Estimating Food Quality from Trade Data: An Empirical Assessment

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AIEAA Conference
Alghero, 25-27 June 2014
Research objective

➢ To test the properties and the reliability of some recent methods developed to measure the quality of the exported food products

✓ Methods used: Khandelwal (2010) and Khandelwal, Schott and Wei (2013)
  • «Higher quality is assigned to product with higher market share, conditional on price»

➢ To analyze the evolution of our quality measure in comparison with the one of unit value

✓ To test the correlation price-quality
✓ To analyze countries’ export strategies ➔ Price vs. Quality competition strategies
Outline

- Motivations
- Data
- Quality estimations
- Empirical strategy
- Results
- Conclusions
Motivations

Why do we focus on quality?

- Exports’ quality has a fundamental role both in driving the direction of trade, and in determining the countries’ (firms) trade performances

  - Richer countries tend to import more from countries producing higher-quality goods (Linder, 1961; Hallak, 2010; Crinò and Epifani, 2012; Curzi and Olper, 2012)
    - Particularly important for developing countries who want to export to richer countries

  - Product quality is considered one of the most important elements that allows firms to have success in the international markets (Sutton, 2007; Helpman, 2011)
    - Often viewed as a pre-condition for export success (Grossman and Helpman, 1991; Amiti and Khandelwal, 2013)
Motivations

However, quality is **unobservable**!

- Commonly proxied using **price** (unit value) from trade data
  - Although widely used, price is an imprecise measure of quality
    - Higher price could reflect higher quality but also higher costs (Aiginger, 1997)
    - Higher unit values could also be the consequence of higher margins created by market power (Knetter, 1997)

- Some recent papers tried to purge all the elements above in order to obtain a more reliable proxy for quality (Hallak and Schott, 2011; Khandelwal, 2010; Khandelwal, Schott and Wei, 2013)
  - Countries selling large quantities of physical output, conditional on price, are classified as high quality producers
Motivation

We measure quality at the country-product level, for food products exported over the period 1995-2007

Methods used:

- Nested logit demand function by Khandelwal (2010)
- CES demand function by Khandelwal, Schott and Wei (2013)

Although the two methods are conceptually similar, our preferred measure is the one of Khandelwal (2010)

- Nested logit demand approach allows for a more reliable substitution pattern, by placing varieties into appropriate nests

However, the Khandelwal, Schott and Wei (2013) method...

- ...allows the use of FOB prices instead of CIF
- ...offers the possibility to decompose FOB price in its quality and price-adjusted-quality components
Outline

- Motivations

- Data
  - Quality estimations
  - Empirical strategy

- Results

- Conclusions
Data

Quality estimation – Khandelwal (2010)

- Trade data from Eurostat Comext: Imports data to EU15 at 8-digit level, for the period 1995-2007
- Production data from Eurostat Prodcom NACE REV 1.1: for the market share estimates in the 14 importing countries
- Feenstra et al. (2002); CEPII, World Bank, Brent Oil: transportation costs; distance, population, oil price.
Data

Quality estimation – Khandelwal, Schott and Wei (2013)

- Bilateral FOB prices and export quantity at the HS 6-digit level from BACI database (CEPII) for all the world trading countries (not only EU 15), over the period 1995-2007
- Elasticities of substitution from Broda, Greenfield and Weinstein (2006), at the HS 3-digit level.

Other data

- WITS-World Bank: Data on import tariff at country-product (HS6-digit) level in the period 1995-2007
- Data on labour productivity and capital from UNIDO database → for estimating TFP
Outline

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Quality estimation (1)

Khandelwal (2010)

‘conditional on price, imports with higher market shares are assigned higher quality’

- Quality of product $h$, exported by country $c$, is estimated using the nested logit demand function (Berry, 1994):

\[
\ln(s_{cht}) - \ln(s_{0t}) = \phi_{1,cht} + \phi_{2,t} + \alpha p_{cht} + \sigma \ln(n s_{cht}) + \gamma \ln pop_{ct} + \phi_{3,cht}
\]

**Market Share**

- Estimation methods: OLS and 2SLS
- The demand function is estimated separately for each EU 15 importer country – NACE 4-digit
## Data

### Industries and products for the quality estimations

<table>
<thead>
<tr>
<th>NACE 4</th>
<th>Short description</th>
<th>#CN8</th>
<th>Mean Ladder</th>
</tr>
</thead>
<tbody>
<tr>
<td>1511</td>
<td>Production and preserving of meat</td>
<td>142</td>
<td>3.54</td>
</tr>
<tr>
<td>1512</td>
<td>Production and preserving of poultry meat</td>
<td>196</td>
<td>3.05</td>
</tr>
<tr>
<td>1513</td>
<td>Production of meat and poultry meat products</td>
<td>108</td>
<td>3.11</td>
</tr>
<tr>
<td>1520</td>
<td>Production and preserving of fish and fish products</td>
<td>401</td>
<td>1.42</td>
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<tr>
<td>1530</td>
<td>Production and preserving of fruit and vegetables</td>
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<tr>
<td>1540</td>
<td>Manufacture of vegetables and animal oils and fats</td>
<td>144</td>
<td>1.60</td>
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<tr>
<td>1550</td>
<td>Manufacture of dairy products</td>
<td>204</td>
<td>2.02</td>
</tr>
<tr>
<td>1560</td>
<td>Manufacture of grain mill products, starches and starch products</td>
<td>178</td>
<td>1.85</td>
</tr>
<tr>
<td>1580</td>
<td>Sugar and cocoa</td>
<td>60</td>
<td>1.70</td>
</tr>
<tr>
<td>1581</td>
<td>Manufacture of bread; manufacture of fresh pastry goods and cakes</td>
<td>2</td>
<td>0.59</td>
</tr>
<tr>
<td>1582</td>
<td>Manufacture of rusked and biscuits</td>
<td>29</td>
<td>1.47</td>
</tr>
<tr>
<td>1585</td>
<td>Manufacture of maccaroni, noodles and couscous</td>
<td>11</td>
<td>2.15</td>
</tr>
<tr>
<td>1586</td>
<td>Processing of tea and coffee</td>
<td>22</td>
<td>2.05</td>
</tr>
<tr>
<td>1587</td>
<td>Manufacture of condiments and seasoning</td>
<td>11</td>
<td>2.37</td>
</tr>
<tr>
<td>1588</td>
<td>Manufacture of homogenized food preparation and dietetic food</td>
<td>7</td>
<td>1.93</td>
</tr>
<tr>
<td>1589</td>
<td>Manufacture of other food products n.e.c.</td>
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<td>2.76</td>
</tr>
<tr>
<td>1590</td>
<td>Production of ethyl alcohol, cider, malt and other non-distilled fermented beverages</td>
<td>18</td>
<td>2.90</td>
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<tr>
<td>1591</td>
<td>Manufacture of distilled potable alcoholic beverages</td>
<td>67</td>
<td>4.78</td>
</tr>
<tr>
<td>1593</td>
<td>Manufacture of wine</td>
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<td>3.44</td>
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<tr>
<td>1596</td>
<td>Manufacture of beer</td>
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<td>0.86</td>
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<tr>
<td>1598</td>
<td>Production of mineral water and soft drinks</td>
<td>11</td>
<td>1.45</td>
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</tbody>
</table>
Quality estimation (2)

Khandelwal, Schott and Wei (2013)

‘conditional on price, a variety with a higher quantity is assigned higher quality’

- Quality of product $h$, exported by country $c$, is estimated using the following CES demand function:

$$\ln q_{cht} + \sigma \ln p_{cht} = \alpha_h + \alpha_{ct} + e_{cht}$$

$$\text{quality} = \hat{\phi}_{cht} \equiv \hat{e}_{cht} / (\sigma - 1)$$

- Estimation method: OLS
- The demand function is estimated \textit{separately} for each \textbf{World} importer country – NACE 4-digit
Outline

- Motivations
- Data
- Quality estimations
- *Empirical strategy*
- Results
- Conclusions and implications
Empirical strategy

1. Testing the reliability of our quality measure
   - Quality rankings in representative food sectors
   - Correlation Quality vs. TFP growth

2. Comparing quality vs. price (unit value) evolution
   - Correlation Quality vs. Price growth in countries with different level of development and in representative food sectors

3. Testing the relationship between price, quality and trade costs (i.e. distance and ad valorem tariffs)
   - By decomposing export FOB price in its quality and price-adjusted-quality components
Outline

- Motivations
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- Empirical strategy
- **Results**
- Conclusions
Results

Quality ranking on “quality white wine” (CN8 code 22042111)

![Graph showing quality ranking on "quality white wine" (CN8 code 22042111).](chart.png)
Main Results

Quality and TFP growth (2000-2007)
Main Results

Change in Quality vs Price OECD and non-OECD Countries (1995-2007)
Main Results

Change in Quality vs Price – Wine Sector (1995-2007)
## Main Results

### Price, quality and trade costs

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>(In) Price</td>
<td>(In) Quality</td>
<td>Price Adj. Quality</td>
</tr>
<tr>
<td>(In) Tariff</td>
<td>-0.00297***</td>
<td>-0.00317***</td>
<td>0.000196</td>
</tr>
<tr>
<td></td>
<td>(0.000752)</td>
<td>(0.000729)</td>
<td>(0.000878)</td>
</tr>
<tr>
<td>(In) Distance</td>
<td>0.0692***</td>
<td>-0.00943***</td>
<td>0.0786***</td>
</tr>
<tr>
<td></td>
<td>(0.000718)</td>
<td>(0.000676)</td>
<td>(0.000811)</td>
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<td>YES</td>
<td>YES</td>
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<td>Importer FE</td>
<td>YES</td>
<td>YES</td>
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<tr>
<td>Product FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
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<tr>
<td>Year FE</td>
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<td>N</td>
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</tbody>
</table>

Significance levels: * 0.10 ** 0.05 *** 0.01.
Outline

- Motivations
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Conclusions

- Our analysis finds evidence for the reliability of the Khandelwal (2010) approach
  - The quality rankings we draw for some representative food products are in line with the quality perceived by the public
  - Positive correlation between Quality growth and TFP growth
- Quality upgrading is often poorly correlated with price variation
  - An increase in quality does not always correspond to a growth in prices, especially for developing and emerging countries
- Pure price and quality components of FOB prices explain different trade costs
- The use of price as proxy for quality may lead to a misinterpretation of the results
THANK YOU
Results

Quality ranking on “beer” (CN8 code 22030001)
Results

Quality ranking on “fresh bovine meat” (CN-8 code 02011000)