ESCAP-World Bank Trade Cost Database - Implication for Asia-Pacific Connectivity

Presented by
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Based on a Joint paper with Jean-François Arvis (WB) and Ben Shepherd (Developing Trade Consultants)
(Trade Costs in the Developing World: 1995-2010)
Outline

1. Background & rationale for the database
2. Trade costs in the ESCAP-WB Database: Definition
3. End result – the ESCAP-World Bank Trade Cost Database
4. Trade costs in developing countries: Main findings
5. Explaining trade costs
6. Conclusion and policy implications
1. Background & Rationale for the Database

- Regional/global trade and production networks as a key engine of development
- Trade Facilitation [TF] (efficient trade procedures and low trade costs) essential to enable firms to participate
- Intraregional (South-South) trade important for A-P countries to continue growing at a time when developed markets slowing/shrinking
- Some cross-country indicators of TF and trade costs available (e.g., WB Doing Business indicators) but none allowing for measuring bilateral/intra-regional trade costs
- Development of a bilateral trade cost database to provide a systematic and standardized way to evaluate trade costs in developing countries
2. ESCAP-WB Trade Cost: Definition

- Based on the comprehensive trade costs measure proposed by Jacks, Meissner and Novy (2009)
  - Measure derived from the theory-consistent gravity equation, i.e., ratio based essentially on Bilateral Trade data and Gross Output data
  - → “objective” measure of costs

- Captures all additional costs involved in trading goods bilaterally relative to those involved in trading goods domestically. It includes:
  - International shipping and logistics costs
  - Tariff and non-tariff costs, including indirect and direct costs associated with trade procedures and regulations
  - Costs from differences in language, culture, currencies…
2. ESCAP-WB Trade Cost: Definition

- Our measure of **ad valorem trade costs**:

\[ \tau_{ij} = \tau_{ji} = \left( \frac{t_{ij} t_{ji}}{t_{ii} t_{jj}} \right)^{\frac{1}{2}} - 1 = \left( \frac{X_{ii} X_{jj}}{X_{ij} X_{ji}} \right)^{\frac{1}{2(\sigma-1)}} - 1 \]

Where:

- \( \tau_{ij} \) denotes geometric average trade costs between country i and country j
- \( t_{ij} \) denotes international trade costs from country i to country j
- \( t_{ji} \) denotes international trade costs from country j to country i
- \( t_{ii} \) denotes intranational trade costs of country i
- \( t_{jj} \) denotes intranational trade costs of country j
- \( X_{ij} \) denotes international trade flows from country i to country j
- \( X_{ji} \) denotes international trade flows from country j to country i
- \( X_{ii} \) denotes intranational trade of country i
- \( X_{jj} \) denotes intranational trade of country j
- \( \sigma \) denotes intra-sectoral elasticity of substitution (which is set = 8)
2. ESCAP-WB Trade Cost: Definition

- Our measure of **ad valorem trade costs**:

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\tau_{ij} = \tau_{ji} = \left( \frac{t_{ij} t_{ji}}{t_{ii} t_{jj}} \right)^{\frac{1}{2}} - 1 = \left( \frac{X_{ii} X_{jj}}{X_{ij} X_{ji}} \right)^{\frac{1}{2(\sigma-1)}} - 1
\]

- Intuition: keeping all else constant, a rise in the ratio of international trade relative to domestic trade must be associated with a fall in international trade costs relative to domestic trade costs

- **Ad valorem** → bilateral trade costs are expressed in % of the value of goods (like tariffs generally are)

- Important note: Change in the value of sigma can change the absolute value of trade costs → **better to look at trade cost relative to each other**
2. ESCAP-WB Trade Cost: Definition

- Our measure of ad valorem trade costs:

\[
\tau_{ij} = \tau_{ji} = \left( \frac{t_{ij}t_{ji}}{t_{ii}t_{jj}} \right)^{\frac{1}{2}} - 1 = \left( \frac{X_{ii}X_{jj}}{X_{ij}X_{ji}} \right)^{\frac{1}{2(\sigma-1)}} - 1
\]

- Note that:
  - Our trade costs are always expressed in terms of international relative to intra-national trade costs
  - Our trade costs are the geometric average of trade costs in both directions (country i to j and country j to i)
    - This can make the identification of policy effects challenging
3. End Result – the ESCAP-WB Trade Cost Database

- “All-inclusive” Bilateral trade costs for 178 countries
- For the period 1995-2010*
- Two macro-sectors covered
  - Agriculture
  - Manufacturing

Underlying data on international trade \((X_{ij}, X_{ji})\) are relatively easy to come by, but data on intranational trade \((X_{ii}, X_{jj})\) are more complicated…

- Intrnational trade = Gross Output (from UN National Account statistics) – export

*Linear interpolation applied to fill in missing trade costs observations
ESCAP-World Bank Trade Cost Database
(Global version issued December 2012)

The ESCAP Trade and Investment Division, in support of the ARTNET research programme on trade facilitation, initiated development of a bilateral trade cost database in 2010 in an effort to increase understanding of the cost of trading between countries in Asia and the Pacific and beyond. The trade cost measure, based on Novy (2012), is a comprehensive all-inclusive measure based on micro-theory and calculated using macro-economic data, providing an alternative measure of trade facilitation performance. Following release of a first version of the database in 2010 using trade and GDP data, an improved and expanded version was released in December 2011 based on gross output data and providing sectoral trade cost estimates for about 100 countries.

In late 2011, United Nations ESCAP and the World Bank (WB) joined hands to develop a common standard methodology for calculating comprehensive international trade costs and provide the research and policy community with a global reference. The resulting ESCAP-World Bank Trade Cost Database covers 176 countries and is available below, as well as on the WB website.

- ESCAP-World Bank Trade Cost Database (stata file)
- Metadata
- User Note

Note: Earlier versions of the databases are available upon request to the authors.

http://www.unescap.org/tid/artnet/trade-costs.asp
World DataBank

ESCAP World Bank: International Trade Costs

4. Main findings

1. All-inclusive international trade costs are at least one order of magnitude (10 times) larger than tariffs
   - Our “all-inclusive” measures cover tariffs, NTMs of all types, trade facilitation, connectivity, and logistics, as well as geographical factors, and cultural/historical/institutional factors—everything that drives a wedge between domestic and international prices
   - Consistent with Anderson and Van Wincoop (2004), who provide a guesstimate of 5% ad valorem for average rich country tariffs, compared with 74% ad valorem for international trade costs
4. Main Findings

2. Trade costs in developing countries are much higher than in developed countries, and they are falling more slowly.
4. Main findings

3. Trade costs in agriculture are much higher than trade costs in manufacturing in all income groups, and they are basically static over time.
4. Main findings

4. Differences in policy and geography/culture translate into different levels of trade costs in different regions
Trade Costs (TC) and TC excluding tariff (NTC) between selected economies and the United States of America (2007-2010)

\[ NTC_{ij} = \frac{TC_{ij}}{1 + \text{tariff}_{ij} \times \text{tariff}_{ji}} \]

where \( \text{tariff}_{ij} \) is the geometric average of tariff_{ij} and \( \text{tariff}_{ji} \).
Agricultural vs. Manufacturing Trade Costs* in Asia and the Pacific

Agricultural and Manufacturing NTC between Selected Economies and the USA

*excluding tariff
### Intra- and Inter-regional trade costs in Asia and the Pacific (2007-2010)*

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## Intra- and Inter-regional trade costs in Asia and the Pacific (2007-2010)*

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4. Explaining trade costs

- From a policy perspective, it is important to break trade costs down into their component parts
  - Which sources of trade costs are the most important in terms of determining the overall pattern observed across countries?
  - What sorts of policies would be most effective in lowering trade costs and reducing the relative isolation of many low income countries?

- Econometric estimation becomes necessary at this point: we use a model with trade cost variables to explain the observed pattern of trade costs across countries
4. Explaining trade costs

Factors included in the trade cost model are:
- Distance
- Common border
- Common language
- Existence of a colonial relationship
- Common colonial heritage
- Once part of the same country
- Tariffs
- Membership of the same RTA
- Exchange rate
- Liner shipping connectivity (UNCTAD)
- Air connectivity (Arvis and Shepherd)
- Logistics Performance Index
- Cost of starting a business

We estimate the models for a single year for all countries, in agriculture and manufacturing sectors
4. Explaining trade costs (Beta coefficients*)

*the amount of increase in trade costs (measured in standard deviations) that is associated with a one standard deviation increase in each independent variable
4. Explaining trade costs (semi-partial R2*)

*the proportion of the observed variation in trade costs that is accounted for by each independent variable, after controlling for the influence of the other independent variables
Trade Costs in Asia and the Pacific

Contribution of natural barriers, behind-the border facilitation and trade-related practice to trade costs

- Tariff Trade Costs
  - 0-10% *
  - 60-90% *

- Policy-Related Non-Tariff Trade Costs
  - Direct Behind- & At-the border Trade Costs: 1%
  - Availability/ use of ICT Services: 6-7%
  - Business (Regulatory) Environment: 6-7%
  - Maritime Connectivity/ Services: 16-18%
  - Other Trade Costs: 52-57%
    - Indirect cost of trade procedure
    - Currency fluctuation
    - Other non-tariff barriers

- Natural Trade Costs (Geographical and Cultural Factors)
  - 10-30% *

* Illustrative based on casual observation of the data only. Natural trade costs for landlocked countries may be outside the range shown for natural trade costs.
Conclusion & policy implications

Key findings:

1. All-inclusive trade costs more than an order of magnitude higher than tariff rates
2. Trade costs in developing countries much higher than in developed countries, and falling more slowly
3. Trade costs in agriculture much higher than trade costs in manufacturing in all income groups, and static over time
4. Very different levels of trade costs in different developing regions
5. Often cheaper for developing countries to trade with far-away developed countries than to trade with neighbors
6. From higher to lower trade costs in A-P: Central Asia → South Asia → Southeast Asia → East Asia (excluding Mongolia)
Conclusion and policy implications

- Some preliminary implications:
  - Streamlining trade procedures (narrow TF), maritime connectivity and logistics most important policy areas for moving forward on trade costs
  - East Asia and the Pacific may provide an important stock of best practice in the developing world when it comes to reducing trade costs
  - To successfully reduce trade costs, action necessary on a number of fronts at once—a broad agenda is appropriate
  - Sectoral focus (on agriculture) of technical assistance/capacity building on trade facilitation may be effective approach
  - Particular attention needed on reducing intra-regional trade costs

- The analysis of trade costs provide a useful starting point in engaging with countries on their trading environment... other tools (micro-level) needed to identify actual bottlenecks and develop solutions
  - E.g., ESCAP-UNECE UNNExT Business Process Analysis Guide
Conclusion and policy implications

Way Forward:

- Continuous updating of the database
- Deepen analysis on agricultural trade cost
- Explore ways to breakdown the “all-inclusive” trade cost measure into components (isolate the “policy-related” component in particular)
- Improve on the trade cost models to include more factors
- Calculate trade costs at a more disaggregated level & add service sector
- Include more developing countries (particularly LDCs and LLDCs in the database)
- …
Thank You for your attention

- For more details on the database please visit:

- Full details available in working paper (PRWP No. 6309, Jan. 2013, or ARTNeT WP No. 121, Dec. 2012)
For more information on what we do on trade and investment at ESCAP,

www.unescap.org/tid/artnet

Visit our website at www.unescap.org/tid

www.unescap.org/tid/unnext/

THANK YOU
ANNEX

- Trade cost in comparative perspective
  - Trade costs by income group
  - Trade costs by region
  - Manufacturing vs. agriculture
  - Trade costs over time

- Derivation of trade costs equation
- Data and Sources
- Trade cost composition (AvW, 2004)
- Comparison with other measures
Appendix – Trade costs in comparative perspectives
Appendix – Trade costs in comparative perspectives

Manufacturing (1996 = 100)
Appendix – Trade costs in comparative perspectives

Agriculture

- High income
- Upper middle income
- Lower middle income
- Low income
Appendix – Trade costs in comparative perspectives

Agriculture (1996 = 100)
Appendix – Trade costs in comparative perspectives

Manufacturing

[Line chart showing trade costs for different regions over time, with regions labeled: East Asia & Pacific, Europe & Central Asia, Latin America & Caribbean, Middle East & North Africa, South Asia, Sub-Saharan Africa.]
Appendix – Trade costs in comparative perspectives

Manufacturing (1996=100)
Appendix – Trade costs in comparative perspectives

Agriculture

- East Asia & Pacific
- Europe & Central Asia
- Latin America & Caribbean
- Middle East & North Africa
- South Asia
- Sub-Saharan Africa
Appendix – Trade costs in comparative perspectives

Agriculture (1996=100)
Appendix – Derivation of Trade Cost Equation

\[ X_{ii} = \frac{Y_i Y_i}{Y_w} \left( \frac{t_{ii}}{\Pi_i P_i} \right)^{1-\sigma} \]

\[ X_{jj} = \frac{Y_j Y_j}{Y_w} \left( \frac{t_{jj}}{\Pi_j P_j} \right)^{1-\sigma} \]

\[ X_{ij} = \frac{Y_i Y_j}{Y_w} \left( \frac{t_{ij}}{\Pi_i P_j} \right)^{1-\sigma} \]

\[ X_{ji} = \frac{Y_j Y_i}{Y_w} \left( \frac{t_{ji}}{\Pi_j P_i} \right)^{1-\sigma} \]
Appendix – Derivation of Trade Cost Equation

- Multiply the equations for internal trade and the equations for international trade to give two new equations:

\[
X_{ii}X_{jj} = \frac{Y_i Y_i}{Y_w} \left( \frac{t_{ii}}{\Pi_i P_i} \right)^{1-\sigma} \frac{Y_j Y_j}{Y_w} \left( \frac{t_{jj}}{\Pi_j P_j} \right)^{1-\sigma}
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\[
X_{ij}X_{ji} = \frac{Y_i Y_j}{Y_w} \left( \frac{t_{ij}}{\Pi_i P_j} \right)^{1-\sigma} \frac{Y_j Y_i}{Y_w} \left( \frac{t_{ji}}{\Pi_j P_i} \right)^{1-\sigma}
\]

- Divide those two equations and GDP and multilateral resistance cancel out:

\[
\frac{X_{ij}X_{ji}}{X_{ii}X_{jj}} = \left( \frac{t_{ij} t_{ji}}{t_{ii} t_{jj}} \right)^{1-\sigma}
\]
Points to note about our approach:

- This is not an econometric estimation, so issues such as endogeneity and omitted variables bias do not arise.

- Inverse gravity relies heavily on theory, but the formula for $\tau$ takes basically the same form for any of the theories that are currently standard in the literature.

- All that is required to implement inverse gravity is data on inter- and intra-national trade, along with a parameter assumption as to $\sigma$.

- Ad valorem equivalents are highly sensitive to the choice of $\sigma$, but index numbers are not.
To calculate trade costs between countries \( i \) and \( j \), we need data on:

- Exports from \( i \) to \( j \)
- Exports from \( j \) to \( i \)
- Production in country \( i \) that is also consumed there, in gross shipments terms (not value added)
- Production in country \( j \) that is also consumed there, in gross shipments terms (not value added)

Getting the international trade data is straightforward:

- WITS-UN Comtrade
- Aggregate into two macro-sectors, manufacturing (ISIC D) and agriculture (ISIC A and B) using a WITS concordance
- Adjustment for re-exports using other sources for a small number of countries

Getting the intra-national trade data is less straightforward
Appendix – Data and Sources

- For some countries, data on domestic production in gross shipments terms are available through the UN national accounts system
  - Coverage is up to 124 countries
  - Conversion from Local Currency Units to USD using the WDI GDP exchange rate
  - Calculation of intra-national trade as domestic production less total exports to the rest of the world
- For countries for which gross domestic production is not available, we infer it from GDP
For those countries that lack domestic production in gross shipments terms:

- We take GDP data by ISIC aggregate from the WDIs, supplemented by the UN national accounts system.
- GDP data cannot be used directly because they are in value added not gross shipments terms (i.e., they net out intermediate input use).
- We therefore calculate average gross shipments to value added ratios for the two ISIC aggregates for those countries where we have both sets of data.
- We use those ratios to “gross up” the value added data to their estimated gross shipments equivalents.
- We then calculate intra-national trade as domestic production less total exports to the rest of the world.
Appendix – Trade costs composition

Direct evidence on border costs shows that tariff barriers are now low in most countries, on average less than 5% for rich countries, on average between 10-20 % for developing countries.

Estimated Trade Costs in Industrialized Countries

- **Trade Costs** (170%)
  - **Transport Costs** (21%)
    - Freight costs
    - Transit costs* (9%)
  - **Border related trade barriers** (44%)
  - **Retail and wholesale distribution costs** (55%)
    - Policy barriers (Tariff and NTBs) (8%)
    - Language barrier (7%)
    - Currency barrier (14%)
    - Information costs barrier (6%)
    - Security barrier (3%)

*Tax equivalent of the time value of goods in transit.

**The combination of direct observation and inferred costs, which, according to author, is an extremely rough breakdown

Source: Anderson and van Wincoop (2004)
Appendix – Comparison with other measures

How does our methodology compare with other measures that capture concepts similar to trade costs?

- OTRI: Captures tariffs and NTMs for which data are available only; does not include other policy factors (trade facilitation, connectivity, logistics) or non-policy factors (geography, history, institutions).

- Doing Business: Captures costs between the seller’s factory and the port only; excludes international transport costs, trade barriers in the importing country, and other factors that drive a wedge between prices.

- Logistics Performance Index: Also only captures costs between the seller’s factory and the port; excludes “between the border” factors, as well as geography, history, etc.

- CIF/FOB ratios: Captures international transport costs only, not other factors that make it more costly to trade internationally rather than domestically.
2. Methodology: Inverse gravity

- Applied international trade typically uses the gravity model to analyze the impact of a particular trade cost factor on **bilateral trade flows**
- Anderson and Van Wincoop (2003, 2004) provide the canonical model:

\[
X_{ij} = \frac{Y_i Y_j}{Y_w} \left( \frac{t_{ij}}{\Pi_i P_j} \right)^{1-\sigma}
\]

- X is exports from i to j
- Y is GDP
- t is iceberg trade costs
- Sigma is the intra-sectoral elasticity of substitution
- Pi and P are the multilateral resistance terms
2. Methodology: Inverse gravity

- A typical gravity paper controls for a range of factors (geography and history) and then adds another trade cost source to see whether it has a significant impact on bilateral trade
  - NTMs and product standards
  - RTA membership
  - Trade facilitation
  - Logistics performance
  - Air or maritime connectivity
  - Entry barriers

- In principle, the estimates from different gravity papers can be combined to give an overall picture of the level of trade costs, but only Anderson and Van Wincoop (2004) have done so: hence their 170% “headline” number
2. Methodology: Inverse gravity

- There are two inter-related problems with the standard approach:
  - The focus is on one source of trade costs at a time, rather than on a comprehensive measure of total trade costs
    - No understanding of the “big picture” as regard to overall trade cost
    - Some policy forums, such as the Asia-Pacific Economic Cooperation, have focused their trade facilitation efforts on the reduction of “trade transaction costs”; but measurement and assessment of performance has proved difficult using standard techniques
  - There is always the possibility of omitted variable bias
    - to the extent that an omitted source of trade costs is correlated with an included one (which is highly likely)
2. Methodology: Inverse gravity

- The methodology is very simple, and is based on some basic algebra done with the standard gravity model.

- Take two countries i and j.

- That gives four gravity models for each direction of international trade, and two types of internal (intra-national) trade.

- The four equations allow us to eliminate the two unobservable multilateral resistance terms as well as GDP, leaving just intra-national and inter-national trade and intra- and inter-national trade costs.

- Note that there is no assumption that trade is balanced or that trade costs are identical in both directions.
2. Methodology: Inverse gravity

- Summarizing the algebra, our measure of ad valorem trade costs:

\[
\tau_{ij} = \tau_{ji} = \left(\frac{t_{ij} t_{ji}}{t_{ii} t_{jj}}\right)^{\frac{1}{2}} - 1 = \left(\frac{X_{ii} X_{jj}}{X_{ij} X_{ji}}\right)^{\frac{1}{2(\sigma-1)}} - 1
\]

- For the purposes of our work, \(\tau\) ("trade costs") is the geometric average of trade costs from i to j and from j to i relative to intra-national trade costs in each country.

- The intuition is that keeping all else constant, a rise in the ratio of international trade relative to domestic trade must be associated with a fall in international trade costs relative to domestic trade costs.

- Data on international trade \((X_{ij}, X_{ji})\) are relatively easy to come by, but data on intra-national trade \((X_{ii}, X_{jj})\) are more complicated…