers and exporters using the standard formula, weighting bilateral distances by trading partner shares in World GDP (see e.g. [UNCTAD and WTO \(2012\)](#)). To obtain a single remoteness measures for any bilateral pair in the interest of parsimony, importer and exporter remoteness are then multiplied before taking the natural logarithm.

### 4.4.2 Estimation on aggregate data

In our first baseline specification we replicate the closest study on the ITA, [Bora and Liu \(2010\)](#) with our extended time coverage<sup>9</sup>

$$\begin{aligned} \ln I_{ijt} = & \alpha(\text{ITAExporter})_{ijt} + \beta(\text{ITAImporter})_{ijt} + \delta(\text{Non} - \text{ITAWTOImporter})_{ijt} \\ & + \theta(\text{OneinWTO})_{ijt} + \gamma\text{Controls}_{ijt} + \alpha_{ij} + y_t \end{aligned} \quad (4.4.2)$$

where the ITA importer dummy only takes a value of one in case the exporter is a WTO member; this is because the concessions of ITA are only guaranteed to the WTO members. However it makes more sense to define the exporter ITA membership variable equal to one simply when the exporter is an ITA member vis-a-vis any trading partner, not just WTO or ITA members, as higher exports due to more technology transfer should not necessarily only go to WTO (or other ITA) members.

We first extend this model to test whether ITA exporters were really those who mainly got the benefits of signing the ITA, because IT industry relocated to these countries. We do so by introducing instead a exporter-ITA participation dummy.

### 4.4.3 Product and tariff controls

The empirical analysis on aggregate bilateral trade has a number of problems. In particular, when assessing the impact of an agreement, sectors pooled together hide inside varying impact of the agreement across sectors due to differences in elasticity, preference margins, trade costs and etc. It follows that using product-level data has the advantage that it avoids and aggregation bias, which may occur on account of trade costs or elasticities with respect to these costs varying by products or groups of products. This has been acknowledged in the literature (See [Clausing \(2001\)](#), [Anderson and Yotov \(2010b\)](#), [Anderson and Van Wincoop \(2004\)](#), [Anderson and Yotov \(2010a\)](#)).

Thus we augment the baseline model to account for such differences by controlling for country-pair-product and product-time fixed effects and import tariffs, obtaining direct estimate of the elasticity of tariffs.

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<sup>9</sup>We report the results without the GDP per capita. The estimation with the GDP per capita is overall very similar, albeit with slightly smaller trade creation magnitude. Overall, we get the message that GDP per capita seems to work well in regressions without country-pair fixed effects. There it picks up a propensity for richer countries to trade more. However, it does not seem to be the case that large increases in income between years translate in a straightforward way also into significant increases in trade in those years.

In light of our panel being unbalanced, traditional estimation would require that one set of fixed effect dummies be held in memory. As each dummy would be more than 3 million observations long, computer memory constraints bind. Traditionally these constraints implied that only one high-dimensional fixed effect could be considered by transforming the estimation equation (Greene (2003))<sup>10</sup>. Labor economists have devised solutions to the challenges of multiple high-dimensional fixed effects, starting with approximations in Abowd et al. (1999). Guimaraes and Portugal (2010) provide an iterative technique to obtain exact estimates of equations with two high-dimensional fixed effects in a computationally manageable way and we rely on their technique here<sup>11</sup>.

Once we control for tariffs, we can include the zero tariff dummy as well. This dummy quantifies whether for IT products there was an additional impact of reducing tariffs to zero. The intuition here is that reducing tariffs from 2 to 0% would have a bigger impact than reducing them from 4 to 2%, because the reduction to 0% also implies that a lot of bureaucratic hurdles in clearing customs will vanish – and there is a growing "time in trade" literature<sup>12</sup>. The latter, as discussed above, is supposed to test the extent to which levying no tariff rather than a small positive tariff reduces trade costs. This constitutes to the following empirical specification:

$$\begin{aligned}
 \ln I_{ijkt} &= \mu \ln(1 + \text{tariff}) + \lambda t_0 + \alpha(\text{ITAE}x\text{porter})_{jt} + \beta(\text{ITAI}m\text{porter})_{ijt} \\
 &+ \delta(\text{Non} - \text{ITAWTO}I\text{mporter})_{ijt} + \theta(\text{OneinWTO})_{ijt} \\
 &+ \gamma \text{Controls}_{ijt} + \alpha_{ijk} + y_t
 \end{aligned} \tag{4.4.3}$$

#### 4.4.4 Addressing endogeneity

This strategy brings to our main specifications where we control for the reason for joining the agreement, be it individual (endogenous participation) or through a larger package (exogenous participation). We distinguish the importer- and exporter-related ITA participation variables across the two types of participants:

<sup>10</sup>In a balanced panel, two sets of fixed effects could be stripped algebraically.

<sup>11</sup>Their technique, available as Stata command `reg2hdfe`, relies on the notion that the matrices for the computation of the coefficient estimates are sparse and only identifies non-zero entries. This reduces memory constraints at the cost of higher computation time.

<sup>12</sup>Freund and Pierola (2012) show that customs clearings times have a big impact on trade.

$$\begin{aligned}
\ln I_{ijkt} &= \mu \ln(1 + \text{tariff}) + \lambda t_0 + \alpha_1 (ITAE\text{ exporter } Ind)_{jt} + \beta_1 (ITAI\text{ importer } Ind)_{ijt} \\
&+ \alpha_2 (ITAE\text{ exporter } Exog)_{jt} + \beta_2 (ITAI\text{ importer } Exog)_{ijt} + \delta (Non - ITAWTO\text{ importer})_{ijt} \\
&+ \theta (One\text{ in } WTO)_{ijt} + \gamma Controls_{ijt} + \alpha_{ijk} + y_t
\end{aligned} \tag{4.4.4}$$

#### 4.4.5 Did joining the ITA lead to higher GVC participation in the IT sector?

Here we assess the GVC participation in IT sector using the (Sturgeon and Memedovic, 2010) data on mapping several sectors of HS2007 6-digit classification into electronic components, parts of electronic devices, and final goods. Overall, 47 goods covered by the ITA in HS1996 classification, were mapped into raw, intermediate and final goods. We have split the sample into intermediate (parts and components) and final goods. This gives us an IT sector GVC participation measure through trade in parts and components versus trade in final goods.

Many of the countries that grouped as exogenous ITA participants are associated with being offshoring destination for manufacturing, especially for IT products. This phenomenon is at the center of the global value chains discussions. According to that understanding, the exogenous ITA participants, by offering guaranteed duty-free imports to all WTO members, could serve as promising offshoring destinations. The hypothesis that follows from this is that the exogenous ITA participants are expected to import more of the intermediate products and export final products. Similarly, the endogenous participants, many of which are high-income countries with developed IT industries, are home to the companies that would be offshoring. Thus we would expect these countries to import less of the intermediate products and more of the final products.

#### 4.4.6 Robustness check estimations

##### Zero trade flows

All the estimations above contain only the positive trade flows, ignoring the product lines with no trade. Eliminating zero trade flows by taking logs of the gravity equation had crucial advantages in deriving our main results discussed above. Foremost, it allowed us to introduce the two high-dimensional fixed effect controls on an already very large dataset of more than 3 million observations. This ensured that omitted variable bias is kept to a minimum on product level data which can be subject to many unobserved determinants with respect to importers, exporters, products, and time. Baldwin and Taglioni (2007) underscore

the importance of adding such comprehensive fixed effect controls by calling their exclusion the "gold metal mistake" of gravity estimation.

Nonetheless, we recognize that the existence of zero trade flows is a pervasive problem in log gravity equations, because it can induce selection bias (Helpman et al., 2008). The most straightforward common way to handle this, and we will pursue it here, is to avoid taking logs altogether, thereby preserving the zero trade flows, and estimate the gravity equation in multiplicative form using Poisson estimation as proposed by Silva and Tenreyro (2006). We will illustrate that results from such an estimation are broadly comparable to those obtained by least squares on a log gravity equation. However as inclusion of zero trade lines makes the size of dataset unworkably large. we switch from the HS 6-digit products to only having the 7 groups of products (Computers, Instruments and apparatus, Semiconductors, Semiconductor manufacturing equipment, Data-storage media and software, Telecommunications equipment, Parts and accessories)

#### Multilateral Resistance

Our main estimations addressed multilateral resistance through a combination of three elements. First, country-pair-product fixed effects accounted for average multilateral resistance patterns during the sample period. Second, we proxied for the time-varying element of multilateral resistance through two instruments: inclusion of GDP, whose variation tends to be associated with that of multilateral resistance Anderson and Yotov (2010b) and a distance-based remoteness index. Latter two instruments can naturally only imperfectly capture any time variation of multilateral resistance. We therefore implement in this subsection an alternative estimation strategy to account for multilateral resistance.

This alternative recognizes that the most common and often preferred way of controlling for multilateral resistance in the empirical literature is by including country-time or a combination of importer-time and exporter-time effects (e.g. Feenstra, 2002; Baldwin and Taglioni, 2007). However, in our application including such effects would eliminate most of our explanatory variables of interest, which also only have variation in the country-time dimension. In order to retain these variables, we thus follow some other authors by instead adding a set of "country-period" dummies as a third set of fixed effects. Each period covers either 4 or 5 years, giving us four of such periods for our sample.<sup>13</sup> The assumption is that

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<sup>13</sup>Our periods are 1996-2000, 2001-04, 2005-08 and 2009-12. Limiting ourselves to 4 periods keeps the problem computationally manageable as these dummies need to be created in memory and added as dummies into the `reg2hdfe` estimation routine of Guimaraes and Portugal (2010), which can only handle two sets of fixed effects on its own. The division between the 2004-08 and 2009-12 periods is consciously chosen to coincide with the great trade collapse induced by the global crisis, so as to obtain two relatively homogeneous periods. Other authors that have implemented such approach in a gravity setting are Bora and Liu

multilateral resistance would not vary too considerably within such periods to introduce serious bias into the estimation.<sup>14</sup>

## 4.5 Results

### 4.5.1 An initial benchmark: [Bora and Liu \(2010\)](#)

[Bora and Liu \(2010\)](#) (BL) have undertaken the, to our knowledge, most comprehensive investigation of ITA trade impacts to date. We therefore start our results discussion from their preferred specification. BL conduct their estimation on aggregate data, i.e. their panel dataset includes one observation per country-pair in each year with the total trade value in ITA products. We repeat BL's results for comparison purposes at the beginning of [table 4.3](#).<sup>15</sup> They decompose the "Both in WTO" dummy, which is commonly used in studies on the trade impact of joint WTO membership ([Rose \(2004\)](#) and subsequent literature), into two dummies by whether the importing WTO member is also an ITA member or not.

By doing so, they can analyse trade creation and diversion of the ITA. BL find that countries experience trade creation from joining the ITA. After accession, they import 7.25 per cent ( $= \exp(0.07) - 1$ ) more from other WTO members. ITA preferences apply to all WTO members on an MFN basis. WTO exporters, in light of these preferences, may therefore have reoriented their exports toward ITA members and away from non-ITA WTO importers. BL's estimates suggest that such trade diversion does occur with non-ITA WTO importers now importing 6 per cent less. Taking these two estimates for ITA trade creation and ITA trade diversion (within the WTO) together, BL conclude that a WTO member should see its imports increase by 14% ( $= \exp[0.07 - (-0.06)] - 1$ ) upon joining the ITA. We report this important linear combination of coefficients throughout our tables below the direct regression output.

In addition, BL find that the WTO also diverts trade away from non-members, as highlighted by the "One in WTO" coefficient; that RTAs boost bilateral trade substantially; but they fail to find a significant positive impact of currency unions.

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(2010), using biannual dummies in a robustness check, and [Ruiz and Vilarrubia \(2007\)](#) using triennial and quinquennial dummies.

<sup>14</sup>We exclude the remoteness index from all our regressions including country-period effects; its continued inclusion would not affect results.

<sup>15</sup>See [Bora and Liu \(2010\)](#), Table 2.3, column 2.

Table 4.3: Aggregate Data: A benchmark and extension for ITA exporter effects 3/

Time coverage of sample	1988-2003		1996-2012		
	Yes	Yes	No	Yes	No
Regression No.	BL (2010) 4/	1	2	3	4
ITA Exporter				0.404*** (17.31)	0.312*** (12.88)
ITA Importer 1/	0.07* (2.29)	0.422*** (8.49)	0.156** (3.00)	0.267*** (5.29)	0.0478 (0.91)
Non-ITA WTO Importer 1/	-0.06* (-2.07)	0.235*** (4.57)	-0.105 (-1.95)	0.0646 (1.24)	-0.224*** (-4.11)
One in WTO	-0.16*** (-5.11)	-0.00948 (-0.21)	-0.184*** (-3.96)	-0.0598 (-1.35)	-0.216*** (-4.66)
RTA	0.42*** (10.88)	0.270*** (11.20)	0.271*** (11.16)	0.240*** (9.90)	0.248*** (10.17)
Currency Union	0.48 (0.59)	0.293*** (4.39)	0.264*** (3.96)	0.266*** (3.98)	0.245*** (3.67)
ln(Remoteness)	0.65 (1.21)	-1.176*** (-8.75)	-1.177*** (-8.70)	-1.216*** (-9.06)	-1.218*** (-9.01)
ln(Importer GDP)	-0.86*** (-6.79)	1.307*** (32.70)	1.271*** (31.46)	1.303*** (32.61)	1.269*** (31.41)
ln(Exporter GDP)	0.20 (1.51)	1.200*** (27.21)	0.787*** (16.96)	1.142*** (25.84)	0.769*** (16.59)
Number of observations	133,352	173,124	170,657	173,124	170,657
R2 adjusted (per cent)	82.0	84.74	84.47	84.76	84.49
Linear combination of coefficients: 2/					
ITA Importer minus Non-ITA WTO Importer	0.13* (4.96)	0.187*** (4.96)	0.260*** (6.97)	0.202*** (5.35)	0.262*** (6.97)

All regressions include country-pair and time fixed effects.

1/ ITA importer variables only take the value of one if exporter is a WTO member.

2/ The difference of these two variables – ITA trade creation and ITA trade diversion within the WTO – expresses how much more ITA importers import compared to non-ITA WTO members. In other words, this would be the amount that a country, which is already a WTO member, could expect to import more from other WTO members by joining the ITA. Statistical significance for the linear combination of coefficients of Bora and Liu (2010) cannot be computed without access to their dataset. However, it would seem likely that it might be significant at the 5% level (which we assume here), given that the two individual coefficients are significant at this level.

3/ All regressions include country-pair and time fixed effects. \*, \*\*, \*\*\* denote 5, 1, 0.1 per cent significance levels. T-statistics in parentheses, based on robust standard errors clustered by country-pair combinations.

4/ Bora and Liu's (2010) preferred specification (their Table 2.3, column 2). In addition, Bora and Liu also include (logs of) importer and exporter GDP per capita, a dummy variable for a formal alliance between countries and dummies for existence of a GSP preference scheme, which we do not report in this table.

### 4.5.2 An updated sample: A changing world economy and the rise of China

To ensure comparability to BL, we also report our initial regressions on aggregate data. Regression 1 is our closest analogue. It differs mainly in terms of our updated sample, covering 1996-2012 (versus BL's of 1988-2012).<sup>16</sup> Our sample therefore covers many more years of trade within the ITA after its establishment in 1997, including the rise of emerging Asia and particularly China as IT production hubs.

The updated sample gives a markedly different view of the ITA's impact. Contrary to BL, our results do not show trade diversion. WTO members import 26 per cent more IT products, as highlighted by the non-ITA importer coefficient. ITA membership boosts imports by a further 21 per cent.<sup>17</sup> Also, we do not find any trade diversion of the WTO. With regards to currency union membership, we now find it to be statistically significant, in line with much previous literature (again started by Rose, 2000), boosting trade similarly as RTA membership by 30-35 per cent.<sup>18</sup>

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<sup>16</sup>Apart from the different sample coverage, the second main difference is that Bora and Liu maintain GDP per capita regressors. Arguably, BL include them, because they start their analysis from specifications which do not include country-pair fixed effects. In regressions without country-pair fixed effects, such regressors can serve a purpose, capturing that, from a cross-sectional perspective, richer countries trade more, for instance to better transport connections and domestic infrastructure in addition to higher preference for variety. However, as BL's estimates suggest that such relations do not hold within a country over the short time-frame portrayed by the sample periods, country-pair fixed effects are included and thereby only variation across time within any country-pair is considered. Their inclusion seems to capture effects typically captured by GDPs, as their coefficients are diminished, even becoming negative for importers, while GDP per capita coefficients take very high values (1.96\*\*\* for importers and 1.16\*\*\* for exporters in BL's preferred regression). We therefore do not include GDP per capita in our regressions, as we maintain country-pair (or more detailed) fixed effects throughout to forestall possibly substantial omitted variable bias from unobservable country-pair characteristics (Baldwin and Taglioni, 2007). Dropping GDP per capita variables does not affect our main results, particularly on the impact of the ITA on exporters, and in later tables, the impact of tariffs and zero tariffs. In the aggregate regressions of Table 4.3, however, exclusion of GDP per capita does increase the magnitude of the ITA importer coefficient by around 0.2. Furthermore there are a couple of further minor differences of our regression 1 vis-a-vis BL. BL also include a couple of other variables which are not commonly included in gravity equations and we therefore drop. These variables are dummies for political alliances and for presence of a Generalized System of Preferences scheme. Any bias that could be introduced by exclusion of the latter will be addressed by inclusion of the tariff directly in our further analysis from Table 4.4 forward.

<sup>17</sup>Equals  $\exp(0.187) - 1$ . See the linear combination of coefficients at the bottom of Table 4.3.

<sup>18</sup>It is furthermore noteworthy that (given that GDP per capita are not included) both our GDP coefficients take values close to unity as suggested by many theoretical models (e.g Anderson and Van Wincoop (2003)).

We follow BL by including remoteness in most of our regressions. To obtain a single remoteness measures for any bilateral pair in the interest of parsimony, importer and exporter remoteness are then multiplied before taking the natural logarithm. [Anderson and Van Wincoop \(2003\)](#) have highlighted the importance of controlling for "multilateral resistance, i.e. general equilibrium effects represented by a country's overall trade cost (with the rest of the world in general). If a country faces relatively high overall trade costs, for instance because it is very remote, it will trade more with the few trade partners that are relatively proximate. We agree with [Anderson and Van Wincoop \(2003\)](#) that a remoteness index is not theoretically adequate to control for multilateral resistance, as it is only based on distance, and overall trade costs are determined by various factors.<sup>19</sup> Nonetheless it constitutes a limited distance-based proxy, which can be valuable in applications such as ours, where inclusion of more complete multilateral resistance controls has important drawbacks in eliminating identifying variation; we will elaborate on this further below). Furthermore, [Anderson and Yotov \(2010a\)](#) illustrate that multilateral resistance is correlated with country size and therefore including GDPs as explanatory variables will likely address some of the variation attributable to multilateral resistance.

In Regression 1, remoteness takes a statistically significant negative sign. In presence of the country-pair fixed effects, this implies that, when countries become more remote, they will trade less on average.<sup>20</sup> Coefficients on remoteness remain negative and statistically significant in the vast majority of our regressions.

One of the main novelties of our dataset compared to BL is that it covers a substantial period of time after China's ITA accession. This allows us to analyse to which extent China's performance has differed from that of other ITA members. As section II already highlighted, China's importance in trade of ITA products has increased immensely on the export side, and to a lesser extent on the import side.<sup>21</sup> Interestingly, however, excluding China's imports from the sample hardly changes results; in other words, in terms of its import behaviour regarding ITA product, China does not act significantly differently from other countries.<sup>22</sup> However, on the export side, China has a substantial impact on results, i.e. its export

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<sup>19</sup>For instance, a country that is proximate to many other countries that represent a significant share of the world economy could nonetheless face high overall trade costs, if it is politically and economically isolated vis-à-vis those neighbouring countries.

<sup>20</sup>The remoteness index varies over time as the geographical composition of world GDP shifts. Thereby countries close to Asia, for instance, have become less remote over time.

<sup>21</sup>Higher Chinese IT imports are partly also a result of its higher exports given its high integration into supply chains.

<sup>22</sup>These results are not reported in the tables for space reasons. They are available from the authors upon request.

performance has been much different from other countries. To analyse which results hold for other ITA members and to gauge China's impact, we therefore present results for the whole sample and the sample excluding China's exports side-by-side in all our tables.<sup>23</sup>

Regression 2 excludes China's exports. This implies that we are looking at ITA importer coefficients derived from an incomplete import sample, which is somewhat artificial from the viewpoint of importers. However, from the viewpoint of non-Chinese exporters they provide a notion of how much more sales can be expected to these importer groups. The ITA importer coefficient is now much lower, signalling that much of ITA members' increased imports originated from China. There is also some weak evidence that exporters are diverting shipments away from non-ITA WTO importers. Meanwhile, China defies this trend, exporting strongly to non-ITA WTO members.<sup>24</sup> The same is true for non-WTO members, from which WTO members deviate trade away, while China aggressively orients its exports also toward these countries.<sup>25</sup> On the whole, the Regression 2 results are much closer to the BL specification, which seems intuitive, because BL's sample excludes much of China's rise to being a powerful exporter of IT products. On the flipside, this suggests that when imports from China are disregarded, import patterns have not changed as much since BL's sample end in 2003. However, we still estimate that a country joining the ITA would increase its imports from countries other than China by 30 per cent – more than double BL's estimate.

### 4.5.3 How does the ITA boost trade: Peeling away the layers

We posit that there may be various layers to the ITA's impact on trade. As their quantification requires tariff data, these can hardly be quantified in aggregate data, requiring product-level data instead. We hold that the ITA's impact on imports may be three-layered and there may also be a fourth layer operating through ITA members' exports.

The three layers on the import side are the following. First, the ITA may boost imports by reducing tariffs. Introducing tariffs directly as an explanatory variable in the estimation will identify this impact.

Second, reducing tariffs to zero may have an additional impact on imports beyond tariff reduction. Reducing the tariff to zero implies that there might less transaction and administrative costs related to clearing customs and have a positive impact on trade (e.g. [Freund](#)

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<sup>23</sup>This can of course also be seen as an ongoing first robustness test of our results.

<sup>24</sup>This interpretation results from the decrease in the "Non-ITA WTO importer" coefficient from Regression 1 to Regression 2.

<sup>25</sup>This interpretation results from the decrease in the "One in WTO" coefficient from Regression 1 to Regression 2.

and Pierola (2012)). However one must note that in the case of ITA these gains could be smaller due to complexities of product coverage of ITA.

Third, the ITA may have a further positive trade impact apart from tariff reductions. This is suggested by the literature positing that trade policy uncertainty has an impact on investment and entry decisions of firms, including through firm location (Handley and Limao (2012) and Handley and Limão (2013)), which in light of global production sharing depend increasingly on importers.

This last layer may apply also on the export side. It is well documented that the IT sector (see Milberg and Winkler (2013) chapter 2 for analysis of US economy) is among those most strongly characterized by global production sharing. Given that in global production chains, imports are crucial inputs, particularly for downstream firms, the trade policy certainty inherent in ITA membership can be positive for exports.

We proceed in reverse in introducing these layers into the estimation, starting from the exporter side. This is because an ITA exporter dummy (for the fourth layer) can also be added already to specifications on aggregate data.<sup>26</sup> Obtaining an estimate of the exporter impact on aggregate data is useful for comparison purposes, because such aggregation may reduce noise inherent in disaggregate product level data.

Regressions 3 and 4 suggest that this ITA impact on exports may indeed be positive and strong – a 50 per cent boost in exports for all ITA members and a 37 per cent boost for ITA exporters other than China – with estimates highly statistically significant. These export boosts are across all importers on average. In addition, imports by ITA members also remain higher, but mainly on account of exports from China, as the comparison between the two regressions highlights.<sup>27</sup>

Table 4.4 uses product-level data, which allows quantification all four layers of ITA trade impacts. Fixed effect controls consequently generalize to country-pair-product to also account for any product-specific characteristics in bilateral relationships. Likewise, the time fixed effects generalize to product-time to account for any global shocks to trade in different products.<sup>28</sup>

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<sup>26</sup>Unlike the ITA importer dummy, the ITA exporter dummy will take the value of "1" for all ITA exporter observations, regardless if the importer is WTO member or not. Making the dummy's value dependent on an importer's status would not make sense as any barriers to exporting from a country would not vary depending on such status. The same applies consequently to any potential exporter analogue to the trade diversion variable on the import side ("Non-ITA WTO importer" in Table 4.3).

<sup>27</sup>Evidence in Regression 4 also suggests that exporters other than China are diverting away shipments from non-ITA importers, but this result does not hold up in later specifications.

<sup>28</sup>Evidence in Regression 4 also suggests that exporters other than China are diverting away shipments from non-ITA importers, but this result does not hold up in later specifications.

Table 4.4: Product-level data: The layers of ITA trade creation

Includes China's Exports Regression No.	Yes	No	Yes	No
	5	6	7	8
ITA Exporter	0.349*** (26.54)	0.0767*** (4.82)	0.362*** (23.95)	0.0886*** (4.77)
ln(1+tariff)			-0.248** (-2.77)	-0.198* (-2.17)
Zero tariff			0.108*** (19.78)	0.105*** (18.99)
ITA Importer 1/	0.317*** (15.87)	0.168*** (8.29)	0.343*** (14.14)	0.243*** (9.81)
Non-ITA WTO Importer 1/	0.227*** (10.91)	0.0525* (2.47)	0.337*** (13.33)	0.198*** (7.71)
One in WTO	0.00710 (0.38)	-0.0231 (-1.25)	0.0725** (3.18)	0.0786*** (3.44)
RTA	0.0640*** (6.38)	0.0846*** (8.31)	0.0475*** (3.89)	0.0742*** (5.98)
Currency Union	0.178*** (9.40)	0.168*** (8.86)	0.137*** (7.22)	0.128*** (6.72)
ln(remoteness)	-0.314*** (-4.81)	-0.586*** (-8.89)	-0.192* (-2.43)	-0.447*** (-5.60)
ln(Importer GDP)	0.956*** (45.72)	0.897*** (42.46)	1.104*** (39.28)	1.031*** (36.16)
ln(Exporter GDP)	1.439*** (55.96)	0.517*** (17.83)	1.417*** (47.00)	0.537*** (15.64)
Number of observations	3,216,747	3,100,247	2,477,294	2,386,043
R2 adjusted (per cent)	74.58	74.24	76.39	76.02
Linear combination of coefficients: 2/				
ITA Importer minus Non-ITA WTO Importer	0.090*** (9.28)	0.116*** (11.75)	0.007 (0.55)	0.044*** (3.57)

All regressions include country-pair-product and product-time fixed effects.

Notes 1/ and 2/, see Table 2. Note 3/ of Table 2 also applies.

Results experience some important changes when we use product-level data and subsequently allow for different layers of impacts in the import side by introducing tariffs and the zero tariff dummy.

First, purely moving to product-level data mutes ITA exporter trade impacts for countries other than China. Joining the ITA increases these countries' exports by about 8-9 per cent across all importers (Regressions 6 and 8). Yet, some additional impact for these exporters is now contained in the ITA importer and non-ITA WTO importer coefficients, which rise across specifications. These export boosts are accessible to all WTO members, however, regardless of ITA membership. To see this, recall that these two dummies are a decomposition of a "Both in WTO" dummy. When the non-ITA WTO importer coefficient becomes positive as in table 4.4, its interpretation changes from ITA trade diversion (within the WTO) to WTO trade creation. The additional impact of ITA accession on imports – expressed by the difference between the ITA importer and non-ITA WTO importer coefficients – is meanwhile much diminished (see bottom of table 4.4).<sup>29</sup>

Second, when tariffs and the zero tariff dummy are introduced directly into estimation, the ITA importer effect in fact disappears completely (Regression 7). However, it is crucial to highlight that after these additional variables are included, the interpretation of the ITA importer effect changes: It now quantifies only the third layer of ITA trade creation, i.e. benefits over and above those of tariff reductions and setting the tariff to zero, for instance those related to trade policy certainty. Thus, that the ITA importer effect in Regression 7 "peels away" completely suggests that for importers ITA accession's benefits are exclusively related to the tariff reductions and "zeroing" of tariffs that the agreement institutes.<sup>30</sup> Not surprisingly, exporter impacts stays the same in response to introducing tariffs and zero tariffs, because these really only decompose effects related to the importer side.

Our tariff coefficient signals that each one percentage point reduction in tariffs would result in an import increase of 0.25 per cent, i.e. an import demand elasticity of -0.25. This is low relative to most import demand elasticities reported in the literature and derived based on aggregate trade (rather than ITA products). For instance, [Kee et al. \(2008\)](#) and [Tokarick \(2014\)](#) estimate such elasticities for many different countries and come up with averages in the range of -1.1 to -1.2. Only an earlier study by [Senhadji \(1998\)](#) is relatively close to our value, at -0.32.

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<sup>29</sup>This is shown by the linear combination of the ITA importer trade creation and diversion coefficients, reported at the bottom of all regression tables.

<sup>30</sup>Recall that odd-numbered regressions, which include Chinese exports, are the relevant ones from importers' perspective, as they cover all imports.

The reason for this divergence seems to be that the impact of tariff reductions on import demand seems to be highly non-linear. Reducing tariffs to zero has an immense impact on imports, boosting them by over 11 per cent. Thus, making the last effort to reduce small tariffs, say from 1 to 0 per cent, will bring double the impact than reducing a high tariff by 20 percentage points without reaching zero. The big deal about the ITA is therefore that it gets tariffs down to zero. That there is an additional impact of “zeroing” the tariff seems intuitive, because zero tariffs reduce border formalities considerably. In our view, these results have a broader significance than the IT sector. We believe that it would seem reasonable to expect such non-linearity also in other sectors, particularly in light of aforementioned literature on trading costs, as well as the large empirical literature on preferential trade agreements (PTAs). The large PTA trade impacts often found in the latter literature also suggest that there may be additional impacts of reducing tariffs to zero, as many of these agreements do. With regards to policy, these results make strong cases for countries (i) to expand the ITA’s product coverage through an ITA 2 agreement, (ii) to pursue further zero-for-zero sectoral agreements and/or (iii) unilateral, non-discriminatory, tariff reductions to zero. There is a particularly strong case for reducing those tariffs to zero that are already small

In concluding our discussion of Table 4.4, we note a few other interesting changes in these product-level results. Any evidence of WTO trade diversion disappears. If anything, trade between WTO and non-WTO members is higher than that between two non-WTO members – by an order of 8 per cent. The magnitudes of RTAs’ and currency unions’ effects on trade are diminished to 8 and 16 per cent, respectively. These smaller effects are maintained in our further specifications going forward. These results are retained, as we continue to introduce further refinements.

#### 4.5.4 Exogenous versus individual joiners

We next explore whether impacts of the ITA were different among individual and exogenous joiners. Recall that the graphical evidence in section II pointed to higher impacts for exogenous exporters. To explore this comprehensively, we split both the ITA importer and exporter dummies into individual and exogenous joiners. Regressions 9 and 10 in Table 4.5 present the results.

Among exporters, indeed exogenous ITA joiners seem to be the only ones profiting from accession. The average exogenous joiner increases its exports by about 14 per cent (Regression 10), when China is disregarded, whose out-performance persists throughout our estimates. Exports of individual joiners, on the other hand, experience a statistically significant 7 per cent decrease with China partly crowding out their exports (Regression 9). This

Table 4.5: A natural experiment to control for endogeneity

Goods type China's Exp. Reg. No.	All goods				Intermed. Goods 5/		Final goods 5/	
	Yes 9	No 10	Yes 11	No 12	Yes 13	No 14	Yes 15	No 16
Individual	-0.0752***	0.00602	-0.0739**	-0.00126	-0.0253	0.0604	-0.109**	-0.0801*
ITA Exporter	(-3.32)	(0.25)	(-3.25)	(-0.05)	(-0.59)	(1.32)	(-2.94)	(-2.04)
Exogenous	0.480***	0.128***	0.429***	0.0177	0.393***	0.0597	0.507***	0.0808*
ITA Exporter	(26.56)	(5.55)	(23.41)	(0.75)	(12.17)	(1.48)	(16.05)	(2.01)
ln(1+tariff)	-0.262**	-0.185*	-0.347***	-0.296**	-0.116	-0.142	-0.677***	-0.560***
	(-2.92)	(-2.03)	(-3.87)	(-3.25)	(-0.66)	(-0.80)	(-4.18)	(-3.41)
Zero tariff	0.104***	0.103***	0.101***	0.101***	0.130***	0.131***	0.0709***	0.0683***
	(19.13)	(18.61)	(18.60)	(18.09)	(12.90)	(12.77)	(7.81)	(7.37)
Individual	0.290***	0.173***	0.336***	0.393***	0.405***	0.448***	0.339***	0.437***
ITA Imp. 1/	(10.84)	(6.23)	(10.58)	(12.35)	(6.76)	(7.36)	(6.13)	(7.98)
Exogenous	0.327***	0.269***	0.349***	0.381***	0.478***	0.497***	0.347***	0.380***
ITA Imp. 1/	(12.78)	(10.36)	(13.02)	(14.13)	(9.59)	(9.84)	(7.54)	(8.23)
Non-ITA	0.293***	0.191***	0.325***	0.340***	0.446***	0.453***	0.265***	0.281***
WTO Imp. 1/	(11.58)	(7.41)	(11.55)	(12.02)	(8.43)	(8.47)	(5.43)	(5.76)
One in	0.0669**	0.0723**	0.0702**	0.101***	0.0656	0.0907*	0.181***	0.207***
WTO	(2.93)	(3.16)	(3.12)	(4.50)	(1.61)	(2.20)	(4.45)	(5.16)
Exporter late			-0.0357	-0.256***	-0.0468	-0.249***	-0.0265	-0.294***
WTO joiner 3/			(-1.32)	(-8.85)	(-0.94)	(-4.70)	(-0.57)	(-6.03)
Exporter late			0.480***	0.665***	0.376***	0.534***	0.823***	1.013***
EU joiner 4/			(16.69)	(23.12)	(7.31)	(10.39)	(16.49)	(20.32)
Exporter late			-0.116	0.0860	-0.0686	0.133	0.0178	0.229
US-FTA joiner 4/			(-1.58)	(1.18)	(-0.53)	(1.05)	(0.15)	(1.94)
No. obs.	2,477,294	2,386,043	2,477,294	2,386,043	680,728	658,002	825,203	793,820
R2 adj. (%)	76.40	76.02	76.41	76.05	79.26	78.90	74.24	73.71
Linear combinations of coefficients: 2/								
Indiv. ITA Im.	-0.003	-0.018	0.010	0.052***	-0.041	0.005	0.074**	0.156***
- non-ITA WTO Im.	(-0.21)	(-1.14)	(-0.63)	(3.21)	(-1.36)	(-0.16)	(2.57)	(5.49)
Exog. ITA Im.	0.034*	0.078***	0.023	0.041*	0.032	0.044	0.082**	0.099***
- non-ITA WTO Im.	(2.27)	(5.00)	(1.49)	(2.56)	(1.08)	(1.44)	(3.08)	(3.67)

All regressions include country-pair-product and product-time fixed effects. They also include the standard gravity variables as in Table 2 before (coefficients not reported). Notes 1/ and 2/, see Table 2. Note 3/ of Table 2 also applies. 3/ Takes the value of one for all exporters that acceded to WTO after 1997. 4/ Takes the value for exports of "1" for intra-EU trade (after accession) of all countries that joined the EU after 1997. Analogously for US FTA. 5/ Intermediate/final goods classification based on that developed for electronics by Sturgeon and Memedovic (2010). Unfortunately, their classification only covers about half of our ITA products, resulting in a loss of usable observations in these regressions.

is intuitive in view of China's strongly rising and (individual joiners' strongly falling) market share in world IT export markets during our sample period, as illustrated in Section II.

One explanation why only exogenous joiners may gain from ITA accession may be based on political economy considerations.<sup>31</sup> Many individual joiners may have already had an established domestic IT industry, which lobbied them to join; thereby their decision to pursue ITA membership as a policy objective in and out of itself. Through ITA membership, the domestic IT industry in these countries realized cost savings through lower trade costs, which in this highly competitive industry may have been at least partly passed on to consumers.<sup>32</sup> As a result, export value did not rise much. Exogenous joiners, on the other hand, more likely did not yet have a domestic IT sector (because they joined the ITA mainly to achieve another broader policy objective). As a result, ITA membership and increased ease of importing may have led to the development of a domestic IT sector, which took to exporting. ITA membership may have been a particularly important catalyst in these cases, because countries which are only starting to develop their capabilities tend to initially integrate in downstream production stages such as manufacturing and assembly, where access to imports is very important (Gereffi et al., 2005; Park et al., 2013).

Returning to the results of Regressions 9 and 10, we note that not much changes on the import side. The impacts of tariff reductions, in general and to zero, remain on the same order as before. ITA accession does not increase imports compared to other WTO importers, neither for individual nor for exogenous joiners.<sup>33</sup>

We point out here again that exogenous joiners approximate a natural experiment, having joined the ITA to a significant extent as a by-product of a broader policy objective. The results of Regressions 9 and 10 therefore also shed light also on whether endogeneity bias may be a concern mainly in the estimates for the individual joiners. As [Baier and Bergstrand \(2007\)](#) rightly highlight, joining a trade agreement is a policy decision, which may more likely be taken affirmatively if a country produces a lot of the products covered by the prospective agreement. In this case, estimates could be biased upwards and we agree with the authors' recommendation to incorporate country-pair-product fixed effects, in our case as controls, to limit such bias. But incorporation of such fixed effects may not suffice if individual joiners accede to the ITA, because they can already foresee that their production and exports of ITA

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<sup>31</sup>See [Grossman and Helpman \(1994\)](#) and subsequent literature on the political economy of trade policy.

<sup>32</sup>[Hallak and Schott \(2011\)](#) for instance, show that Malaysia, whose exports are heavily concentrated in electronics, needs to upgrade the quality of its exports at a fast pace only to maintain the price of its exports constant.

<sup>33</sup>To be exact, there is an economically small impact of 3 Å per cent in Regression 9 for imports of exogenous joiners, but it is less statistically significant and does not hold up as we move to Regression 11.

products will rise disproportionately in the future. For this case our individual/exogenous split serves a distinct purpose. That estimates for exogenous joiners are higher throughout than those for individual ones, suggests that endogeneity bias is not a big concern for latter countries, for which – in contrast to the exogenous joiners – it is hard to rule out such reverse causation.

We now present a second robustness check, which (along the sample split to exclude China) is directly incorporated into our main analysis. Indeed this robustness check is sufficiently important that we consider the resulting Regressions 11 and 12 our preferred specifications covering all ITA goods. This check questions whether the export increases identified for exogenous joiners were really due to ITA accession, or whether they were caused by achievement of the broader policy objective, i.e. WTO accession, EU accession, or accession to an FTA with the United States.

We control for this by including three additional variables. The first is a WTO membership dummy, which is one for the exports of all countries that joined the WTO late, i.e. after 1997. The research by [Tang and Wei \(2009\)](#) suggest that WTO accession for such late joiners often included far-reaching reforms. To the extent that thereby WTO accession (unrelated to the ITA) had a bigger effect on their trade than for earlier WTO joiners, it would not be correctly picked up in the regression and could bias the ITA exogenous exporter coefficient upwards.<sup>34</sup> The second variable is a dummy for exports to other EU members after EU accession for those countries that joined the EU after 1997. Because EU members are also ITA members, this variable helps avoid that intra-EU trade creation is identified as ITA trade creation. The third variable is an U.S. FTA analogue to this EU late joiner dummy. It is one for the exports to the United States of those countries that have joined an FTA with the U.S. after 1997. It can be necessary to avoid bias if some RTAs' trade impact differs from that of RTAs on average, as captured by the RTA dummy. Such heterogeneous impacts are suggested by some of the empirical literature analysing trade impacts of many individual RTAs (e.g. [Eicher et al., 2011](#)).

In Regressions 11 and 12, we add these three additional dummies. As these dummies speak to export, we note that, as expected, the results on imports including tariff and zero tariff elasticities remain the same. Inclusion of the 3 additional dummies, however, shows that intra-EU trade in IT products is substantially higher. And some of this impact was attributed to the ITA exogenous exporter effect previously. Thus, as a result of including

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<sup>34</sup>In Table 4.5, this would be picked up by the combination of the individual and exogenous ITA importer and non-ITA WTO importer dummies, which, as pointed out previously, together make up a "Both in WTO" dummy.

these additional effects, the exogenous ITA exporter effect vanishes for countries other than China – but only for the moment.

### 4.5.5 Intermediate versus final goods

The literature on global value chains highlights that different countries occupy different positions in these chains with some (upstream) countries focusing on the production of intermediate components while other countries are more engaged in downstream stages including assembly (see Park et al., 2013 for a comprehensive review of this literature). It is therefore likely that impact of ITA membership differ depending on a country's position in these supply chains. We therefore rerun our preferred regressions on separate samples only containing intermediate and final goods, respectively. The classification of electronics products by [Sturgeon and Memedovic \(2010\)](#), which is set to become part of an updated BEC classification, allows us to classify half of our HS 6-digit ITA product lines into these two categories and retain over 60 per cent of our observations.<sup>35</sup>

The results are presented in Regressions 13-16. As expected, the exogenous ITA exporter dummy regains statistical significance in the final goods regressions, signaling an 8 per cent increase in exports for downstream countries in response to ITA membership. This seems intuitive, given that these countries rely highly on imports for production of their exports; therefore a liberal and certain trade regime as created by ITA accession will bring the most benefits for these countries.

ITA accession has just a single-layered effect on intermediate goods imports, but three-layered effects on final goods imports. First, a one percentage point tariff reduction stimulates final goods imports by 0.7 per cent, closer to the import demand elasticities by [Kee et al. \(2008\)](#) and [Tokarick \(2014\)](#) cited above.

Second, zero tariffs have favourable trade impacts for both intermediate and final goods imports, intermediate goods double those of final goods (14 versus 7 per cent). This is also intuitive from a supply chain perspective: Being able to bypass transaction and administrative costs inherent in border formalities is most trade-enhancing for downstream countries, which rely heavily on imported inputs.

Third, ITA members, whether individual or exogenous, also import 8 per cent more final goods imports than non-ITA WTO members – above and beyond the impact of tariff reductions. With tariff costs borne by consumers in these countries, ITA membership seems to be

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<sup>35</sup>The other half of ITA product lines are not covered by the [Sturgeon and Memedovic \(2010\)](#) classification either because they are not electronics or because they cannot be identified as being predominantly intermediate or final goods.

valuable in assuring durable absence of zero tariffs. Thereby it may motivate deeper investments by exporters in distribution and marketing in ITA countries (given that continuity in competitive position is assured not to suddenly change in response to tariff increases). This may then in turn explain deviation of more final products by exporters toward ITA importers.

## 4.6 Robustness

Alongside our main results, we already incorporated two robustness checks, for China's exceptionalism and for WTO, EU, and U.S. FTA trade creation among late accession countries to such agreements. This section adds a further two robustness checks to address econometric concerns: First, we address the issue of zero trade flow observations. Second, we consider an alternative way of controlling for multilateral resistance.

### 4.6.1 Zero trade flows

To be able to ensure that non-linear Poisson estimation achieves convergence in our application, we need to first improve its tractability in various ways. We start by reducing the number of observations in our data set in two ways. First, we aggregate the data along the 7 broad product categories of [World Trade Organization \(2012\)](#) described in section II. Second, we eliminate all countries that do not account for at least 0.25 per cent of world trade in either imports or exports in at least one of the seven product categories in 2010. This reduces the number of countries by half to 112, while still retaining more than 97 per cent of world trade in the sample. In addition, we need to simplify the dimensionality of the fixed effects. We therefore substitute time fixed effects for the more detailed product-time controls.

We start in Table 4.6 by presenting least squares analogues to our preferred specifications 11 and 12, which only incorporate the changes in fixed effects while maintaining the 6-digit product disaggregation (Regressions 17 and 18). Coefficient estimates remain very similar throughout, suggesting that global shocks are relatively symmetric across ITA products.<sup>36</sup>

Regressions 19 and 20 then incorporate in addition the aggregation into product categories and reduction in the number of countries. As also noted before, when we moved from aggregate to product-level data, the estimates now change a bit more. However, they remain

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<sup>36</sup> Regressions 11 and 12 with the product-time fixed effects are, however, statistically preferred at higher than the 0.1 per cent level based on F-statistics.

Table 4.6: Robustness I: Addressing zero trade flows with Poisson estimation

Estimation technique	Least Squares				Poisson	
	6-digit products		Prod. Categories 5/		Prod. Categories 5/	
Data disaggregation	No	No	Yes	Yes	Yes	Yes
Zero trade flows	No	No	Yes	Yes	Yes	Yes
Includes China's Exports	Yes	No	Yes	No	Yes	No
Regression No.	17	18	19	20	21	22
Individual ITA Exporter	-0.134*** (-5.83)	-0.0820*** (-3.36)	-0.0360 (-0.62)	-0.0159 (-0.26)	-0.629*** (-5.30)	-0.901*** (-5.57)
Exogenous ITA Exporter	0.413*** (21.79)	0.0580* (2.41)	0.315*** (5.38)	0.162* (2.22)	0.783*** (8.35)	0.245 (1.58)
ln(1+tariff)	-0.416*** (-4.47)	-0.356*** (-3.77)	-1.576*** (-4.78)	-1.545*** (-4.56)	-3.855*** (-4.26)	-3.492*** (-3.71)
Zero tariff	0.0669*** (12.02)	0.0672*** (11.82)	-0.176*** (-6.41)	-0.172*** (-6.12)	-0.215** (-3.21)	-0.238*** (-3.31)
Individual ITA Importer 1/	0.333*** (10.16)	0.377*** (11.52)	0.390*** (4.00)	0.401*** (3.99)	0.0116 (0.08)	-0.0349 (-0.21)
Exogenous ITA Importer 1/	0.350*** (12.73)	0.379*** (13.70)	0.489*** (6.30)	0.437*** (5.47)	0.794*** (5.24)	0.827*** (5.31)
Non-ITA WTO Importer 1/	0.318*** (11.01)	0.331*** (11.40)	0.459*** (5.29)	0.414*** (4.69)	0.396*** (3.54)	0.394*** (3.46)
One in WTO	0.0674** (2.91)	0.0933*** (4.02)	0.106 (1.52)	0.0354 (0.49)	0.0565 (0.52)	0.0746 (0.66)
Exporter late WTO joiner 3/	-0.0793** (-2.81)	-0.277*** (-9.10)	-0.100 (-1.13)	-0.189 (-1.95)	0.194 (1.15)	0.174 (0.88)
Exporter late EU joiner 4/	0.518*** (17.61)	0.682*** (23.16)	1.307*** (16.64)	1.372*** (17.39)	0.955*** (5.74)	1.187*** (8.70)
Exporter late US-FTA joiner 4/	-0.110 (-1.43)	0.0681 (0.90)	-0.0275 (-0.12)	0.0156 (0.07)	-0.556 (-1.95)	-0.478 (-1.67)
Number of observations	2,477,294	2,386,043	230,386	224,840	262,011	256,240
R2 adjusted (per cent)	75.39	75.03	84.30	83.92	N/A	N/A
Linear combinations of coefficients: 2/						
Individual ITA Importer minus non-ITA WTO Importer	0.015 (0.86)	0.046** (2.69)	-0.069 (-1.39)	-0.014 (-0.26)	-0.385*** (-4.18)	-0.426*** (-3.88)
Exogenous ITA Importer minus non-ITA WTO Importer	0.031 (1.93)	0.048** (2.90)	0.030 (0.50)	0.022 (0.36)	0.398*** (4.13)	0.432*** (4.41)

All regressions include the standard gravity variables as in Table 2 before (coefficients not reported). They also include country-pair-product and time fixed effects. While the time fixed effects regressions 17 and 18 are statistically rejected in favor of the product-time fixed effects of our analog preferred specifications (Regressions 11 and 12) at the 0.1 percent level or higher by F-Statistics, Poisson estimation does not achieve convergence in the presence of the high dimensional product-time fixed effects.

Notes 1/ and 2/, see Table 2. Notes 3/ and 4/, see Table 4. Note 3/ of Table 2 also applies. 5/ For these regressions the dataset is collapsed to the 7 broad ITA product categories

broadly comparable. Mainly, the elasticity of tariff reductions rises considerably, while the zero tariff dummy now carries a little intuitive negative sign.

Regressions 21 and 22 then repeat the exact exercise using Poisson estimation. We find that magnitudes of some coefficients, and in a few instances their statistical significance, can indeed vary somewhat. We, however, take comfort that the general pattern of results remains the same with respect to the four layers of ITA effects, which are our main focus.

One drawback of regressions 21 and 22 as robustness checks is that ultimately only about 12 per cent of their sample consists of zero trade flows. The culprits behind this are the tariff data, which are missing for many of those zero trade observations. Therefore, Annex Table 4.8 repeats regressions 19-22 without the tariff regressors, which increases the fraction of zero observations to about one third of the sample. Reassuringly, the general pattern of results again remains comparable between the least squares and Poisson regressions.

#### 4.6.2 Multilateral resistance

This subsection presents results from an estimation strategy to account for multilateral resistance that includes a set of "country-period" dummies as another set of fixed effects. Our identification relies on time variation. The obvious drawback of introducing the country-period dummies is therefore that we curtail our identifying variation. A concrete example is useful to illustrate this point. Vietnam joined the ITA in 2006. In our baseline estimation, we therefore identify the ITA impacts for Vietnam by comparing its trade during 1996-2005 to that of 2006-12. Introduction of the country-period effects implies that the comparison is now shortened to 2005 versus 2006-2008. Thus, to the extent that (i) ITA impacts build over longer periods of time, as the graphs in Section II suggest or (ii) trade flows are volatile, as is typically the case in product-level data or (iii) 2005 was an abnormal year for Vietnam's ITA trade, we run the risk of obtaining misleading estimates.

Table 4.7 presents the results. It is an exact analogue to Table 4.5 with added country-period effects. As expected, the magnitudes of most all coefficients are muted against the background of the reduced identifying variation. The main exception is the zero tariff coefficient, which suffers from less of such a loss as it is also driven non-ITA members that have reduced tariffs to zero on certain products. However, a few effects that were closer to zero or less statistically significant in our baseline results now become insignificant. These include for instance the 8 per cent ITA exogenous exporter impact in final goods of Regression 16, which is now negated. Most importantly, however, the pattern of results resembles otherwise very closely the one of Table 4.5, albeit with smaller magnitudes and some reductions in statistical significance. We therefore draw much comfort from this robustness check and

look forward to exploring further alternatives to control for multilateral resistance in future work.<sup>37</sup>

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<sup>37</sup>Yet other alternatives to control for multilateral resistance would be to introduce a control sector of non-ITA products and then rely on between-product variation within any year and country pair to identify ITA trade impacts. Yet another option may be to apply the approximation method of [Baier and Bergstrand \(2007\)](#).

Table 4.7: Robustness II: Addressing multilateral resistance using country-period effects

Goods type China's Exp. Reg. No.	All goods				Intermed. Goods 5/		Final goods 5/	
	Yes	No	Yes	No	Yes	No	Yes	No
	23	24	25	26	27	28	29	30
Individual	-0.0554*	-0.000232	-0.0469*	0.00585	-0.00150	0.0641	-0.0872*	-0.0732
ITA Exporter	(-2.56)	(-0.01)	(-2.16)	(0.25)	(-0.04)	(1.48)	(-2.48)	(-1.93)
Exogenous	0.232***	0.00669	0.190***	-0.0731**	0.173***	-0.0339	0.249***	-0.0522
ITA Exporter	(13.57)	(0.30)	(10.91)	(-3.14)	(5.65)	(-0.86)	(8.40)	(-1.32)
ln(1+tariff)	-0.0640	-0.0144	-0.0619	-0.0171	-0.480*	-0.377	0.151	0.0962
	(-0.65)	(-0.14)	(-0.63)	(-0.17)	(-2.43)	(-1.88)	(0.84)	(0.53)
Zero tariff	0.0790***	0.0800***	0.0792***	0.0806***	0.0974***	0.101***	0.0590***	0.0576***
	(14.32)	(14.18)	(14.35)	(14.28)	(9.57)	(9.72)	(6.43)	(6.14)
Individual	0.114***	0.180***	0.0531	0.204***	0.152*	0.299***	0.0854	0.298***
ITA Imp. 1/	(4.15)	(6.39)	(1.63)	(6.08)	(2.46)	(4.57)	(1.53)	(5.33)
Exogenous	0.0857**	0.157***	0.0533	0.176***	0.149**	0.270***	0.0868	0.250***
ITA Imp. 1/	(3.18)	(5.76)	(1.89)	(6.10)	(2.78)	(4.75)	(1.82)	(5.22)
Non-ITA	0.116***	0.166***	0.0634*	0.179***	0.219***	0.329***	0.0233	0.195***
WTO Imp. 1/	(4.41)	(6.25)	(2.15)	(5.85)	(3.90)	(5.48)	(0.46)	(3.81)
One in	0.101***	0.107***	0.0798***	0.104***	0.0551	0.0661	0.182***	0.214***
WTO	(4.41)	(4.58)	(3.56)	(4.58)	(1.38)	(1.63)	(4.59)	(5.36)
Exporter late			0.0697*	-0.0264	0.0691	-0.0273	0.101*	-0.0580
WTO joiner 3/			(2.47)	(-0.82)	(1.34)	(-0.46)	(2.12)	(-1.10)
Exporter late			0.377***	0.491***	0.175***	0.277***	0.702***	0.822***
EU joiner 4/			(12.81)	(16.56)	(3.31)	(5.21)	(13.86)	(16.13)
Exporter late			0.00444	0.119	0.120	0.227	0.0662	0.205
US-FTA joiner 4/			(0.06)	(1.66)	(0.99)	(1.89)	(0.56)	(1.72)
No. obs.	2,477,294	2,386,043	2,477,294	2,386,043	680,728	658,002	825,203	793,820
R2 adj. (%)	76.40	76.02	76.41	76.05	79.26	78.90	74.24	73.71
Linear combinations of coefficients: 2/								
Indiv. ITA Im.	-0.003	-0.018	0.010	0.052***	-0.041	0.005	0.074**	0.156***
- non-ITA WTO Im.	(-0.21)	(-1.14)	(-0.63)	(3.21)	(-1.36)	(-0.16)	(2.57)	(5.49)
Exog. ITA Im.	0.034*	0.078***	0.023	0.041*	0.032	0.044	0.082**	0.099***
- non-ITA WTO Im.	(2.27)	(5.00)	(1.49)	(2.56)	(1.08)	(1.44)	(3.08)	(3.67)

All regressions include country-pair-product, product-time and country period effects. They also include the standard gravity variables as in Table 2 before (coefficients not reported), except for the remoteness regressor, because the country-period fixed effects now proxy for Anderson and van Wincoop's (2003) multilateral resistance effects. Retaining the remoteness regressor would leave results virtually unchanged. All regressions in Table 7 are statistically preferred to their analogs excluding country-period effects. Specifically, Table 3 specifications are rejected at the 0.1 per cent level or higher by F-Statistics in favor of the corresponding Table 7 specifications.

Notes 1/ and 2/, see Table 2. Notes 3/ to 5/, see Table 4. Note 3/ of Table 2 also applies.

## 4.7 Conclusion

The Information Technology Agreement (ITA) is perhaps the most significant plurilateral tariff reduction agreement to date. Under the aegis of the WTO, 75 countries eliminated all import tariffs on a wide range of IT-related goods. The broad coverage within the sector, as well as comprehensive implementation of the agreement, makes the ITA an ideal case study to understand the impacts of tariff reduction – or indeed elimination – agreements.

This paper contributed to the understanding of the impact of the ITA in three ways. First, by using a large panel data set of product-level data, we were able to dissect the layers through which the agreement affects trade flows. In particular, we distinguish three effects: the tariff reduction effect, tariff elimination effect and value chain effect (through intermediate goods prices). Second, we carefully investigate the role of China and verify that ITA effects are not driven just by the experience of this single country. Finally, we use Poisson maximum likelihood regression to correct for the presence of zero trade flows.

The positive impact of the ITA on trade is driven by tariff-related factors. In particular, the elimination of tariffs has a benign impact over and above the trade gains predicted from tariff reductions alone. After controlling for these tariff policies, the ITA dummy is no longer significant. This creates some hope that similar tariff elimination treaties in other sectors may promote trade just as strongly. Furthermore, elimination of tariffs on intermediate IT goods due to ITA helps to promote exports in two ways: first, by creating policy certainty, it affects the location decisions of MNEs. Second, lowering the cost of inputs makes producers more competitive when exporting. This is reflected in a much higher ITA semi-elasticity for zero tariffs in intermediate goods vis-à-vis final goods.

While China is clearly a key beneficiary of the ITA, having become a dominant exporter of electronics products in the world, a careful investigation reveals that other “exogenous joiners” also benefited from the agreement. In particular, the layers identified earlier are robust to estimation on a sub-sample containing all signatories except China. Finally, Poisson maximum likelihood regression confirms the robustness of our results to taking into account zero trade flows.

## 4.8 Appendix

Table 4.8: Maximizing the number of zero observations in the Poisson

Estimation technique Includes China's Exports Regression No.	Least Squares		Poisson	
	Yes A1	No A2	Yes A3	No A4
Individual ITA Exporter	-0.129* (-2.56)	-0.0675 (-1.23)	-0.350** (-2.97)	-0.882*** (-5.86)
Exogenous ITA Exporter	0.319*** (5.58)	0.159* (2.25)	0.761*** (8.19)	0.345* (2.28)
Individual ITA Importer 1/	0.491*** (5.34)	0.512*** (5.48)	0.0753 (0.51)	0.0473 (0.31)
Exogenous ITA Importer 1/	0.564*** (7.36)	0.488*** (6.22)	0.963*** (6.64)	0.970*** (6.55)
Non-ITA WTO Importer 1/	0.473*** (5.47)	0.418*** (4.77)	0.502*** (4.27)	0.511*** (4.31)
One in WTO	0.200** (2.92)	0.0993 (1.40)	0.101 (0.95)	0.120 (1.09)
Exporter late WTO joiner 3/	-0.0742 (-0.90)	-0.212* (-2.36)	0.182 (1.22)	0.180 (1.02)
Exporter late EU joiner 4/	1.348*** (17.51)	1.418*** (18.35)	0.987*** (6.20)	1.179*** (8.72)
Exporter late US-FTA joiner 4/	-0.0710 (-0.30)	-0.0279 (-0.12)	-0.564 (-1.90)	-0.486 (-1.64)
Number of observations	268,438	261,936	392,416	384,816
R2 adjusted (per cent)	0.836	0.832	N/A	N/A
Linear combinations of coefficients: 2/				
Individual ITA Importer minus non-ITA WTO Importer	0.018 (0.48)	0.093* (2.44)	-0.426*** (-5.96)	-0.463*** (-5.71)
Exogenous ITA Importer minus non-ITA WTO Importer	0.091 (1.58)	0.070 (1.20)	0.461*** (5.39)	0.459*** (5.28)

In all regressions, the dataset is collapsed to the 7 broad product categories described in Section II and includes zero trade flows; see also note 5/ of Table 5.

Notes 1/ and 2/, see Table 2. Notes 3/ and 4/, see Table 4. Note 3/ of Table 2 also applies.



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