A Comparison of Approaches to Modelling Non-Tariff Measures

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Motivation

- To model NTMs use econometric estimates of AVEs, then implement into CGE model using one (or more) of three methods (tariffs, export taxes, iceberg).
- Our concerns:
  - wide variety of NTMs not captured in econometrics or modelling methods
  - econometrics provides one AVE to summarize all the NTMs for a trade flow
  - modelling provides three methods, but:
    - method used is rarely linked to type of NTM and how it works
    - Iceberg method is very popular, but it has issues (Fugazza and Maur, 2006)
    - no method for NTMs to alter exporters' production costs

Purpose of Paper

- Compare and contrast the methods to illustrate the differences between them and how they impact the world economy.
- Introduce another “simple” method for the standard GTAP model that allowed the NTM to impact production costs. We called it the export cost or AXS method.

Five Methods Compared

Method	When to use it?
Iceberg cost (AMS) (Samuelson's iceberg cost)	NTM raise costs to importer (e.g., customs procedures and delays and the quality of cattle or vegetables diminishes)
Export cost (AXS) method (production costs)	NTM raises the production costs (e.g., requirements that wine be produced in a certain way increases costs, installing airbags in cars)
Tariff equivalents (TMS)	NTM increases the rents for importer (e.g., quotas, visas, licenses)
Export tax equivalents (TXS)	NTM increases the rents for exporter (e.g., VERs, export licenses)
Willingness to pay method (WTP) (Walmsley and Minor, 2019)	NTM decreases preferences (e.g. delays in customs for Xmas toys). Could also be useful for 'positive' NTMs (e.g., Georgia's introduction of NTMs, airbags in cars)

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Implementation of the methods: Direct

$$qxs_{i,r,s} = qim_{i,s} - \boldsymbol{ams_{i,r,s}} - ESUBM_i \left(pms_{i,r,s} - \boldsymbol{ams_{i,r,s}} - pim_{i,s}\right) + ESUBM_i \left(\boldsymbol{dpms_{i,r,s}} - dpm_{i,s}\right)$$

Method	Model	Source of gains/losses
Iceberg cost (AMS)	Alters import demand ($qxs_{i,r,s}$) directly. Two offsetting effects: • Expansion: removal of NTM reduces demand (need less imports to satisfy demand) $-\mathbf{ams_{i,r,s}}$ • Substitution: removal of NTM reduces the price of imports, raising demand $-\mathbf{ams_{i,r,s}}$	Productivity: Iceberg grows as the good travels from exporting to importing countries.
Willingness to pay method	Removal of NTM raises demand ($qxs_{i,r,s}$) directly by raising relative demand ($\mathbf{dpms_{i,r,s}} - dpm_{i,s}$)	Preferences only: No rents/revenues or productivity gains (relative demand changes)

Implementation of the methods: Prices

$$qxs_{i,r,s} = qim_{i,s} - ams_{i,r,s} - ESUBM_i \left(\boldsymbol{pms_{i,r,s}} - ams_{i,r,s} - pim_{i,s}\right) + ESUBM_i \left(\mathrm{dpms}_{i,r,s} - dpm_{i,s}\right)$$

Method	Model	Source of gains/losses
Tariff equivalents (TMS)	Impacts $pms_{i,r,s}$: removal of NTM reduces tariff equivalent, decreasing the price ($\boldsymbol{pms_{i,r,s}}$) and raising demand, via $\boldsymbol{pms_{i,r,s}} = pcif_{i,r,s} + tms_{i,r,s}$	Allocative efficiency: Reduction in revenues/ rents.
Export tax equivalents (TXS)	Impacts $pms_{i,r,s}$: removal of NTM reduces the export tax equivalent, decreasing the price ($\boldsymbol{pms_{i,r,s}}$) and raising demand, via $pfob_{i,r,s} = pm_{i,r} - txs_{i,r,s}$	Allocative efficiency: Reduction in revenues/ rents.

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Implementation of the methods: Prices

$$qxs_{i,r,s} = qim_{i,s} - ams_{i,r,s} - ESUBM_i \left(\boldsymbol{pms_{i,r,s}} - ams_{i,r,s} - pim_{i,s}\right) + ESUBM_i \left(\mathrm{dpms}_{i,r,s} - dpm_{i,s}\right)$$

Method	Model	Source of gains/losses
Export cost (AXS) method	Impacts $pms_{i,r,s}$: Two effects: • Removal of NTM reduces the amount of inputs needed to produce the export good • Reduces the price of the export good ($\boldsymbol{pms_{i,r,s}}$), raising demand by importers	Productivity: Demand for inputs used in production of export goods falls.

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Two effects of the AXS Method: Assume an NTM of 25% on exports

1. Expansion

- If exports ($QXS_{i,r,s}$) are 10 units, then need to produce the equivalent of 12.5 units (i.e., more inputs).

$$\frac{QXS_{i,r,s}}{AXS_{i,r,s}} = \frac{10}{0.8} = 12.5$$

Where: $AXS_{i,r,s} = \frac{1}{1+NTM} = \frac{1}{1.25} = 0.8$

2. Substitution

- Assume 12.5 units of goods are produced at a cost of \$1 each ($PS_{i,s}$).
- Then the 10 units exported ($QXS_{i,r,s}$) will need to be sold at \$1.25:

$$PMX_{i,r,s} = \frac{PS_{i,r}}{AXS_{i,r,s}} = \frac{1}{0.8} = 1.25$$

- Rise in $PMX_{i,r,s}$ works its way through price linkage equations to raise the price of the imported good ($\boldsymbol{pms}_{\mathrm{i,r},s}$).

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Two effects of the AXS Method: Assume an NTM of 25% on exports

1. Expansion

- If exports ($QXS_{i,r,s}$) are 10 units, then need to produce the equivalent of 12.5 units (i.e., more inputs – value added and intermediate inputs).

$$\frac{QXS_{i,r,s}}{AXS_{i,r,s}} = \frac{10}{0.8} = 12.5$$

Where: $AXS_{i,r,s} = \frac{1}{1+NTM} = \frac{1}{1.25} = 0.8$

Calculating shock to AXS (or AMS)

$$\text{shock} = \frac{(\text{Final Value} - \text{Initial Value})}{\text{Initial Value}} \times 100$$

- To remove 50% of NTM (i.e., NTM falls from 25% to 12.5%):

$$\text{shock} = \left(\frac{\frac{1}{1.125} - \frac{1}{1.25}}{\frac{1}{1.25}}\right) \times 100$$

$$= \frac{0.89 - 0.8}{0.8} \times 100 = 11.1\%$$

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Simulations

- Impact of a reduction in NTMs between 6 ASEAN countries
- NTM AVE Estimates from Webb, Strutt, Gibson and Walmsley (2020)
- Standard GTAP model and closure
- 5 mechanisms although I am going to focus on the differences between:
  - AMS: iceberg costs
  - AXS: exporter costs

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Real GDP (% change)

Real GDP	AMS	AXS	TMS	TXS	WTP
Vietnam	0.29	0.23	0.04	0.06	0.01
Philippines	0.25	0.07	0.07	0.05	0.04

Shocks	Aggregated by importer (NTMs imposed on imports)	Aggregated by exporter (NTMs faced by exports)
Vietnam	0.256	0.244
Philippines	0.507	0.062

Philippines imposes more NTMs (on imports) than it faces (on exports)

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Philippines' welfare decomposition

	Allocative efficiency	Technological change	Terms of trade	Capital goods	Preferences	Total
Iceberg (AMS)	60.3	497.1	2.6	5.1	0.0	565.1
Export Cost (AXS)	104.4	43.8	409.8	6.7	0.0	564.7
Tariffs (TMS)	160.6	0.0	-90.7	-19.5	0.0	50.3
Export Taxes (TXS)	108.4	0.0	412.3	6.2	0.0	526.9
Willingness to pay (WTP)	94.7	0.0	-119.4	-26.5	440.1	388.8

Philippines imposes more NTMs (on imports) than it faces (on exports) – hence large AMS productivity gain > AXS

Importers gain welfare even in AXS due to transfer of gains via TOT

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Trade (% change)

	Global Trade
Iceberg (AMS)	0.003 (0.012)*
Export Cost (AXS)	0.011
Tariffs (TMS)	0.012
Export Taxes (TXS)	0.010
Willingness to pay (WTP)	0.007

* Results in brackets represent imports calculated using qimreg. These are the amounts received by consumers in the importing country, compared to amounts of goods sent (qiwreg).

Conclusions: The Mechanism is Important

- Who gains? Importer or exporter?
  - Matters for real GDP results (NTMs imposed (imports) v faced (exports))
  - Matters for where the welfare gains come from: direct (productivity gains) or indirect (terms of trade)
- Where do the gains come from?
  - Does the removal of NTMs increase productivity (i.e., reduce costs) or allocative efficiency? Or simply change preferences?
  - Matters for real GDP and Welfare results
- AMS is concerning: trade impacts are smaller and the productivity gains in imports (iceberg expanding) can be difficult to justify

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Key resources

- Kravchenko, A., Strutt, A., Utoktham, C., & Duval, Y. (2022). New Price-based Bilateral Ad-valorem Equivalent Estimates of Non-tariff Measures *Journal of Global Economic Analysis, 7(2).*
  - Including online appendix available at *https://jgea.org/ojs/index.php/jgea/article/view/159*
  - With full database available at https://r.tiid.org/AVEs
- Walmsley, T., & Strutt, A. (2021). A Comparison of Approaches to Modelling Non-Tariff Measures. *Journal of Global Economic Analysis, 6(1), 1-33.*
  - Including online appendix available at *https://jgea.org/ojs/index.php/jgea/article/view/102*
  - Example of identifying shocks to apply through different mechanisms:

    Webb, M., Strutt, A., Gibson, J., & Walmsley, T. (2020). Modelling the impact of non-tariff measures on supply chains in ASEAN. *The World Economy, 43(8), 2172-2198.* *https://doi.org/10.1111/twec.12955*
- Lots of areas for future development…

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