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# *The impact of RTAs on trade in agricultural products*

Sébastien JEAN (*INRA & CEPII*)  
*and*

Jean-Christophe BUREAU (*AgroParisTech and CEPII*)

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# What do RTAs change?

## **The global environment**

- WTO stalled. Protectionist tendencies since 2009 (Global Trade Alert)
- Several interpretations for WTO failure (Bagwell & Staiger 2011; Evenett, forthcoming). Special role of agriculture.

## **But a considerable development of PTAs**

- Even the EU turned to PTAs (post Prodi/Lamy)
- Several motivations for PTAs: lack of WTO progress, dissatisfaction with non market aspects, treadmill, “Freund effect”, etc.
- Still unclear whether they are building blocks or not (e.g. EU-Chile quite WTO compatible) . But apparent victory of regionalism over multilateralism

# What do we know about RTAs?

- **Knowledge of the impact of RTAs is unimpressive**
  - Not many RTAs have been studied extensively. The EU started to take the issue seriously with extensive ex post impact assessments only in 2012
  - Non reciprocal North-South PTAs have been studied more intensively (GSP). But conflicting results (econometrics) and limited conclusions (supply side problems)

## **Some unsubstantiated beliefs circulate**

- For example, that North South trade concessions are disappointing; that PTAs and RTAs mostly lead to trade diversion, etc. Not a lot of hard evidence.... (example: Copenhagen consensus conclusions)

# What do we know about RTAs? (2)

## **The regionalism / multilateralism debate**

- Growth in the number of RTAs or correlations between aggregate trade flows and RTAs don't tell the whole story
- Hard to conclude to stumbling stone / building block without an assessment of the impact of RTAs
- Both in the Bagwell & Staiger and in the Evenett's frameworks, useful to quantify the alternative to multilateralism

## **Several questions**

- Do RTAs increase trade among partners and if so by how much?
- Do they simply affect trade flows of existing traded goods or do they increase the probability of new trade flows?
- Do these impacts differ according to partners' income level? Do the impacts differ according to tariff reduction benefits offered, that is the preferential margin under the agreement?

# What is new in this paper?

## Challenges

- Complicated provisions over time (progressive implementation schemes, heterogenous across products)
- Uneven product coverage of the agreements. Even more uneven starting tariffs and preferential margin across products
- Particular complexity in agriculture (higher protection, some products excluded from RTAs, specific tariffs, quotas)
- Simplifying assumptions: one-off implementation, uniformity across RTAs, homogeneity across products are not realistic

## In the paper

- Use of trade and tariff data at a detailed product level (HS6)
- For each of the 74 RTAs considered, over the period 1998-2009, accounting for the progressive implementation of the RTAs

# What is new in this paper? (2)

Impacts of RTAs often measured using “gravity models”. Results highly variable: negative to tripling or more of the initial flow of trade. **Two main problems** (make early work and meta analyses obsolete):

- Specifications that rely only on economic masses of partners, such as GDP/GDP per-capita/population and fail to account for price terms – “**multilateral trade resistance factors**”
- **Endogeneity**. a number of unobservable determinants simultaneously affect the intensity of trade and the probability of an agreement. Their omission can seriously affect estimation

## **In the paper**

- Method based on transformation of dependent variable (akin to DID): trends in differences vs control groups, differenced across products.
- Avoid selection bias linked to non-zero flows
- Extra analysis of intensive & extensive margins

# Methodology

- Start from gravity : Generalization of Newton's

$F_{ij}=G.M_i.M_j/D_{ij}^2$  in  $X_{ij}=M_i^a.M_j^b/D_{ij}^c$ , or more generally:

$$(1) \quad X_{ijt} = G_t S_{it} M_{jt} \phi_{ijt}$$

where  $i$  is exporter,  $j$  importing,  $X$  trade flow,  $G$  a time specific constant,  $S$  variable of exporter attributes,  $M$  variable of importer attributes and  $\phi$  determinants of bilateral trade (of interest)

- Endogeneity and multilateral resistance are major obstacles for the estimation of a log form of this equation.
- At such a disaggregated level other problems (heteroskedasticity, many zeros) are more challenging. Very large number of fixed effects a la Grant-Lambert (2008) make estimation cumbersome.
- Here: transformation of the dependent variable à la Romalis (paper on NAFTA 2007). Requires control groups.



# Methodology (2)

- Use of panel data. Unit by unit division of (1) for two exporting countries  $i$  and  $i'$ , to market  $j$ , product  $k$ , time  $t$

$$(4) \quad R_{ii'jkt} = \frac{X_{ijkt}}{X_{i'jkt}} = \frac{S_{ikt}}{S_{i'kt}} \frac{\phi_{ijkt}}{\phi_{i'jkt}}$$

*R is the ratio of imports of j from i and i'*

- Further control by relative volume of imports from suppliers  $i$  and  $i'$  by countries  $j$  and  $j'$ :

$$(5) \quad B_{ii'jj'kt} = \frac{R_{ii'jkt}}{R_{ii'j'kt}} = \left( \frac{X_{ijkt}}{X_{i'jkt}} \right) / \left( \frac{X_{ij'kt}}{X_{i'j'kt}} \right) = \left( \frac{\phi_{ijkt}}{\phi_{ij'kt}} \right) / \left( \frac{\phi_{i'jkt}}{\phi_{i'j'kt}} \right)$$

*B (Bi-ratio) is the relative volume of imports from supplier i and i'*

# Methodology (3)

- With a multiplicative structure of the time specific and sector specific effects and a tariff factor  $\tau$

$$(6) \quad \phi_{ijkt} = a_{ijk} b_t c_k \tau_{ijkt}^\sigma$$

$$(7) \quad B_{ii'jj'kt} = \left[ \left( \frac{a_{ijk}}{a_{i'jk}} \right) / \left( \frac{a_{ij'k}}{a_{i'j'k}} \right) \right] \left[ \left( \frac{\tau_{ijkt}}{\tau_{i'jkt}} \right) / \left( \frac{\tau_{ij'kt}}{\tau_{i'j'kt}} \right) \right]^\sigma$$

Using control groups I (countries not participating to the RTA) instead of  $i'$  and  $j'$  (bilateral comparison)

$$(8) \quad B_{iljJkt} = \lambda_{ijk} \left( \frac{\tau_{ijkt}}{\tau_{IJkt}} \right)^\sigma$$

$$\text{where } \lambda_{ijk} = \left[ \left( \frac{a_{ijk}}{a_{Ijk}} \right) / \left( \frac{a_{ijk}}{a_{Ijk}} \right) \right] \left[ \left( \frac{1}{\tau_{ijkt_0}} \right) / \left( \frac{\tau_{IJkt_0}}{\tau_{IJkt_0}} \right) \right]^\sigma$$

# Methodology (4)

- Makes it possible to estimate the substitution elasticity  $\sigma$  with econometric methods, knowing  $\tau$  and the ratio of ratio  $B_{ijklkt}$

$$(9) \quad \ln(B_{ijklkt}) = \alpha_{ijk} + \sigma \ln\left(\frac{\tau_{ijklkt}}{\tau_{ljkkt}}\right) + u_{ijklkt}$$

- Santos-Silva and Tenreyro (2006): bias due to logarithmic form, and problem of null flows: Poisson Pseudo Maximum Likelihood estimation technique suggested (further critiques to the method proved unfounded)

$$(10) \quad B_{ijklkt} = \exp\left(\alpha_{ijk} + \sigma \ln\left(\frac{\tau_{ijklkt}}{\tau_{ljkkt}}\right)\right) + v_{ijklkt}$$

# Methodology (5)

- Ratios: absorb some of the source of multilateral resistance; also, less endogeneity problems at the detailed product level
- Control group: entire population of countries that have not signed a preferential agreement with the country of interest by 2009
- Poisson PML: Does not require very strong assumptions (conditions on conditional mean suits well the particular problem, see Chapter 19 in Woolridge) . Deal with zero values, remaining efficient (Santos-Silva and Tenreyro, 2011)

# Data

- Need panel: Here we work at HS6 lines. 74 agreements, control group (countries outside agreements). 12 years starting 1998. Data on bilateral tariffs (MFN) and tariff concessions for every year, to account for the progressive implementation of the RTAs
- Specific treatment of year 1 of the RTA (often inconsistent with tariff data on Jan 1)
- Questions about accurate measurement of MFN before 2001 (still in the Uruguay Round implementation process)
- Filters for low values, which, in the control group introduce very large ratios (results presented in the paper)
- Number of observations depends on the zero flows in the control group

# Data (2)

- Data on trade flows from BACI developed by CEPII (source: primary data from UNCTAD, same original source as COMTRADE)
- Data on HS6 MFN tariffs and applied bilateral tariffs from McMAP HS6, developed by CEPII and ITC
- Data on annual tariff concessions by product for each RTAs: most of the data was developed by M. Shearer and colleagues at IADB (see the paper by Almeida-Salles, Shearer and Fulponi, IADB and OECD, 2012) with extensions by S. Jean (4 RTAs were discarded because of low quality data)
- As a result, not all RTAs are covered and there is a bias towards RTAs involving Latin American countries (currently, new RTAs are being added to the dataset at INRA, with focus on Asia).

# Results: methodology

**Warning: results presented here only for ag and food products !**

## **On the methodology**

- We find Romalis' approach really a plus. With alternative approaches may have to work with thousands of dummies.

## **On the estimation**

- Tends to support Santos Silva & Tenreyro (2006, 2009, 2011) on estimating the multiplicative form
- Supports the interest of Poisson approach compared to other approaches (note: on a bilateral approach on EU Chile, several other methods were tested)
- OLS approach is indeed not working well, while PPML is robust. As predicted by S-S & T, OLS seem to suffer from the transformation of a largely heteroskedastic model and from zero values.

# Results : data

## Results and lessons on data

- MacMAP dataset appears once again as a major ‘innovation’ for applied trade analysis. Need to develop the RTA implementation data. International collaboration is welcome
- In the study of a particular agreement it would be good to use classification beyond HS6 (e.g. EU agreements and US Agreements implemented at the 8 digit level) but limitation HS6 with the control group
- Still some weird data (agreements, flows, e.g. Hong-Kong, African RTAs) that need to be cleaned. Thresholds of trade flows in the control group need further work
- Useful to isolate the Year 1, which is often specific.



# Results

## On the economic results

- On the intensive margin: what we get is an elasticity of substitution: measures the impact of a given bilateral tariff reduction on trade between the signatories vs trade with other countries
- e.g. in a bilateral comparison: an elasticity of -5 means that if the RTA cuts the tariff applied by country A to country B exports by 1%, the EU imports from B would increase by 5% relative to the imports from the control group.
- Intuition: measure whether A imports from B changed in a way that is specifically linked to the RTA between A and B, rather than from a increase in demand from A (control group) or an increase in the competitiveness of B on all export markets (control group)

# Results (2)

## **Average results on 74 RTAs**

- Import elasticity of substitution between of -4.1 and -4.5 (after 1 year). Consistent with Romalis on NAFTA (a bit lower), but lower than what is suggested by Broda and Weinstein for the US for all products. Higher than direct import elasticities by Kee et al.

## **Results by types of agreement:**

- Run into the limitation of the sample (e.g. not enough North-North RTAs). The estimated elasticity seems lower for North to South than for South-South. But caution needed before drawing lessons for development.

# Results (3)

## Results per type of products

- The import elasticity differs according to the degree of preferential margin. Products for which the RTA leads to a 5%-10% margin intensive have a higher import elasticity. Again, interaction with the product coverage and the agreements.
- Results for group of commodities can be used (e.g. EU-Chile study). Here estimates for large categories: higher elasticities for fats and oils than for vegetable products for example
- Can be useful for simulation (see conclusion)

	Base estimates		
	(1)	(2)	(3)
South-South	-4.61 *** (1.66)		
North-to-South	-3.18 *** (1.06)		
South-to-North	-3.78 *** (1.25)		
0 < preferential margin < 5%		-3.82 (2.98)	
5% < preferential margin < 10%		-5.07 *** (1.67)	
10% < preferential margin		-3.86 *** (1.08)	
I Animals & products			-2.89 (1.96)
II Vegetable products			-2.86 * (1.63)
III Fats & oils			-11.13 ** (5.33)
IV Foodstuffs, beverages, tobacco			-4.20 *** (1.52)
Non food ag. products			-8.05 * (4.17)
Observations	100,398	100,398	100,398
Panel units	13,292	13,292	13,292

# Results (4)

## The issue of the extensive margin

- Goal is to account for the impact of the RTA on the creation of new flows between countries (i.e. products that were not exported before the RTAs ).
- Start with zero flows. Idiosyncratic variables no longer controlled by the transformation of the dependent variable.
- Use a different estimate (linear model on the probability to export), without control groups but with dummies (note: sample much larger, close 1 million observations; interpretation of the results different)

$$(11) \quad P(X_{ijkt} > 0) = \alpha'_{ijk} + \beta'_{it} + \gamma'_{jt} + \sigma' \ln \left( \frac{\tau_{ijkt}}{\tau_{Ijkt}} \right) + w_{ijkt}$$

# Results (5)

## Extensive margin

- Significant impact of RTAs on the probability of exporting. If a preferential margin that lowers the tariff inclusive price by 10% , probability to export on average of 0.45%. Rather low, but linked to capacity to export (many Southern countries in the sample, some heavily specialized) and the fact that the probability to export at the HS6 level is low by definition.
- Results on South-North not statistically significant, though.
- An interesting approach is the classification of the probability to export per class of preferential margin. In particular, a RTA with no preferential margin for the product may give an estimate of its impact on Non Tariff Barriers

Dependant variable:	Diff in diff log exports			Export probability	
	Sample:	All (1)	Excl. low- mean panels (2)	Excl. low, post-2000 (3)	All (4)
Independent variable:					
Dummy variable indicating					
PTA in force,					
preferential margin = 0 for this product		0.03 (0.10)	0.11 (0.11)	0.11 (0.11)	-0.004 (0.003)
0 < preferential margin < 5%		0.13 (0.11)	0.19 (0.12)	0.19 (0.12)	0.003 (0.002)
5% < preferential margin < 10%		0.40 *** (0.14)	0.47 *** (0.15)	0.47 *** (0.15)	0.008 *** (0.003)
10% < preferential margin		0.50 *** (0.16)	0.57 *** (0.18)	0.57 *** (0.18)	0.004 (0.003)
Estimation method		PPML	PPML	PPML	Linear prob. model
Observations		100,398	53,947	41,670	978,840
Panel units		13,292	6,673	6,346	81,570

Note: Here, the  $\sigma$  are estimated with a dummy indicated the class, so interpretation differs relative to the previous estimates

# Results (6)

## Extensive margin

- Results: a RTA that has low preferential measures does not generate new trade flows. Positive but not significant estimate
- But if the preferential margin is larger than 5%, the creation of the RTA has large effect on the flow (intensive margin) as well as the creation (extensive margin) of trade. On average, the increase in a given trade flows is 49% if the preferential margin exceeds 5%, and the impact on new trade flows is also significant (probability to export increases by 0.8%).



# Further developments

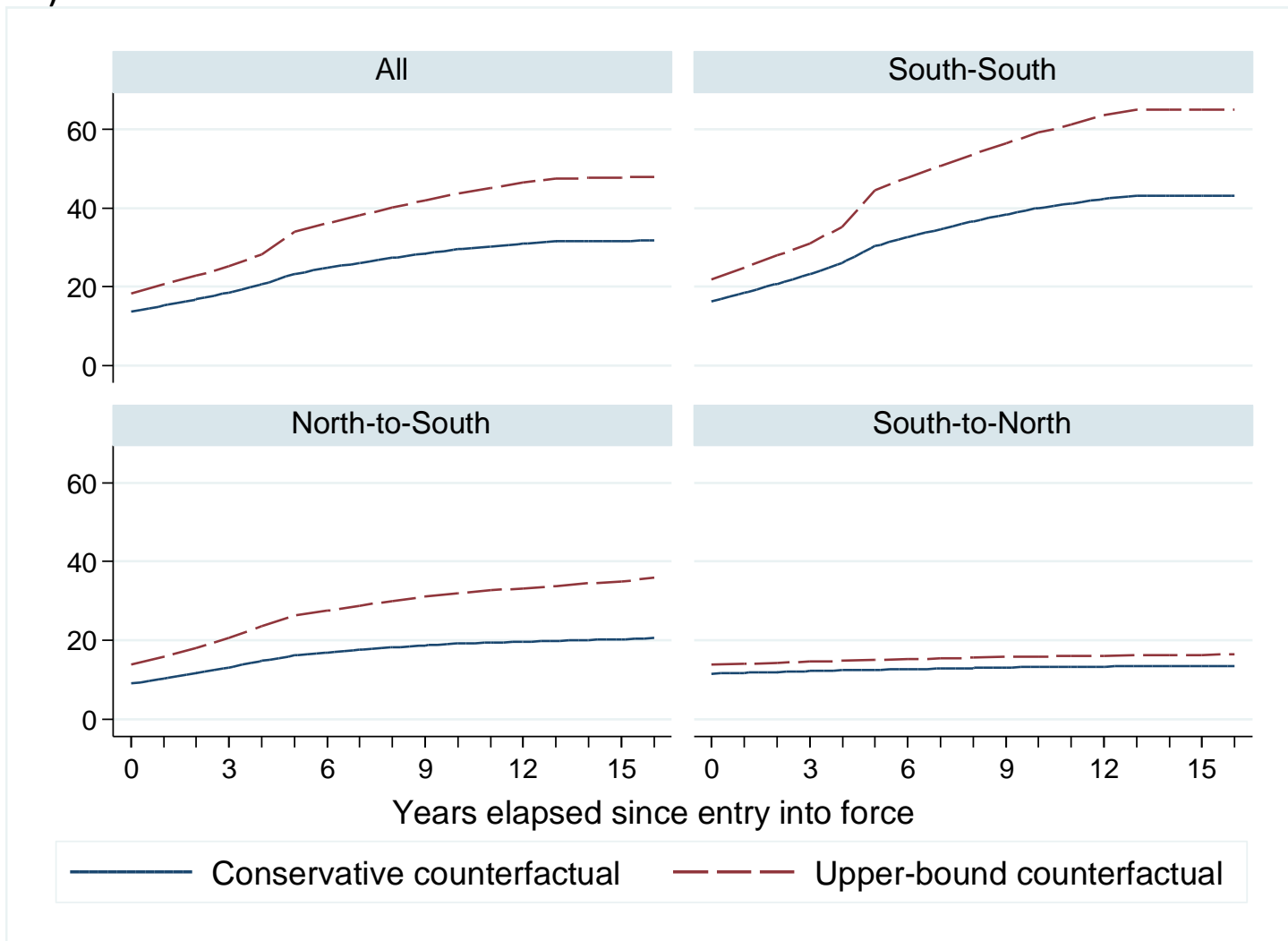
## Simulations: ongoing work

- Methodology: start from a CES import demand function and dual price
- Use the fact that

$$(1) \quad \tilde{X}_{ijkt} = X_{ijkt_0} \left( \frac{\tau_{ijkt}}{\tau_{ijkt_0}} \right)^{-\sigma} \left[ \theta_{ijk} \left( \frac{\tau_{ijkt}}{\tau_{ijkt_0}} \right)^{1-\sigma} + (1 - \theta_{ijk}) \right]^{-1}$$

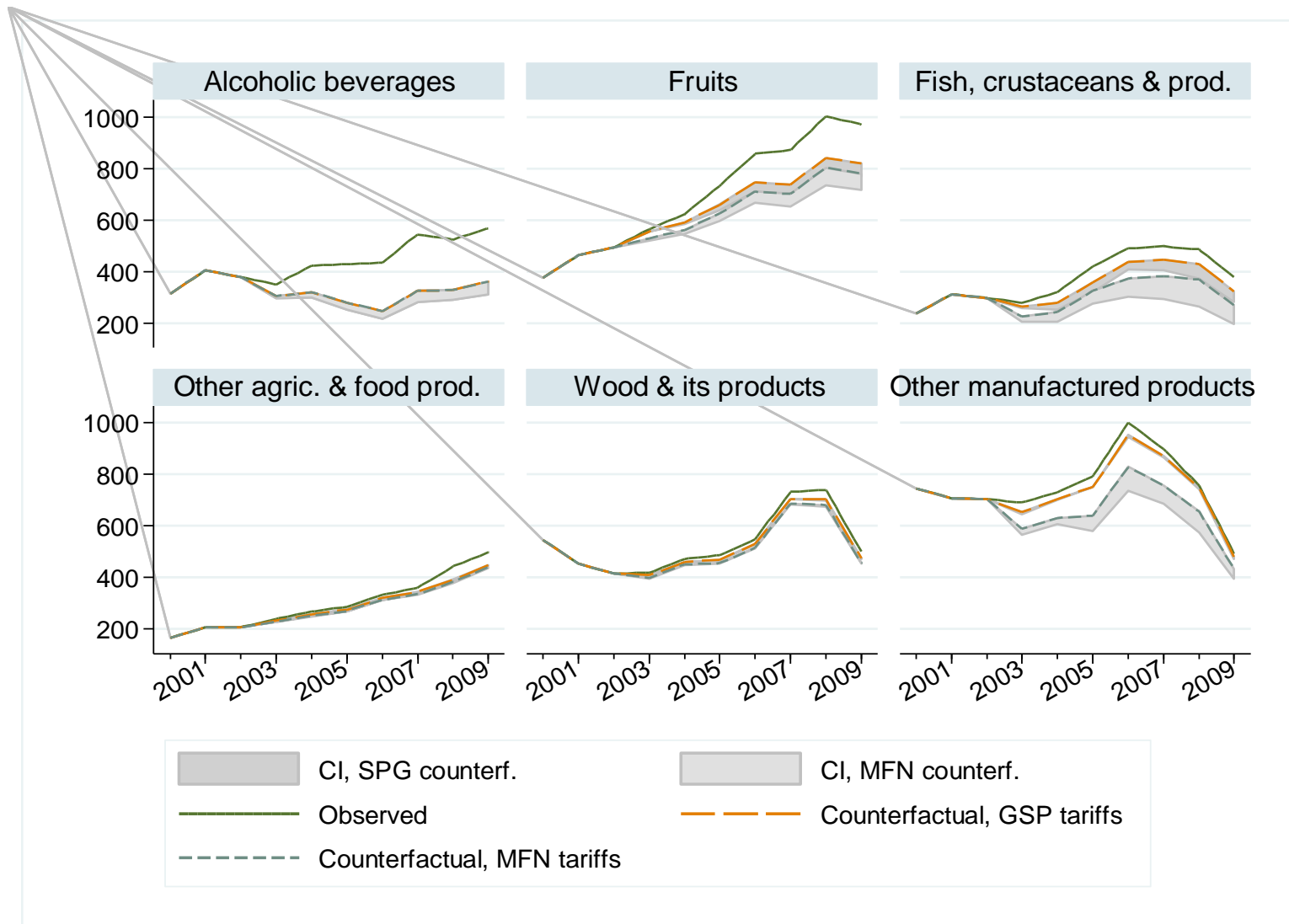
Where  $\theta$  is the value share of supplier in country imports of good at year  $t_0$ , to simulate changes in trade from  $X_{ijkt}$  to  $\tilde{X}_{ijkt}$

Counterfactual simulations, by type of agreement and years elapsed since entry into force (average % growth in agrofood exports) (preliminary results)





# Illustration of possible extensions: example bilateral analysis EU-Chile. Counterfactual imports of the EU from Chile, with no RTA, either MFN or GSP), in million euros)



# Conclusions

- Impact of RTAs is not well known while it is becoming a major feature of international trade. Many related questions
- This work: real scale experiment of estimating the actual impact of RTAs. Methodology for EU ex post SIAs. Attempt to find an easily implementable but robust method
- Debate on econometric issues in gravity: Supports the PPML and all the Santos-Silva & Tenreyro point of view
- Data is progressing. Still some tedious work to be done
- Large set of possible applications: e.g. EU-Chile ex post SIA study, where these estimates fuel HS6 CGE model, and are used for simulations at a more detailed level
- These approaches could prove useful to investigate the role of North-South preferences.

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