Trade in quality and income distribution: an analysis of the enlarged EU market

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Very preliminary results - please do not quote without authorization
Determinants of trade: supply vs. demand

- Classical models of inter-industrial trade: emphasis on supply-side determinants of trade (Ricardo, HOS)
- New models of intra-industrial trade: introduction of demand-side determinants through consumers’ love for variety (Krugman, 1980), possibly with the addition of supply-side determinants (Melitz, 2003)
- Further refinement of intra-industrial trade: horizontal vs. vertical differentiation (Hummels and Klenow, 2005; Fontagné, Gaulier and Zignago, 2008)
- Determinants of intra-industrial vertical patterns of trade between countries:
  - Supply-side explanation of the quality content of exports: exporter production techniques and exporter relative factor endowment (Flam and Helpman, 1987; Schott, 2004; Verhoogen, 2008; Khandelwal, 2010)
  - Demand-side explanation of the quality content of imports: importer income and income distribution (Hallak, 2006; Choi et al., 2009)
Income distribution and vertical comparative advantage

- Fajgelbaum, Grossman and Helpman (2011): trade model with non-homothetic preferences and monopolistic competition leading to vertical intra-industrial trade
  - Main result: the quality mix of production and exports of a given country is solely driven by income distribution
  - Unambiguous role of income: for a given level of inequalities, richer countries will export a larger number of varieties of the high-quality good
  - Ambiguous role of inequalities: inequalities might push up or down the aggregate demand for high-quality goods

- In the same vein, our paper focuses on demand-side determinants of vertical comparative advantage

- Theoretical and empirical contributions
  - Theory: ambiguous role of inequalities explained by pointing at a heterogeneous impact of inequalities along the income level
  - Empirics: test of theoretical predictions by investigating the impact of income and income distribution on unit values of exporters within the enlarged EU
Content and results

- **Theoretical framework:**
  - As Fajgelbaum et al. (2011), trade model with non-homothetic preferences and monopolistic competition...
  - ...but Stone-Geary utility rather than nested logit demand functions, allowing for clear predictions concerning the impact of average income and inequalities
  - Main result: inequalities have a positive impact on the quality content of production and exports for high enough levels of income

- **Empirical exercise:**
  - As predicted by the model, for a given HS6 product, unit values of EU25 exporters positively related to the interaction of average income and interquintile ratio (or Gini index)
  - Results robust to the inclusion of controls for supply-based determinants of vertical comparative advantage
Consumers (1): Income heterogeneity

- Two-class society with rich (R) and poor (P) consumers, being distinguished by their labor endowment ($l_R$ and $l_P$)
- Fixed number $N$ of consumers, with an overall labor supply of $L$ units of effective labor, paid at an exogenous wage $w = 1$
- Income distribution:
  - Share of poor consumers within the population: $\beta$
  - Ratio of the labor endowment of a poor consumer relative to the average per-capita labor endowment: $d = \frac{l_P}{L/N}$
  - We hence have $l_P = d \frac{L}{N}$ and $l_R = \frac{1-\beta d}{1-\beta} \frac{L}{N}$
Consumers (2): Non-homothetic preferences

- The consumer maximisation problem is of the form:

\[
\max_{c_{iL}, c_{iH}} U_i = c_{iL}^{1-\mu}(c_{iH} + \gamma)^\mu
\]

\[
\text{s.t. } P_L c_{iL} + P_H c_{iH} = l_i
\]

with \(c_{iL}\) and \(c_{iH}\) being the consumption level (in real terms) of two bundles of respectively low and high quality varieties of a given good:

\[
c_{ij} = \left[ \sum_{j=0}^{n_j} q_{ij}^{\frac{\sigma-1}{\sigma}} (s) \right]^{\frac{\sigma}{\sigma-1}}
\]

- Optimal consumption level of each quality:

\[
c_{iL} = \frac{(1 - \mu)(l_i + \gamma P_H)}{P_L}, \quad c_{iH} = \frac{\mu l_i - (1 - \mu) \gamma P_H}{P_H}
\]

- Positive demand for high quality above an income threshold \(l^*\):

\[
c_{iH} > 0 \quad \iff \quad l_i > \frac{(1 - \mu) \gamma P_H}{\mu} = l^*
\]
Low and high quality vs. first necessity and luxury goods

- Usual modeling of consumer quality choice: unit consumption of a quality-differentiated good and income inequalities...
  - ...leads to strategic pricing of firms in a situation of natural oligopoly (Shaked and Sutton, 1983)
- Our specification rather used in structural change models (Murata, 2002) depicting first-necessity vs. luxury goods consumption patterns...
  - ...but is compatible with both vertical and horizontal differentiation and monopolistic competition
- Interpretative issues:
  - Absence of objective utility increment for the consumption of the high quality bundle (low quality varieties consumed at any income level)
  - However, the consumption share of the high-quality good increases along income:
    \[
    \frac{c_{iL}}{l_i} = (1 - \mu) \left( \frac{1}{P_L} + \frac{\gamma P_H}{l_i P_L} \right), \quad \frac{c_{iH}}{l_i} = \frac{\mu}{P_H} - (1 - \mu) \frac{\gamma}{l_i}
    \]
  - At the macro level, those results are reminiscent of those obtained with a logistic function with idiosyncratic shocks
  - At the micro level, simultaneous individual consumption of low and high quality varieties in line with some categories of goods
**General equilibrium equations**

- Fixed and constant marginal labor production costs for each quality
- Standard resolution of the model through free entry and market-clearing conditions:
  
  \[ Q_H = n_H \left( \frac{f_H(\sigma - 1)}{a_H} \right) = n_H^{\frac{\sigma}{\sigma - 1}} C_H \]  
  
  \[ Q_L = n_L \left( \frac{f_L(\sigma - 1)}{a_L} \right) = n_L^{\frac{\sigma}{\sigma - 1}} C_L \]  

- Three possible parametric cases:
  - Case 1 - nobody consumes the high quality bundle \( (l_R < l^* \text{ and } l_P < l^*) \)
  - Case 2 - only the rich consume the high quality bundle \( (l_R > l^* \text{ and } l_P < l^*) \)
  - Case 3 - both rich and poor consume the high quality bundle \( (l_R < l^* \text{ and } l_P > l^*) \)
Equilibrium definition and comparative statics

- **Within** each possible case, we have the following results:
  - There exists a unique positive solution to the system (1)-(2), defining the number of active firms in the high- and low-quality segments of the markets, $n_H$ and $n_L$
  - In case 2, we have the following comparative statics for $n_H$: $\frac{\partial n_H}{\partial d} < 0, \frac{\partial n_H}{\partial L} > 0$
  - In case 3, we have the following comparative statics for $n_H$: $\frac{\partial n_H}{\partial L} > 0$

- The relationship between quality content of production and income distribution hence depends on **which case** corresponds to the equilibrium, given this said income distribution

- We carry out simulations for various parametric values to determine the equilibrium subcase for a given level of inequalities and average income
  - For high enough values of $\gamma$ and low enough values of $\mu$, Case 3 disappears
  - Higher income increases the probability to be in Case 2 rather than in Case 1
  - Higher inequality levels have a much smaller impact on this probability (much lower marginal impact and explanatory power)
  - ... unambiguous positive impact of average income on the quality content of production
  - ... positive impact of inequalities on the quality content of production for rich economies only!
We model two countries D and F, identical in all characteristics except for their level of inequalities \(d_D\) and \(d_F\) and average income \(\frac{L_D}{N}\) and \(\frac{L_F}{N}\).

Iceberg trade costs: a firm needs to ship \(\tau_j\) (\(\tau_j \geq 1\)) units of a good belonging to the quality category \(j\) to sell 1 unit on the foreign market.

- We assume that the low-quality is freely traded \((\tau_L = 1)\), which equalizes wages across countries.
- Trade in high qualities is costly \((\tau_H > 1)\).

It is then possible to demonstrate that each country partly or fully specializes in the quality for which it has a demand-based comparative advantage, depending on the value of the trade costs \(\tau_H\) (Fajgelbaum et al, 2011).

This is the vertical equivalent of the “home-market effect” in horizontal intra-industrial trade models (Krugman, 1980).
Data

- BACI database for years 2005-2007 recording bilateral trade flows at the HS-6 product level (around 5000 product lines), in value and in volume.

- Assumption: the higher the unit value, the higher the quality mix of products nested into the HS-6 considered product category.

- Limitation of unit value: it might capture other determinants than quality, like production costs or strategic pricing-to-market.
  - Alternative quality indices proposed by Khandelwal (2010), Hallak and Schott (2011), Martin and Méjean (2011)...
  - ... however, much more data demanding, hence we rather add specific controls for other possible determinants.

- Country-level information on income, inequalities (inter-quintile ratio and Gini index), wages, qualification and population in Eurostat databases.
Empirical investigation

Estimated equation

- Baseline regression:

\[ \bar{u}v_{xpt} = \alpha gdpc_{xt} + \beta ineq_{xt} + \gamma bal_{xpt} + \mu pt + \epsilon_{xpt} \quad (3) \]

- Dependent variable: for a given exporter \( x/ \)product \( p \) at time \( t \), weighted average unit value of its exports to other EU-25 members

- Explanatory variables:
  - GDP per capita and interquile ratio for average income and level of inequalities
  - Balassa index of revealed comparative advantage (in volume): prices in comparative advantage industries potentially lower due to tougher firm selection (Bernard, Redding and Schott, 2007)
  - Share of educated workers, wages, size of the population: additional controls for potential supply side determinants of vertical comparative advantage
  - Product/year fixed effect: estimation of results exploiting cross-country differences in repeated cross-sections
  - All regressions clustered at the exporter/year level
### Empirical investigation

#### Export prices and exporter characteristics

<table>
<thead>
<tr>
<th>Model:</th>
<th>Dependent Variable: $u_{xpt}$</th>
<th>All manuf. products</th>
<th>Highly diff. manuf. products</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Ln GDP per cap.</td>
<td></td>
<td>0.190&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.189&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Ln Interquintile ratio</td>
<td></td>
<td>0.190&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.189&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Ln Balassa ind. vol.</td>
<td></td>
<td>0.190&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.189&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Ln GDP per cap. × Ln Interquintile ratio</td>
<td></td>
<td>0.190&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.189&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Ln&lt;sup&gt;2&lt;/sup&gt; GDP per cap.</td>
<td></td>
<td>0.190&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.189&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>N</td>
<td>237477</td>
<td>237477</td>
<td>237477</td>
</tr>
<tr>
<td>R&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.139</td>
<td>0.142</td>
<td>0.143</td>
</tr>
</tbody>
</table>

Note: Standard errors in parentheses<sup>a</sup>, <sup>b</sup> and <sup>c</sup> respectively denoting significance at the 1%, 5% and 10% levels. HS6 product-year fixed effects in all regressions. Standard errors are clustered at the importing country-year level.
## Empirical investigation

### Export prices and exporter characteristics: additional controls

<table>
<thead>
<tr>
<th>Model</th>
<th>Dependent Variable: $\bar{uv}_{xpt}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Ln GDP per cap.</td>
<td>-0.009</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
</tr>
<tr>
<td>Ln Interquintile ratio</td>
<td>-1.473&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>(0.095)</td>
</tr>
<tr>
<td>Ln GDP per cap. × Ln Interquintile ratio</td>
<td>0.151&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
</tr>
<tr>
<td>Ln Balassa ind. vol.</td>
<td>-0.114&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
</tr>
<tr>
<td>LnShare. pop. tert. educ.</td>
<td>-0.105&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
</tr>
<tr>
<td>LnIndividual wage</td>
<td>0.147&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
</tr>
<tr>
<td>Ln Population</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Ln Gini index</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Ln GDP per cap. × Ln Gini index</td>
<td></td>
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<tr>
<td>$R^2$</td>
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Export prices and exporter characteristics: high- vs. low-countries

<table>
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<tr>
<th>Model:</th>
<th>Dependent Variable: ( \bar{u}v_{xpt} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High income (1)</td>
</tr>
<tr>
<td>Ln GDP per cap.</td>
<td>-0.045</td>
</tr>
<tr>
<td></td>
<td>(0.058)</td>
</tr>
<tr>
<td>Ln Interquintile ratio</td>
<td>0.144(^a)</td>
</tr>
<tr>
<td></td>
<td>(0.051)</td>
</tr>
<tr>
<td>Ln Balassa ind. vol.</td>
<td>-0.104(^a)</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
</tr>
<tr>
<td>N</td>
<td>123982</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.108</td>
</tr>
</tbody>
</table>

Note: Standard errors in parentheses \(^a\), \(^b\) and \(^c\) respectively denoting significance at the 1\%, 5\% and 10\% levels. HS6 product-year fixed effects in all regressions. Standard errors are clustered at the importing country-year level.
## Bilateral approach

<table>
<thead>
<tr>
<th>Model:</th>
<th>Dependent Variable: $\tilde{y}_{x \cdot m \cdot p \cdot t}$</th>
<th>All manuf. products</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Ln GDP per cap.</td>
<td></td>
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<td>(2)</td>
</tr>
<tr>
<td>Ln Interquintile ratio</td>
<td></td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Ln Interquintile ratio $\times$ LnGDP per cap.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LnDistance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln Balassa ind. vol.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>2421833</td>
<td>2421833</td>
<td>1039186</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.052</td>
<td>0.053</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Note: Standard errors in parentheses $^a$, $^b$ and $^c$ respectively denoting significance at the 1%, 5% and 10% levels. HS6 product-importing country fixed effects in all regressions. Standard errors are clustered at the exporting country level.
Conclusion

- **Theoretical framework:**
  - As Fajgelbaum et al. (2011), trade model with non-homothetic preferences and monopolistic competition...
  - ...but CES-type rather than nested logit demand functions, allowing for clear predictions concerning the impact of average income and inequalities
  - Main result: inequalities have a positive impact on the quality content of production and exports for high enough levels of income

- **Empirical exercise:**
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