# Chapter 8

# Vertical differentiation

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## Introduction

- In most trade models, export performances are driven by cost (and price) differences:
  - Comparative advantages
  - Standard oligopolistic models (Brander & Krugman)
  - Models of monopolistic competition and heterogeneous firms (Melitz, 2003)…
- But quality obviously matter also

# Introduction

- Considering vertical differentiation helps:
  - To explain (a part of) observed intra-industry trade

# Quality matters for intra-industry trade assessment

- Greenaway, Hine, Milner (*Ec. Jour.* 1995) ; Fontagné et al. (1995, 2005)
- Simple idea: Split bilateral trade flows into 3 categories
  - Inter-industry / Horizontal intra-industry / Vertical intra-industry
- Simple methodology: For each good and each country pair:
  - If one does not observe a significant overlap of the two trade flows = Inter-industry
  - If one does observe a significant overlap of the two trade flows = Intra-industry
    - If one does not observe a significant difference in prices = Horizontal Intra-industry
    - If one does observe a significant difference in prices = Vertical Intra-industry

# Quality matters f trade ass

- Fontagné et al. 2005

One-way trade

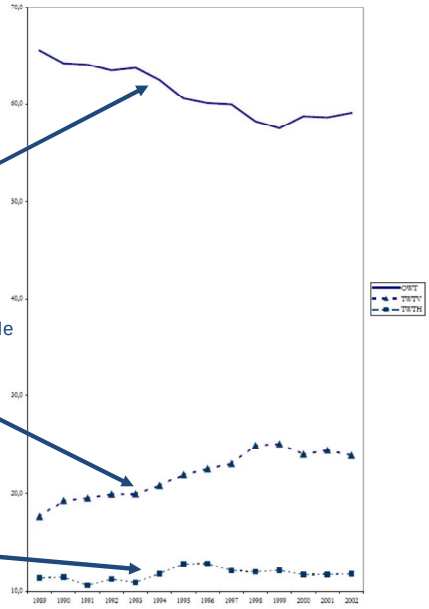
- Horizontal 2-way trade (= pure intra-industry) represents a small share of world trade

Two-way trade Vertical

- Comparative advantage probably still matter a lot… **Within industries**

Two-way trade Horizontal

Figure 7 - Evolution 1989-2002 of the 3 trade types (% of world trade)




# Introduction

- Considering vertical differentiation helps:
  - To explain (a part of) observed intra-industry trade
  - To better estimate trade price elasticities:
    - Higher quality goods have a higher price ⇨ downward bias of trade price elasticity estimates.

# Quality matters for the estimation of price elasticities

- Crozet & Erkel-Rousse (2004)
  - Estimate bilateral import functions for 5 European countries
  - Use proxies for product quality from a survey on "bilateral quality images"

*Table 2. Estimation Results for All Products Together*

| | *Quality image excluded* | | | | *Quality image included* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Estimation method*[a] | *QGLS 1* | *2 SLS* | *QGLS 1* | *QGLS 2* | *QGLS 1* | *QGLS 1* | *OLS* | *2 SLS* | *QGLS 1* | *QGLS 2* |
| Quality image ($e_q$) | — | — | — | — | 0.31 | 0.29 | 0.22 | 0.23 | 0.22 | 0.22 |
| | | | | | (169.98) | (117.12) | (13.52) | (9.05) | (67.30) | (58.30) |
| Price [$-(e_p - 1)$] | 0.22 | 0.06 | 0.06 | 0.06 | −0.19 | −0.17 | −0.15 | −0.16 | −0.14 | −0.15 |
| | (110.16) | (2.69) | (38.66) | (29.03) | (−56.15) | (−44.97) | (−7.64) | (−5.26) | (−40.15) | (−34.45) |
| GDP ($e_g$) | — | 1.16 | 1.19 | 1.20 | — | 0.45 | 0.68 | 0.62 | 0.68 | 0.68 |
| | | (8.45) | (390.56) | (92.40) | | (38.45) | (8.21) | (5.02) | (49.47) | (38.86) |
| Specialization ($e_s$) | — | 0.71 | 0.72 | 0.72 | — | — | 0.34 | 0.31 | 0.34 | 0.34 |
| | | (9.99) | (135.41) | (75.84) | | | (7.07) | (4.41) | (35.64) | (33.45) |
| Distance ($e_d$) | −0.26 | −0.14 | −0.15 | −0.15 | −0.21 | −0.16 | −0.15 | −0.15 | −0.15 | −0.15 |
| | (−94.90) | (−3.02) | (−47.80) | (−55.44) | (−49.69) | (−71.56) | (−6.02) | (−4.09) | (−33.84) | (−30.31) |
| Number of observations | 336 | 168 | 336 | 336 | 336 | 336 | 336 | 168 | 336 | 336 |
| $R^2$ | 1.000[b] | 0.759 | 1.000[b] | 0.999[b] | 1.000[b] | 1.000[b] | 0.859 | 0.847 | 1.000[b] | 0.999[b] |
| Root MSE | 1.014 | 0.348 | 1.017 | 1.017 | 1.014 | 1.016 | 0.267 | 0.277 | 1.017 | 1.018 |
| *F*-statistic | $10.2 \times 10^5$ | 45 | $1.6 \times 10^7$ | $2.3 \times 10^4$ | $8.5 \times 10^5$ | $1.2 \times 10^5$ | 164 | 71 | $1.0 \times 10^5$ | $1.9 \times 10^5$ |
| Multicollinearity[c] | No | No | Yes | No | No | No | No | No | No | No |
| (max. condition index) | (14) | (4) | (38) | (10) | (6) | (6) | (7) | (7) | (12) | (18) |
| Heteroskedasticity | No | No | No | No | No | No | Yes | No | No | No |
| (*P*-value) | (1.000) | (0.869) | (1.000) | (1.000) | (1.000) | (1.000) | (0.002) | (0.300) | (1.000) | (1.000) |

Without control for quality:

Price elasticites are (too) small

With control for quality:

Price elasticites are larger and in line with theoretical predictions (>1)

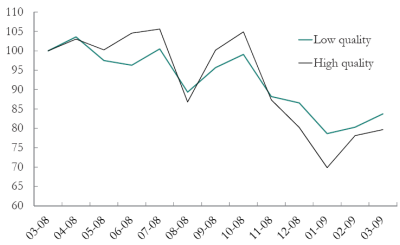
# Introduction

- Considering vertical differentiation helps:
  - To explain (a part of) observed intra-industry trade
  - To better estimate trade price elasticities
  - To better estimate trade income elasticities:
    - Higher quality goods may have a higher income elasticity
    - Exports of countries specialized in high quality goods over-react to world GDP fluctuations

# Quality matters for the estimation of price elasticities

- During recent crisis :
  - Collapse of world trade
  - More pronounced for export flows which price on a given market is above the mean (= high quality)

Figure 2 – Evolution of low quality and high quality import quantity by the EU15
March 2008 = 100



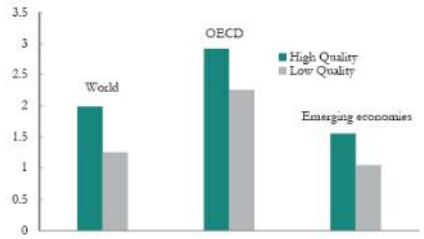

*Source*: Eurostat, Comext, authors' calculations.

Berthou & Emlinger (CEPII, 2009)

# Quality matters for the estimation of price elasticities

– This is (partly) explained by differences in income elasticities

Figure 3 – Income elasticity of imports according to their quality ladder
Estimation result for 1996-2007




*Note:* Income elasticity of imports correspond to the growth of imports in percentage when the income increase by 1%.
*Source:* BACI, authors' calculations.

Berthou & Emlinger (CEPII, 2009)

# Road map

- Quality matters in international trade

1. Country-level
   - Estimation of quality from unit values
   - Estimation of quality from unit values and prices
2. Firm-level
   - How firms self-select across destinations according to the quality of their products?
   - Quality versus productivity competitiveness

# Export prices

- Most of the literature relies on export prices to proxy the quality of the products
- Intuition: high quality varieties should be more expensive

# Export prices: Peter Schott

- Peter Schott (*QJE*, 2004): Supply side
  - Study prices of product-level US import data
  - US increasingly s nd high countries

Products sourced from one group of countries

(Low, Middle or High wage)

Products sourced from at least 2 groups of countries

More and more products are imported from both low wage and high wage countries

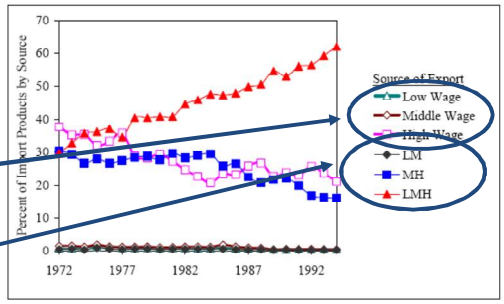
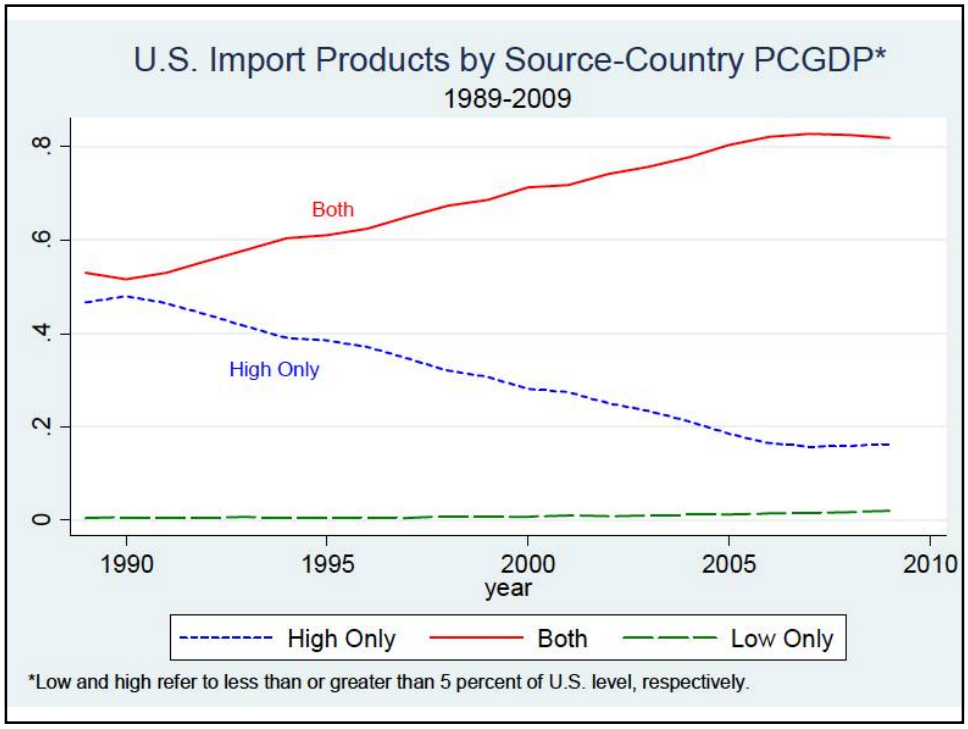



FIGURE III
Breakdown of U.S. Imports By Exporter Per Capita GDP Level, 1972-1994

Notes: U.S. import products are classified according to the income level of the exporting country. Exporters are classified as low-, middle- or high-wage if their per capita GDP is below the 30th, between the 30th and 70th or above the 70th percentiles of world PCGDP, respectively. Low-wage products (L) originate solely in low-wage countries (e.g. China), while LMH products originate simultaneously in at least one low- and one high-wage country. The six product classifications in the figure are mutually exclusive.




# Export prices: Peter Schott

- But prices differ greatly from an importing country to another

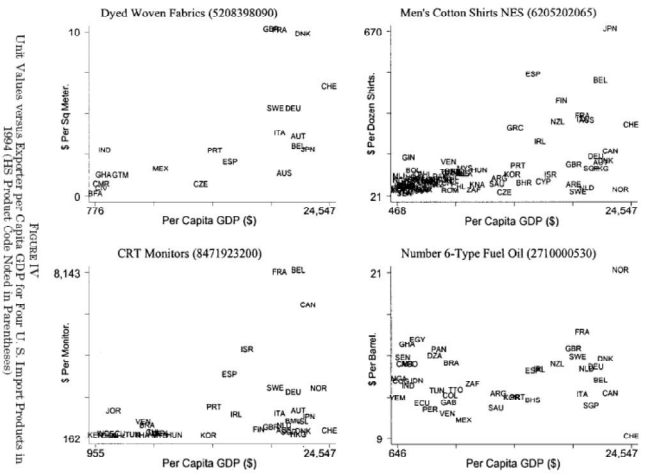



Figure IV
Unit Values versus Exporter per Capita GDP for Four U.S. Import Products in 1994 (HS Product Code Noted in Parentheses)

# Export prices: Peter Schott

- Rich and high-wage countries export more expensive varieties (higher quality?)

TABLE V
UNIT VALUES AND EXPORTER CHARACTERISTICS, 1972–1994

| Regressor | Log unit value | Log unit value | Log unit value |
|---|---|---|---|
| Log PCGDP | 0.134*** | | |
| | 0.037 | | |
| Log capital per labor ($000) | | 0.435*** | |
| | | 0.065 | |
| Log skill per labor | | | 0.501** |
| | | | 0.089 |
| Product-year dummies | Yes | Yes | Yes |
| Product-country-year observations | 214,852 | 214,852 | 214,852 |
| Number of unique products | 12,024 | 12,024 | 12,024 |
| Number of unique countries | 48 | 48 | 48 |
| $R^2$ | 0.77 | 0.78 | 0.77 |

This table reports OLS regression results of exporter unit value on real exporter PCGDP, real exporter capital per worker, and exporter skill abundance across LMH products (see text). Sample restricted to available data across independent variables. GDP data are from the World Bank [2000]. Capital per labor ratios are from Penn World Tables 5.6; 1992 values are used for 1994. Education attainment data are from Barro and Lee [2000]; 1970 and 1995 data are used for 1972 and 1994, respectively. Robust standard errors adjusted for exporter clustering are noted below coefficients. Results for fixed effects are suppressed. ***, **, and * refer to statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

# 1. Specialization along quality ladders

- Economic development goes with a rise on quality ladder

TABLE IX
UNIT VALUE CHANGES AND RELATIVE FACTOR ACCUMULATION, 1972 TO 1988

| Regressor | Change in exporter-product unit value | Change in exporter-product unit value | Change in exporter-product unit value |
|---|---|---|---|
| Change in exporter's relative PCGDP | 0.476** | | |
| | 0.232 | | |
| Change in exporter's relative capital per worker | | 0.463* | |
| | | 0.246 | |
| Change in exporter's relative skill per worker | | | 0.006* |
| | | | 0.003 |
| Product-country observations | 2111 | 1456 | 1897 |
| Number of unique countries | 91 | 49 | 82 |
| $R^2$ | 0.30 | 0.32 | 0.30 |

This table reports OLS estimation results across the constant set of LMH products exported to the United States in both 1972 and 1988. Dependent variable is log difference of exporter-product unit value between 1972 and 1988. First regressor is change in exporter PCGDP percentile between 1972 and 1988. Second regressor is change in exporter real capital per worker (from Penn World Tables Mark 5.6) between 1972 and 1992. Third regressor is change in exporter secondary and higher education attainment [Barro and Lee 2000] between 1970 and 1990. All changes are relative to the mean change for the product. All countries do not export all products. Robust standard errors adjusted for country clustering are noted below coefficients. Results for the constant are suppressed. ***, **, and * refers to statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

# Export prices: Hummels & Klenow

- Hummels and Klenow (AER 2005)
  - Consider trade patterns of 126 exporting countries to 59 importing destinations / HS6 (about 5000 products).
  - Decompose the trade flows into different margins:

**EXPORT** → **Exported Value of each product *(intensive margin)*** → **Quantities** / **Prices**

**EXPORT** → **Number of productcs *(extensive margin)***

# Klenow

| Independent Variable → / Dependent Variable ↓ | *Y/L* | *L* | Adj. $R^2$ | *Y* | Adj. $R^2$ |
|---|---|---|---|---|---|
| Overall Exports | 1.29 (0.07) | 0.89 (0.04) | 0.86 | 1.00 (0.04) | 0.83 |
| Intensive Margin | 0.44 (0.05) | 0.36 (0.03) | 0.60 | 0.38 (0.03) | 0.60 |
| | 34% | 41% | | 38% | |
| Extensive Margin | 0.85 (0.05) | 0.53 (0.03) | 0.79 | 0.61 (0.03) | 0.74 |
| | 66% | 59% | | 62% | |

Notes: All variables are in natural logs. Number of exporting countries = Number of observations = 126. Standard errors are in parentheses. For definitions of each margin see equations (8), (9) and (10). Percentages describe the contribution of each margin to the overall export elasticity. *L* = 1995 employment in the exporting country relative to the sum of employment in the other 125 exporters. *Y* = 1995 PPP GDP in the exporting country relative to the sum of GDP in the other 125 exporters. *Y/L* is simply the ratio of these two variables.

Data Sources: UNCTAD for 1995 exports to 59 countries by 126 countries in 5,017 6-digit categories. Heston, Summers, and Aten (2002) for employment and PPP GDP.

**Richer and bigger countries:**

Export more

Export more of each goods

Export more goods

## Price and Quantity Components of the Intensive Margin

Klenow

| Independent Variable → / Dependent Variable ↓ | $Y/L$ | $L$ | Adj. $R^2$ | $Y$ | Adj. $R^2$ |
|---|---|---|---|---|---|
| Prices | 0.09 (0.02) | -0.01 (0.01) | 0.14 | 0.02 (0.01) | 0.01 |
| Quantities | 0.34 (0.05) | 0.37 (0.03) | 0.58 | 0.36 (0.03) | 0.58 |

Richer countries export more of each goods because:

They export more quantities

They export more expensive varieties

Notes: All variables are in natural logs. Number of exporting countries = Number of observations = 126. Standard errors are in parentheses. For definitions of the price and quantity components see equations (11) and (12). $L$ = 1995 employment in the exporting country relative to the sum of employment in the other 125 exporters. $Y$ = 1995 PPP GDP in the exporting country relative to the sum of GDP in the other 125 exporters. $Y/L$ is simply the ratio of these two variables.

Data Sources: UNCTAD for 1995 exports to 59 countries by 126 countries in 5,017 6-digit categories. Heston, Summers, and Aten (2002) for employment and PPP GDP.

## Export prices: Hallak

- Hallak (*JIE*, 2006) considers the demand side of the story
  - Hypothesis: demand for quality should increase with GDP per capita
  - Data:
    - Cross-section of bilateral trade flows and country-level variables for 60 countries in 1995. Sectors are defined at the 3-digit SITC (Rev.2) level.
  - Estimation:

Fixed effects

$$\ln \mathrm{imp}_{iz}^{k} = \varphi_{iz} + \psi_{z}^{k} + \tilde{\sigma}_z \eta_z \ln \mathrm{Dist}_{i}^{k} + \beta_z \mathbf{I}_{i}^{k} + \tilde{\sigma}_z \mu_z \ln \theta_{i} \ln y^{k} + \varepsilon_{iz}^{k}$$

Imports in country $k$, of good $z$ exported by country $i$

Trade costs: Distance, common border, language...

GDP per capita of country $k$

Prediction: $\sigma\mu>0$ ⇨ richer countries are more likely to import more expensive varieties

Quality of $i$'s exports

Proxied by the price index (computed with 10-digit products) of $i$'s exports

# Export prices: Hallak

- 252 J.C. Hallak / Journal of International Economics 68 (2006) 238–265

Table 2
Price indices as quality indices differentiated goods (114 Sectors)—OLS and ML estimates

| | Regressions by sector | | | | | | Pooled regression | |
|---|---|---|---|---|---|---|---|---|
| | Sign | | Significance (5%) | | | Median | Coefficient (unweighted) | Coefficient (weighted) |
| | Pos. | Neg. | Pos. | Not Sig. | Neg. | | | |
| *A. OLS estimation* | | | | | | | | |
| $\ln(P_i)*\ln(y_k)$ | 79 | 35 | 44 | 55 | 15 | 0.1839 | 0.1120*** (0.0359) | 0.1153*** (0.0396) |
| $\ln(\text{Distance}_{ik})$ | 0 | 114 | 0 | 0 | 114 | −1.0365 | | |
| $\text{Border}_{ik}$ | 102 | 12 | 38 | 76 | 0 | 0.3328 | | |
| $\text{Common Lang}_{ik}$ | 112 | 2 | 95 | 19 | 0 | 0.5321 | | |
| $\text{PTA}_{ik}$ | 96 | 18 | 63 | 48 | 3 | 0.3846 | | |
| $\text{Colonial Link}_{ik}$ | 111 | 3 | 86 | 28 | 0 | 0.7912 | | |
| $\text{Common Colony}_{ik}$ | 84 | 30 | 17 | 95 | 2 | 0.2893 | | |

# Export prices: Choi et al.

- Choi, Hummels & Xiang (*JIE* 2010)
  - Importance of income distribution
  - ⇨ countries' demand for quality non only depends on the mean level of wealth, but also on income distribution
  - They estimate:

$$\ln M^m(P_{c,k}) - \ln M^m(P_{c',k}) = \alpha_0 + \beta_M(\ln M^m(I_c) - \ln M^m(I_{c'})) + \varepsilon_{cc',k}.$$

Difference in a given moment of price distribution measures of consumption in countries c and c' for product k

Difference in a given moment of income distribution measures of consumption in countries c and c'

# Export prices: Choi et al.

- Choi, Hummels & Xiang (*JIE* 2010)
- Data:
  - Income distribution for 26 countries (from Luxembourg Income Study) in 2000
  - Price distribution of varieties consumed in each countries in not available ⇨ consider the price distribution of imports (from Comtrade - HS6 products)

# Export prices: Choi et al.

Figure 1 Income Dispersion Across Countries

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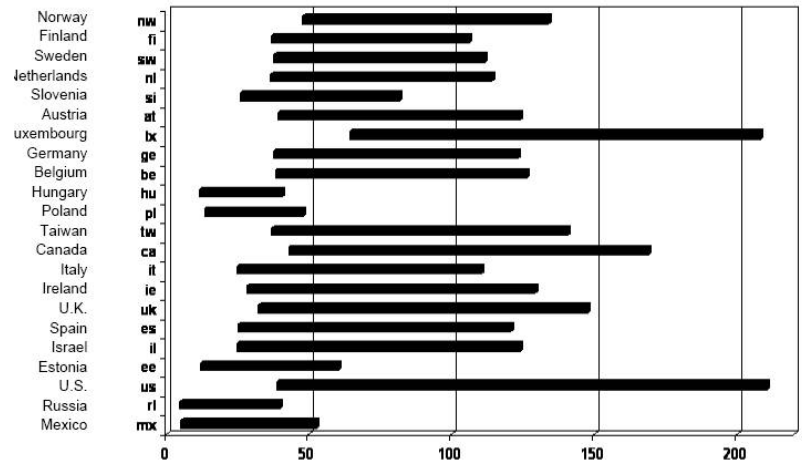


# Export prices: Choi et al.

- Choi, Hummels & Xiang (*JIE* 2010)

inter-decile range
(the 90th percentile minus the 10th percentile)

Moments of the price and income distributions.

| Full sample | Mean | Median | SD | CV | Range | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|
| Beta | **0.138** | **0.160** | **0.131** | **0.381** | **0.190** | **0.146** | **0.108** |
| $t$-stat | (15.68) | (16.29) | (7.42) | (10.62) | (7.80) | (5.30) | (4.77) |
| $R^2$ | 0.076 | 0.091 | 0.024 | 0.045 | 0.037 | 0.008 | 0.011 |
| $N$ | 1,145,518 | 1,145,518 | 1,115,180 | 1,115,180 | 1,115,180 | 979,885 | 1,115,180 |

- All coefs beta are significantly > 0

Countries with similar income have more similar price of imports (consumers with more or less the same quality mix)

Countries with greater variability in incomes over time have also greater variability of imports prices

Countries with income distributions have fat or skewed tails.

# Road map

- Quality matters in international trade

1. Country-level
   - Estimation of quality from unit values
   - Estimation of quality from unit values and prices
2. Firm-level
   - How firms self-select across destinations according to the quality of their products?
   - Quality versus productivity competitiveness

# Khandelwal (2010)

- Khandelwal (*ReStud* 2010)

Basic idea: Prices are not good proxies for quality… but quality may be infered from the part of export performance that is not explained by prices.

# Khandelwal (2010)

- 2 countries: North and South
- Exogenous wages (outside goods), but lower wages in the South
- In a given industry, firms produce varieties that are both horizontally and vertically differentiated
- Firms in the North have a better technology facilitating the production of higher quality

- To produce a quality $\lambda$ a firm in country c incurs the cost:

$$w_c + \frac{\lambda_j^2}{2Z_c}$$

## Khandelwal (2010)

- For a consumer *n,* the indirect utility of consuming a variety $j$ is: $$V_{nj} = \theta\lambda_j - \alpha p_j + \epsilon_{nj}$$
- The mean valuation of a variety across all consumers in a country is $\delta_j = \theta\lambda_j - \alpha p_j$
- The market share of variety $j$ is (logit demand structure):

$$m_j = \frac{e^{\delta_j}}{\sum_k e^{\delta_j}}$$

## Khandelwal (2010)

- Firms choose their prices and quality in order to maximize their profits
- Optimal price: $p_j^* = \frac{1}{\alpha} + w_c + \frac{\lambda_j^{*2}}{2Z_c}$
- = firms charge a constant markup $1/\alpha$
- Then, the optimal quality is: $\lambda_j^* = \theta Z_c/\alpha$
- All firms from a given country have the same price and quality:

$$\delta_c^* = \frac{\theta^2 Z_c}{2\alpha} - \alpha w_c - 1$$

# Khandelwal (2010)

- Quality Ladder = difference between the highest quality and the lowest one (as perceived by consumers):

$$Ladder(\theta) = \theta\lambda_N^* - \theta\lambda_S^* = \frac{\theta^2}{\alpha}(Z_N - Z_S)$$

# Khandelwal (2010)

- Empirical implementation:
  - For each product *h* exported by country *c* to the USA, at time *t*, the indirect utility is for consumer *n* is:

$$V_{ncht} = \lambda_{1,ch} + \lambda_{2,t} + \lambda_{3,cht} - \alpha p_{cht} - \mu_{cnht}$$

Quality

Horizontal differentiation (depends on the number of existing varieties)

# Khandelwal (2010)

- The mean utility of the domestic variety is normalized to zero for all products *h*:

$$u_{0t} = \lambda_{1,0} + \lambda_{2,t} + \lambda_{3,0t} - \alpha p_{0t} - \mu_{0t}$$

- The nested logit demand structure gives:

$$ln(s_{cht}) - ln(s_{0t}) = \lambda_{1,ch} + \lambda_{2,t} + \lambda_{3,cht} - \alpha p_{0t} + \sigma ln(ns_{cht})$$

where $s_{cht}$ is the share of variety *ch* over all market, and $ns_{cht}$ is the share of variety *ch* over market *h.*

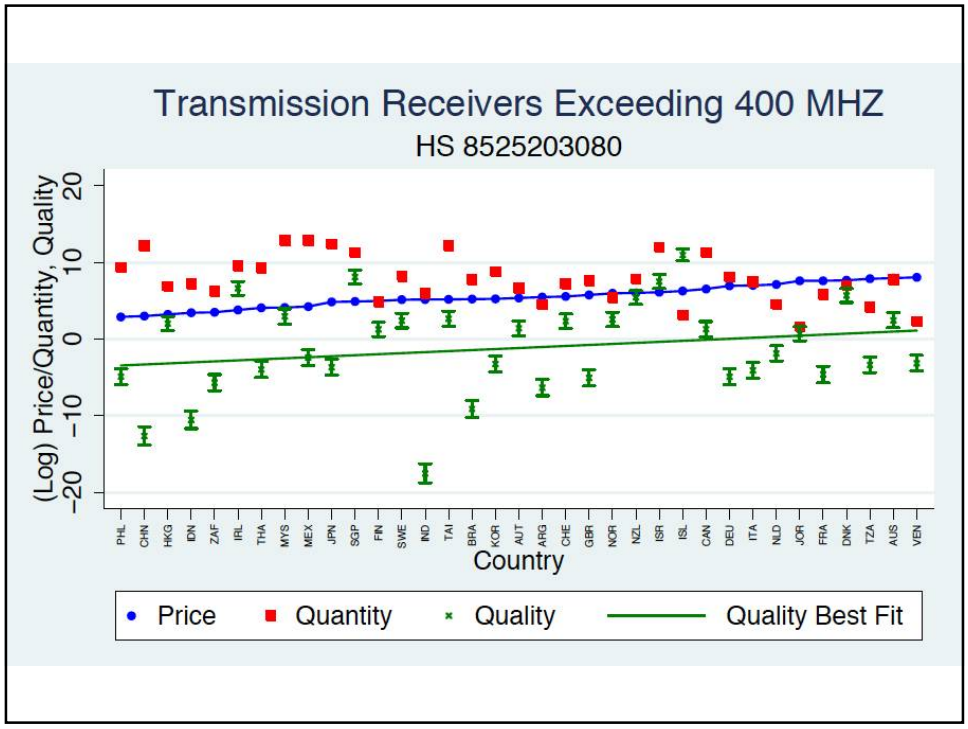
# Khandelwal (2010)

$$ln(s_{cht}) - ln(s_{0t}) = \lambda_{1,ch} + \lambda_{2,t} + \lambda_{3,cht} - \alpha p_{0t} + \sigma ln(ns_{cht})$$

Fixed effect

Error term

$$Quality_{cht} = \hat{\lambda}_{1,cht} + \hat{\lambda}_{2,cht} + \hat{\lambda}_{3,cht}$$


Transmission Receivers Exceeding 400 MHZ
HS 8525203080
(Log) Price/Quantity, Quality
20
10
0
−10
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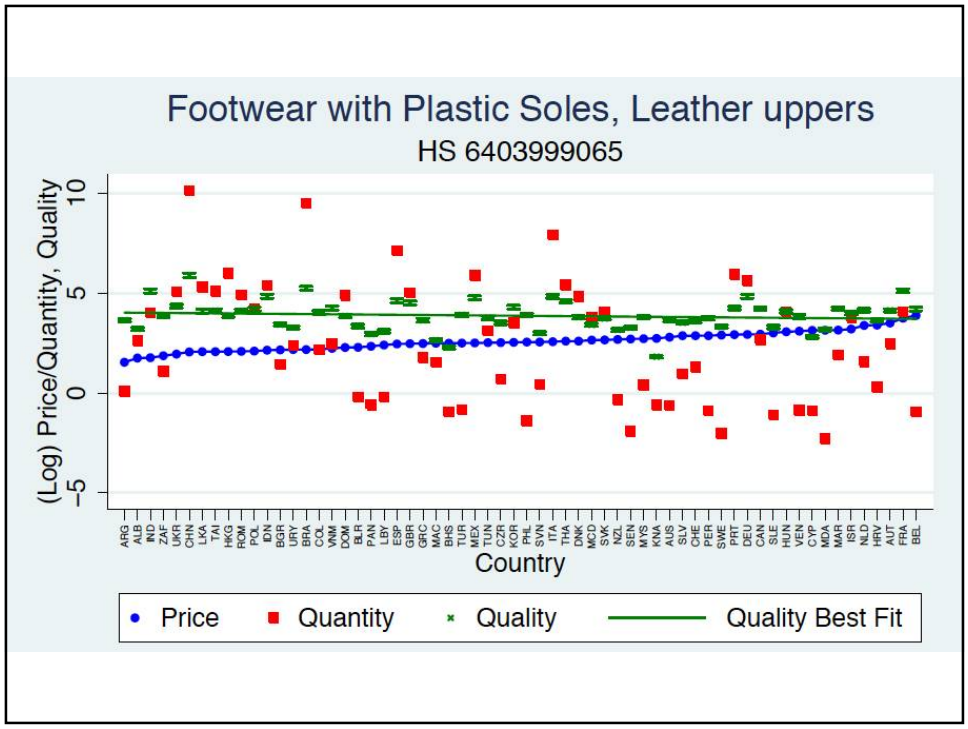
PHL CHN HKG IDN ZAF IRL THA MYS MEX JPN SGP FIN SWE IND TAI BRA KOR AUT ARG CHE GBR NOR NZL ISR ISL CAN DEU ITA NLD JOR FRA DNK TZA AUS VEN
Country
Price
Quantity
Quality
Quality Best Fit


Footwear with Plastic Soles, Leather uppers
HS 6403999065
(Log) Price/Quantity, Quality
10
5
0
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ARG ALB IND ZAF UKR CHN LKA TAI HKG ROM POL IDN BGR URY BRA COL VNM DOM BLR PAN LBY ESP GBR GRC MAC BHS TUR MDX TUN CZR KOR PHL SVN ITA THA DNK MCD SVK NZL SEN MYS KWA AUS SLV CHE PER SWE PRT DEU CAN SLE HUN VEN CYP MDA MAR ISR NLD HRV AUT FRA BEL
Country
Price
Quantity
Quality
Quality Best Fit

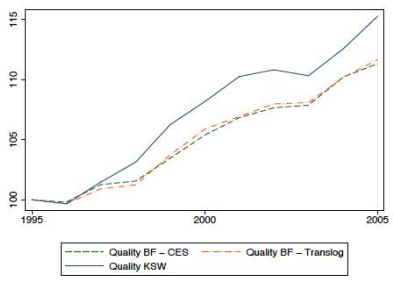
# Endogenous quality

- Julien Martin and Isabelle Mejean (2015)
- Use Khandelwal approach to estimate the average quality of French exports
- Relate this to the intensity of competition from low-wage countries exports on the foreign (non-French) markets where French exporters are active

# Endogenous quality

- Julien Martin and Isabelle Mejean (2015)

Figure 1: Evolution of the Aggregate Quality of French Exports



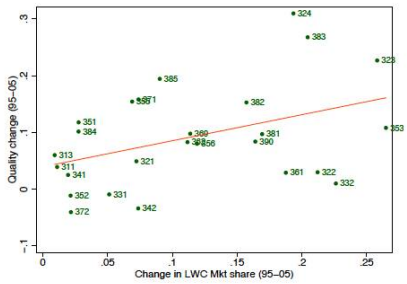

Notes: the multilateral quality index is obtained from an aggregation of sectoral and country-specific quality indices ($Qlt_{ykct}$). The aggregation weights are either the Sato-Vartia ones for the BF-CES and KSW indices or the Tornqvist ones in the BF-Translog case.

# Endogenous quality

- Julien Martin and Isabelle Mejean (2015)

Figure 2: Quality & Competition from Low-Wage Countries, Across Industries

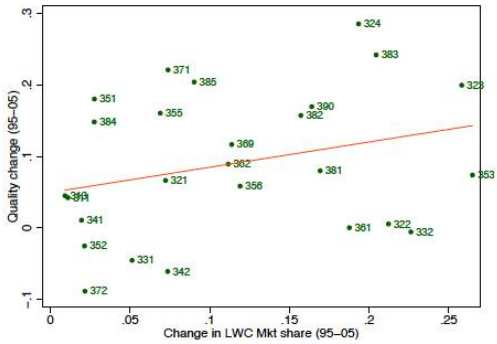
(a) BF-CES index




# Endogenous quality

- Julien Martin and Isabelle Mejean (2015)

(b) KSW index



# Endogenous quality

- Julien Martin and Isabelle Mejean (2015)

Table 3: Quality and the Penetration of Low-Wage Countries: Panel Results

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Dep. var: $\Delta \ln Qlty_{kct}$ | | | | | |
| | BF-CES | | BF-Translog | | KSW | |
| $\Delta$ LWC MShares | 0.35** | 0.30* | 0.29** | 0.29** | 0.28** | 0.24* |
| | (2.566) | (1.802) | (2.499) | (1.971) | (2.491) | (1.715) |
| Observations | 3,513 | 3,513 | 3,513 | 3,513 | 3,513 | 3,513 |
| $R^2$ (within) | 0.067 | 0.059 | 0.068 | 0.061 | 0.073 | 0.070 |
| Country-year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Sector-year FE | 3d | 2d | 3d | 2d | 3d | 2d |
| 3d Sector-country FE | No | Yes | No | Yes | No | Yes |

Notes: Robust t-statistics in parentheses. $^a$ $p < 0.01$, $^b$ $p < 0.05$, $^c$ $p < 0.1$.
The dependent variable is the log difference of the quality index over three-year periods (1995-1998, 1998-2001, and 2001-2005), computed at the 3-digit ISIC (revision 2) level for each destination country. "$\Delta$ LWC MShares" denotes the corresponding change in market shares of low-wage countries (countries with a GDP per capita below 5% of the US one). "2d" and "3d" respectively refer to 2-digit and 3-digit sector effects.

# Endogenous quality

- Focus on Textile industry, the impact of the end of Multifiber agreements (in 2002) and Chinese Exports

Table 5: Quality and Competition from China: Natural Experiment

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Dep. var: $\Delta \ln Qlty_{kct}$ | | | | | |
| | BF-CES | BF-Translog | KSW | BF-CES | BF-Translog | KSW |
| Post2002 | - | - | - | -0.16** | -0.14* | -0.16** |
| | - | - | - | (-2.169) | (-1.926) | (-2.235) |
| MFA Quota | -0.11* | -0.09 | -0.13** | - | - | - |
| | (-1.685) | (-1.491) | (-2.373) | - | - | - |
| - × Post2002 | 0.21** | 0.19** | 0.26** | 0.23*** | 0.19** | 0.29*** |
| | (2.128) | (2.012) | (2.568) | (2.766) | (2.217) | (3.700) |
| Observations | 5,896 | 5,896 | 5,896 | 5,896 | 5,896 | 5,896 |
| $R^2$ | 0.219 | 0.207 | 0.195 | 0.011 | 0.007 | 0.022 |
| Sector FE | Yes | Yes | Yes | No | No | No |
| Cty - Year FE | Yes | Yes | Yes | No | No | No |
| Cty - Sect FE | No | No | No | Yes | Yes | Yes |

# Road map

- Quality matters in international trade

1. Country-level
   - Estimation of quality from unit values
   - Estimation of quality from unit values and prices
2. Firm-level
   - How firms self-select across destinations according to the quality of their products?
   - Quality versus productivity competitiveness

# Firm-level export prices and export performances

- Manova and Zhang (QJE, 2012)
  - Use Chine firm-level export data
  - Compute, for each firm-product, the average price and the total export revenue
  - Show that firms with larger export revenues also charge higher prices, especially for differentiated goods
  - Show that it is also true within firms, across destination

TABLE III

FIRMS' EXPORT PRICES AND WORLDWIDE EXPORT REVENUES
(DEPENDENT VARIABLE: (LOG) AVERAGE F.O.B. EXPORT PRICE, BY FIRM AND HS-8 PRODUCT)

| | | | Variation across firms within products | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| (log) Revenue | 0.094*** | | 0.040*** | 0.097*** | 0.091*** | 0.085*** | 0.067*** |
| | (49.25) | | (14.15) | (48.26) | (47.14) | (41.31) | (24.07) |
| (log) Quantity | | −0.165*** | | | | | |
| | | (−103.75) | | | | | |
| (log) Revenue x different. good | | | 0.065*** | | | | |
| | | | (22.83) | | | | |
| (log) Revenue x R&D intensity | | | | −0.079* | | | |
| | | | | (−1.73) | | | |
| (log) Revenue x high R&D intensity | | | | | 0.008*** | | |
| | | | | | (4.67) | | |
| (log) Revenue x adv. + R&D intensity | | | | | | 0.362*** | |
| | | | | | | (8.23) | |
| (log) Revenue x rich destinations | | | | | | | 0.031*** |
| | | | | | | | (11.37) |
| Product FE | Y | Y | Y | Y | Y | Y | Y |
| $R$-squared | 0.644 | 0.671 | 0.642 | 0.637 | 0.637 | 0.637 | 0.649 |
| # observations | 898,247 | 898,247 | 619,357 | 871,596 | 871,596 | 875,097 | 974,033 |
| # products | 6,908 | 6,908 | 4,276 | 6,182 | 6,182 | 6,252 | 6,879 |
| # firm clusters | 96,522 | 96,522 | 84,464 | 93,514 | 93,514 | 94,005 | 94,664 |

*Notes.* This table examines the relationship between firms' worldwide export prices and revenues. It exploits the variation across firms within products, by including HS-8 product fixed effects. The outcome variable is the (log) average f.o.b. export price by firm and HS-8 product, constructed as the ratio of worldwide revenues and quantities exported by firm and product. Products' scope for quality differentiation is proxied by (1) a dummy variable equal to 1 for differentiated products as classified by Rauch (1999), column (3); (2) R&D intensity by three-digit ISIC sector from Klingebiel, Kroszner, and Laeven (2007), column (4); a dummy variable equal to 1 for R&D intensity above the median, column (5); or (3) the combined advertising and R&D intensity by three-digit ISIC sector from Kugler and Verhoogen (2011), column (6). In column (7), the average price and worldwide revenues are computed separately for countries above and below the median income in the sample, and the regression includes a dummy for rich destinations and its interaction with revenues. All regressions include a constant term and cluster errors by firm. $t$-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

TABLE VI

VARIATION IN EXPORT PRICES ACROSS DESTINATIONS WITHIN A FIRM
(DEPENDENT VARIABLE: (LOG) F.O.B. EXPORT PRICE, BY FIRM, DESTINATION, AND HS-8 PRODUCT)

| | | | Variation across destinations Within firm-product pairs | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| (log) Revenue | 0.021*** | | 0.020*** | 0.015*** | 0.018*** | 0.017*** | 0.004*** |
| | (36.34) | | (35.77) | (6.52) | (23.79) | (13.92) | (4.29) |
| (log) Quantity | | −0.080*** | | | | | |
| | | (−117.98) | | | | | |
| Market share | | | 0.015*** | | | | |
| | | | (4.53) | | | | |
| (log) Revenue x different. good | | | | 0.008*** | | | |
| | | | | (3.27) | | | |
| (log) Revenue x R&D intensity | | | | | 0.093*** | | |
| | | | | | (3.90) | | |
| (log) Revenue x adv. + R&D intensity | | | | | | 0.145*** | |
| | | | | | | (3.81) | |
| (log) Revenue x (log) GDP per capita | | | | | | | 0.002*** |
| | | | | | | | (21.60) |
| Firm-product FE | Y | Y | Y | Y | Y | Y | Y |
| $R$-squared | 0.954 | 0.957 | 0.954 | 0.950 | 0.953 | 0.953 | 0.954 |
| # observations | 2,179,923 | 2,179,923 | 2,179,923 | 1,494,839 | 2,130,413 | 2,139,735 | 2,098,634 |
| # dest-product clusters | 258,056 | 258,056 | 258,056 | 163,873 | 247,867 | 249,874 | 242,403 |
| # firm-product pairs | 898,247 | 898,247 | 898,247 | 619,357 | 871,596 | 875,097 | 869,203 |

*Notes.* This table examines the relationship between firms' bilateral export prices and revenues. It exploits the variation across destinations within a firm by including firm–HS-8 product pair fixed effects. The outcome variable is the (log) f.o.b. export price by firm, destination, and HS-8 product. Column (3) controls for the share of each firm's exports in total Chinese exports, by destination and product. Products' scope for quality differentiation is proxied as in Table III. Column (7) includes the interaction of revenues with the destination's GDP per capita. All regressions include a constant term and cluster errors by destination-product pair. $t$-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

## Firm-level export prices and export performances

- Two mechanisms may be at work:
  - Firm-selection across markets
  - Quality to market

+ one: markup strategies

## Quality sorting

**Firm-Level selection though a quality sorting**

Baldwin & Harrigan (*AEJ micro*) present a very simple model of trade with firm's heterogeneity.

Heterogeneity is not in term of productivity, as in Meltiz…

… but in capacities to produce higher quality goods

Only the firms with the highest quality can be profitable on distant markets

## Quality sorting

- Utility function (country *d*):

$$U_d = \left( \int_{j \in \Omega_d} \left[ s(j)^{\gamma} q(j) \right]^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$$

- Where *s(j)* is the quality of variety *j*.
- Firms are assumed to draw a quality level *s*.
- And each quality level entails a specific set of inputs and production methods such that marginal costs are increasing in *s*

- Marginal cost function for firm *i*:

$$c(i) = \omega s(i)^{\lambda}$$

## Quality sorting

- FOB price (mark-up function):

$$p(i) = \frac{\sigma}{\sigma - 1} \omega s(i)^{\lambda}$$

- Demand:

$$x_{do}(i) = \left[ p(i) \tau_{do} \right]^{1-\sigma} \left[ s(i)^{\gamma} \right]^{\sigma-1} \frac{E_d}{\int_{j \in \Omega_d} \left[ p(j) \tau_{do'} \right]^{1-\sigma} \left[ s(j)^{\gamma} \right]^{\sigma-1} dj}$$

$$x_{do}(i) = \left[ \frac{\sigma}{\sigma - 1} \right]^{1-\sigma} \left[ s(i)^{\lambda-\gamma} \tau_{do} \right]^{1-\sigma} \frac{E_d}{\int_{j \in \Omega_d} \left[ p(j) \tau_{do'} \right]^{1-\sigma} \left[ s(j)^{\gamma} \right]^{\sigma-1} dj}$$

# Quality sorting

- Quality "pays" if the cost of quality is lower than the willingness to pay:

$$\lambda - \gamma < 0$$

- In this case, firms drawing a higher $s$
  - Charge a higher price
  - But receive larger demand from each market
  - Are more likely to export and export more

  - In more distant market, only high quality firms export
  - Thus aggregate price increase with distance

TABLE 3—STATISTICAL DETERMINANTS OF NONZERO US EXPORTS, 2005

| Specification | Linear distance | | | Distance step function | | |
|---|---|---|---|---|---|---|
| Estimator | Probit | OLS | RE probit | Probit | OLS | RE probit |
| clustering | ctry., HS | ctry., HS | none | ctry., HS | ctry., HS | none |
| HS10 effects | none | fixed | random | none | fixed | random |
| Log distance | −0.1247*** | −0.0943*** | −0.1466*** | | | |
| | (0.0156) | (0.0144) | (0.0018) | | | |
| 1 < km ≤ 4,000 | | | | 0.1056 | 0.0132 | 0.1574*** |
| | | | | (0.132) | (0.0730) | (0.00712) |
| 4,000 < km ≤ 7,800 | | | | −0.1507 | −0.195*** | −0.1522*** |
| | | | | (0.104) | (0.0732) | (0.00473) |
| 7,800 < km ≤ 14,000 | | | | −0.2169* | −0.253*** | −0.2344*** |
| | | | | (0.110) | (0.0744) | (0.00548) |
| 14,000 < km | | | | −0.2050** | −0.288*** | −0.1890*** |
| | | | | (0.0662) | (0.0778) | (0.00357) |
| Log real GDP | 0.2032*** | 0.1696*** | 0.2400*** | 0.1983*** | 0.1679*** | 0.2346*** |
| | (0.0147) | (0.0146) | (0.00283) | (0.01425) | (0.07304) | (0.00281) |
| Log real GDP per worker | 0.1208*** | 0.0892*** | 0.1424*** | 0.1244*** | 0.0895*** | 0.1461*** |
| | (0.0155) | (0.0158) | (0.00184) | (0.0178) | (0.0171) | (0.00194) |
| Log remoteness | 0.0727*** | 0.0633*** | 0.0872*** | 0.0528*** | 0.0477*** | 0.0636*** |
| | (0.0094) | (0.01193) | (0.0012) | (0.0135) | (0.0136) | (0.00108) |
| NAFTA | −0.1653 | −0.1020 | −0.1653*** | | | |
| | (0.129) | (0.162) | (0.00316) | | | |
| Landlocked | −0.04502 | −0.0207 | −0.0482*** | −0.0444 | −0.0208 | −0.0470*** |
| | (0.0337) | (0.0296) | (0.00222) | (0.0358) | (0.0310) | (0.00228) |
| Island | −0.01311 | 0.0299 | −0.0138*** | −0.01819 | 0.0172 | −0.0200*** |
| | (0.0310) | (0.0327) | (0.00217) | (0.0288) | (0.0304) | (0.00213) |
| English language | 0.0963*** | 0.0551** | 0.1168*** | 0.0768*** | 0.0467* | 0.0938*** |
| | (0.0322) | (0.0277) | (0.00214) | (0.0288) | (0.0262) | (0.00202) |

*Notes:* Dependent variable is indicator for positive exports in particular HS code to particular importing country. Manufacturing observations only (5,834 HS10 codes × 100 importing countries). Reported probit and random effects probit results are marginal effects, evaluated at sample mean for continuous variables. Continuous variables are scaled to have mean zero and standard deviation one, so coefficient gives effect on probability of a one standard deviation increase in the continuous RHS variable. For indicator variables, coefficient is change in probability from turning on indicator. Robust standard errors in parentheses, asterisks denote statistical significance. Except for random effects probit, standard errors are clustered on both country and HS10.

Table 4—Statistical Determinants of US Export Unit Values, 2005

| Linear distance | Distance step function | |
|---|---|---|
| Log distance | 0.272*** | |
| | (0.0667) | |
| $1 < \text{km} \leq 4{,}000$ | | 0.0436 |
| | | (0.103) |
| $4{,}000 < \text{km} \leq 7{,}800$ | | 0.427*** |
| | | (0.0894) |
| $7{,}800 < \text{km} \leq 14{,}000$ | | 0.516*** |
| | | (0.0905) |
| $14{,}000 < \text{km}$ | | 0.644*** |
| | | (0.0920) |
| Log real GDP | −0.0523*** | −0.0649*** |
| | (0.0177) | (0.0146) |
| Log real GDP per worker | −0.0560** | −0.0766*** |
| | (0.0274) | (0.0268) |
| Log remoteness | −2.706*** | −2.413*** |
| | (0.328) | (0.396) |
| NAFTA | −0.0141 | |
| | (0.231) | |
| Landlocked | 0.0709 | 0.0365 |
| | (0.0646) | (0.0666) |
| Island | 0.0319 | 0.0700 |
| | (0.0582) | (0.0515) |
| English language | −0.0380 | −0.0732* |
| | (0.0625) | (0.0390) |
| $R^2$ within | 0.030 | 0.035 |
| Sample | 123,547 observations on 4,886 HS10 codes | |

*Notes:* Dependent variable is log unit value of exports by HS10 product and export destination, relative to HS10 code mean (that is, HS10 code fixed effects are included in all regressions). Manufacturing observations only, 123,547 observations on 4,886 HS10 codes. Includes only trade flows over $10,000. Independent variables are characteristics of export destinations. Estimator is OLS with HS10 product fixed effects, and errors are clustered by HS10 and country. Robust standard errors clustered by HS10 code and importing country in parentheses.

# Quality sorting

- Empirical evidence: Champagne exports (Crozet, Head and Mayer, 2012)

## Quality sorting

- Empirical evidence: Champagne exports (Crozet, Head and Mayer, 2012)
  - Use expert assessments to evaluate the quality of the variety: Juhlin's Champagne guide
- Richard Juhlin is considered as the world's foremost expert on Champagne.
- His book gives ratings of one to five stars to each "important" producer based on the average quality of its Champagnes over several years.
- Juhlin rates over 500 producers, about ten times as many as other sources
- Robustness checks use alternative rating (e.g. Parker's guide)

## Quality sorting

- Empirical evidence: Champagne exports (Crozet, Head and Mayer, 2012)
  - Use expert assessments to evaluate the quality of the variety: Juhlin's Champagne guide
  - Merge this information with French firm-level exports of champagne
  - 8-digit product detail:
    - wine is 2204
    - sparkling wine is 220410 (hs6)
    - Champagne is 22041011, distinct from other sparkling white wines

## Quality sorting

- Empirical evidence: Champagne exports (Crozet, Head and Mayer, 2012)

Merging procedure:

- Juhlin gives firm names and addresses for each producer.
- INSEE gives firm names and addresses for each exporter.
- We found matches for 284 exporting producers.
- They account for 94% of Champagne exports in 2005.

## Quality sorting

- Why Champagne ?

- Producers cannot relocate production (as in the Helpman, Melitz, Yeaple 2004 framework).
  - Because it is legally impossible
  - Because it is technically impossible:

"combination of chalky soil and fickle northern European weather yields sparkling wines that simply can't be replicated anyplace else" (Steinberger, 2005)

## Quality sorting

- Why Champagne ?
- Quality is determined at firm level and higher quality is costly:
  - Higher quality requires more expensive inputs (more expensive grapes and better dosage)
  - Higher quality requires more inputs (Extended ageing on lees incur extra input resources per bottle)

## Quality sorting

- Why Champagne ?
- Champagne is a blended wine:
  - Manufacturing production is distinct from grape-growing activity = no strict capacity constraints
  - Quality is constant over time (no vintage production is exceptional)

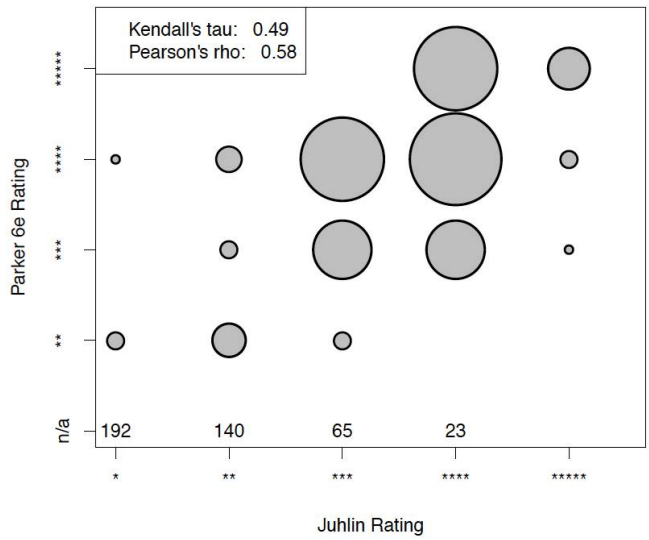
# Quality sorting

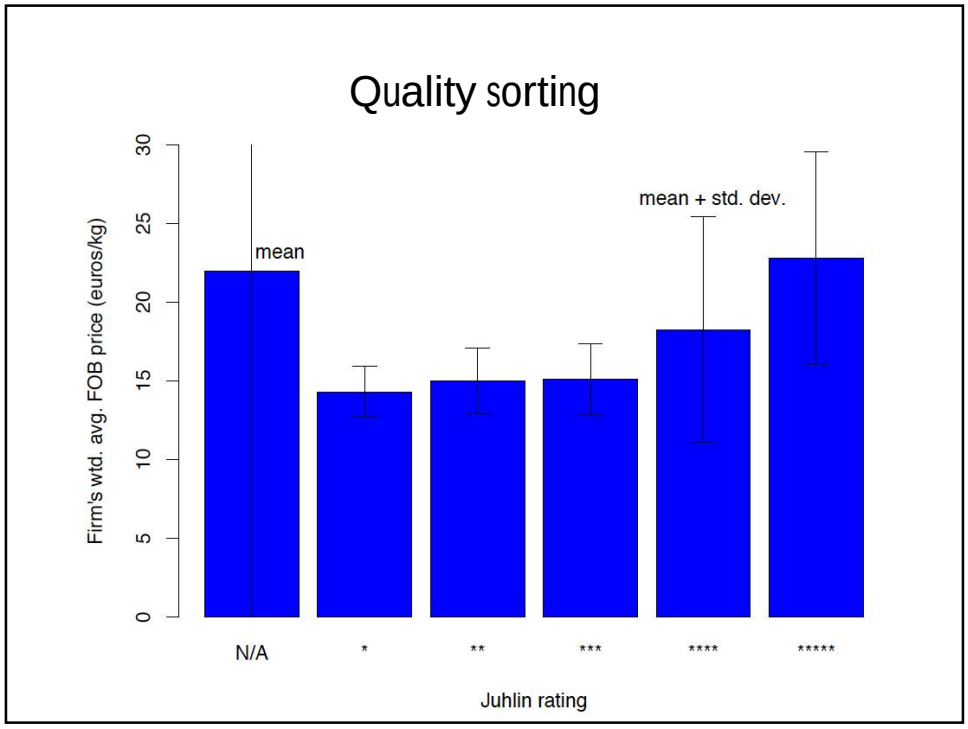
- Why Champagne ?
- Quality ratings available for firms that account for most exports.

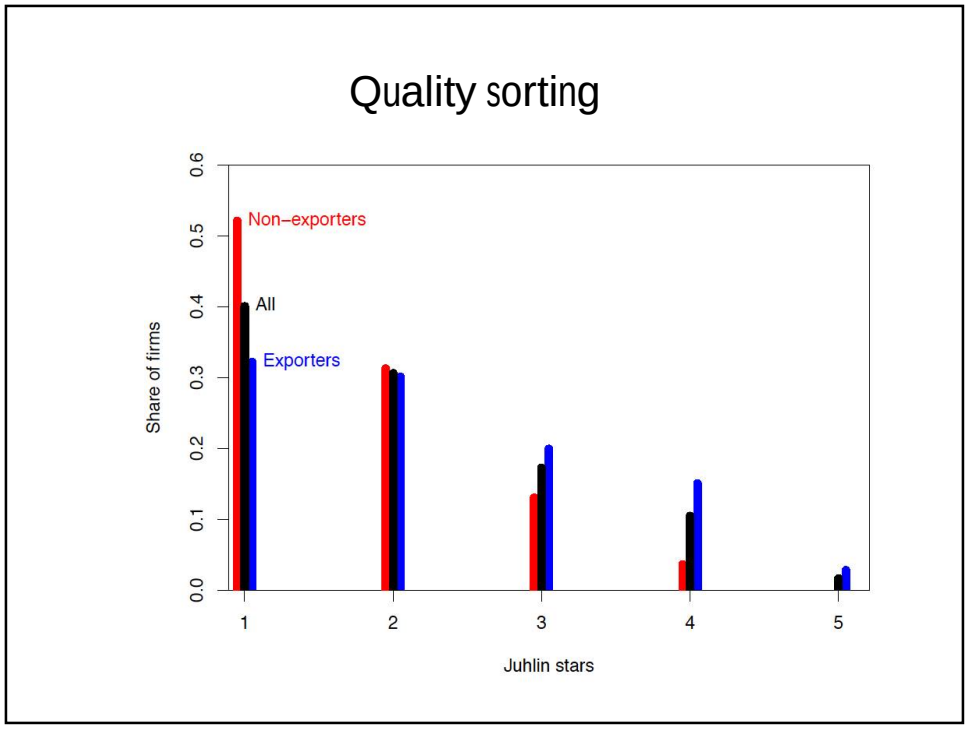
Table 1: Exporters classified according to primary activity and size category

| Activity | code | Champagne | Burgundy (white) | Burgundy (red) | Bordeaux (red) |
|---|---|---|---|---|---|
| | | Share of all Champagne exports | | | |
| grape-growers | 011G | 2% | 14% | 20% | 7% |
| wine-makers | 159F/G | 78% | 17% | 2% | 2% |
| wholesalers | 513J | 13% | 66% | 65% | 82% |
| others | various | 7% | 4% | 12% | 8% |

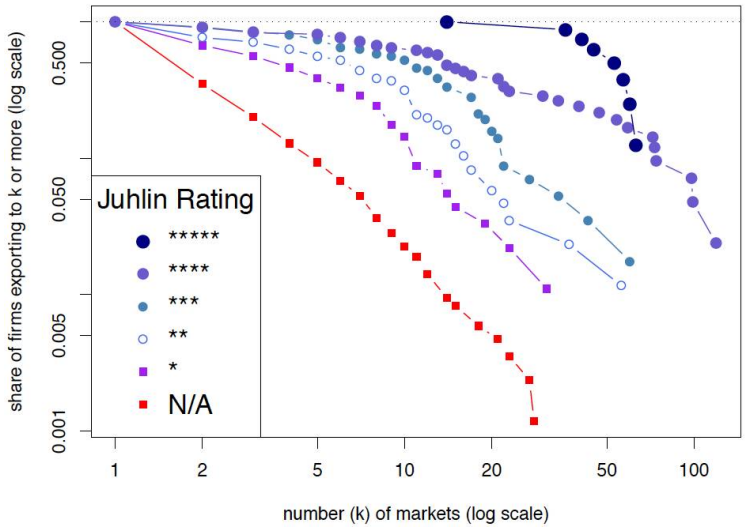
# Quality sorting




Quality sorting
Firm's wtd. avg. FOB price (euros/kg)
0
5
10
15
20
25
30
mean
mean + std. dev.
N/A
*
**
***
****
*****
Juhlin rating


Quality sorting
Share of firms
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Non−exporters
All
Exporters
1
2
3
4
5
Juhlin stars

## Quality sorting




## Quality sorting

- Estimate:
  - The impact of quality on export prices
    - OLS with destination-country FE
  - The impact of quality on export decision
    - Probit and LPM with destination-country FE
  - The impact of quality on export value
    - EK-like Tobit (with destination-country FE) to control for selection bias

## Quality sorting

Table 2: Firm-level regressions for quality-rated Champagne exporters

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Dependent variable: | $\ln p_d^{\text{fob}}(j)$ | $\mathcal{E}_d(j)$ | $\mathcal{E}_d(j)$ | $\ln x_d^{\text{fob}}(j)$ | $\ln x_d^{\text{fob}}(j)$ |
| Method | OLS | LPM | Probit | OLS | Tobit |
| Observations | 3205 | 44586 | 44586 | 3205 | 44586 |
| | | | Parametric | | |
| ln stars | $0.22^a$ | $0.09^a$ | $0.09^a$ | $1.31^a$ | $4.58^a$ |
| | (0.04) | (0.01) | (0.01) | (0.19) | (0.54) |
| $\psi$, std. dev. of $\ln \alpha_d(j)$ | | | | | $4.30^a$ |
| | | | | | (0.16) |
| $R^2$ | 0.24 | 0.27 | 0.32 | 0.23 | 0.62/ 0.15 |

## Quality sorting

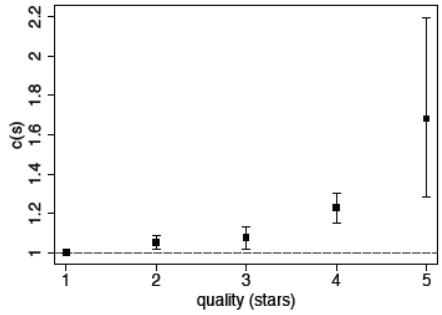
Table 2: Firm-level regressions for quality-rated Champagne exporters

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Dependent variable: | $\ln p_d^{\text{fob}}(j)$ | $\mathcal{E}_d(j)$ | $\mathcal{E}_d(j)$ | $\ln x_d^{\text{fob}}(j)$ | $\ln x_d^{\text{fob}}(j)$ |
| Method | OLS | LPM | Probit | OLS | Tobit |
| | | | Non-Parametric | | |
| 2 stars | $0.05^a$ | $0.02^a$ | $0.02^b$ | 0.32 | $1.25^b$ |
| | (0.02) | (0.01) | (0.01) | (0.23) | (0.52) |
| 3 stars | $0.07^a$ | $0.04^a$ | $0.05^a$ | $0.63^a$ | $2.68^a$ |
| | (0.03) | (0.01) | (0.01) | (0.23) | (0.55) |
| 4 stars | $0.20^a$ | $0.13^a$ | $0.11^a$ | $1.99^a$ | $5.80^a$ |
| | (0.03) | (0.03) | (0.02) | (0.34) | (0.79) |
| 5 stars | $0.52^a$ | $0.26^a$ | $0.16^a$ | $1.67^a$ | $7.70^a$ |
| | (0.14) | (0.03) | (0.02) | (0.23) | (0.59) |
| $\psi$, std. dev. of $\ln \alpha_d(j)$ | | | | | $4.19^a$ |
| | | | | | (0.16) |
| $R^2$ | 0.32 | 0.29 | 0.33 | 0.26 | 0.63 / 0.17 |

# Quality sorting

- Structural interpretation of the coefficients
  - The coefs in the price equation give the "cost of quality" (λ)
    - The production of a 5-stars champagne costs 68% more than a 1-star

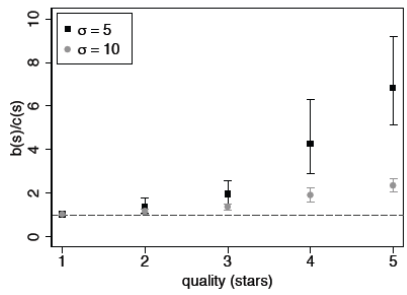
(a) prices: the cost of quality




# Quality sorting

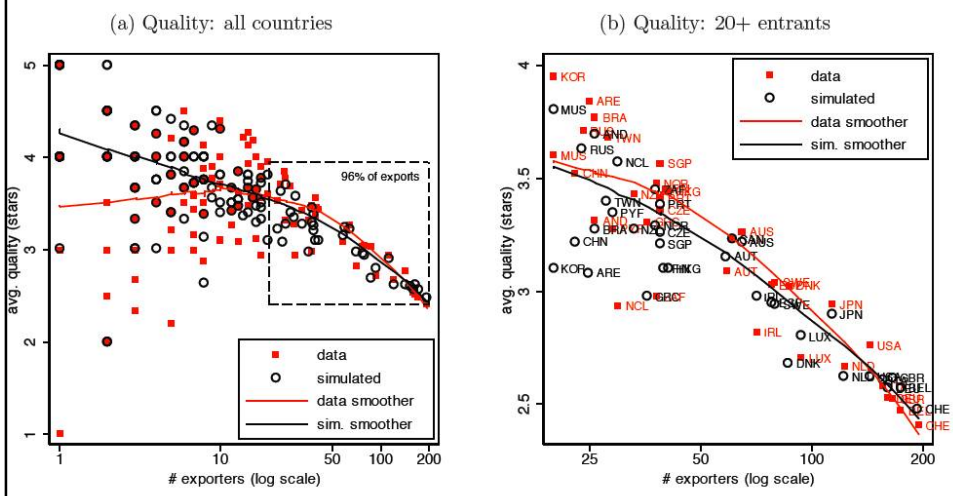
- Structural interpretation of the coefficients
  - The coefs in the export value equation is $(\lambda-\gamma)(1-\sigma)$
  - They give the "willingness to pay for quality" (©)
    - With σ=5, the consumers are willing to trade 12 bottles of 1-star champ for one 5-star

(b) values: the benefit-cost ratio



# Quality sorting

Figure 7: Fit of data to the quality sorting model




# Firm-level export prices and export performances

- Two mechanisms may be at work:
  - Firm-selection across markets
  - **Quality to market**

+ one: markup strategies

## Shipping the good apples out

- Hummels & Skiba (*JPE*, 2004)
  - Adapt the Alchian Allen conjecture to international trade
  - Idea:
    - Most trade theories assume for simplicity "iceberg transport costs"
      - = add valorem transport cost
    - But if trade cost are per unit (rather than per monetary unit), then shipping expensive goods is relatively cheaper
    - If producers can choose the quality they send on each market, they sell the highest quality on distant markets
    - "Shipping the good apples out"

## Shipping the good apples out

- Exporting country *j* produces high (H) and low (L) qualities.
- Demand in country *i* for country j's product depends on prices of the 2 qualities and the price of alternative goods

$$q_{ijg} = h(p^*_{ijH}, p^*_{ijL}, p_{iC}), \quad g = H, L. \qquad (1)$$

- For any quality, CIF price depend on FOB price, ad valorem tariff and transport cost *f*

$$p^*_{ij} = p_j t_{ij} + f_{ij}. \qquad (2)$$

## Shipping the good apples out

- A marginal change in the transport cost affects the relative demand for quality:

$$\frac{\partial(q_{ijH}/q_{ijL})}{\partial f_{ij}} = \frac{q_{ijH}}{q_{ijL}}\left[\underbrace{(\epsilon_{HH} - \epsilon_{LH})}\left(\frac{1}{p^*_{ijH}} - \frac{1}{p^*_{ijL}}\right) + \underbrace{(\epsilon_{LC} - \epsilon_{HC})}\frac{1}{p^*_{ijL}}\right]. \qquad (3)$$

Difference in own-price elasticity of the quality good with the cross-price elasticity of the low-quality good with respect to the quality good (<0)

Difference in the two cross-price elasticities with respect to the outside good (=0)

- The second parenthesis is positive since quality good is more expensive
- The first parenthesis is negative if the (negative) direct price elasticity is larger thant the (negative) cross-price elasticity
- If the 2 cross-prices elasticites with respect to the outside good are the same the second term is zero
- ⇨ An increase in transport cost increases the relative demand of quality good
- The magnitude of this Alchian-Allen effect depends on $(\epsilon_{HH} - \epsilon_{LH})$

## Shipping the good apples out

- Data:
  - Bilateral trade of 6 importers (Argentina, Brazil, Chile, Paraguay, Uruguay, and the USA)
  - 6-digit classification (more than 5000 products)
  - Data provides
    - Total freight rates : $F_{ijk}$
    - Shipment value (fob) : $V_{ijk}$-$F_{ijk}$
    - Shipment weight (= proxy for quantities) : $WGT_{ijk}$
  - They compute the per unit freight rate: $f_{ijk}$=$F_{ijk}$ / $WGT_{ijk}$
  - and the fob price: $p_{ijk}$=($V_{ijk}$-$F_{ijk}$) / $WGT_{ijk}$

## Shipping the good apples out

- Estimated equation (1) = are freight rates ad-valorem (i.e. proportional to prices)?

$$\ln f_{ijk} - \overline{\ln f_k} = a + \beta(\ln p_{ijk} - \overline{\ln p_k}) + \omega(\ln \mathrm{WGT}_{ijk} - \overline{\ln \mathrm{WGT}_k}) + \delta(\ln \mathrm{DIST}_{ij} - \overline{\ln \mathrm{DIST}_k}) + (\epsilon_{ijk} - \overline{\epsilon_k}). \quad (10)$$

- Iceberg transport cost ⇨ $\beta=1$
- Alchian Allen conjecture: $\beta<1$ (or $\beta=0$ if freight cost is only per unit)
- $\omega<0$ if there are some increasing return to scale (or discount prices of transport for large shipments)
- $\delta>0$ if transport costs increase with distance
- AA ⇨ cost per unit should be lower for higher price… but more expensive good need more expensive insurance and handling requirement ⇨ IV strategy to control for endogeneity

## Shipping the good apples out

**Instruments for prices = tariffs and countries' income**

TABLE 1
DETERMINANTS OF FREIGHT COSTS
Dependent Variable: ln(Freight Cost)

| | Variables (in Logs) | | | | |
|---|---|---|---|---|---|
| | Price $\beta$ | Distance $\delta$ | Quantity $\omega$ | $R^2$ | Observations |
| | | | All Countries | | |
| OLS | .64 | .26 | −.12 | .64 | 275,398 |
| | (.0012) | (.0019) | (.0005) | | |
| IV | .61 | .25 | −.18 | … | 254,031 |
| | (.0048) | (.0020) | (.0022) | | |
| | | | U.S. Sample | | |
| OLS | .716 | .114 | −.219 | .83 | 299,409 |
| | (.0017) | (.0017) | (.0024) | | |
| IV | .125 | .221 | −.480 | … | 277,756 |
| | (.0138) | (.0050) | (.0142) | | |

NOTE.—The estimating equation is eq. (10) in the text. For the instrumental variable estimates, price and quantity are instrumented by tariffs and exporter and importer GDP per capita.

**US data are more disagregated (10-digit) and some quantities are reported in units, not in tons ⇨ Better control for changes in the quality mix exported by countries**

## Shipping the good apples out

- Estimated equation (2):

$$\ln p_{ijk} - \overline{\ln p_k} = \phi(\ln f_{ijk} - \overline{\ln f_k}) + \tau(\ln t_{ijk} - \overline{\ln t_k}) + \gamma_1(\ln y_i - \overline{\ln y_k}) + \gamma_2(\ln y_j - \overline{\ln y_k}) + (e_{ijk} - \overline{e_k}). \quad (11)$$

- Alchian Allen conjecture: $\phi>0$
  - Import prices for a given country increase with trade cost .
- $\tau<0$ : ad-valorem trade costs (such like tariffs) reduce more the imports of expensive varieties (⇨ decrease import prices)
- $\gamma_1$ and $\gamma_2$ >0 : richer countries export and import more expensive goods

## Shipping the good apples out

Within product (eq. 11)

Within product-exporting country

TABLE 2
ALCHIAN-ALLEN EFFECTS ON PRICES
Dependent Variable: ln(Price)

| | Variables (in Logs) | | | | |
|---|---|---|---|---|---|
| | Freight Cost $\phi$ | Tariff $\tau$ | GDP per Capita (Importer) $\gamma_1$ | GDP per Capita (Exporter) $\gamma_2$ | Observations |
| | Instruments: Shipment Weight and Distance | | | | |
| Eq. (11) | .798 | −1.56 | .46 | .20 | 254,031 |
| | (.0023) | (.0368) | (.0044) | (.0029) | |
| Eq. (12) | .84 | −1.46 | .53 | ... | 275,398 |
| | (.0026) | (.0289) | (.0036) | | |
| | Instruments: Lagged Values of Price | | | | |
| Eq. (11) | 1.33 | −2.56 | .34 | −.03 | 91,989 |
| | (.0072) | (.0787) | (.0092) | (.0067) | |
| Eq. (12) | 1.41 | −2.28 | .62 | ... | 100,118 |
| | (.0144) | (.0689) | (.0087) | | |

NOTE.—For eq. (11), all variables are commodity differenced. For eq. (12), all variables are exporter commodity differenced.

## No Selection, no quality… just transport costs

- **Julien Martin (2009)**
  - Just assume (like Hummels & Skiba) a mix of an ad valorem and per unit fixed cost:

$$Transport\ Cost = p_{fj}^{cif} - p_{fj}^{fob} = (\tau_{fj} - 1)p_{fj}^{fob} + T_{fj}$$

    - If $\tau$=1 we have a purely additive trade cost.
  - Then:

$$p_{fj}^{cif}(\tau_{fj}, T_{fj}, w_f) = \tau_{fj} p_{fj}^{fob}(\tau_{fj}^{ij}, T_{fj}, w_f) + T_{fj}$$

## No Selection, no quality… just transport costs

- **Julien Martin (EER 2012)**
  - He replicates the Baldwin and Harrigan test of the impact of distance on export prices
  - But with (French) firm-level data

Table 2: Price and distance, 2003

| Dependent variable: | Price (log) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Distance (log) | $0.042^a$ | $0.045^b$ | $0.011^c$ | $0.050^a$ | $0.051^a$ | $0.019^b$ | $0.050^a$ | $0.051^a$ | $0.019^b$ |
| | (0.012) | (0.017) | (0.005) | (0.010) | (0.013) | (0.007) | (0.010) | (0.013) | (0.007) |
| GDP (log) | | | | -0.004 | 0.000 | 0.003 | -0.004 | 0.000 | 0.003 |
| | | | | (0.004) | (0.006) | (0.002) | (0.004) | (0.006) | (0.002) |
| GDP per capita (log) | | | | $0.020^a$ | $0.047^b$ | 0.014 | $0.018^a$ | $0.046^b$ | 0.014 |
| | | | | (0.006) | (0.020) | (0.010) | (0.006) | (0.020) | (0.010) |
| Mean UV (log) | | | | | | | $0.018^a$ | $0.010^c$ | 0.003 |
| | | | | | | | (0.005) | (0.005) | (0.002) |
| Fixed effects | Firm × Product | | | | | | | | |
| Sample: | All | OECD | Eurozone | All | OECD | Eurozone | All | OECD | Eurozone |
| Observations | 1,199,711 | 910,108 | 591,733 | 1,199,711 | 910,108 | 591,733 | 1,198,282 | 909,398 | 591,268 |
| $R^2$ | 0.003 | 0.004 | 0.000 | 0.004 | 0.005 | 0.000 | 0.005 | 0.005 | 0.000 |
| rho | 0.911 | 0.923 | 0.933 | 0.911 | 0.923 | 0.933 | 0.910 | 0.922 | 0.933 |

This table investigates the impact of distance on firm's export prices. It uses the variance of prices across destination country within firm-product pairs by including firm×product fixed effects. The dependent variable is the log free on board export unit value by firm, destination and CN8 product. Explanatory variables are the distance to the destination country, the wealth of the destination country measured by the GDP per capita, the size of the destination country measured by the GDP, and the level of competition in the destination country measured by the average unit value of imports in this country. In columns 1, 4, 7 all destinations are considered. In columns 2, 5, 8 only exports toward OECD countries are considered. In columns 3, 6, 9, only exports toward euro countries are considered. Reported standard errors are clustered by country. $^c$, $^b$, $^a$ indicate significance at the 10%, 5% and 1% level.

## No Selection, no quality… just transport costs

- **Julien Martin (EER 2012)**
  - The positive relationship between distance and export prices is not (only) due to a selection effect as suggested by:
    - Alchian Allen
    - Baldwin and Harrigan
  - It is also explained by firm-level pricing strategies (pricing to markets):
    - On average, firms charge higher prices on more distant destinations

## No Selection, no quality… just transport costs

- Assume the following trade cost function (similar to Humels and Skiba/AA):

$$p_d^{cif}(i) = p(i)\tau_d + T_d$$

–If there is no vertical differentiation, the profit maximization gives the following mark-up equation:

$$p_d^{cif}(i) = \frac{\sigma}{\sigma - 1}(T_d + c(i)\tau_d) \qquad p_d^{fob}(i) = \frac{1}{\sigma - 1}\frac{T_d}{\tau_d} + \frac{\sigma}{\sigma - 1}c(i)$$

–Prices are not anymore a constant mark-up over marginal cost.

–Now, fob prices differ across destinations: they are higher on more distant (=higher T) countries

–⇨ "Reversed – dumping"

## No Selection, no quality… just transport costs

- Bottom line:
  - A positive relationship between transport cost and export product prices is not sufficient to prove the existence of vertical differentiation and productivity sorting
  - *fob* unit value can not be considered as proxies for quality
  - Assuming iceberg transport cost in trade models is not innocuous:
    - Under monopolistic competition with CES functions:
      - With iceberg transport cost firms charge a constant mark-up on all destinations
      - With additive transport cost firms charge a higher mark-up on distant markets