The Two Alternative Strategies of Dissecting Intra-Industry Trade*

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The problem

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2. The traditional approach to dissecting IIT
3. The proposed strategies of dissecting IIT
4. Demo calculating schemes for the strategies
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Conclusion

* Hereinafter, IIT stands for intra-industry trade
Intra-industry trade (IIT) – the two-way exports and imports of the same commodity group

- Horizontal IIT: varieties of the commodity are equal in quality
- Vertical IIT: varieties of the commodity differ in quality
  - Vertical IIT ≠ vertical integration or fragmentation of production!

It is impossible to explain IIT without dissecting it on 2 types

- Factors of horizontal IIT: economies of scale, number of firms within an industry and per capita income (Gullstrand, 2002)
- Factors of vertical IIT: difference in comparative advantages between countries, in capital endowments and technology (Díaz Mora, 2002)
The problem

• In the literature, IIT is dissected on 2 types exclusively through the unit value (the ratio of trade value to net weight)
  – Horizontal IIT: commodities with close unit values
  – Vertical IIT: commodities with different unit values
    • The threshold is usually set at 15-25%

• However, quality is a complex phenomenon. I propose the two alternative strategies of dissecting IIT:
  – Altering product quality measures (weighted per capita income)
  – Applying a different theoretical basis (comparative advantage)
1. The ways of calculating IIT

- The way of calculating IIT doesn’t affect the key results
  - However, I should specify how do I calculate IIT before dissecting it

- The two ways applied in the literature (traditional approach)
  - “Trade-type approach”
    - Abd-el-Rahman, 1991
    - Fontagne and Freudenberg, 1997
  - “Overlap approach”
    - Greenaway, Hine and Milner, 1994

\[
GL_{t,c} = 1 - \frac{V_{i,c}^X - V_{i,c}^M}{V_{i,c}^X + V_{i,c}^M}
\]

- Intra-industry trade
- Inter-industry trade
1. The ways of calculating IIT

- I prefer “overlap approach”
  - It allows dividing a bilateral trade flow into two parts instead of simply marking it as intra- or inter-industry trade flow
  - So, using the “overlap approach” instead of the “trade-type approach” helps to account for relative factor endowment differences (that are important for inter-industry trade) more carefully, as the “trade-type approach” just ignores this factor if the reversal trade flows exceed a fairly low threshold of 10% (Gullstrand, 2002, p. 323)
  - The “overlap approach” does not need an arbitrary threshold, unlike “trade-type approach”, while the level of IIT is very sensitive to the empirical overlapping criterion (Crespo and Fontoura, 2004).
2. The traditional approach to dissecting IIT

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Criteria for IIT</th>
<th>Criteria for Horizontal IIT</th>
<th>Criteria for Vertical IIT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Abd-el-Rahman, 1991</strong></td>
<td>Reversal import (export) flows more than 10 percent compared with the other flows (“trade-type approach”)</td>
<td>The difference between export and import unit values is less than 15 percent</td>
<td>The difference is more than 15 percent</td>
</tr>
<tr>
<td><strong>Greenaway, Hine and Milner, 1994</strong></td>
<td>Grubel-Lloyd index (“overlap approach”)</td>
<td>The ratio of export and import unit values is within the limits of [0.85; 1.15]</td>
<td>The ratio is beyond the limits of [0.85; 1.15]</td>
</tr>
<tr>
<td><strong>Fontagne and Freudenberg, 1997</strong></td>
<td>Imports represent at least 10 per cent of exports or reciprocally (“trade-type approach”)</td>
<td>The ratio of export and import unit values is within the limits of [0.8; 1.25]</td>
<td>The ratio is beyond the limits of [0.8; 1.25]</td>
</tr>
<tr>
<td><strong>Azhar and Elliott, 2006</strong></td>
<td>Not specified</td>
<td>PQH index is within the limits of [0.85; 1.15]</td>
<td>PQH index is beyond the limits of [0.85; 1.15]</td>
</tr>
</tbody>
</table>

\[
PQH_{i,c} = 1 - \frac{UV^X_{i,c} - UV^M_{i,c}}{UV^X_{i,c} + UV^M_{i,c}}
\]
2. The traditional approach to dissecting IIT

• Advantages of the traditional approach
  – Unit values are available at the most detailed level of commodity disaggregation (6-digit HS, for the wide range of countries)
    • Greenaway, Hine and Milner, 1994: unit values are “certainly the most accessible source of information about consumer assessments of products”
  – Unit values were shown to be correlated with capital abundance and per capita GDP (that, in turn, at least partially reflect quality of the economy)
    • Schott, 2004, p. 647-648; Aiginger, 1997, p. 581
2. The traditional approach to dissecting IIT

• Disadvantages of the traditional approach
  – The resulting share of IIT is not stable, while a proper quality measure should not vary much from year to year
    • Lüthje and Nielsen, 2002
  – The threshold of 15 or 25% is arbitrary, but its choice influences the results much (Fontagne, Freudenberg and Gaulier, 2006)
    • Moreover, the average ratio of export-to-import unit values substantially differs from this threshold for many countries: for example, it equals 2.84 for China (Ito and Okubo, 2014).
2. The traditional approach to dissecting IIT

• Disadvantages of the unit value indicator
  – It depends on various characteristics of the commodity such as durability, finish and reliability
    • Greenaway, Hine and Milner, 1994
  – It may reflect monopolistic markups and international trade costs that differ among the pairs of trade partners
    • Szczygielski and Grabowski, 2012
  – It may vary due to differences in the product mix, even at fine levels of disaggregation
    • Durkin and Krygier, 2000
3. The proposed strategies of dissecting IIT

- The two alternative strategies of dissecting IIT
  - Altering product quality measures
    - For example, weighted per capita GDP such as PRODY by *Hausmann, Hwang and Rodrik (2007)*: rich countries tend to export higher-quality goods (higher wages are compensated by higher quality to maintain competitiveness)
    - PRODY can be calculated at least in 75 different ways (*Huber, 2017*)
  - Applying a different theoretical basis
    - *Lüthje and Nielsen, 2002*, p. 602: “an alternative method worth considering would be to take point of departure in comparative advantages as the theoretical basis for separating trade in horizontally from trade in vertically differentiated goods.”

- Further, a “strategy” stands for the general concept, and a “calculating scheme” – for the particular method used to obtain the quantitative results
4. Demo calculating schemes for the strategies

The data

- Two EU countries (Italy and Hungary)
  - **Italy**: example of a country that has strong trading ties with non-members (in 2014, around 46 per cent of Italy’s exports was directed to non-member countries, and about 43 per cent of its imports originated from these countries)
  - **Hungary**: example of a country that trades with the EU very intensively (in 2014, only 22 per cent of its exports was directed to non-member countries, and about 25 per cent of its imports originated from these countries)

- International trade in commodities (UN COMTRADE)
  - Disaggregation – HS 2007, 6-digit
  - Period – 2012-2014
4. Demo calculating schemes for the strategies

- Two simple tests to check the validity of calculating schemes
  - The share of horizontal IIT of the EU member country should be higher for trade with other EU member countries and for trade with countries with a similar per capita GDP than for trade with the world
  - The resulting decomposition shouldn’t vary much from year to year for all of the three groups of trading partners outlined above

- Other ways to test (do not used in the paper)
  - Gullstrand, 2002: tests econometrically if the factors that influence the two trade flow types are in line with the theory
  - Lüthje and Nielsen, 2002: look at the stability of the results by performing runs test at the product level
4.1. Altering product quality measures: weighted per capita income

- I develop the calculating scheme with PRODY indicator (only an example; one may use other indicators as well)
  - *Hausmann, Hwang and Rodrik, 2007*

\[
PRODY_i = \sum_c BI_{i,c}^X y_c
\]

\[
BI_{i,c}^X = \frac{\sum V_{i,c}^X}{\sum \sum V_{i,c}^X}
\]

- Disadvantage: inability to differentiate quality by country of origin (PRODY varies across products but not across countries)
  => It is necessary to complement this indicator with a country-specific variable
4.1. Altering product quality measures: weighted per capita income

• The idea: to compare PRODY and partners’ per capita GDP
  – Horizontal IIT: PRODY within the marked range
    • Countries have close per capita GDP or PRODY is not close to one of them

\[
LowerBound_{c,p} = \frac{y_c + y_p}{2} - 0.25 \cdot \max \left( \left| y_c - y_p \right|, \frac{y_c + y_p}{2} \right) \\
UpperBound_{c,p} = \frac{y_c + y_p}{2} + 0.25 \cdot \max \left( \left| y_c - y_p \right|, \frac{y_c + y_p}{2} \right)
\]

Countries sorted by GDP per capita

- A country
- Trade partners
- Lower bound
- Upper bound
4.2. Applying a different theoretical basis: comparative advantage

- I develop the calculating scheme with sign of the net exports* (only an example; one may use other indicators as well)
  - Advantage: there is no an arbitrary threshold (either a coincidence or a difference in signs)

- The reasoning:
  - Countries with equal sign of the net exports of a product are treated as having close capabilities (all possible product-specific factors defined in the spirit of Hausmann and Hidalgo, 2011)
    - The parallel from the world with two factors: capital-abundant country has positive net exports of a capital-intensive product

* Why do I prefer to measure comparative advantage through the net trade – see Gnidchenko and Salnikov (2015).
4.2. Applying a different theoretical basis: comparative advantage

- The idea: if two countries have equal comparative advantage in a product but still trade with each other – most likely, the quality of their products is close
  - An exception: different competitiveness strategies (if partners’ per capita GDP are significantly different, the reach country may export higher-quality goods to a poor country and import lower-quality goods from poor country)
    - There is strong theoretical evidence that richer countries tend to be net exporters of higher-quality goods and net importers of lower-quality goods (Fajgelbaum, Grossman and Helpman, 2011)
- So, we should account for the gap in partners’ per capita GDP
4.2. Applying a different theoretical basis: comparative advantage

• Calculation:
  – 1: vertical IIT
  – 0: horizontal IIT

\[
\text{type}_{c,p} = \frac{y_c + y_p}{2} - \frac{|y_c - y_p|}{2} - \frac{V_{i,c}^X - V_{i,c}^M}{|V_{i,c}^X - V_{i,c}^M|} \cdot \frac{V_{i,p}^X - V_{i,p}^M}{|V_{i,p}^X - V_{i,p}^M|} \cdot \frac{1}{2}
\]

• 1\textsuperscript{st} part of the equation – close (1) / distant (-1) per capita GDP
• 2\textsuperscript{nd} part of the equation – equal (1) / different (-1) signs of NX
4.2. Applying a different theoretical basis: comparative advantage

• Example 1: China-Malaysia trade, clothing
  - Case 1: Both countries have positive net exports (with the world)
    • Interpretation: Quality of their products is equal
    • Countries have close comparative advantage and per capita GDP, so they are likely to trade with other mainly due to horizontal differentiation
  - Case 2: Countries have different signs of the net exports
    • Interpretation: Quality of their products is different
    • Though one country does not have a comparative advantage, it exports a product to other country that has comparative advantage – may be, quality differs?
4.2. Applying a different theoretical basis: comparative advantage

• Example 2: China-Italy trade, clothing
  – Case 1: Both countries have positive net exports
    • Interpretation: Quality of their products is different
    • China has positive net exports due to price competitiveness, while Italy – due to non-price competitiveness (quality)
  
  – Case 2: Only Italy has negative net exports
    • Interpretation: Quality of their products is equal
    • Italy has higher quality but even higher costs
  
  – Case 3: Only China has negative net exports
    • Interpretation: Quality of their products is equal
    • An average Chinese product is not competitive even on the world market, so China has to export higher-quality varieties to penetrate the Italian market
5. Empirical results: traditional approach (unit values)

- Italy
  - Trade with the world
  - Trade with other EU member countries
  - Trade with countries with a similar per capita GDP
  - Variability: $\text{var}^* = 0.02$, $\text{var} = 0.01$, $\text{var} = 0.04$

- Hungary
  - Trade with the world
  - Trade with other EU member countries
  - Trade with countries with a similar per capita GDP
  - Variability: $\text{var}^* = 0.04$, $\text{var} = 0.03$, $\text{var} = 0.13$

*Coefficient of variation across years*
5. Empirical results: altering product quality measures

*coefficient of variation across years

<table>
<thead>
<tr>
<th>Country</th>
<th>2012 (PPP)</th>
<th>2013 (PPP)</th>
<th>2014 (PPP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>var = 0.03</td>
<td>var = 0.04</td>
<td>var = 0.04</td>
</tr>
<tr>
<td>var (PPP)</td>
<td>0.07</td>
<td>0.08</td>
<td>0.10</td>
</tr>
<tr>
<td>Hungary</td>
<td>var = 0.02</td>
<td>var = 0.03</td>
<td>var = 0.20</td>
</tr>
<tr>
<td>var (PPP)</td>
<td>0.05</td>
<td>0.04</td>
<td>0.06</td>
</tr>
</tbody>
</table>
5. Empirical results: applying a different theoretical basis

*coefficient of variation across years

**Italy**

<table>
<thead>
<tr>
<th>Year</th>
<th>Trade with the world</th>
<th>Trade with other EU member countries</th>
<th>Trade with countries with a similar per capita GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>var = 0.02</td>
<td>var = 0.02</td>
<td>var = 0.02</td>
</tr>
<tr>
<td>2013</td>
<td>var = 0.02</td>
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</tr>
<tr>
<td>2014</td>
<td>var = 0.02</td>
<td>var = 0.02</td>
<td>var = 0.03</td>
</tr>
<tr>
<td>var* (PPP)</td>
<td>= 0.04</td>
<td>var (PPP) = 0.02</td>
<td>var (PPP) = 0.03</td>
</tr>
</tbody>
</table>

**Hungary**

<table>
<thead>
<tr>
<th>Year</th>
<th>Trade with the world</th>
<th>Trade with other EU member countries</th>
<th>Trade with countries with a similar per capita GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>var = 0.01</td>
<td>var = 0.01</td>
<td>var = 0.02</td>
</tr>
<tr>
<td>2013</td>
<td>var = 0.01</td>
<td>var = 0.01</td>
<td>var = 0.01</td>
</tr>
<tr>
<td>2014</td>
<td>var = 0.01</td>
<td>var = 0.01</td>
<td>var = 0.01</td>
</tr>
<tr>
<td>var* (PPP)</td>
<td>= 0.02</td>
<td>var (PPP) = 0.02</td>
<td>var (PPP) = 0.02</td>
</tr>
</tbody>
</table>
Conclusion

• According to the chosen simple tests, the best strategy is applying a different theoretical basis relying on comparative advantage

  – However, there is a problem: the resulting decomposition diverges significantly from the standard results

    • The share of horizontal IIT for Italy and Hungary according to the traditional approach does not exceed 25%, in the proposed approach – equals 50-60%

  – So, there is a need in additional analysis to check the results

    • Enlarging the country list and the period

    • Testing econometrically if the factors that influence horizontal and vertical IIT are in line with the theory
Conclusion

• The main result of the paper:
  – Choosing a decomposition strategy for IIT is very important and may critically affect the empirical results
    • Though all alternative strategies are conceptually grounded, they provide substantially different results
  – The results are most stable for the case of applying a different theoretical basis relying on comparative advantage, but it is not proved that it has a strong priority over other approaches
    • Stability of the decomposition is a necessary but not sufficient condition
    • On the other hand, even this condition doesn’t hold for the traditional approach
Conclusion: an afterword

• So, I’ve shown that there are alternatives to the traditional (and to date the only) approach

• Each alternative has a number of implementation options
  – For example, one of the possible quality measures may rely on the level of international trade diversification according to the following stylized fact (Hausmann and Hidalgo, 2011, p. 318):
    • “poorly diversified countries export products that are, on average, exported by many other countries, whereas highly diversified countries make products which are made, on average, by fewer other countries,” because such products require specific capabilities that are not wide-spread (have low “ubiquity”)
Thanks for your attention!