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Very preliminary results - please do not quote without authorization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: β
  - 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:

$$\max_{c_{iL},c_{iH}} U_i = c_{iL}^{1-\mu}(c_{iH}+\gamma)^{\mu}$$
$$\text{s.t.} \quad P_L c_{iL} + P_H c_{iH} = I_i$$

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:
$c_{ij} = \left[\sum_0^{n_j} q_{ij}^{\frac{\sigma-1}{\sigma}}(s)\right]^{\frac{\sigma}{\sigma-1}}$

- Optimal consumption level of each quality:

$$c_{iL} = \frac{(1-\mu)(I_i+\gamma P_H)}{P_L}, \qquad c_{iH} = \frac{\mu I_i - (1-\mu)\gamma P_H}{P_H}$$

  - positive demand for high quality above an income threshold I^*:

$$c_{iH} > 0 \quad \Longleftrightarrow \quad I_i > \frac{(1-\mu)\gamma P_H}{\mu} = I^*$$

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:

$$\frac{c_{iL}}{I_i} = (1-\mu)\left(\frac{1}{P_L} + \frac{\gamma P_H}{I_i P_L}\right), \qquad \frac{c_{iH}}{I_i} = \frac{\mu}{P_H} - (1-\mu)\frac{\gamma}{I_i}$$

  - 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:

$$Q_H = n_H \left(\frac{f_H(\sigma - 1)}{a_H} \right) = n_H^{\frac{\sigma}{\sigma-1}} C_H \quad (1)$$

$$Q_L = n_L \left(\frac{f_L(\sigma - 1)}{a_L} \right) = n_L^{\frac{\sigma}{\sigma-1}} C_L \quad (2)$$

- Three possible parametric cases:
  - Case 1 - nobody consumes the high quality bundle ($I_R < I^*$ and $I_P < I^*$)
  - Case 2 - only the rich consume the high quality bundle ($I_R > I^*$ and $I_P < I^*$)

$$C_H = \frac{\mu w(1 - \beta d)L - (1 - \beta)N(1 - \mu)\gamma P_H}{P_H}$$

  - Case 3 - both rich and poor consume the high quality bundle ($I_R < I^*$ and $I_P > I^*$)

$$C_H = \frac{\mu wL - N(1 - \mu)\gamma P_H}{P_H}$$

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 γ and low enough values of μ, 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!

The model in open economy

- 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 τ_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 τ_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

Estimated equation

- Baseline regression:

$$\bar{uv}_{xpt} = \alpha \text{gdpc}_{xt} + \beta \text{ineq}_{xt} + \gamma \text{bal}_{xpt} + \mu_{pt} + \epsilon_{xpt} \quad (3)$$

- 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

Export prices and exporter characteristics

	Dependent Variable: $\bar{uv}_{xpt}$					
	All manuf. products			Highly diff. manuf. products		
Model :	(1)	(2)	(3)	(4)	(5)	(6)
Ln GDP per cap.	0.190^a	-0.189^b	1.229^b	0.214^a	-0.293^a	0.685
	(0.015)	(0.079)	(0.557)	(0.020)	(0.098)	(0.918)
Ln Interquintile ratio	-0.018	-2.410^a	-1.694^a	-0.020	-3.230^a	-2.743^a
	(0.033)	(0.455)	(0.472)	(0.042)	(0.566)	(0.686)
Ln Balassa ind. vol.	-0.109^a	-0.112^a	-0.113^a	-0.140^a	-0.144^a	-0.144^a
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Ln GDP per cap. $\times$ Ln Interquintile ratio		0.247^a	0.173^a		0.331^a	0.280^a
		(0.047)	(0.049)		(0.058)	(0.071)
Ln^2 GDP per cap.			-0.067^b			-0.046
			(0.027)			(0.044)
N	237477	237477	237477	114868	114868	114868
R^2	0.139	0.142	0.143	0.169	0.173	0.173

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.

Export prices and exporter characteristics: additional controls

Model :	Dependent Variable: $\bar{uv}_{xpt}$			
	(1)	(2)	(3)	(4)
Ln GDP per cap.	-0.009	-0.202[a]	-0.192[a]	-1.015[a]
	(0.016)	(0.021)	(0.021)	(0.051)
Ln Interquintile ratio	-1.473[a]	-1.678[a]	-1.707[a]	
	(0.095)	(0.095)	(0.096)	
Ln GDP per cap. × Ln Interquintile ratio	0.151[a]	0.174[a]	0.177[a]	
	(0.010)	(0.010)	(0.010)	
Ln Balassa ind. vol.	-0.114[a]	-0.115[a]	-0.114[a]	-0.112[a]
	(0.001)	(0.001)	(0.001)	(0.001)
LnShare. pop. tert. educ.	-0.105[a]	-0.121[a]	-0.125[a]	
	(0.005)	(0.005)	(0.005)	
LnIndividual wage		0.147[a]	0.138[a]	
		(0.011)	(0.011)	
Ln Population			-0.005[a]	
			(0.001)	
Ln Gini index				-3.50[a]
				(0.147)
Ln GDP per cap. × Ln Gini index				0.356[a]
				(0.015)
N	237477	237477	237477	237477
R^2	0.144	0.145	0.145	0.142

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.

Export prices and exporter characteristics: high- vs. low-countries

	Dependent Variable: $\bar{uv}_{xpt}$			
	High income		Low income	
Model :	(1)	(2)	(3)	(4)
Ln GDP per cap.	-0.045	0.091	0.266^a	0.293^a
	(0.058)	(0.086)	(0.017)	(0.018)
Ln Interquintile ratio	0.144^a	0.222^a	-0.105^a	-0.162^a
	(0.051)	(0.067)	(0.048)	(0.046)
Ln Balassa ind. vol.	-0.104^a	-0.131^a	-0.122^a	-0.155^a
	(0.002)	(0.003)	(0.003)	(0.004)
N	123982	62011	149076	70910
R^2	0.108	0.139	0.154	0.187

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

	Dependent Variable: $\bar{uv}_{xmpt}$			
	All manuf. products		Highly diff. manuf. products	
Model :	(1)	(2)	(3)	(4)
Ln GDP per cap.	0.166^a	-0.130^c	0.190^a	-0.180^b
	(0.016)	(0.070)	(0.020)	(0.088)
Ln Interquintile ratio	-0.077^c	-1.976^a	-0.117^b	-2.506^a
	(0.040)	(0.429)	(0.055)	(0.563)
Ln Interquintile ratio$\times$LnGDP per cap.		0.193^a		0.242^a
		(0.046)		(0.060)
LnDistance	0.125^a	0.124^a	0.143^a	0.142^a
	(0.008)	(0.008)	(0.009)	(0.009)
Ln Balassa ind. vol.	-0.084^a	-0.086^a	-0.102^a	-0.106^a
	(0.003)	(0.003)	(0.003)	(0.003)
N	2421833	2421833	1039186	1039186
R^2	0.052	0.053	0.06	0.061

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:**
  - 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