UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

UNCTAD

Session C

Measuring the impact of NTMs

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Training Workshop

Economic Implications of Non-Tariff Measures

Geneva, April 10-11

Introduction

Outline

- C.1 Main effects and main assessment methods
- C.2 NTMs price effects: computing ad valorem equivalents
- C.3 Pro and cons of main assessment methods

Learning Objectives

- Describe major estimation methods of NTMs impact
- Understand strengths and weaknesses of each method

C1. Main effects and main assessment methods

NTMs effects: a taxonomy

NTM (technical regulation) imposed by an importing country

	Importing Country	Exporting Country
Consumption	+,-	0,+
Production costs	+, (-)	+, (-)
Trade costs	+	+
Imports	+, -	(+,-)
Exports	(+,-)	+,-
Welfare	+, -	+,-

⇒ **Complexity in impact**

- Multiple channels of influence
- Multiple impacts
- Interaction with market structure

Assessing the effects of NTMs

- The choice of a methodology is not necessarily straightforward
- It involves choosing between descriptive statistics and modeling approaches, between econometric estimation and simulation, between ex ante and ex post approaches, between partial and general equilibrium, between aggregated (country/sector) and disaggregated analysis (product/firm/consumer)

Assessing the effects of NTMs

- Ex ante simulation involves projecting the effects of a policy change onto a set of economic variables of interest, while ex post approaches use historical data to conduct an analysis of the effects of past trade policy
- The ex ante approach is typically used to answer “what if” questions
- Ex-post approaches, however, can also answer “what if” questions under the assumption that past relations continue to be relevant
- The latter assumption however underlies all approaches (ex-ante & ex-post) that use estimated parameters for simulation

Assessing the effects of NTMs

- In econometric models, parameter values are estimated using statistical techniques and they come with confidence intervals
- In simulation models, behavioral parameters are typically drawn from a variety of sources (e.g. econometric models), while other parameters are chosen so that the model is able to reproduce exactly the data of a reference year (calibration)
- Partial equilibrium analysis focuses on one or multiple specific markets or products, ignoring the link between factor incomes and expenditures, while general equilibrium explicitly accounts for all the links between sectors of an economy – households, firms, governments and the rest of the world

Assessing the effects of NTMs: Partial *versus* General equilibrium

- In partial equilibrium analysis results are based on basic supply and demand based mechanisms
- In general equilibrium the analytical framework is comprehensive and more complex
- Choice of the approach depends on several elements
  - Nature of policy change
    - Does it cut across many markets or sectors?
  - Potential impact of change
    - Are there economy-wide impacts?
  - Constraints imposed by availability of data and resources (financial and skills)

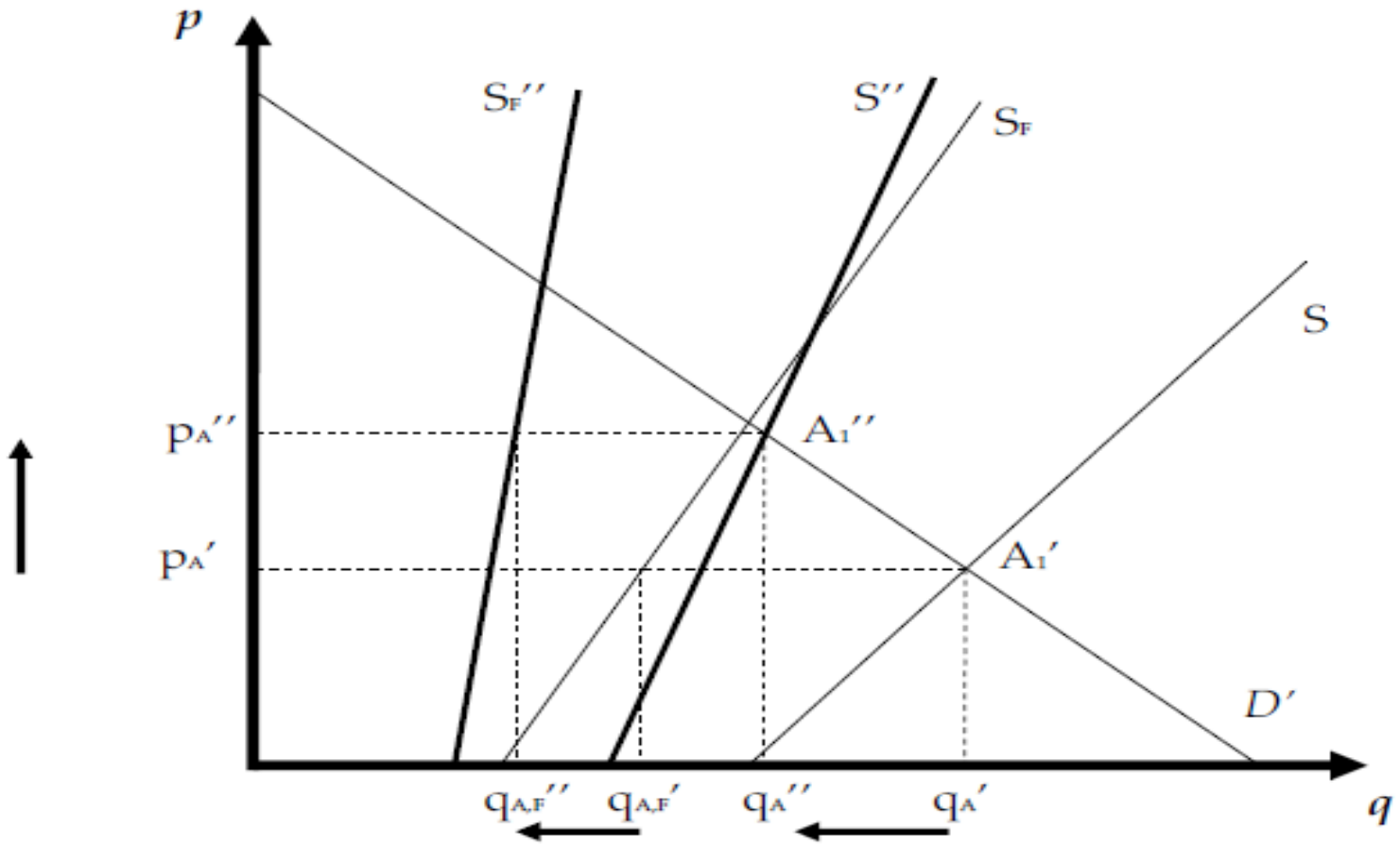
Supply and demand effects of NTMs

- NTMs affect domestic production, consumption, traded quantities (foreign production) & prices
- Meeting NTMs leads to a shift in supply &/or demand curves
  - **Supply shift (domestic and or foreign)**: induces by changes in cost of production
  - **Demand shift**: induces by changes in consumption behaviour

- **Simplest Framework** (Disdier & Marette, 2010). Assumptions:
  - Focus on a specific good market
  - Homogeneous market good except for a characteristic potentially dangerous to consumers
  - Foreign & domestic goods can carry this characteristic. Domestic consumers may (or not) be aware of it

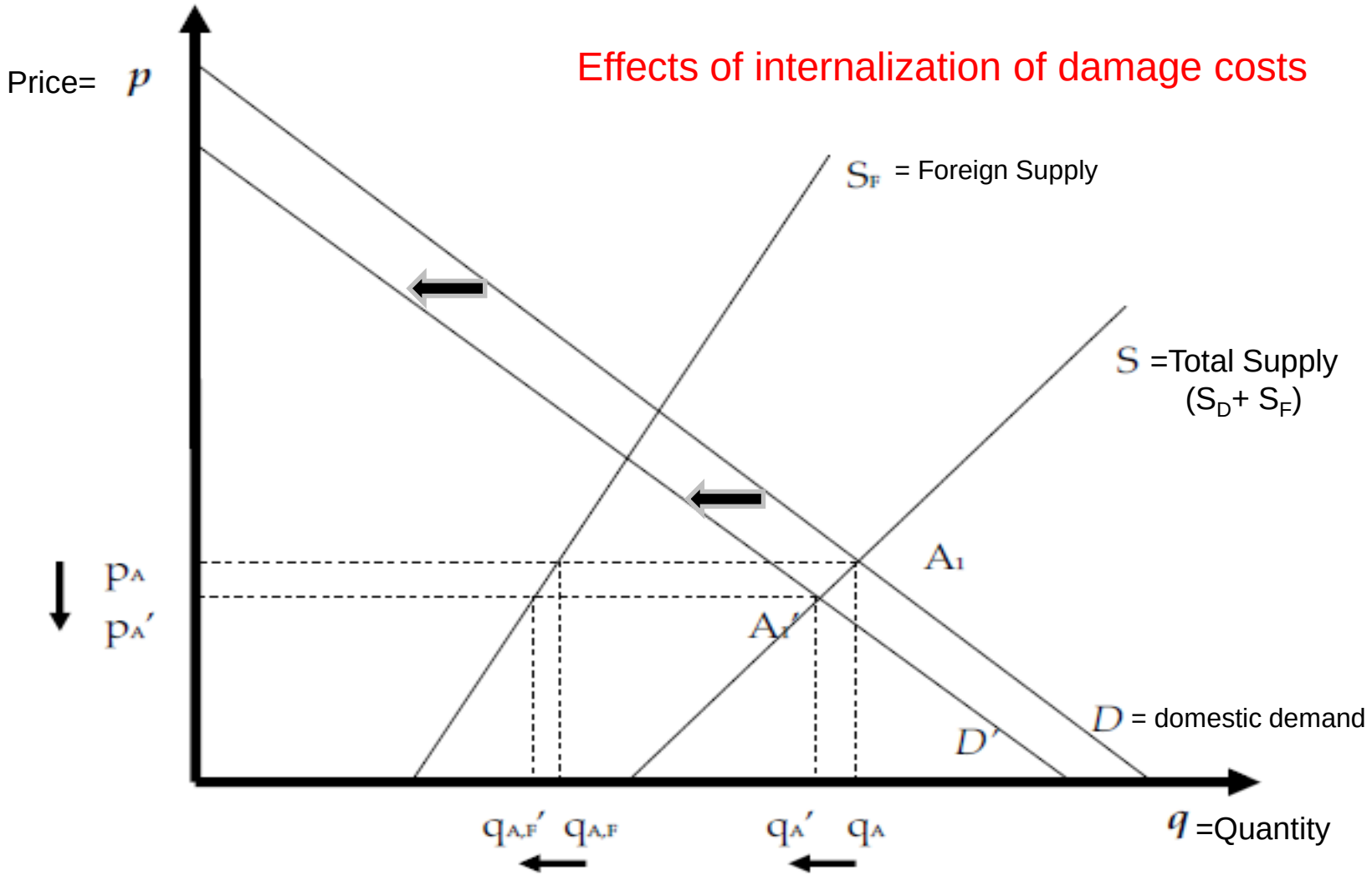
Supply and demand shifts with a NTM: graphical evidence

Effects of application of a public standard



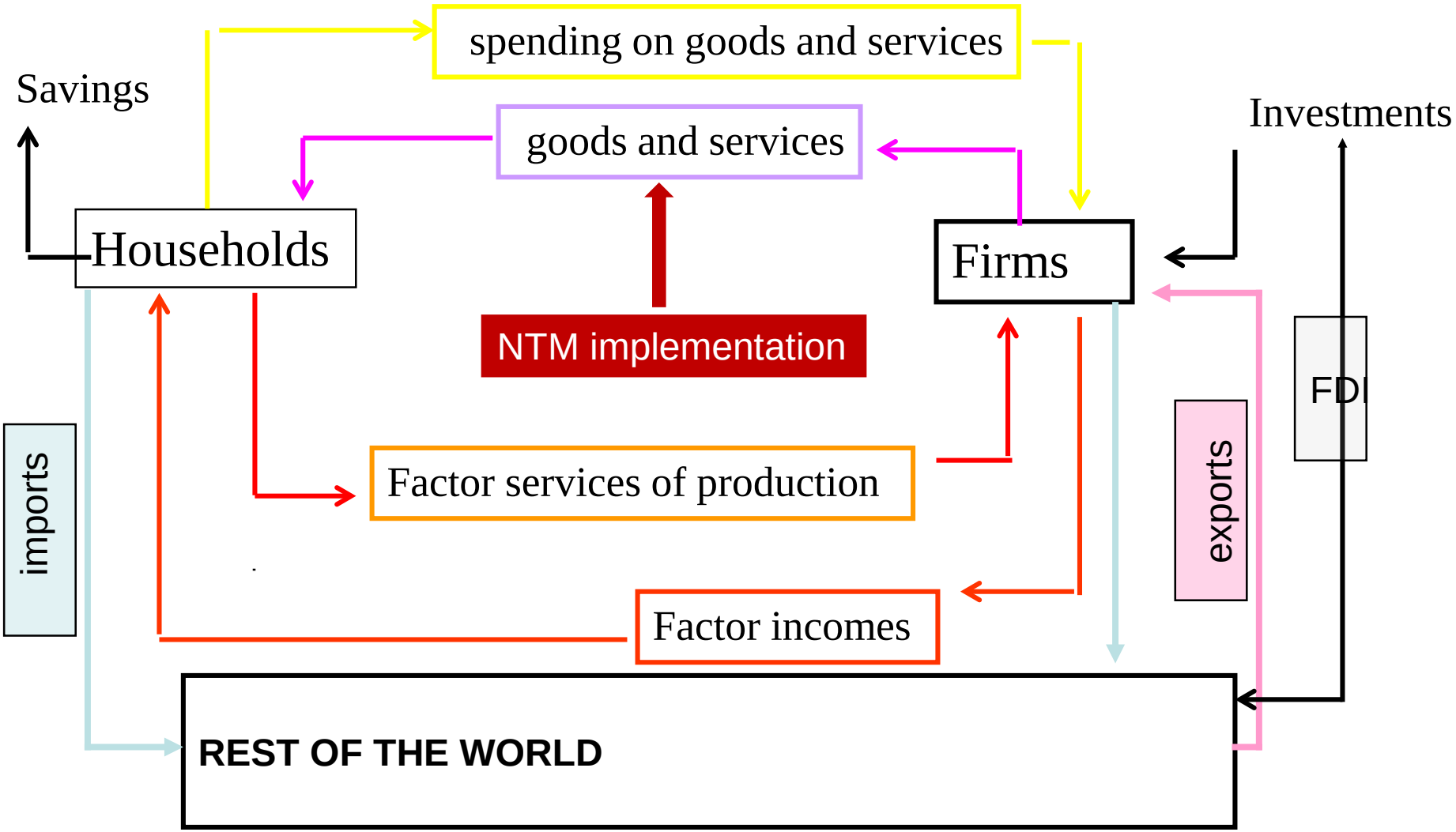
Source: Fugazza (2013)

Supply and demand shifts: graphical evidence



Source: Fugazza (2013)

A General Equilibrium Analysis



NTMs effects: Trade

Expected trade effects of NTMs

- NTMs (even non-protectionist ones) are likely to 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

- ***Procedural obstacles*** may dampen trade facilitation effects and/or amplify trade destruction effects

Trade effects: Empirical evidence (ex-post estimation)

- Workhorse trade empirical model: Gravity model
- Initially, NO theoretical foundations
- The gravity model has gone from a theoretical orphan to being the inescapable empirical counterpart of all main theories of international trade
- Applies to country, sector/product and firm level analysis similarly
- Extremely popular:
  - High explanatory power
  - Easy access to relevant data
  - Estimation standards and benchmarks clearly established
- Despite its relative simplicity gravity is non-trivial !

Quantifying 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 <u>country/firm</u>, *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 <u>(control for non-observables)</u>

Evidence: NTMs trade effects across DCs

Anders & Caswell (2009)

- Focus on trade impact of HACCP requirements (SPS measures) on seafood imports in US between 1990-2004
- Loss in trade due to HACCP: btw. USD 11.4-30.6 million
  - Impact on Developing countries as a group: export value reduction of 0.9%
  - Developed countries as a group gain from the measure
- **But, strong variation across DCs**
  - DCs are found among both the gaining and the losing group
  - Trade impact of SPS measures depends on the exporter's size
  - Larger seafood exporters gain trade shares with the US, while smaller exporters lose ground

Evidence: NTMs trade effects across firms

- Little evidence on the impacts of SPS & TBTs on individual firms and on their export decisions
- Overall, firm-level studies show a negative effect of SPS and TBTs on trade, through:
  - a reduced market entry (Extensive margin)
  - a lower volume of trade per firm (Intensive margin)
- **Potential explanations**
  - Types of SPS and TBTs used in some studies (only restrictive ones)
  - SPS & TBTs may be particularly trade restrictive for small firms and outsourcing firms

Evidence: NTMs trade effects across firms

- NTMs may represent a **fixed cost** (product adaptation)
  - Increases cost of entry
  - Less productive firms may be excluded from export market
  - Large firms may see their market share increased

- NTMs may represent a **variable cost** (shipments' inspections)
  - Affects domestic and foreign producers differently
  - Affects equally exporters of different sizes
  - Affects less exporters of high-quality products

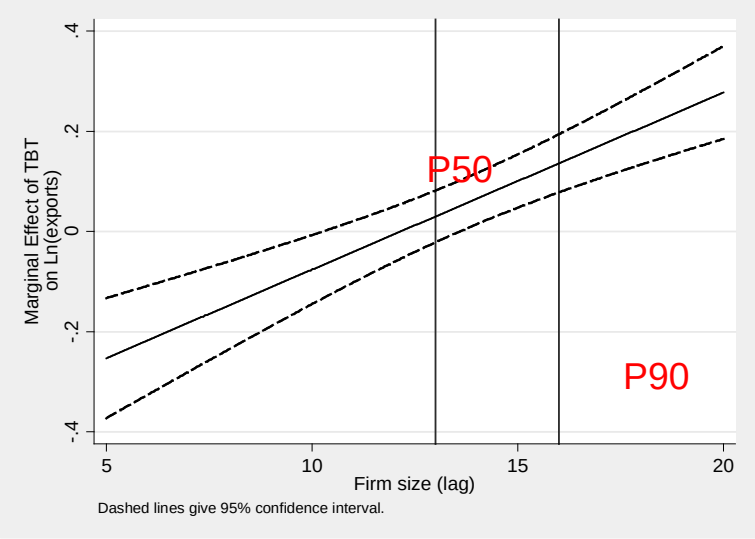
- Heterogeneous exporters face shocks to NTM-related fixed and variables costs differently

Evidence: NTMs trade effects across firms

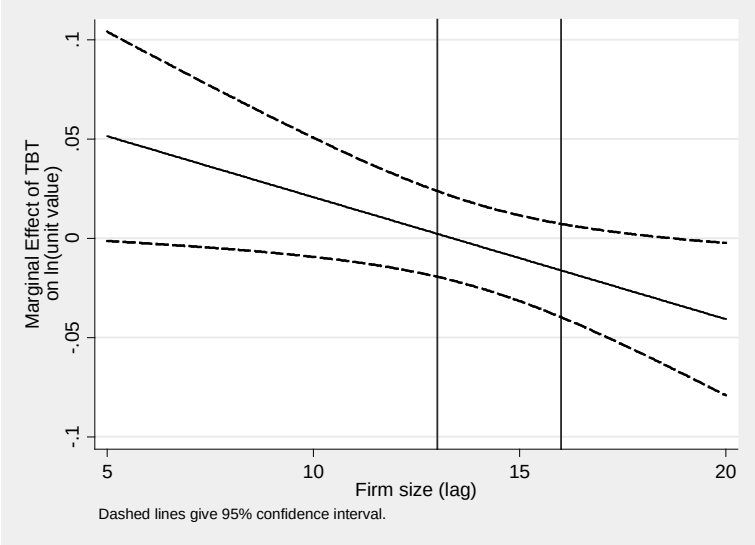
Fugazza, Olarreaga and Ugarte (2017)

- Based on Peruvian firms exports (2000-2014) to LAIA countries
- The imposition of a technical measure (in particular TBTs) is detrimental to small exporting firms but can benefit large ones along both margins of trade
- The impact of a technical measure on unit trade values also varies with firm size

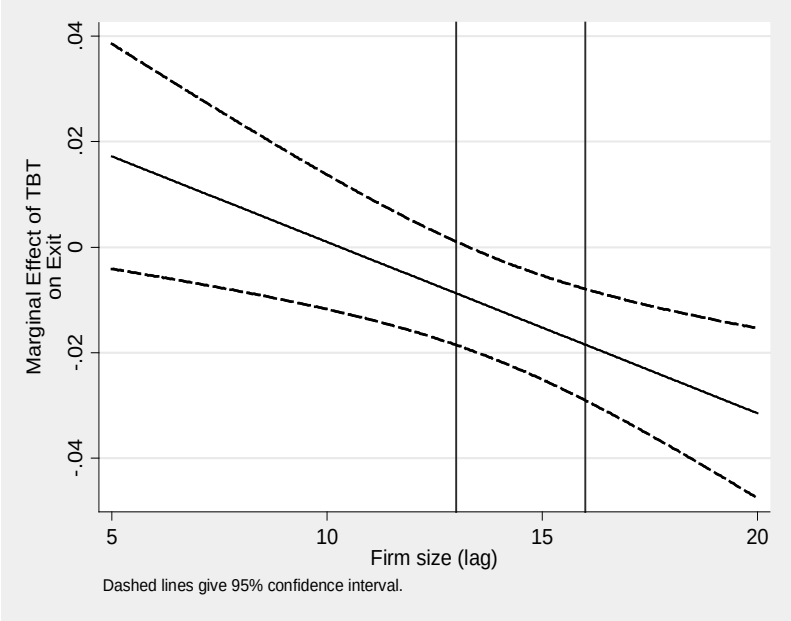
Exports value (Intensive margin)



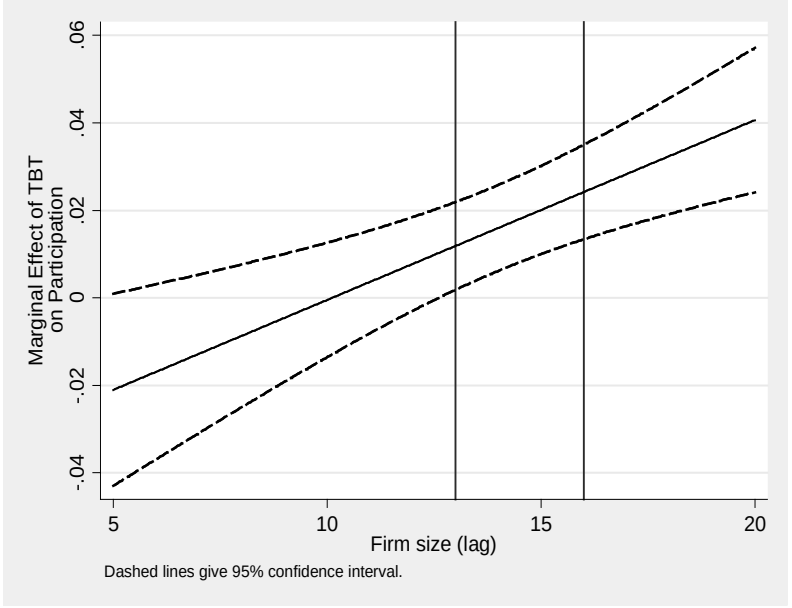
Unit value



Firms' exit (Extensive margin)



Participation & entry (Extensive margin)



NTMs effects: domestic welfare

Welfare effects

- Limits of studies on NTMs' trade effects: some NTMs may restrict trade but improve welfare if they address market failures

– **Welfare quantification**
- Cost-benefit analysis
- Standard's impact on each type of agents (consumers, producers, government..)

– **Limits of the welfare approach**
- Overlook the trade effects
- Do not account for complementary/substitutability of products and of varieties of the same product

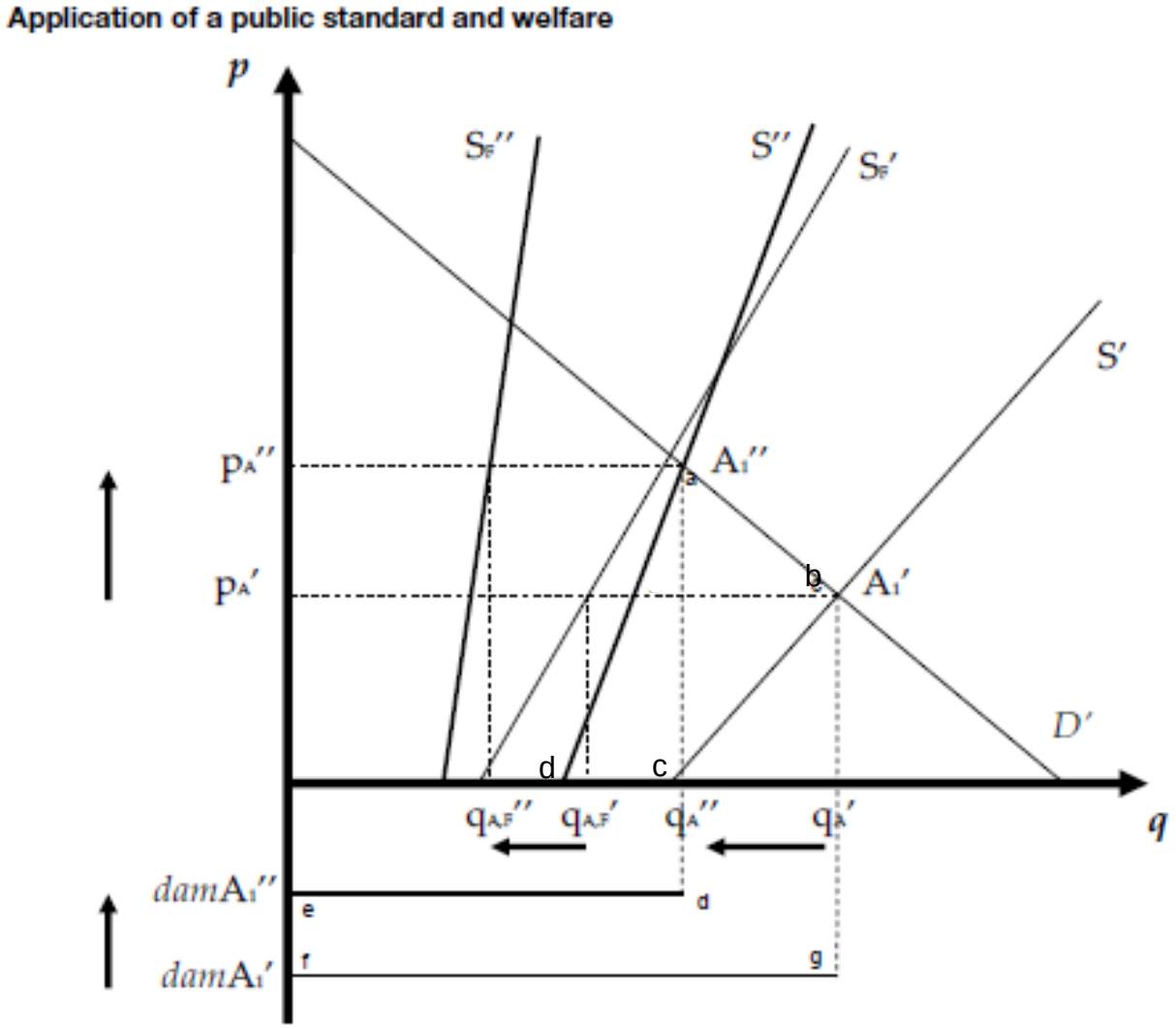
Framework

Framework (Disdier & Marette, 2010)

- Same assumptions as in figures shown above

- **Additional assumptions**
  - Account for damage cost related to dangerous characteristic
  - Dangerous characteristic pertains to foreign goods only
  - No internalization of the damage by consumers
  - Reduction in damage: fall in probability of contamination following NTM's implementation

Graphical evidence



- Damage reduction: move from damA1′ to $damA_1''$
- Welfare net impact : Positive as long as damage cost's reduction ($q_A'q_A''defg$) larger than deadweight loss (abcd)

Welfare= consumer surplus and firms (foreign and domestic) profits

Valuation (domestic) of externalities

- **Consumer-based externalities**
  - 2 types of non-market valuation methods:
    - QALYs (Quality Adjusted Life Years) approach: used in medical & public-health field
    - Willingness to pay (WTP) approach for/against certain product characteristics: used in environmental economics
  - Big challenge when a market for the good does not exist

- **Producer-based externalities**
  - Impact of pests & pathogens on agriculture
  - Costs associated with invasive species
  - Integration of epidemiological models into economic analysis
  - GMOs: costs & benefits of growing GMO crops

Empirical evidence

- Very few studies (some on European Union & developing countries)

- **Example**: Effects of border measures protecting human health against contaminants found in shrimps
  - OECD countries' imports from Asian countries. Various scenarios investigated
  - Results: If OECD countries were to ban imports, then a substantial profit incentive exists to adopt improved production methods in Asian producing countries

Combination of trade and welfare effects

- **Unified approach**
  - Estimated coefficient on NTM in the gravity equation used for determining the relative price & quantity variations in the welfare analysis
  - Both effects do not necessarily go in the same direction

  → Decision-makers should examine trade & welfare effects of NTMs

Illustration

Disdier & Marette, 2010

- Stringent standard capping residues of an antibiotic (e.g. chloramphenicol) in seafood products

- **Hypotheses**
  - Market good: homogenous except for a given characteristic (dangerous for consumers)
  - Damage not internalized by consumers
  - Standard aims at eliminating unsafe products from the market
  - Only foreign producers are concerned by the standard (stringent standard reduces their probability of entering the domestic market)

Gravity approach

$$\ln x_{ijt} = \mathrm{fe}_i + \mathrm{fe}_j + \beta_1 D_{ij} + \beta_2 \mathrm{cb}_{ij} + \beta_3 \mathrm{clang}_{ij} + \beta_4 \mathrm{colony}_{ij} + \beta_5 \mathrm{NTM}_{ijt} + \mathrm{fe}_t + \varepsilon_{ijt}.$$

- Main interest: β_5: sensitivity of trade flows to NTMs
- Value of exports is: $x = p.q$ (*p* & *q:* price & quantity of exports)
- If β_5 is statically significant, it can be used for the welfare analysis (specific trade effect of the NTM)

Welfare approach

- Market equilibrium under standard reinforcement (see figure above)
- Ambiguous standard's impact on welfare: depends on the price effect

Gravity and welfare parameters

- **Gravity**
  - Bilateral imports of crustaceans. 4 countries: US, Canada, European Union, Japan
  - All exporters. Period: 2001-2006
  - NTMs: MRL (in ppb) applied by each importer since 2001
  - Estimated coefficient on $\beta_5 = 0.13$ (significant)

- **Welfare analysis**
  - Quantities and prices: UN FAO
  - Own-price elasticities of demand & supply: literature
  - Value of the per-unit damage: r = 0.767*p (0.767: consumers' WTP for avoiding antibiotic, Lusk et al., 2006)
  - Probability of contamination (γ): Baseline scenario: γ= 1
  - After standard's implementation: γ= 0.75 and 0.5

Welfare results: ex post estimations

Annual international welfare change linked to a reduction of the MRL (in ppb) between 2001 and 2006

(%, *relative variation compared to the baseline scenario)*

	ΔMRL (ppb, 2001 → 2006)	γ =0.75	γ =0.5
US	ΔMRL= -4.7 (5 → 0.3)	-12.5%	-12.5%
Canada	ΔMRL= -2.2 (2.5 → 0.3)	7.2%	13.1%
Japan	ΔMRL= 0 (50 → 50)	0%	0%
EU	ΔMRL= -1.2 (1.5 → 0.3)	23.4%	45.3%

Welfare results: ex ante simulations

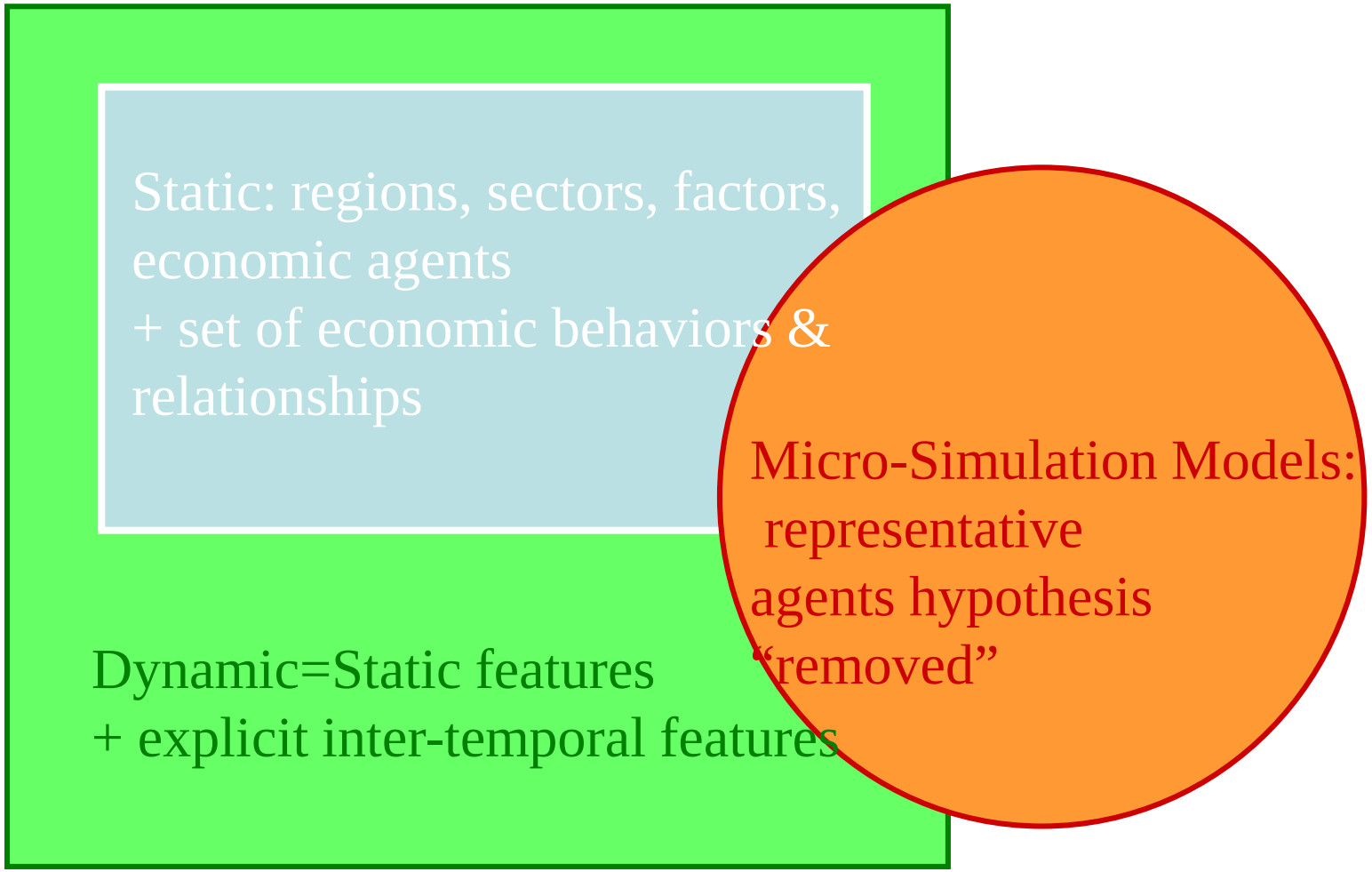
Relative international welfare change for the year 2006 with a potential MRL equal to zero

	γ =0.5	γ =0.25
US (ΔMRL= -0.3)	15.3%	32.7%
Canada (ΔMRL= -0.3)	8.1%	16.5%
Japan (ΔMRL= -50)	-52.0%	-52.0%
EU (ΔMRL= -0.3)	15.0%	31.9%

Trade and Welfare effects in a CGE framework

- CGE models are used to simulate the impact of a pre-determined policy change: scenario
- All policy changes correspond to some price effect
- In the case of NTMs their (ad valorem) tariff equivalent must be informed
- AVEs are computed “outside” the model and then introduced and impacted
- CGEs are Deterministic – outcome is completely determined by choice of inputs and model (no “residuals”)
- Differences in simulation results = differences in choice of inputs and model/closure

A Typology of CGE Modeling



Trade and Welfare effects in a CGE framework

Effects that can be estimated using CGE models

Effects		Assessment
Impact on welfare	yes	Assessment using equivalent or compensating variation
Impact on production	yes	Aggregated and disaggregated
Impact on factor returns	yes	Impact on skilled and unskilled labour and capital
Impact on prices	yes	By sector, terms of trade
Impact on trade volume	yes	Aggregated and disaggregated, imports and exports, changes in trade balance
Impact on custom income	yes	
Impact on dynamic variables	depends on the model	Some models may include economies of scale, imperfect competition, changes in capital flows, FDI, productivity spillovers

Source: Plummer, Cheong, Hamanaka (2010).

Precise numbers are generated

- However serious issues remain unsolved: Fugazza and Maur (2008)

C2. NTMs price effects: computing ad valorem equivalents

Introduction: AVEs of NTMs

Definition ad valorem equivalents (AVEs)

- AVE: tariff equivalent which has the same impact on trade
- NTMs affect trade flows and consequently prices
- AVE: gap btw. product's price with and without the NTM
- Ex: price without NTM: 100. AVE: 5% → price with NTM: 105

Why do we compute AVE?

- Quantification of NTMs' effects difficult: diversity of NTMs; no simple metric; few data

→ AVEs solve (partially) these issues

Introduction: AVEs of NTMs

- Based on AVEs of NTMs, one should be able to:
  - Distinguish btw. protectionist and non protectionist NTMs
  - Rank NTMs according to their stringency

- **Examples of questions investigated using AVEs** (non-exhaustive list)
  - Which countries have the most stringent NTMs?
  - Which are the most affected products?
  - Which are the most affected exporters (given their export structures even if NTMs are usually unilateral measures)?

How to compute AVEs for NTMs

- **Price-comparison approach (direct method)**
  - Principle: NTMs affect product's price (increase)
  - Comparison of prices with & without NTMs provides the AVE
- **Approach based on quantities (indirect method)**
  - Principle: NTMs affect trade flows btw. countries
  - Comparison of flows with & without NTMs provides the quantity impact of NTMs
  - Quantity impact then converted into AVE using import demand elasticities

- Price & quantity are linked → both methods should provide similar results
- Which approach should be used? depends on data availability

Price-comparison approach

- **AVE**: gap on domestic market btw. product's price with & without NTM)
- Product's price without NTM: not observable → Use of alternatives
  - World/border price of the same good (or comparable good)
  - Potential adjustments can be made on world price using quantities, prices, supply/demand price elasticities
  - Need to account for all other factors influencing prices (tariffs, transport costs, etc.)
- **Drawbacks**
  - Detailed price data not always available
  - Quality differences btw. domestic & imported goods not included

Price-comparison approach

- Tariff equivalent of a NTM can be written as:

$$TE_{BNT} = (p_d / p_w) - (1 + \tau + c)$$

- p_d: domestic price (without retailers' margins)
- p_w: world price (without producers & exporters' margins)
- τ: ad valorem tariff
- c: ad valorem transport & insurance costs (CIF/FOB margin)
- If all determinants (others than NTM) influencing prices are controlled for → **remaining gap btw. world & domestic prices (%): AVE of NTM**
- **2 methods**: i) Handicraft method; ii) Econometric method

Limits and issues

Price gap: simple method but difficult to implement

- Availability & quality of price data
  - Retail prices often used (more easily observable) but not available for all primary & intermediate products & include retailers' margins and transaction costs
- Domestic production & imports not always available in the same classification
- Even at a disaggregated level, classifications often include several products (prices for product mix)
- Imperfect substituability btw. domestic & foreign varieties (quality differences)
- If more than one NTM on a product, AVE: global measure and not specific to each measure
- If NTM is not protectionist → Price decrease?

Source: price data

- National data
- World Bank: International Comparison Program (ICP) http://icp.worldbank.org/
- FAO: price data for agrifood products
- CEPII: Trade Unit Values Database: unit values (USD/t), 2000-2012, 182 countries, 253 partners, 5000 products http://www.cepii.fr/CEPII/fr/bdd_modele/presentation.asp?id=2

Evidence

- **Breaux, Ferrantino, Cabral, Signoret (USITC, 2014)**
  - Account for quality differences btw products (Source data: CEPII Trade Unit Values Database) & for extreme values in AVEs' computation
  - Results: NTMs increase prices of imported goods but sources of price gaps btw. countries & sectors difficult to identify

- **Cadot & Gourdon (JAE, 2014)**
  - Data: Prices: ICP; NTMs: TNT initiative; 1260 observations (country-product). Country fixed effects & control for tariffs
  - Results: SPS measures increase prices of African food products by 14%
  - Most affected products: riz & other cereals, chicken, food oils

Indirect approach based on quantities

- NTMs affect international trade flows
- **2-steps approach**
  - Step 1: Quantity effect of NTMs (trade equation: difference btw. predicted & observed flows)
  - Step 2: Conversion of quantity effect into AVE (using import demand elasticities)
- **Advantages**
  - Availability of trade data even at a disaggregated level for many products and countries
  - Target of NTMs often imports → Relevant to focus on NTMs' trade effects (rather than on prices)
- **Drawback:** Indirect calculation

Empirical implementation

Kee, Nicita & Olarreaga (2009) http://go.worldbank.org/FG1KHXSP30

- **Step 1**
  - Estimation of import demand equations at HS6 level (78 countries, 4575 products)
  - Product-by-product estimation. Dependent variable: aggregated imports at the importing country-product level
  - Control for tariffs and countries' characteristics (Leamer, 1990: comparative advantage: trade btw. countries explained by differences in factor endowments)
  - NTMs: dummy variable (TRAINS data)

- **Step 2**
  - Quantity effect converted into an AVE using import demand elasticities

AVEs of NTMS: KNO results

- **Significant AVEs**
  - Mean AVE of NTMs for entire sample at 12%. If weighted by imports: mean AVE: 10%
  - If computation only done for tariff lines with a NTM, mean AVE much higher (45% and 32% respectively)
- **Strong variation in NTMs' AVEs across countries**
  - Simple mean AVE: varies from almost 0 to 51% (Import-weigthed AVE varies from 0 to 39%)
  - But no clear link btw. NTMs' AVEs & countries' GDP per capita
- **Comparison btw. NTMs and tariffs?**
  - For 55% of tariff lines subject to NTMs, AVE of these NTMs higher than the tariff

Limits and issues

- Data on NTMs: incomplete for some countries/products
- Trade data: in value not in volume
- NTMs' endogeneity → Estimation with instrumental variables (instruments' quality?)
- Other variables included in trade equation (production, demand): difficult to get them at product level (fixed effects)
- 2-steps method → 2 sources of statistical uncertainty: on trade flows & on import demand elasticities
- Import demand elasticities: KNO data but in practice vary with period & countries covered by estimations
- Treatment of non-protectionist NTMs (positive trade effect)

AVEs of NTMs: comparison with other studies

KNO results similar to other studies

- **Hoekman & Nicita (2011)**: reducing AVE of NTMs by half, from 10% to 5% would increase trade by 2 to 3%

- **Andriamananjara et al. (2004)**
  - For apparel sector, prices in US, EU and Canada are 15%, 66% and 25% higher, respectively, due to the NTMs
  - NTMs on leather shoes raise prices in Japan by 39% and in Mexico/Central America by 80%
  - NTMs on vegetable oils & fats raise prices in Mexico by 30%, in South East Asia by 49% and in South Africa by 90%

- **But main limit of KNO approach**: NTMs are necessarily trade impeding measures

AVEs of NTMs with trade-enhancing NTMs

Beghin, Disdier and Marette (2015)

- Same approach & same data as in KNO (2009) but relax the assumption about trade-impeding NTMs

- About 39% of product lines affected by NTMs exhibit negative AVEs
  - Indicate a net trade-facilitating effect of these measures
  - Accounting for these effects significantly reduces AVEs of NTMs

AVEs: results with trade-enhancing NTMs

HS section codes	HS section names	Simple frequency ratio of NTMs	AVE of NTMs all HS6 lines (mean)		AVE of NTMs if NTM=1 (mean)	
			Unconstrained estimation[a]	Constrained estimation[b]	Unconstrained estimation[a]	Constrained estimation[b]
I	Live animals, animal products	0.209	0.018	0.128	0.084	0.609
II	Vegetable products	0.223	0.028	0.128	0.126	0.574
III	Fats and oils	0.202	0.067	0.145	0.333	0.717
IV	Beverages, spirits, tobacco	0.259	0.013	0.157	0.049	0.608
V	Minerals	0.054	0.027	0.046	0.500	0.846
VI	Chemicals, allied industries	0.134	0.033	0.088	0.244	0.657
VII	Plastics, rubber	0.121	0.052	0.094	0.432	0.774
VIII	Hides, leather, furskins	0.074	0.029	0.056	0.395	0.763
IX	Wood and wood articles	0.105	0.051	0.077	0.486	0.732
X	Pulp of wood, paper, printing	0.096	0.039	0.071	0.404	0.744
XI	Textiles, apparel	0.097	0.033	0.068	0.339	0.695
XII	Footwear, headgear	0.103	0.025	0.064	0.241	0.622
XIII	Stone, cement, ceramic, glass	0.081	0.055	0.074	0.681	0.917
XIV	Pearls, precious metals and stones	0.003	0.002	0.002	0.732	0.732
XV	Base metals and articles	0.085	0.044	0.067	0.516	0.796
XVI	Machinery, electric and video	0.129	0.083	0.114	0.648	0.887
XVII	Vehicles, aircraft, vessels	0.109	0.035	0.080	0.317	0.730
XVIII	Optical, photo., medical instr.	0.096	0.042	0.074	0.441	0.775
XIX	Arms, ammunition	0.044	0.008	0.021	0.182	0.474
XX	Miscellaneous	0.108	0.062	0.100	0.570	0.925
	All sections	0.121	0.044	0.088	0.362	0.729

[a]: Unconstrained estimation means that impact of technical regulation NTMs on trade is not restricted in the estimation

[b]: Constrained estimation means that technical regulation NTMs are constrained to have a non positive impact on trade

Source: Beghin, Disdier and Marette (2015)

C.3. Pro and cons of existing assessment methods

General concern

- The key question that a researcher/practitioner is faced with when asked to assess the effects of a given policy measure is deciding which methodological approach is best suited to answer the question given existing constraints
- At this stage, dialogue between researchers and policy stakeholders is crucial as, depending on the circumstances, researchers may help policy-makers to determine relevant questions and to guide the choice of appropriate methodologies
- Any methodological approach must be based on «some» internally and externally consistent economic model (intuition could be seen as reflecting some model and its consistency must be verified)

Ex-post versus Ex-ante analysis

- Ex-ante analysis based on CGE models should be considered with a lot of caution as a primary input is AVEs
- AVEs can take negative values whenever NTMs are trade enhancing
- As a consequence any policy scenario to be simulated may have dubious interpretation:
  - What should we do about trade-enhancing measures?
  - Simulations in CGE models assume a partial or total removal of an NTM (lower AVEs): what does that mean? Are compliance costed reduced? Are production costs reduced? No consistent story may correspond to the simulated policy scenario

$\Rightarrow$ As long as more refined simulation scenarios are not implementable (e.g. cost effects of NTMs) CGE models should not be used or only very parsimoniously

Ex-post versus Ex-ante analysis

- Ex-post analysis can only assesses the impact of policy shocks that have been introduced effectively
- Even if some policy reform has occurred at some point in time data availability may be limited and may not allow for any assessment of this reform
- This is particularly the case for NTMs data:
  - Coverage is limited both in terms of countries and years
  - Classification of measures may not be consistent across countries and years (consultant effect)
- Identification of NTMs impact will necessarily be based on differences across products and across(within) countries/firms but rarely across years (only with WTO data)

Ex-post and Ex-ante analysis nexus

- Ex ante analysis can be based on econometric estimations and some counterfactual exercises as long as some assumptions are satisfied
- Major assumption needed: what (i.e. relationships between some variables) was observed in the past (through ex-post estimation) still holds and will hold in the future (relationships are not affected by endogeneity)
- Welfare analysis can be undertaken using non CGE approaches but either in a Partial Equilibrium context or requires intensive data work and non-trivial computational techniques