ARTNeT Capacity Building for Trade Policy Researchers

Supporting Equitable Development in ASEAN: Impact of Regional Integration on CLMV Countries

Measuring the economic impacts of NTMs **(Part 1)**	1. **Gravity** 2. **Other. Substitution/ complementarity: empirical evidence**

Session 9

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Bangkok, Thailand, June 2016

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Still a new area of study

Still building knowledge !

- Descriptive
- Gravity (Ex-post estimation)
  - Incidence measures
- General Equilibrium (Ex-ante estimation)
  - AVE
- Welfare

Economic analysis of NTMs

- Existing investigations
  - “Mercantilist” assessments
  - Limited welfare analyses

- Limits
  - Insufficient data
  - Few studies on private standards

- Future:
  - Improve NTM impact measurement,
  - Better account for microeconomic effects

Conceptual discussion

- NTMs (even non-protectionist ones) may affect trade
- **Facilitate trade** – Increasing demand for foreign products:
  - Better quality of products
  - Reduction in informational asymmetries btw. domestic consumers and foreign producers
- **Eliminate trade** – NTM may:
  - Exclude some (non-complying) varieties from the market
  - Exclude some firms (e.g. small DCs' producers) from the market (additional cost: NTM compliance cost)
  - Effect exacerbated if NTMs differ among countries & if they are implemented in a way that favors national industry

Import or export obstacles

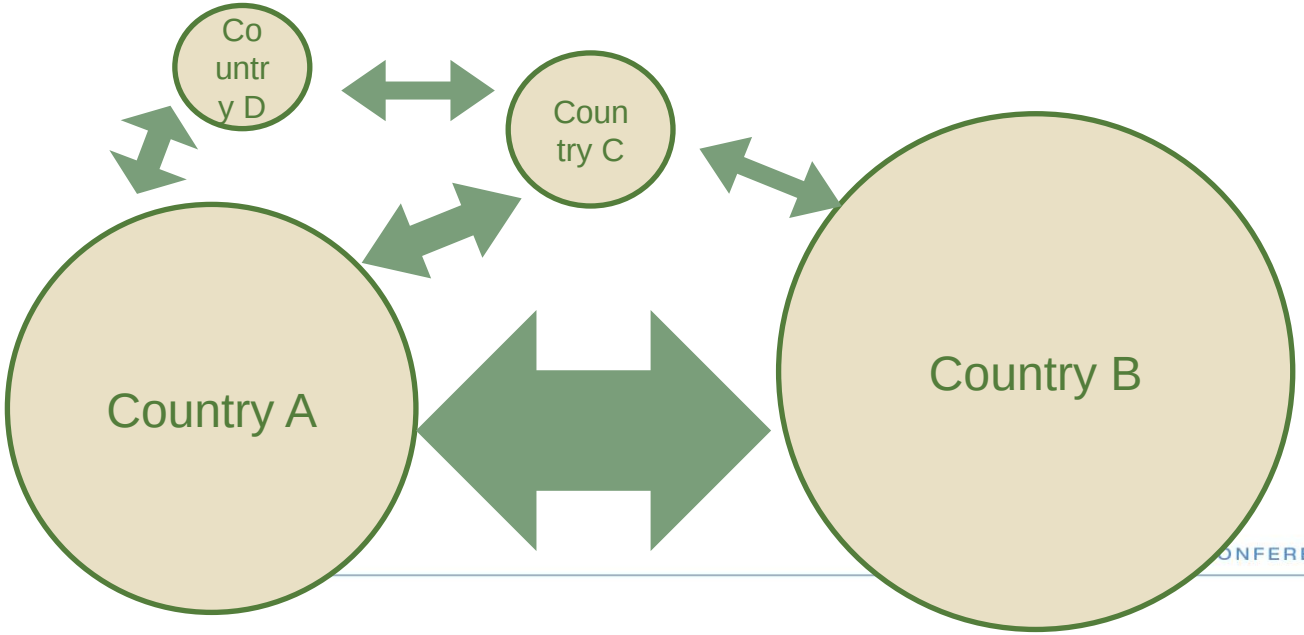
	Export Measures	Import Measures
My country's policies	Obstacle to Export Caused within my country / because of national policies	Obstacle to Import Caused within my country / because of national policies
Other CEFTA partner's policies	Obstacle to Export Caused in another CEFTA party / because of other party's policies	Obstacle to Import Caused in another CEFTA party / because of other party's policies

Gravity estimations based on empiric verification but do not contradict theory

Trade theories explain why there is trade.

Different Reasons and benefits (impact)

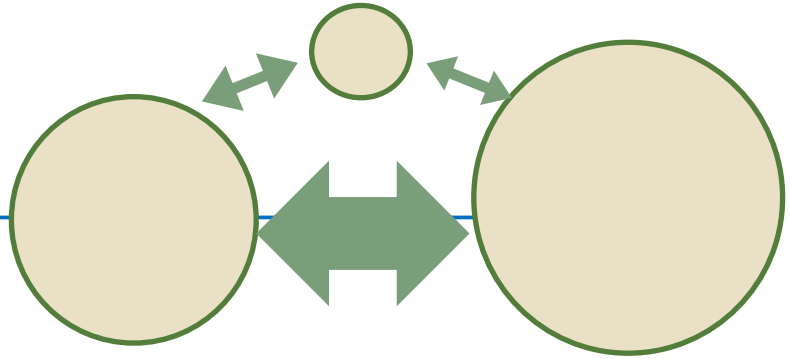
- Efficiency differences (technology)
- Endowments of productive factors
  - comparative advantage , inter industry trade
- Products are different (love for variety)
- Firms are different
  - Economies of scale, intra industry trade



Gravity

- Was based on empiric verification

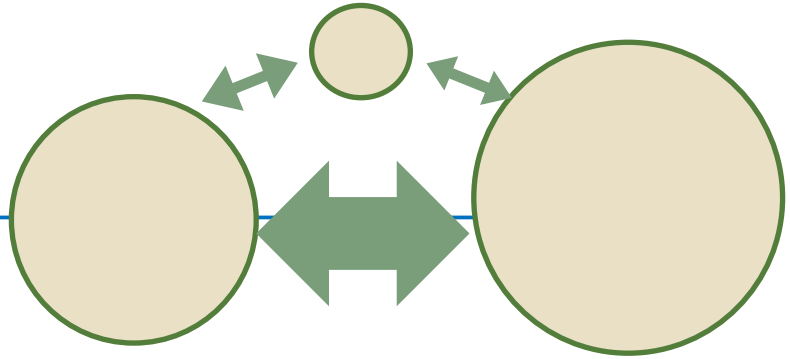
The gravity model of international trade



- The gravity model has gone from a theoretical orphan to being the favoured child of all main theories of international trade

- Why so popular?
  - High explanatory power (R^2 between 0.65 and 0.95)
  - Easy access to relevant data
  - Estimation standards and benchmarks clearly established

Gravity estimations



Geographical variables

- Size of economy
- Geographical closeness (proxy for transport cost)
- Neighbours? Island?

Institutional variables, historical and political features

- Language and other cultural or historical ties
- Common currency or other institutional relationships
- Same FTA?

Endogenous trade costs. ‘Thickness’ of border

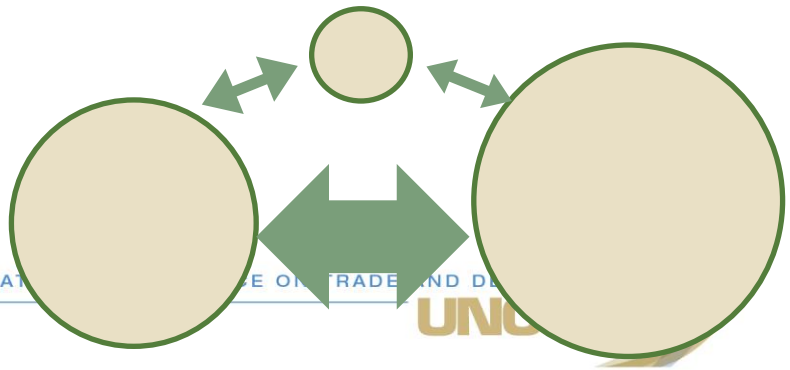
- Logistics performance, cost , delay, reliability
- International connectivity, existence of regular maritime or air services

Gravity estimations

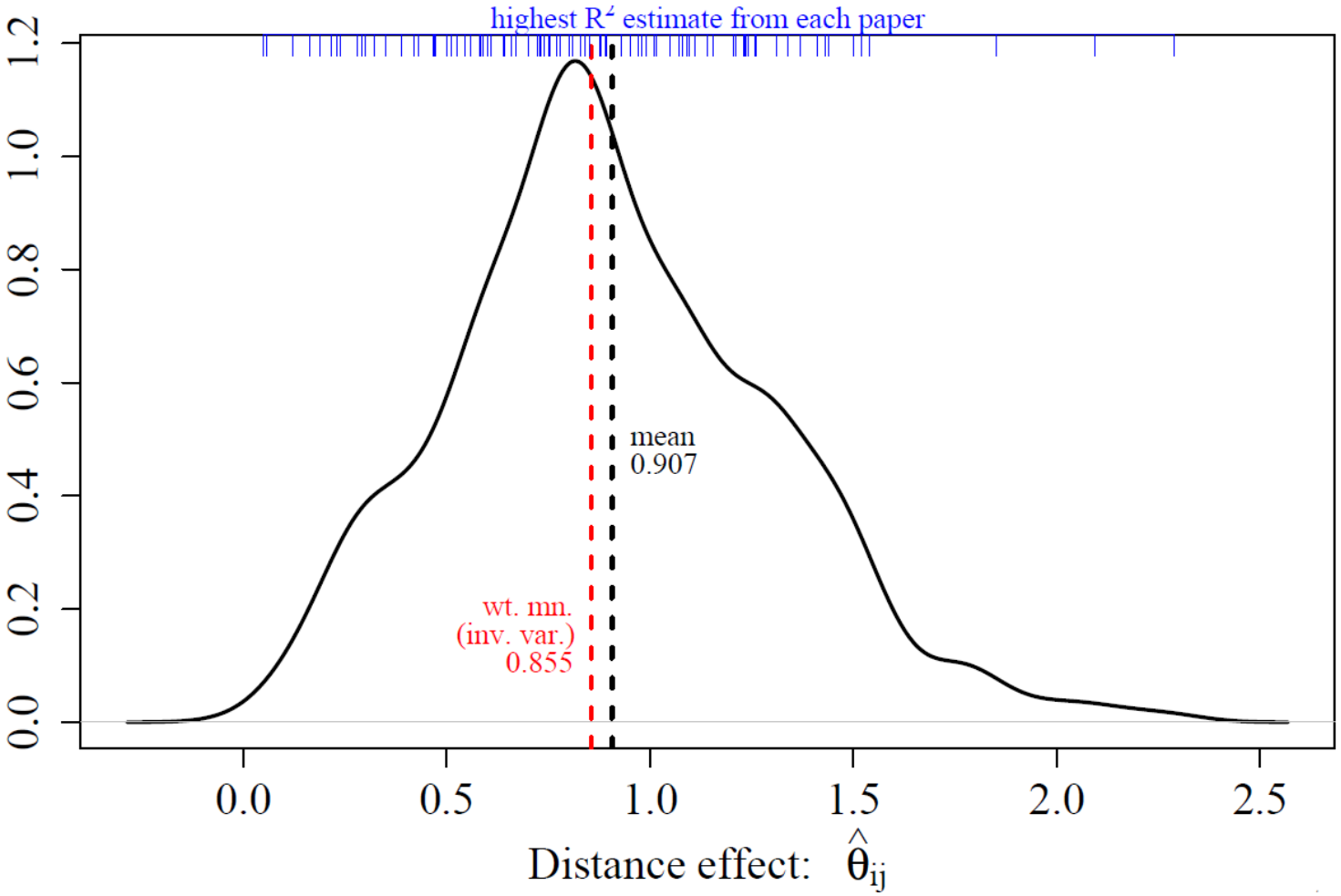
- Is compatible with multiple theoretical models
  - Because it does not norm on ***why*** customers buy imported products instead of national

These are taken as the cost measurement econometric regression (proxies for in the cost)

But could omit variables



Density of 1467 distance estimates



Significant years in the history of gravity

- 1687: Newton \invents" the gravity equation.
- 1962: Tinbergen applies it to the study of bilateral trade
- 1979: Anderson is the first to provide a clear microfoundation but rests on an assumption that was viewed as ad hoc at that time,
  - namely that each nation produced a unique good that was only imperfectly substitutable with another nation's goods
- 80's: Although, the gravity model fell into disrepute in the 1970s and early 1980s, an attempt was initiated by Bergrstrand (1985) to give it a sound microeconomic foundation
- 1995:
  - Trefler (AER): Missing (factor services) trade
  - McCallum (AER): The border effect
  - Leamer and Levinsohn (Handbook): Admitting distance
- 2002-2003: **Eaton and Kortum & Anderson and Van Wincoop** pointed to the way towards estimation methods that took into account the structure of the theoretical models + gravity is generalized
- 2008: Gravity/Het. firms merger (**Chaney, Helpman-Melitz-Rubinstein**)

NEWTON

Where , *F*= attraction force;
M= Mass; *D*=Distance
G= Gravitational Constant
(6.673 84 x 10^{-11} m^3 kg^{-1} s^{-2})

$$F_{ij} = G\frac{M_i M_j}{D_{ij}^2}$$

- Original Gravity model specification for trade

Where X_{ij} = exports from *i* to *j* or total trade;
Y, X = economic sizes (GDP, POP)
Y reflects production and X expenditures; and
T= Trade costs ("distances")

Estimated equation

- Newton's Law-based Normal Trade

$$\ln(Trade_{ij}) = \ln(G) + \beta_1 \ln(GPD_i) + \beta_2 \ln(GPD_j) + \theta \ln(dist_{ij}) + \varepsilon_{ij}$$

- The previous regression fits the data very well.
  - An R-squared of 0.7 on cross-section data.
- However this naïve version can lead to very biased results
  - It is the regression of endogenous variables on endogenous variables

→ Insights from theory (Anderson and van Wincoop (2003))

Structural Gravity

Major contribution of Anderson and Van Wincoop (2003): bilateral trade is determined by bilateral and relative trade costs

$$X_{ij} = GY_i X_j \phi_{ij}$$ Estimation consistent with theory

$$Y_i = \sum_j X_{ij}$$ is the value of production

$$X_j = \sum_i X_{ij}$$ is the value of the importer's expenditure on all source countries

$$G \equiv \frac{1}{\Omega_i} \frac{1}{\Phi_j}$$

$$X_{ij} = \frac{Y_i X_j}{\Omega_i \Phi_j} \phi_{ij}$$

Freeness of trade

- The 'capabilities' of a country to export
- The characteristics of a country which make it a large importer

Ω_i and Φ_j are multilateral resistance terms

$$\Omega_i = \sum_l \frac{\phi_{il} X_l}{\Phi_l} \qquad \Phi_j = \sum_l \frac{\phi_{lj} Y_l}{\Omega_l}$$

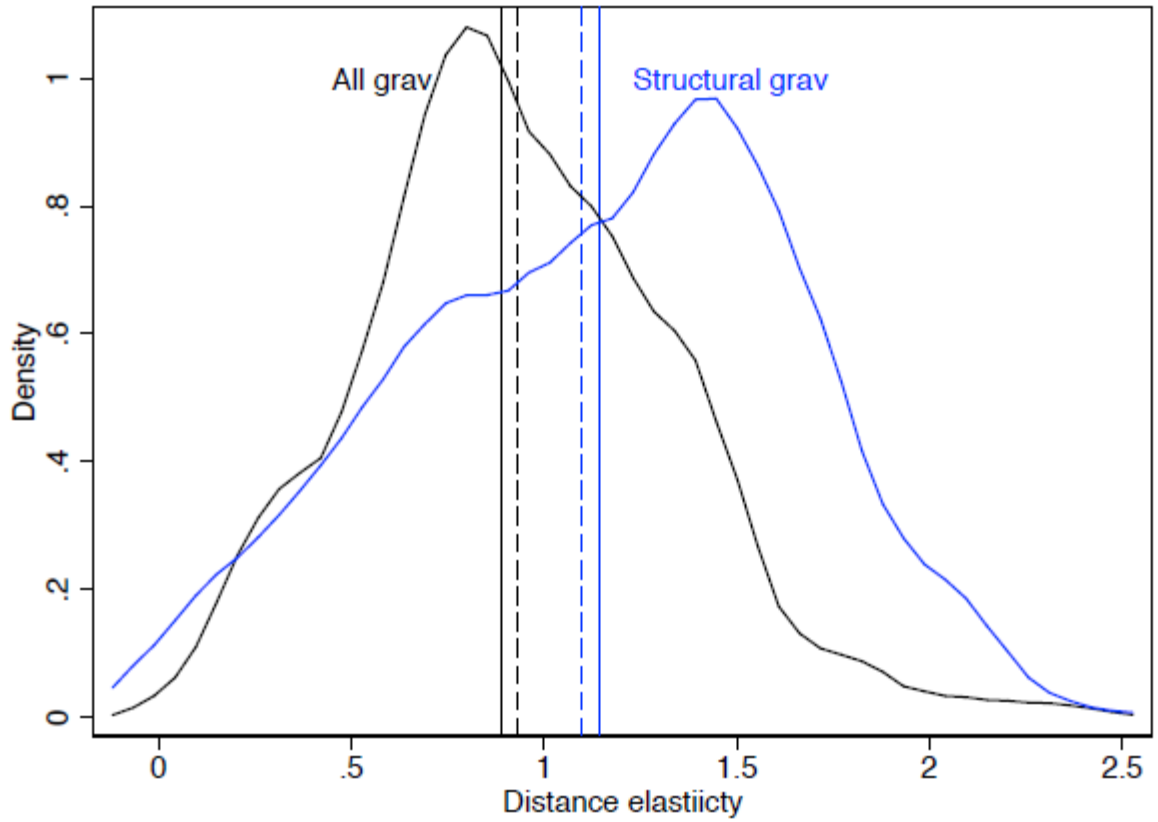
NB: The original multiplicative form is predicted by trade theory

Structural Gravity

- G here is not a unique constant as it is in the physical world
- Major contribution of **Anderson and Van Wincoop (2003)**:
  - bilateral trade is determined by bilateral and relative trade costs
  - The level of trade flows between i and j is affected by third countries only through the **Multilateral Resistance (MR)** terms that are specific to i and j respectively (it will be necessary to account for their time variation in panel estimation)

- Direct effects of trade costs changes go through the freeness of trade indicator (bilateral term) and indirect effects through the MR terms (unilateral term)

What difference do fixed effects make? The distribution of 1835 estimates of distance effects, 328 structural



Estimates:	All Gravity median	mean	s.d.	#	Structural Gravity median	mean	s.d.	#
Distance	-0.89	-.93	0.4	1835	-1.14	-1.1	0.41	328
Contiguity	0.49	0.53	0.57	1066	0.52	0.66	0.65	266
Same language	0.49	0.54	0.44	680	0.33	0.39	0.29	205
Colonial link	0.91	0.92	0.61	147	0.84	0.75	0.49	60
RTA/FTA	0.47	0.59	0.5	257	0.28	0.36	0.42	108
Same currency	0.87	0.79	0.48	104	0.98	0.86	0.39	37
Border coef.	1.93	1.96	1.28	279	1.55	1.9	1.68	71

Structural gravity here $\equiv$ country fixed effects or ratio method. Border effect is exponential of border coeff (all: 6.9, structural: 4.7)

Note: The dataset includes a total of 161 papers and more than 2500 usable estimates

Source: Head and Mayer (2014)

Fixed effects estimation

- Benchmark empirical specification must account for relative trade costs and but also <u>for their time variation</u>

$$\ln(x_{ijt}) = \ln(G) - (bil\,trade\,barriers)_{ijt}\Theta + \\ + \sum_i \gamma_{it} D_{it} + \sum_j \gamma_{jt} D_{jt} + \sum_t \delta_t K_t + \varepsilon_{ij}$$

Where

- *D*=time-varying country specific dummies;
- *K*=time dummy (to take global inflation trends into account)
- There are 2nT+T dummies, where T denotes the time period

- Impossible to estimate the coefficient of GDPs

Quantify NTMs' trade effects: gravity estimations

- Comparison btw. predicted trade flows (without NTMs) & observed flows (with NTMs)
- **Gravity** implemented at industry/product level
- **General specification of gravity model**

$$\ln x_{sijt} = \phi_{sijt} \ln(1 + tar_{sijt}) + \gamma' NTM_{sjt} + \beta' z_{ij} + fe_{si} + fe_j + fe_t + \varepsilon_{sijt}$$

- With:
  - *s*: sector, *i*: exporting country, *j*: importing country, *t*: year
  - *tar*: applied tariff
  - *NTM*: dummy, frequency ratio, coverage ratio, AVE
  - *z*: bilateral gravity variables (distance, ...)
  - *fe*: set of fixed effects

NTMs' trade effects: gravity estimations (cont'd)

- **"New" new trade theory**: Export sunk costs → affects firms' export probability (selection bias)
- **Heckman model applied to gravity**

$$\ln(x_{sijt}|x_{sijt}>0) = \phi_{sijt}\ln(1+tar_{sijt}) + \gamma' NTM_{sjt} + \beta' z_{ij} + \eta IMR_i + fe_{si} + fe_j + fe_t + \varepsilon_{sijt}$$

$$x^*_{sijt} = \phi^*_{sijt}\ln(1+tar_{sijt}) + \gamma'^* NTM_{sjt} + \beta'^* z_{ij} + fe^*_{si} + fe^*_j + fe^*_t + \mu_{sijt}$$

where $x_{sijt} > 0$ if and only if $x^*_{sijt} > 0$. IMR: inverse Mill's ratio

- **Exclusion variable**: common language, common religion (Helpman et al., 2008), proxies for fixed costs of exporting (Doing Business WB database)

Trade costs measurement

Novy 2011

Direct

- Cost of shipping one container to different places
- ocean and air transport cost
- Trade restrictiveness index (Nicita Olarrreaga 2009) tariff and non-tariff

- Are more precise for the specific source of cost
- Restricted to data limitations
- Some cost components not observable

- Lower bound to trade cost

Indirect

- Based on observable trade data
  - If 2 big countries do not trade it must be because there are high costs which make not profitable

- Based on available data, allow for time series and bilateral information
- All possible sources of cost together
- Proves that inferring trade cost for observed data is consistent with theory

- Higher bound to trade cost

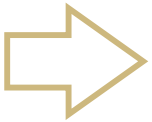
- So, Countries do not trade (trade less) because of bilateral costs
- Or also because of lack of know-how?
- Can cost also include “the price of experience”?
  - **Survival**
    1. Duration. Trade relationships from richer economies face lower hazard rates (i.e. longer duration).
    2. Trade relationships involving differentiated products show a hazard rate that is 6% to 14% lower than trade relationships involving homogeneous goods.
    3. High export costs systematically increase the probability of export failure but the effect diminishes with time, thus suggesting that export experience plays a role.
    4. Size of exports. The larger the transaction, the higher the probability of survival.

      - There is room for support policy

One example, Number of measures matter
More ‘measures’ may actually reduce trade

- Method. Frequency count. ‘*Intensity*’
  Nbr of measures on a single product

Cost by:
- NTM
- Exporter
- Company



"Adding up average cost“
across measures and companies
for a given country/region

- A country has a level of development that provides an average level of service to all companies located in it.
- The average cost (or availability) of certification and verification bodies as well as export services can be higher in developing countries, especially in LDCs.
- Institutional capacity can, then, affect negatively less developed countries, and all companies located in it

- In a nutshell

$$\text{Imports (EU, agri-food)} = \beta 1\ \text{Frequency} + \beta 2\ \text{LDC} + \beta 3\ \text{Frequency*LDC} + \text{control}$$

Data

- Trade data from COMTRADE
  - 2008 to 2010, EU imports of agri-food products (ch 1 to 24) at 4 digits
  - Average year imports, in log
- Control variables
  - (a) World market size. Value of world imports for product i, in log.
  - (b) Lead Time to export, from the World Bank survey Doing Business.
  - (c) Tariffs. Trade weighted tariff data from WITS, and using the AVE calculations from the same source.
  - (d) Distance
  - (e) GDP, in log
  - (f) Exports to other markets, also in log. Exports from country j of product i to the World, except for EU.
    - (f) It accounts also for any particular condition in a country (e.g. endowments, traditional production) that makes it an important exporter of a particular product, regardless of importing conditions in Europe.

Objective

- The exercise is set to show if the imports of the agri-food products affected with more SPS measures are imported less, compared to others, in which case SPS would have a restrictive effect on trade.

- When proved statistically significant, **the interaction term** (frequency & LDC dummy) would show if the condition of being an LDC affects in a special way the level of exports of these products when confronted to SPS measures.

Results and Conclusions

- The results suggest the SPS measures are relevant for exports of agri-food products to Europe
- But categorical analysis is of limited use

	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6
(a) World market size	0.053	0 .0743*	0.0846**	0.0734*	0.0842**	0.0848**
(b) DayDelay	-0.0196***	-0.0198***	-0.0126	-0.0217***	-0.0235***	-0.0237***
(c) Tariffs	-1.11***	-1.12***	-1.27***	-1.1***	-1.31***	-1.31***
(d) Distance	-0.578***	-0.578***	-0.567***	-0.577***	-0.556***	-0.555***
(e) GDP	5.7E-14	5.5E-14	-5.4E-14	6E-14	-1.5E-14	-2.7E-14
(f) Exports to other markets	0 .593***	0.593***	0.584***	0.593***	0.587***	0.586***
(g) SPS dummy		-0.648**	-0.599**	-0.586**	-0.668**	-0.602**
(h) SPS dummy*LDC			-0.497			
(i) SPS dum*LDC Africa				-0.881*		-0.889**
(j) SPS dum*LDC Asia					0.263	0.175
(k) LDC dummy			0.0864			
(l) LDC Africa				0.884**		0.813*
(m) LDC Asia					-1.62**	-1.54**
(n) Frequency of SPS						
(o) FreqSPS*LDC						
(p) Freq SPS*LDC Africa						
(q) Freq SPS*LDC Asia						
constant	5.14***	5.45***	5.25***	5.4***	5.23***	5.16***

legend: * p<.1; ** p<.05; *** p<.01

- The higher frequency of measures seems to decrease exports around 3% worldwide
- if the LDC group is split in regions, a specific effect emerges for African countries

	Eq.7	Eq.8	Eq.9	Eq.10	Eq.11	Eq.12	Eq.13	Eq.14	Eq.15
(a) World market size	0.0899**	0.1**	0.0892**	0.0992**	0.1**	0.0997**	0.0887**	0.0993**	0.0997**
(b) DayDelay	-.0198***	-0.0121	-0.0207***	-0.0235***	-0.0226***	-0.0122	-0.0209***	-0.0235***	-0.0228***
(c) Tariffs	-1.13***	-1.28***	-1.12***	-1.31***	-1.32***	-1.29***	-1.12***	-1.31***	-1.32***
(d) Distance	-0.577***	-0.567***	-0.578***	-0.555***	-0.555***	-0.567***	-0.577***	-0.555***	-0.555***
(e) GDP	5E-14	-5.7E-14	5.7E-14	-2.1E-14	-3E-14	-5.6E-14	5.8E-14	-2.1E-14	-2.9E-14
(f) Exports to other markets	0.592***	0.584***	0.593***	0.587***	0.587***	0.584***	0.593***	0.587***	0.586***
(g) SPS dummy									
(h) SPS dummy*LDC									
(i) SPS dum*LDC Africa									
(j) SPS dum*LDC Asia									
(k) LDC dummy		-0.388***				-0.168			
(l) LDC Africa			0.037		-0.0415		0.411**		0.33
(m) LDC Asia				-1.37***	-1.37***			-1.58***	-1.55***
(n) Frequency of SPS	-0.0305***	-0.0304***	-0.0305***	-0.0305***	-0.0305***	-0.0289***	-0.0287***	-0.0308***	-.0289***
(o) FreqSPS*LDC						-0.012			
(p) Freq SPS*LDC Africa							-0.0204**		-.0203**
(q) Freq SPS*LDC Asia								0.0118	0.00952
constant	5.16***	5.01***	5.17***	4.93***	4.92***	4.98***	5.14***	4.93***	4.9***

legend: * p<.1; ** p<.05; *** p<.01

An extra 2% decrease in exports for African LDC countries apart from the general 3%

- Equations 13 and 15 suggest there is an extra 2% decrease in exports for African LDC countries apart from the general 3%, while there is no effect for Asian LDC.
  - These results suggest that LDC in Africa, in particular, find extra difficulty in exporting; they are relatively more affected than the rest whenever the number of SPS measures are increasing.
- The total effect rises to almost 5% of decreased exports for any product for each extra SPS measure imposed by the European Union (which is the only importing market analyzed). **On average, other countries would face a reduction of about 3%.**

Policy

- Negotiation. reduction, harmonization or elimination
- Compensate the effect by technical assistance or capacity building.
  - Conformity assessment and testing and certification capacity in exporting countries

- Lastly, the assessed percentage of decrease is not likely to affect all companies in a region (country) alike
  - A few companies not being able to continue exporting, and probably being excluded from business.

- This feature could be more damaging for the economy and labour market of a country than an even decrease in all companies active in the export sector.
  - Provide resources and facilities to assist vulnerable companies to be competitive.

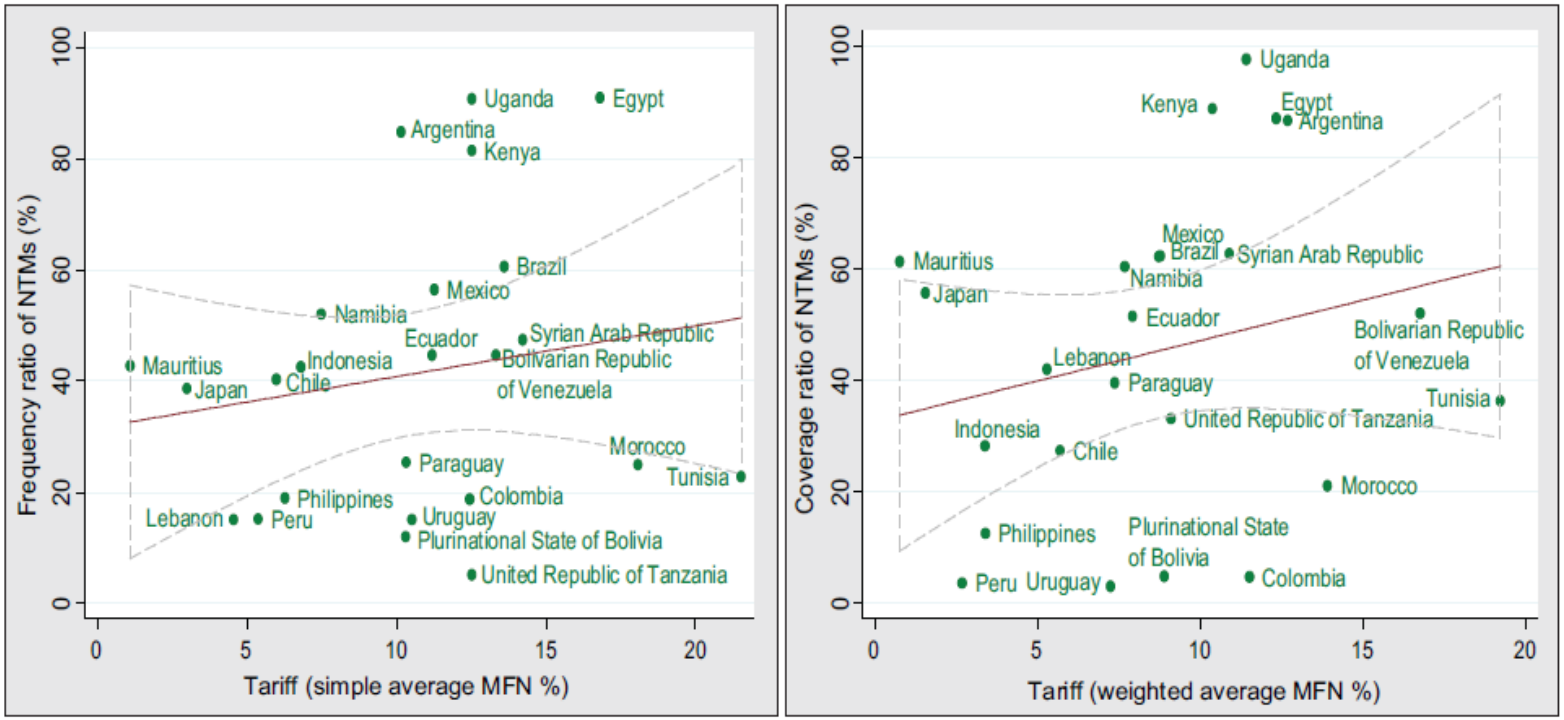
Other analysis
Other research questions

Substitution/complementarity: empirical evidence

- **Goldberg and Pavcnik (2005)**: Colombian data for mid-80s & early 90s. Find a positive correlation btw. tariffs and NTMs
- **Broda, Limao & Weinstein (2008)**: After GATT/WTO commitments imposing constraints in the use of tariffs, the US set significantly higher NTMs in import-competing sectors
- **Kee, Nicita & Olarreagea (2009)**: data for 91 countries in early 2000s. Evidence of substitution btw. tariffs & NTMs
  - Overall level of protection decreases with GDP per capita
  - But, average AVE of NTMs increases with GDP per capita
- **Limao and Tovar (2011)**: Turkish data. Evidence of substitution
  - Reductions of tariffs imposed via multilateral and preferential commitments increase the probability of NTMs
  - But imperfect policy substitution (tariff cuts partially but not totally offset by higher NTMs)

Policy complementarity: Illustration

Frequency index & coverage ratio versus MFN tariffs



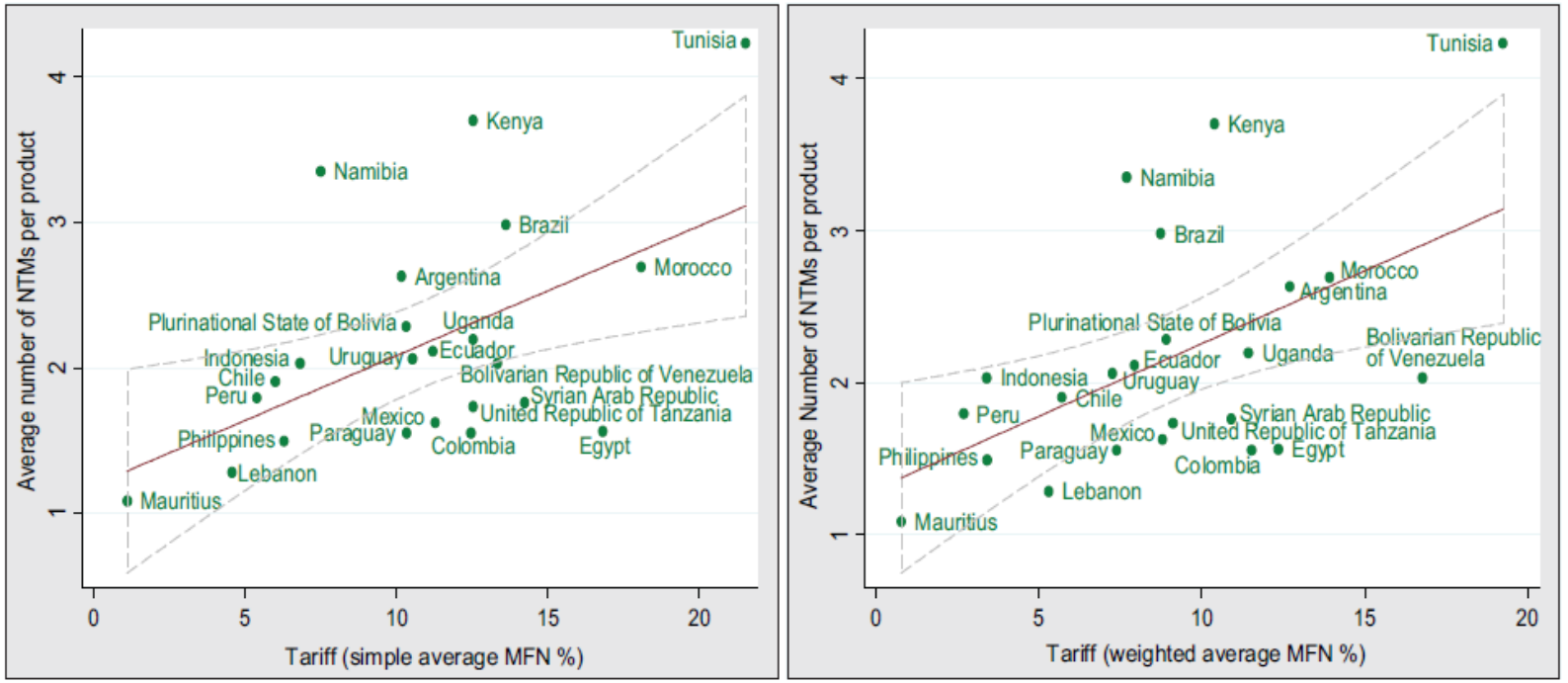
Positive correlation: countries with higher MFN tariffs also adopt more NTMs.

Stronger correlation for coverage ratio: NTMs & tariffs more strongly correlated for most traded products.

Source: Nicita and Gourdon (2013)

Policy complementarity: Illustration (cont'd)

NTMs' prevalence versus MFN tariffs

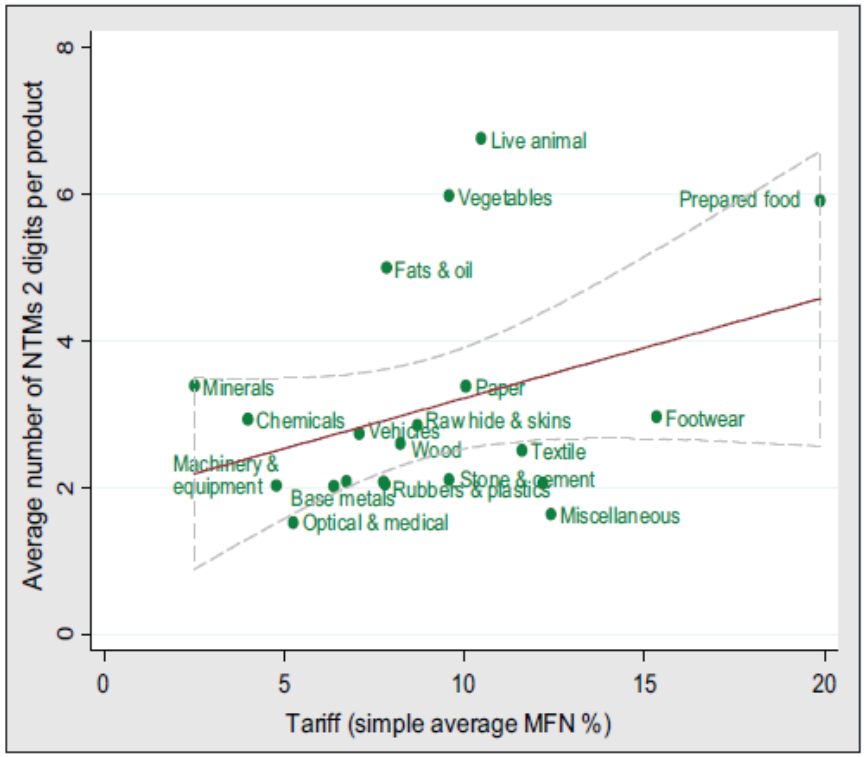


Positive correlation: countries with higher MFN tariffs also adopt a larger number of NTMs per product

Source: Nicita and Gourdon (2013)

Policy complementarity: Illustration (cont'd)

Correlation btw. NTMs' prevalence & MFN tariffs, by product



Positive but weak correlation btw. tariffs and number of products covered by NTMs;

Largely driven by 4 agricultural product groups

Source: Nicita and Gourdon (2013)

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