Income distribution and vertical comparative advantage
Theory and evidence

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September 25th, 2012
Climbing up the quality ladder

- Climbing up the quality ladder = Important objective for many developed and developing countries

- The position of a country’s production and exports on the quality ladder is an important issue
  - Hausmann et al (2007): countries exporting more sophisticated products grow faster
  - Aghion et al (2002): climbing up the quality ladder is a way to escape competition
  - High quality varieties, greater source of technological spillovers and less likely to delocate?

- So far, in the literature, main emphasis on **supply-side determinants** of vertical patterns of trade
  - quality content of exports explained by exporter production techniques and exporter relative factor endowment (Flam and Helpman, 1987; Schott, 2004; Verhoogen, 2008; Fieler, 2011a, 2011b)
Evidence of quality-upgrading of Chinese and Eastern European exports (Pula and Santabarbara, 2011; Cheptea et al., 2010; Porter and Ketels, 2007 etc.), along the emergence of new middle classes

⇒ Causal impact of income distribution on the vertical comparative advantage of countries?

**Home-market effect**: production follows demand (Krugman, 1991; Davis and Weinstein, 2003; Hanson and Xiang, 2005)

- Both theoretical results and empirical evidence obtained in a horizontal, intra-industrial framework

Our paper focuses on the demand-side determinants of vertical comparative advantage: vertical home market effect
Literature review

- Literature already tackled the demand-driven determinants of the quality content of imports (Hallak, 2006; Choi et al, 2009; Bekkers et al, 2012)

- Only one paper tackled the demand-driven determinants of the quality content of exports
  - Fajgelbaum, Grossman and Helpman, 2011: income distribution and the corresponding patterns of aggregate demand translate into patterns of vertical specialization and trade (Linder hypothesis, home markets effect)
  - Positive impact of avg income, positive impact of ineq. in “poor” economies only
  - However, theoretical model of unit consumption precluding any adjustment of the quality content of consumption along the intensive margin (extensive margin only)

- In this paper, adjustment of the quality content of individual consumption in a framework where consumers buy both high and low quality varieties
  - “joint-purchase” feature relevant for many categories of goods (Gabszewicz and Wauthy, 2009)
  - adjustment of the quality content of aggregate demand through the “intensive” margin, and not only the “extensive” margin
  - very general and tractable framework, suitable for various empirical exercises on both individual and aggregate data
Main results of our paper

Main theoretical contributions:
- Confirmation of results obtained by Fajgelbaum et al. (2011), in a model featuring love for variety for both high and low quality varieties
  \[ \Rightarrow \] Demonstration, in a vertical framework, of the equivalence between heterogeneous consumers models and love for variety models, highlighted in a horizontal framework by Anderson et al. (1992)
- Heterogeneous impact of inequalities on the quality mix of exports along the average income dimension

Empirical contribution:
- Empirical tests on trade flows within enlarged EU (integrated market, important disparities in terms of average income and inequality levels)
- For a given HS6 product, unit values of exporters positively related to:
  - average income
  - the interaction of average income and inequalities
- Results robust to instrumentation and inclusion of controls for supply-based determinants of vertical comparative advantage
- Quantitative assessment of the effects: potentially non negligible impact of inequalities, magnified when coupled with an increase in average income
  \[ \Rightarrow \] Critical role of middle classes in quality upgrading of exports?
Modeling non homothetic preferences

- For the distribution of income to influence the demand structure, we need non-homothetic preferences, i.e. variations in the consumption bundle along income

- Ignoring strategic pricing:
  1. Models of discrete qualitative adjustment: either fixed unit consumption and increasing number of high quality consumers (Flam and Helpman, 1987; Fajgelbaum et al., 2011), or both increasing number and quality level of goods consumed (Foellmi et al., 2010; Fieler, 2011)
  2. Models of quantitative adjustment, using VES individual utility functions with a variable elasticity of substitution across vertically differentiated varieties along the consumption level (in a horizontal framework, Zhelobodko et al., 2012; Dhingra and Morrow, 2012; in a vertical framework, Hallak, 2006; Bekkers et al., 2011)

- We build along this second line of models
Non-homothetic preferences - main properties

- Assumption: Consumption of two qualities H and L of the same good

- Utility function \( U(C_H, C_L) \) with a variable elasticity of marginal utility along the consumption level: \( \frac{C_H U''(C_H)}{U'(C_H)} = f(C_H) \) with \( \frac{\partial f}{\partial C_H} > 0 \) ...

...which yields a variable marginal propensity to consume along the income level:
\[
\frac{\partial P_H C_H}{\partial y} = g(y) \text{ with:}
\]
- \( g(y) > 0 \) for all income levels: marginal utility of high quality increases with income
- \( \frac{\partial g}{\partial y} > 0 \) up to a certain income level: convexity of the Engel curve up to a certain income level, i.e. existence of at least one inflection point before the Engel curve converges to the first bisector
Non-homothetic preferences - Engel curves and expenditure shares
Consumers: income heterogeneity

- Fixed number $N$ of consumers, with an overall labor supply of $L$ units of effective labor paid at an exogenous wage $w = 1$
- Two-class society with rich (R) and poor (P) consumers, being distinguished by their labor endowment ($l_R$ and $l_P$)
- 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: preference structure

- Cobb-Douglas utility function:

\[ U_i = (U_i[C_{iH}, C_{iL}])^\theta A^{1-\theta} \]

with A being the consumed quantity of the homogeneous good, and \( U_i \) a two-tier function of two bundles of the vertically differentiated good.

- In order to focus on the quantitative adjustment between the two bundles \( C_{iH} \) and \( C_{iL} \), we fix the allocation rule between the horizontally differentiated varieties of a given quality segment by imposing CES bundles:

\[ C_{ij} = \left[ \int_0^{n_j} c_{ij}^{\frac{\sigma-1}{\sigma}} (k) dk \right]^{\frac{\sigma}{\sigma-1}} \]

with

\[ c_{ij}(k) = \left( \frac{p_j(k)}{P_j} \right)^{-\sigma} C_{ij} \]
Properties of the consumption bundle

- Allocation of $\theta l_i$ between $C_{iH}$ and $C_{iL}$ following optimization of $U_i$ under budget constraint

$$A + P_H C_{iH} + P_L C_{iL} = l_i$$

- Strict non-homotheticity of $U_i$, so that, denoting $s_j(l_i) = \frac{P_j C_{ij}}{\theta l_i}$ the average propensity to consume quality $j$, we have the following three properties

1. **The average propensity to consume varieties of high- (resp. low-) quality increases (resp. decreases) along income:** \( \frac{\partial s_H(l_i)}{\partial l_i} > 0, \frac{\partial s_L(l_i)}{\partial l_i} < 0. \)

2. **The marginal propensity to consume varieties of high- (resp. low-) quality increases (resp. decreases) along the income level:** \( \frac{\partial^2 P_H C_{iH}}{\partial l_i^2} > 0, \frac{\partial^2 P_L C_{iL}}{\partial l_i^2} < 0. \)

3. **The average propensity to consume varieties of high- (resp. low-) quality is convex (resp. concave) along the income level:** \( \frac{\partial^2 s_H(l_i)}{\partial l_i^2} > 0, \frac{\partial^2 s_L(l_i)}{\partial l_i^2} < 0. \)
Equilibrium equations

- Otherwise classic monopolistic competition model
- Constant fixed and marginal labor production costs for each quality
- Free entry and market-clearing conditions:

\[ \pi_L = a_L \left( \frac{\sigma_L}{\sigma_L - 1} - 1 \right) n_L^{\frac{\sigma_L}{1-\sigma_L}} D_L - f_L \leq 0, \quad n_L \pi_L(n_H, n_L) = 0 \]

\[ \pi_H = a_H \left( \frac{\sigma_H}{\sigma_H - 1} - 1 \right) n_H^{\frac{\sigma_H}{1-\sigma_H}} D_H - f_H \leq 0, \quad n_H \pi_H(n_H, n_L) = 0 \]

- The two equilibrium equations boil down to:

\[ \frac{f_L \sigma n_L}{\theta} = \beta d_L s_L(l_P) + (1 - \beta d) L s_L(l_R) \]

\[ \frac{f_H \sigma n_H}{\theta} = \beta d_L s_H(l_P) + (1 - \beta d) L s_H(l_R) \]

- For given income distribution parameters and under strict non-homotheticity of \( U_i \), unique positive solution \( (n_L, n_H) \) to the system
Comparative statics (1)

- Due to resource constraint, for fixed $L$, any increase in $n_H$ must be compensated by a decrease in $n_L$

- Number of firms active on each quality segment positively related to the size of aggregate demand for each segment

- Unambiguous positive impact of average income on quality content of production
  - $\frac{\partial n_H}{\partial N} < 0$: for a given $L$ and $d$, number of high quality firms increases with average income
  - $\frac{\partial n_L}{\partial N} > 0$: for a given $L$ and $d$, number of low quality varieties decreases with average income

$\Rightarrow$ Quality content of production increases with average income
Comparative statics (2)

When both rich and poor are on the convex part of the Engel curve, heterogenous impact of inequalities

- \( \frac{\partial n_H}{\partial d} < 0 \): for a given \( \frac{L}{N} \), number of high quality firms increases with inequalities

- \( \frac{\partial^2 n_H}{\partial d \partial N} < 0 \): number of high quality firms increases with inequalities more and more rapidly along income

- The opposite is true for the number of low quality varieties

\( \Rightarrow \) Heterogeneous positive impact of inequalities on the quality content of production along income
Graphical intuition

(1) Low income per capita level

(2) High income per capita level

\[ y'_P \quad y_P = y_R \quad y'_R \]

\[ y'_P \quad y_P = y_R \quad y'_R \]

\[ \rightarrow \rightarrow \text{: total consumption of high quality goods when strong inequalities} \]

\[ \leftarrow \rightarrow \text{: total consumption of high quality goods when no inequalities} \]
The model in open economy (1)

- 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 ($N_D$ and $N_F$).

- Iceberg trade costs: a firm needs to ship $\tau_k$ ($\tau_k \geq 1$) units of a good belonging to the quality category $k$ to sell 1 unit on the foreign market.
  - We assume that the homogenous good is freely traded ($\tau_A = 1$), which equalizes wages across countries.
  - $\tau_H = \tau_L = \tau > 1$

- We define the number of "effective competitors" of quality $k$ present on the domestic market $r$ as $\tilde{n}_r^r = n_r^r + \tau^{1-\sigma} n_s^r$
  - number of foreign competitors $n_s^r$ discounted by a factor $\tau^{1-\sigma}$, expressing the fact that those foreign producers are less competitive on the local market.
The model in open economy (2)

- Equilibrium defined by two independent systems of two equations, each one jointly determining $\tilde{n}^r_H$ and $\tilde{n}^r_L$, $r = D, F$:
  \[
  \pi^D_k \leq 0, \quad \tilde{n}^D_k \pi^D_k = 0, \quad j = H, L \\
  \pi^F_k \leq 0, \quad \tilde{n}^F_k \pi^F_k = 0, \quad j = H, L
  \]

  ...each system is exactly similar to the equilibrium conditions that defined the distribution of firms across qualities in a closed economy, except that $n_j$ has been replaced by $\tilde{n}^r_j$.

- We have $n^r_k = \frac{\tilde{n}^r_k - \tau^{1-\sigma} \tilde{n}^s_k}{1 - \tau^{1-\sigma}}$, positive provided $\tau^{1-\sigma} < \frac{\tilde{n}^r_k}{\tilde{n}^s_k} < \frac{1}{\tau^{1-\sigma}}$.

- We restrict ourselves to parametric cases where both countries produce at least one of the two qualities (trade with partial or total specialization):
  - for highly asymmetric countries and low enough trade costs, both qualities are entirely produced and exported by the big country
  - this parametric case is however not captured by our empirical strategy (comparison across EU25 countries of the weighted average unit value of their exports to other EU25 members for a given product)
Predictions on $\tilde{n}_k^r$ translate into predictions on $n_k^r$.

Trade costs and fixed production costs: at equilibrium, firms will tend to follow demand.

Predictions concerning variations of $\tilde{n}_j^r$ along $N_r$ and $d_r$ similar to the ones obtained in closed economy for $n_j$.

“Vertical home market effect”: a domestic demand tilted towards high-quality goods translates into a higher quality content of a country’s exports.

Main prediction: the impact of inequalities on the quality content of exports is all the more positive that average income is high, provided that rich and poor are both on the convex part of the Engel curve of $P_H C_H$. 
Unit value at the product-exporter level can be written as:

$$q^e = \frac{n_H d_H p_H + n_L d_L p_L}{n_L d_L + n_H d_H}$$

In our framework, we have:

$$q^e = \frac{\theta L}{\theta L f_L (\sigma - 1) + n_H f_H (\sigma - 1) \left( \frac{a_L - a_H f_L \sigma}{a_H a_L} \right)}$$

If $a_H > \frac{a_L}{f_L \sigma}$, then $\frac{\partial q^e}{\partial n_H} > 0$

$q^e$ being a convex function of $n_H$, non-linear relationship along income between inequality and $n_H$ also holds for unit values.
Empirical investigation

Data

- Empirical part focused on bilateral trade flows between EU25 countries because
  - highly integrated market, which limits interference between trade policy and quality content of production (Zhou et al., 2002)...
  - ...displaying huge heterogeneity across countries in terms of average income and inequalities...
  - ...and with reliable information on country-level characteristics and trade flows

- 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
  - We use the data to compute for each bilateral trade flow between EU25 members unit value of the flow
  - **Assumption: the higher the unit value, the higher the quality mix of products nested into the HS-6 considered product category**

- Country-level information on income, inequalities (Gini index and interquintile ratio), wages, population and skills in Eurostat databases
Quality measure

- Limitation of unit value as a proxy for quality: it might capture other determinants of prices, like production costs or strategic pricing-to-market

- Alternative quality indices have been recently proposed, combining information on prices and quantities
  - Hallak and Schott (2011): for a given price, countries with lower trade deficits produce a higher quality. However, index based on a model with homothetic preferences
  - Khandelwal (2010): for a given price, countries that sell more produce a higher quality. However, index that is hardly comparable across importers

- In this paper, we rely on unit values (as in Schott, 2004; Choi et al., 2009; Fieler, 2011b; Bekkers et al., 2012)
  - Results robust to inclusion of controls for skills of the workforce and labor costs
Our theoretical model yielded two main empirical predictions:

1. Within a given product category, richer countries specialize in high quality varieties, and thus exhibit higher unit values of exports than their partners.

2. Within a given product category, within-country inequalities have a heterogeneous impact on vertical specialization. Inequalities increase specialization in high-quality varieties more strongly for richer countries.

To test directly prediction (2), we implement the following regression:

$$ uv_{xpt} = \alpha_{avg\_inc_{xt}} + \beta_{ineq_{xt}} + \eta_{avg\_inc_{xt}} \times ineq_{xt} + \gamma_{bal_{xpt}} + \mu_{pt} + \epsilon_{xpt} $$
Dependent variable: for a given exporter $x$/product $p$ at time $t$, unit value of its exports to importer $m$

Explanatory variables:
- $\text{avg}\_\text{inc}_{xt}$: average PPP income of country $x$
- $\text{ineq}_{xt}$: Gini index for country $x$
- $\text{bal}_{xpt}$: Balassa index of revealed comparative advantage (in volume), since prices in comparative advantage industries are potentially lower due to tougher firm selection (Bernard, Redding and Schott, 2007)

Estimation of results exploiting cross-country differences in repeated cross-sections: importer/product/year fixed effect $\mu_{mpt}$

All regressions clustered at the exporter/year level (Moulton, 1990)
Demand based determinants - Endogeneity

- Interpretation of our results as demand-based determinants of vertical comparative advantage

- Strictly speaking, average income and inequalities can capture both demand and supply based determinants. However:
  - Skills, but also skills dispersion might confer countries specific comparative advantages (Grossman and Maggi, 2000; Bombardini et al., 2011)
  - Results robust to inclusion of population skills and skills diversity
  - Heterogeneous impact of inequalities that cannot be accounted for by these supply-based explanations

- Inequalities might reflect specialization in terms of quality and not the opposite (Verhoogen, 2008; Costinot and Vogel, 2010)
  - Reverse causality probably reduced here
    - focus on income inequality and not wage inequality
    - cross-sectional analysis: long-run effects, so that skills supply should have adapted to movements in relative wages
  - However, reverse causality tackled thanks to instrumentation strategy
Instrumentation strategy

- Average income and inequalities both assumed as potentially endogeneous
- Two sets of variables potentially correlated with current income and inequalities without being directly correlated with current quality content of exports
  - *Average income*: GDP per capita in 1992 and geographic centrality of the country, as measured by the distance to Germany
  - *Inequalities*: Value of the Gini index in the 1990’s and number of years with left-wing governments from 1991 to 2000
- Rationale for the choice of instruments
  - Persistency in income and inequalities, that can explain current income distribution, beyond important changes that European countries might have experienced in the income distribution and supply conditions over the past 20 years (especially Eastern European countries)
  - Geographic centrality, which determines income in a standard home market effect framework, without directly effecting technology or quality choices (Head and Mayer, 2006; Hering and Poncet, 2010; Head and Mayer, 2011)
  - Number of years with left-wing government, which might have impacted redistribution policies and thus inequalities, but not directly technology or quality choices
Table: Average income and inequalities in the enlarged EU in 2005 - PPP

<table>
<thead>
<tr>
<th></th>
<th>Poor countries</th>
<th>Rich countries</th>
<th>All countries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Sd</td>
<td>Mean</td>
</tr>
<tr>
<td>Average income</td>
<td>9900</td>
<td>3376</td>
<td>18970</td>
</tr>
<tr>
<td>1st quintile Average income</td>
<td>4084</td>
<td>1593</td>
<td>8311</td>
</tr>
<tr>
<td>5th quintile Average income</td>
<td>19005</td>
<td>6489</td>
<td>35233</td>
</tr>
<tr>
<td>Interquintile ratio</td>
<td>4.88</td>
<td>1.23</td>
<td>4.28</td>
</tr>
</tbody>
</table>

- Distinction between “rich” and “poor” countries: PPP average income higher or lower than 16000 euros over the period
  - “Rich” countries: Italy, Sweden, Finland, France, Denmark, Germany, Belgium-Luxembourg, Netherlands, Cyprus, Ireland, Austria and UK
  - “Poor” countries: Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Slovakia, Slovenia, Spain
Descriptive statistics (2)

Poor countries

Rich countries

All countries
## First stage regressions

<table>
<thead>
<tr>
<th></th>
<th>Ln Average PPP income</th>
<th>Gini</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln GDP per cap. 1992</td>
<td>0.760&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.034)</td>
<td></td>
</tr>
<tr>
<td>Geographic centrality</td>
<td>0.312&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.014)</td>
<td></td>
</tr>
<tr>
<td>Gini 1990’s</td>
<td>0.705&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.014)</td>
<td></td>
</tr>
<tr>
<td># years with left-wing gvt 1991-2000</td>
<td>-0.171&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.036)</td>
<td></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. Standard errors are clustered by year. Geographic centrality is the inverse of distance to Germany.
### Empirical investigation

**Bilateral export prices and exporter characteristics**

<table>
<thead>
<tr>
<th>Model:</th>
<th>Dependent Variable: Ln $uv_{xmnt}$</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>OLS</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Ln Avg PPP Income$_{xt}$</td>
<td>0.242$^a$</td>
</tr>
<tr>
<td></td>
<td>(0.0204)</td>
</tr>
<tr>
<td>Gini$_{xt}$</td>
<td>-0.00163</td>
</tr>
<tr>
<td></td>
<td>(0.00172)</td>
</tr>
<tr>
<td>Ln Balassa ind. vol.$_{xpt}$</td>
<td>-0.0790$^a$</td>
</tr>
<tr>
<td></td>
<td>(0.00289)</td>
</tr>
<tr>
<td>Ln Pop$_{xt}$</td>
<td>-0.0132$^c$</td>
</tr>
<tr>
<td></td>
<td>(0.00737)</td>
</tr>
<tr>
<td>Ln Distance$_{xmt}$</td>
<td>0.126$^a$</td>
</tr>
<tr>
<td></td>
<td>(0.00754)</td>
</tr>
<tr>
<td>Ln Avg PPP Income$<em>{xt} \times$ Gini$</em>{xt}$</td>
<td>0.0130$^a$</td>
</tr>
<tr>
<td></td>
<td>(0.00384)</td>
</tr>
</tbody>
</table>

**Note:** Standard errors in parentheses $^a$, $^b$ and $^c$ respectively denoting significance at the 1%, 5% and 10% levels. Standard errors are clustered at the exporter-year level.
### Additional controls

<table>
<thead>
<tr>
<th>Model:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tbody>
<tr>
<td>Ln Avg PPP Income</td>
<td>-8.711a</td>
<td>-0.359</td>
<td>-0.151</td>
<td>-0.595b</td>
<td>-2.009a</td>
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<tr>
<td></td>
<td>(1.879)</td>
<td>(0.249)</td>
<td>(0.510)</td>
<td>(0.286)</td>
<td>(0.659)</td>
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<tr>
<td>Gini</td>
<td>-0.287a</td>
<td>-0.0458</td>
<td>-0.191c</td>
<td>-0.209a</td>
<td>-0.396b</td>
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<tr>
<td></td>
<td>(0.0886)</td>
<td>(0.267)</td>
<td>(0.110)</td>
<td>(0.0806)</td>
<td>(0.179)</td>
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<td>Ln Avg PPP Income \times Gini</td>
<td>0.0302b</td>
<td>0.0219b</td>
<td>0.0202c</td>
<td>0.0220b</td>
<td>0.0417b</td>
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<tr>
<td></td>
<td>(0.00935)</td>
<td>(0.00853)</td>
<td>(0.0119)</td>
<td>(0.00878)</td>
<td>(0.0189)</td>
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<tr>
<td>Ln Balassa ind. vol.</td>
<td>-0.102a</td>
<td>-0.105a</td>
<td>-0.104a</td>
<td>-0.103a</td>
<td>-0.106a</td>
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<td></td>
<td>(0.00277)</td>
<td>(0.00312)</td>
<td>(0.00282)</td>
<td>(0.00262)</td>
<td>(0.00254)</td>
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<td>Ln Pop</td>
<td>-0.0361a</td>
<td>-0.0472a</td>
<td>-0.0322b</td>
<td>-0.0354a</td>
<td>-0.0303a</td>
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<tr>
<td></td>
<td>(0.00880)</td>
<td>(0.0163)</td>
<td>(0.0127)</td>
<td>(0.00877)</td>
<td>(0.00790)</td>
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<td>Ln Distance</td>
<td>0.156a</td>
<td>0.141a</td>
<td>0.137a</td>
<td>0.137a</td>
<td>0.163a</td>
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<tr>
<td></td>
<td>(0.00832)</td>
<td>(0.00924)</td>
<td>(0.00870)</td>
<td>(0.0106)</td>
<td>(0.00859)</td>
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<tr>
<td>Ln² Avg PPP Income</td>
<td>0.436c</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>(0.0932)</td>
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</tr>
<tr>
<td>Ln Wage</td>
<td>-0.00270</td>
<td></td>
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<td>-0.0835</td>
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</tr>
<tr>
<td></td>
<td>(0.00342)</td>
<td></td>
<td></td>
<td>(0.101)</td>
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<tr>
<td>LnGraduates in math, science &amp; tech. per 1 000 of pop.</td>
<td></td>
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<td>-0.765</td>
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<td>(1.786)</td>
</tr>
<tr>
<td>Ln Avg PPP Income \times Ln Grad. in math, sc. &amp; tech. per 1 000 of pop.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0886</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.188)</td>
</tr>
<tr>
<td>Ln Nb of people with post sec. non tert. educ.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-3.098b</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(1.270)</td>
</tr>
<tr>
<td>Ln Nb of people with tert. educ.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.545c</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(1.495)</td>
</tr>
<tr>
<td>Ln Avg PPP Income \times Ln Nb of people with post sec. non tert. educ.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.345b</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.136)</td>
</tr>
<tr>
<td>Ln Avg PPP Income \times Ln Nb of people with tert. educ.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.259c</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.154)</td>
</tr>
<tr>
<td>Skills diversity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0666</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.0704)</td>
</tr>
</tbody>
</table>

**Note:** Standard errors in parentheses a, b and c respectively denoting significance at the 1%, 5% and 10% levels. Standard errors are clustered at the exporter-year level.
## Alternative samples

<table>
<thead>
<tr>
<th>IV</th>
<th>Final goods</th>
<th>w/o flows &lt;10,000$</th>
<th>w/o CYP and MLT</th>
<th>w/o LVA and POL</th>
<th>w/o DK</th>
<th>GBR and IRL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln Avg PPP Income</td>
<td>-0.394&lt;sup&gt;c&lt;/sup&gt;</td>
<td>-0.429&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-0.509&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.681&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.319</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.222)</td>
<td>(0.207)</td>
<td>(0.179)</td>
<td>(0.251)</td>
<td>(0.256)</td>
<td></td>
</tr>
<tr>
<td>Gini</td>
<td>-0.214&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.243&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.259&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.327&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.189&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-0.0801</td>
</tr>
<tr>
<td></td>
<td>(0.0661)</td>
<td>(0.0630)</td>
<td>(0.0544)</td>
<td>(0.0860)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln Balassa ind. vol.</td>
<td>-0.0782&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.120&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.106&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.103&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.104&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00358)</td>
<td>(0.00326)</td>
<td>(0.00295)</td>
<td>(0.00315)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln Pop</td>
<td>-0.0427&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.0412&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.0366&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.0412&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.0254&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00886)</td>
<td>(0.0111)</td>
<td>(0.00973)</td>
<td>(0.0118)</td>
<td>(0.00985)</td>
<td></td>
</tr>
<tr>
<td>Ln Distance</td>
<td>0.116&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.139&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.134&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.131&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.133&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0121)</td>
<td>(0.00956)</td>
<td>(0.00973)</td>
<td>(0.00973)</td>
<td>(0.0104)</td>
<td></td>
</tr>
<tr>
<td>Ln Avg PPP Income × Gini</td>
<td>0.0229&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.0261&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.0277&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.0347&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.0197&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00721)</td>
<td>(0.00687)</td>
<td>(0.00594)</td>
<td>(0.00910)</td>
<td>(0.00889)</td>
<td></td>
</tr>
</tbody>
</table>

### Notes
- Standard errors in parentheses:<sup>a</sup>,<sup>b</sup>, and<sup>c</sup>respectively denoting significance at the 1%, 5% and 10% levels.
- Standard errors are clustered at the exporter-year level.
Results robust if...

- ... interquintile ratio instead of Gini
- ... income instead of PPP income
- ... average unit value (exporter/product) instead of bilateral unit value
Quantitative assessment

- In the sample
  - average income = 14,435 euros, sd of income = 5,348
  - average Gini = 29.7, sd of interquintile ratio = 4.5

- Three thought experiments
  - One standard deviation of avg income around the mean ⇒ +9.8% in terms of uv
  - One standard deviation of gini around the mean ⇒ +2.6% in terms of uv
  - One standard deviation of both avg income and gini around the mean ⇒ +16.2% in terms of uv

- Matching income distribution in Czech Republic with income distribution in France...
  - ...in terms of avg income ⇒ +11.1% in terms of uv
  - ...in terms of inequalities ⇒ 0.8% in terms of uv
  - ...both in terms of avg income and inequalities ⇒ +13.1% in terms of uv
Conclusion

- Theoretical contribution:
  - Model with non-homothetic preferences and monopolistic competition leading to patterns of trade in quality, predicting...
  - ... a positive impact of average income on the quality mix of exports...
  - ... a heterogeneous impact of inequalities along the average income dimension

- Empirical contribution:
  - As predicted by the model, for a given HS6 product, unit values of EU25 exporters positively related to:
    - average income
    - 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
  - Non negligible impact of inequalities, magnified if coupled with an increase in average income
    \[ \Rightarrow \text{Crucial need to strengthen the middle classes to climb up the quality ladder} \]