

# Export Destinations and Input Prices: Evidence from Portugal

Paulo Bastos  
IADB, World Bank

Joana Silva  
World Bank

Eric Verhoogen  
Columbia University

Preliminary

May 2012

# Introduction

- ▶ There is mounting evidence of effects of exporting on firm behavior.
  - ▶ Productivity literature somewhat mixed (Clerides et al., 1998; Bernard and Jensen, 1999; Van Biesebroeck, 2005; De Loecker, 2007).
  - ▶ Evidence of effects on technology investments (Bustos, 2011; Lileeva and Trefler, 2010).
  - ▶ Evidence of effects on wages, ISO 9000 certification (Verhoogen, 2008).

# Introduction

- ▶ There is mounting evidence of effects of exporting on firm behavior.
  - ▶ Productivity literature somewhat mixed (Clerides et al., 1998; Bernard and Jensen, 1999; Van Biesebroeck, 2005; De Loecker, 2007).
  - ▶ Evidence of effects on technology investments (Bustos, 2011; Lileeva and Trefler, 2010).
  - ▶ Evidence of effects on wages, ISO 9000 certification (Verhoogen, 2008).
- ▶ Important, not yet fully resolved questions:
  - ▶ Does the destination of exports matter?
  - ▶ If so, why?

## Introduction (cont.)

- ▶ A common approach in the literature is to model effects of exporting as operating through scale effects (Yeaple, 2005; Bustos, 2011).
  - ▶ Increase in sales volume with export entry induces firms to pay fixed costs of technology, R&D etc.
  - ▶ Suggests exports *per se*, not destination characteristics, should matter.

## Introduction (cont.)

- ▶ A common approach in the literature is to model effects of exporting as operating through scale effects (Yeaple, 2005; Bustos, 2011).
  - ▶ Increase in sales volume with export entry induces firms to pay fixed costs of technology, R&D etc.
  - ▶ Suggests exports *per se*, not destination characteristics, should matter.
- ▶ But there seems to be a robust within-firm-product correlation between prices and destination-market income:
  - ▶ Bastos and Silva (JIE, 2010): Portugal
  - ▶ Manova and Zhang (QJE, 2012): China
  - ▶ Martin (2010): France
  - ▶ Görg, Halpern and Muraközy (2010): Hungary

## Introduction (cont.)

- ▶ Possible explanations for within firm-product price patterns:
  - ▶ Endogenous mark-ups: “pricing to market”
  - ▶ Differences in demand for quality: richer consumers more willing to pay for quality, firms raise quality of good sold to them (Linder, 1961; Hallak, 2006; Verhoogen, 2008).

## Introduction (cont.)

- ▶ Possible explanations for within firm-product price patterns:
  - ▶ Endogenous mark-ups: “pricing to market”
  - ▶ Differences in demand for quality: richer consumers more willing to pay for quality, firms raise quality of good sold to them (Linder, 1961; Hallak, 2006; Verhoogen, 2008).
- ▶ This paper:
  - ▶ Derives arguably distinctive implications of the quality story
  - ▶ Tests them in combination of customs and firm-level price data from Portugal.

## Introduction (cont.)

- ▶ Difficulty: quality is unobserved. Literature has relied on accumulation of indirect evidence:
  - ▶ Some sectors sell large volumes at high prices, suggesting that goods are high-quality (Hummels and Klenow, 2005; Hallak and Schott, 2011; Khandelwal, 2010)
  - ▶ Plant-level facts (Kugler and Verhoogen, 2012):
    - ▶ Within product categories, larger plants charge higher prices for outputs. (Also consistent with mark-up story.)
    - ▶ Within product categories, larger plants also pay more for material inputs. (Harder to reconcile with mark-up story.)
    - ▶ Price-plant size correlations greater in sectors with greater scope for quality differentiation, as proxied by standard measure from Sutton (1998): R&D and advertising intensity.



## Introduction (cont.)

- ▶ Strategy in this paper:
  - ▶ Use real-exchange-rate movements as instrument for export destination.
  - ▶ Look at effects of average destination income on prices of material inputs.

## Introduction (cont.)

- ▶ Strategy in this paper:
  - ▶ Use real-exchange-rate movements as instrument for export destination.
  - ▶ Look at effects of average destination income on prices of material inputs.
- ▶ Punchline: rich-country export share  $\uparrow \Rightarrow$  input prices  $\uparrow$ 
  - ▶ We interpret results as supportive of quality story.

## Introduction (cont.)

- ▶ Related paper: Brambilla et al. (forthcoming):
  - ▶ Brazilian devaluation generates exogenous variation in destination of exports for Argentinian firms.
  - ▶ Exports to rich countries lead to higher *wages*; exports per se do not.

## Introduction (cont.)

- ▶ Related paper: Brambilla et al. (forthcoming):
  - ▶ Brazilian devaluation generates exogenous variation in destination of exports for Argentinian firms.
  - ▶ Exports to rich countries lead to higher *wages*; exports per se do not.
- ▶ Value-added of current paper:
  - ▶ Have information on material inputs. Arguably less affected by institutional factors (e.g. collective bargaining).
  - ▶ For Argentina, income of destination is highly correlated with distance. For Portugal, correlation is reversed. Can better separate demand-for-quality and "shipping the good apples out" stories.

# Theory

- ▶ Goal: derive comparative-static predictions for how firm-level prices respond to real-exchange rate shocks, to guide empirical work.
- ▶ Draws on ideas from existing models:
  - ▶ Melitz (2003)
  - ▶ Kugler and Verhoogen (2012), variant 1: complementarity between firm capability and input quality in generating output quality.
  - ▶ Linder (1961), Hallak (2006), Verhoogen (2008): richer consumers more willing to pay for quality.

## Theory (cont.)

- ▶ Three countries: Home (h), North (n), South (s)
  - ▶  $i$  indexes production location
  - ▶  $j$  indexes destination market

## Theory (cont.)

- ▶ Three countries: Home (h), North (n), South (s)
  - ▶  $i$  indexes production location
  - ▶  $j$  indexes destination market
- ▶ Three sectors:
  - ▶ Homogeneous-good “outside” sector.
    - ▶ Freely traded, produced by all countries. Pins down wages,  $w_i$ .
    - ▶ Productivity in sector, hence wages, may vary across countries.
  - ▶ Intermediate-input sector
    - ▶ Perfectly competitive, but with quality differences.
  - ▶ Final-good sector
    - ▶ Monopolistic competition, heterogeneous firms, quality differences.

## Theory (cont.)

- ▶ Representative consumer:

$$U_j = \left\{ \left[ \int_{\omega \in \Omega_j} (q(\omega)^{\mu_j} x(\omega))^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}} \right\}^{\beta} Z^{1-\beta} \quad (1)$$

- ▶  $Z$  is consumption of homogeneous good.
- ▶  $q$  is quality of variety  $\omega$ , chosen by firms.
- ▶  $\mu_j$  is valuation of quality, differs across countries.
  - ▶ Assume  $\mu_n > \mu_h > \mu_s > \frac{1}{2}$



## Theory (cont.)

- ▶ Representative consumer:

$$U_j = \left\{ \left[ \int_{\omega \in \Omega_j} (q(\omega)^{\mu_j} x(\omega))^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}} \right\}^{\beta} Z^{1-\beta} \quad (1)$$

- ▶  $Z$  is consumption of homogeneous good.
- ▶  $q$  is quality of variety  $\omega$ , chosen by firms.
- ▶  $\mu_j$  is valuation of quality, differs across countries.
  - ▶ Assume  $\mu_n > \mu_h > \mu_s > \frac{1}{2}$
- ▶ Yields demand for each variety:

$$x_j(\omega) = \beta w_j L_j P_j^{\sigma-1} q(\omega)^{\mu_j(\sigma-1)} p(\omega)^{-\sigma}$$

- ▶ where  $P_j := \left[ \int_{\omega \in \Omega_j} \left( \frac{p(\omega)}{q(\omega)^{\mu_j}} \right)^{1-\sigma} d\omega \right]^{\frac{1}{1-\sigma}}$
- ▶  $L_j$  is endowment of effective units of labor.

# Theory (cont.)

- ▶ Intermediate-input sector:
  - ▶ Transforms unskilled labor into inputs of different qualities.
    - ▶ Can also be thought of as education sector, bundling labor units into skilled workers.
  - ▶ Production function:

$$F_I(\ell, c) = \frac{\ell}{c}$$

- ▶  $\ell$  is units of effective labor.
- ▶  $c$  units of labor required to produce input of quality  $c$ .
- ▶ In equilibrium,  $p_I(c) = w_I c$ .

# Theory (cont.)

- ▶ Final-good sector:
  - ▶ Firms pay investment  $w_i f_e$  to get “capability” draw,  $\lambda$
  - ▶ Pareto distribution:  $G(\lambda) = 1 - \left(\frac{\lambda_m}{\lambda}\right)^k$ ,  $0 < \lambda_m \leq \lambda$
  - ▶ Fixed cost:  $w_i f_{ij} = w_i f$  for  $i = j$ ,  $= w_i f_x > w_i f$  for  $i \neq j$ .
  - ▶ Iceberg trade cost:  $\tau_{ij} = \tau$  for  $i \neq j$ ,  $= 1$  for  $i = j$ .
  - ▶ Capability  $\lambda$  affects production costs: producing one unit of output requires  $\frac{1}{\lambda^a}$  units of input.
  - ▶ Capability  $\lambda$  also affects quality of output:

$$q = \left[ \frac{1}{2} (\lambda^b)^\theta + \frac{1}{2} (c^2)^\theta \right]^{\frac{1}{\theta}}$$

$\theta < 0 \Rightarrow$  complementarity between firm capability and input quality.

## Theory (cont.)

- ▶ First-order conditions for firm yield:

$$c_{ij}^*(\lambda) = (2\mu_j - 1)^{-\frac{1}{2\theta}} \lambda^{\frac{b}{2}}$$

$$p_{lij}^*(\lambda) = w_i (2\mu_j - 1)^{-\frac{1}{2\theta}} \lambda^{\frac{b}{2}}$$

$$q_{ij}^*(\lambda) = \left(2 - \frac{1}{\mu_j}\right)^{-\frac{1}{\theta}} \lambda^b$$

$$p_{Oij}^*(\lambda) = \left(\frac{\sigma}{\sigma - 1}\right) w_i \tau_{ij} (2\mu_j - 1)^{-\frac{1}{2\theta}} \lambda^{\frac{b}{2} - a}$$

$$r_{ij}^*(\lambda) = \beta w_j L_j \Phi_j \left(\frac{P_j}{w_i \tau_{ij}}\right)^{\sigma - 1} \lambda^{\zeta_j}$$

where:

$$\zeta_j := (\sigma - 1) \left[ b \left( \mu_j - \frac{1}{2} \right) + a \right] > 0$$

$$\Phi_j := \left[ \left( \frac{\sigma - 1}{\sigma} \right) \mu_j^{\frac{\mu_j}{\theta}} (2\mu_j - 1)^{-\frac{2\mu_j - 1}{2\theta}} \right]^{\sigma - 1} > 0$$

## Theory (cont.)

- ▶ Key point: conditional on  $\lambda$  and entry,  $q$ ,  $p_O$ ,  $c$ , and  $p_I$  higher for goods sold to richer markets.

## Theory (cont.)

- ▶ Key point: conditional on  $\lambda$  and entry,  $q$ ,  $p_O$ ,  $c$ , and  $p_I$  higher for goods sold to richer markets.
- ▶ Entry cut-offs pinned down by:
  - ▶ Zero-profit conditions for marginal firms:

$$\pi_{ij}^*(\lambda_{ij}^*) = \frac{r_{ij}^*(\lambda_{ij}^*)}{\sigma} - w_i f_{ij} = 0$$

- ▶ Free-entry condition (zero ex ante expected profit):

$$\sum_{j \in h, n, s} \left\{ (1 - G(\lambda_{ij}^*)) \sum_{t=0}^{\infty} (1 - \delta)^t \left[ \frac{E(r_{ij}^*(\lambda))}{\sigma} - w_i f_{ij} \right] \right\} - w_i f_e = 0$$

## Theory (cont.)

- ▶ Using facts that  $\frac{r_{ij}^*(\lambda)}{r_{ij}^*(\lambda_{ij}^*)} = \left(\frac{\lambda}{\lambda_{ij}^*}\right)^{\zeta_j}$  and  $E(r_{ij}^*(\lambda)) = \frac{\sigma k f_{ij} w_i}{k - \zeta_j}$ , the free-entry conditions can be rewritten:

$$\sum_{j \in h, n, s} \frac{f_{ij}}{R_{ij}^k} \left(\frac{\zeta_j}{k - \zeta_j}\right) \left(\frac{w_j}{w_i}\right)^{\frac{\sigma k}{\zeta_j}} \frac{1}{(\lambda_{ij}^*)^k} = \frac{\delta f_e}{\lambda_m^k}, \quad i \in h, n, s \quad (2)$$

- ▶ These can be solved explicitly for  $\lambda_{jj}^*$ , and  $\lambda_{ij}^*$  for  $i \neq j$  can be inferred from them.
- ▶ N.B.: cut-offs do not depend on scale of economy.
- ▶ Measure of firms and share of labor force in manufacturing in each country pinned down by labor-market and goods-market clearing conditions.

## Theory (cont.)

- ▶ Model “real-exchange-rate shock” as a shock to productivity in outside sector, which determines wage rate.
- ▶ Consider effect of changes in  $w_n$  around equilibrium with  $w_n = w_h = w_s = 1$ :

$$\frac{\partial \lambda_{nh}^*}{\partial w_n} > 0 \quad \frac{\partial \lambda_{ns}^*}{\partial w_n} > 0$$

$$\frac{\partial \lambda_{hn}^*}{\partial w_n} < 0 \quad \frac{\partial \lambda_{sn}^*}{\partial w_n} < 0$$

$$\frac{\partial \lambda_{ss}^*}{\partial w_n} > 0 \quad \frac{\partial \lambda_{hh}^*}{\partial w_n} > 0$$

$$\frac{\partial \lambda_{nn}^*}{\partial w_n} < 0$$

$$\frac{\partial \lambda_{hs}^*}{\partial w_n} > 0 \quad \frac{\partial \lambda_{sh}^*}{\partial w_n} > 0$$



## Theory (cont.)

- ▶ Output on each production line varies inversely with cut-offs.

$$x_{ij}^*(\lambda) = \frac{r_{ij}^*(\lambda)}{p_{Oij}^*(\lambda)} = \frac{(\sigma - 1)f_{ij}}{w_i \tau_{ij} (2\mu_j - 1)^{-\frac{1}{2\theta}}} \frac{\lambda \zeta_j^{a - \frac{b}{2}}}{\lambda_{ij}^* \zeta_j}$$

## Theory (cont.)

- ▶ Output on each production line varies inversely with cut-offs.

$$x_{ij}^*(\lambda) = \frac{r_{ij}^*(\lambda)}{p_{Oij}^*(\lambda)} = \frac{(\sigma - 1)f_{ij}}{w_i \tau_{ij} (2\mu_j - 1)^{-\frac{1}{2\theta}}} \frac{\lambda \zeta_j^{a-\frac{b}{2}}}{\lambda_{ij}^* \zeta_j}$$

- ▶ The key observable is average input prices at the plant level:

$$\bar{p}_{l_h}^*(\lambda) = \sum_{j \in h, n, s} \left[ \frac{x_{hj}^*(\lambda)}{x_{hh}^*(\lambda) + x_{hn}^*(\lambda) + x_{hs}^*(\lambda)} \right] p_{l_{hj}}^*(\lambda)$$

## Theory (cont.)

- ▶ Output on each production line varies inversely with cut-offs.

$$x_{ij}^*(\lambda) = \frac{r_{ij}^*(\lambda)}{p_{Oij}^*(\lambda)} = \frac{(\sigma - 1)f_{ij}}{w_i \tau_{ij} (2\mu_j - 1)^{-\frac{1}{2\theta}}} \frac{\lambda \zeta_j^{a-\frac{b}{2}}}{\lambda_{ij}^* \zeta_j}$$

- ▶ The key observable is average input prices at the plant level:

$$\bar{p}_{l_h}^*(\lambda) = \sum_{j \in h, n, s} \left[ \frac{x_{hj}^*(\lambda)}{x_{hh}^*(\lambda) + x_{hn}^*(\lambda) + x_{hs}^*(\lambda)} \right] p_{l_{hj}}^*(\lambda)$$

- ▶ The comparative-static results on entry cutoffs imply:

$$\frac{\partial \bar{p}_{l_h}^*(\lambda)}{\partial w_n} \geq 0$$
$$\frac{\partial \bar{p}_{l_h}^*(\lambda)}{\partial w_s} \leq 0$$

## Theory (cont.)

- ▶ Output on each production line varies inversely with cut-offs.

$$x_{ij}^*(\lambda) = \frac{r_{ij}^*(\lambda)}{p_{Oij}^*(\lambda)} = \frac{(\sigma - 1)f_{ij}}{w_i \tau_{ij} (2\mu_j - 1)^{-\frac{1}{2\theta}}} \frac{\lambda \zeta_j^{a-\frac{b}{2}}}{\lambda_{ij}^* \zeta_j}$$

- ▶ The key observable is average input prices at the plant level:

$$\bar{p}_{l_h}^*(\lambda) = \sum_{j \in h, n, s} \left[ \frac{x_{hj}^*(\lambda)}{x_{hh}^*(\lambda) + x_{hn}^*(\lambda) + x_{hs}^*(\lambda)} \right] p_{l_{hj}}^*(\lambda)$$

- ▶ The comparative-static results on entry cutoffs imply:

$$\frac{\partial \bar{p}_{l_h}^*(\lambda)}{\partial w_n} \geq 0$$
$$\frac{\partial \bar{p}_{l_h}^*(\lambda)}{\partial w_s} \leq 0$$

- ▶ Similarly for average output prices.

# Data

- ▶ Two main datasets:
  - ▶ Customs data on firm-level international trade transactions.
    - ▶ Essentially the universe of transactions.

# Data

- ▶ Two main datasets:
  - ▶ Customs data on firm-level international trade transactions.
    - ▶ Essentially the universe of transactions.
  - ▶ *Inquérito Anual à Produção Industrial (IAPI)* [Annual Survey of Industrial Production]: survey of prices of outputs and inputs of manufacturing firms.
    - ▶ In selected sectors, includes largest firms until 90% of sales are covered.
    - ▶ Available 1997-2005. Sample coverage reduced 2002-2005.

# Data

- ▶ Two main datasets:
  - ▶ Customs data on firm-level international trade transactions.
    - ▶ Essentially the universe of transactions.
  - ▶ *Inquérito Anual à Produção Industrial (IAPI)* [Annual Survey of Industrial Production]: survey of prices of outputs and inputs of manufacturing firms.
    - ▶ In selected sectors, includes largest firms until 90% of sales are covered.
    - ▶ Available 1997-2005. Sample coverage reduced 2002-2005.
- ▶ Baseline estimates are for firm-years appearing in both datasets.
  - ▶ Unbalanced panel
  - ▶ 3,000-3,500 firms/year in 1997-2001
  - ▶ 750-1,350 firms/year in 2002-2005.

# Table 1: Summary statistics, firm-level data, 1997-2005

|                                     | est. sample        | all exporters     | all manufact.    |
|-------------------------------------|--------------------|-------------------|------------------|
| Exports per firm per year           | 6.33<br>(42.35)    | 1.65<br>(18.66)   |                  |
| Export share of sales               | 0.47<br>(0.38)     |                   |                  |
| Number of export destinations, 2005 | 10.21<br>(10.75)   | 3.35<br>(5.29)    |                  |
| Number of export categories, 2005   | 15.2<br>(23.15)    | 9.85<br>(27.5)    |                  |
| Number of source countries, 2005    | 7.38<br>(6.49)     | 2.84<br>(4.34)    |                  |
| Number of import categories, 2005   | 35.46<br>(60.54)   | 14.02<br>(40.08)  |                  |
| Avg. earnings, 2005                 | 9.44<br>(4.1)      | 9.25<br>(28.19)   | 5.54<br>(22.91)  |
| Employment, 2005                    | 172.89<br>(468.05) | 49.37<br>(242.42) | 17.38<br>(62.47) |
| Sales, 2005                         | 27.49<br>(200.27)  | 6.3<br>(70.35)    | 1.24<br>(31.83)  |
| N (firm-year obs.)                  | 17988              | 134655            | 45031            |
| N (distinct firms)                  | 3896               | 39865             | 45031            |



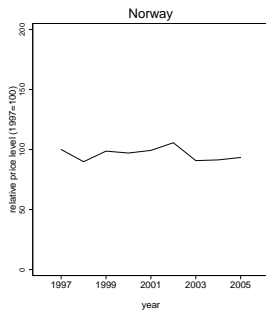
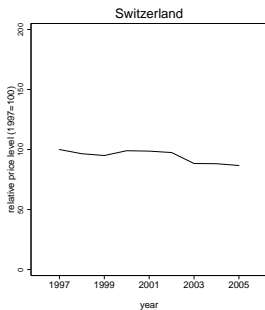
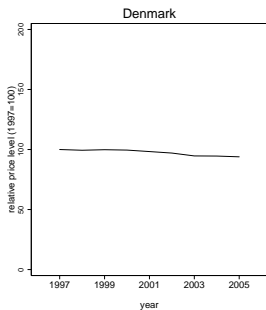
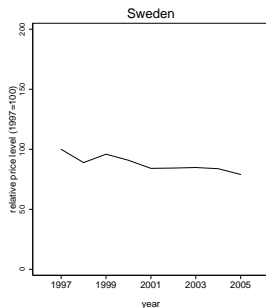
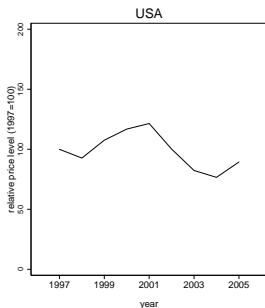
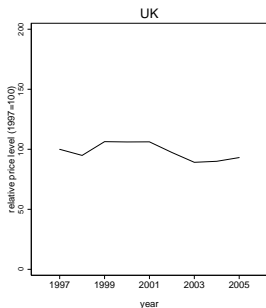
## Table 2: Main export destinations, 1997

| Exports               | Full data<br>(aggreg.)<br>(1) | Est. sample<br>(aggreg.)<br>(2) | Est. sample<br>(firm-level)<br>(3) |
|-----------------------|-------------------------------|---------------------------------|------------------------------------|
| <b>Richer nations</b> | <b>0.922</b>                  | <b>0.937</b>                    | <b>0.807</b>                       |
| Germany               | 0.206                         | 0.221                           | 0.109                              |
| Spain                 | 0.148                         | 0.146                           | 0.187                              |
| France                | 0.145                         | 0.147                           | 0.146                              |
| UK                    | 0.124                         | 0.122                           | 0.086                              |
| Netherlands           | 0.051                         | 0.053                           | 0.04                               |
| Belgium               | 0.046                         | 0.051                           | 0.027                              |
| US                    | 0.042                         | 0.045                           | 0.051                              |
| Italy                 | 0.039                         | 0.039                           | 0.023                              |
| <b>Poorer nations</b> | <b>0.078</b>                  | <b>0.063</b>                    | <b>0.193</b>                       |
| Angola                | 0.018                         | 0.006                           | 0.053                              |
| Brazil                | 0.01                          | 0.009                           | 0.023                              |
| Turkey                | 0.004                         | 0.004                           | 0.002                              |
| Cape Verde            | 0.004                         | 0.002                           | 0.025                              |
| Morroco               | 0.004                         | 0.004                           | 0.005                              |
| Russia                | 0.003                         | 0.003                           | 0.006                              |
| Hungary               | 0.003                         | 0.003                           | 0.002                              |
| South Africa          | 0.003                         | 0.003                           | 0.006                              |

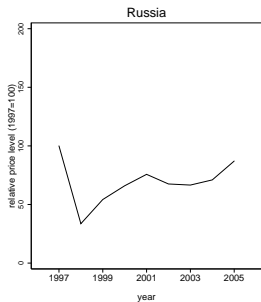
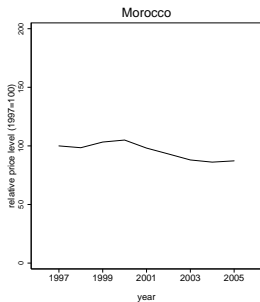
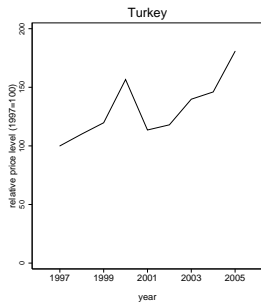
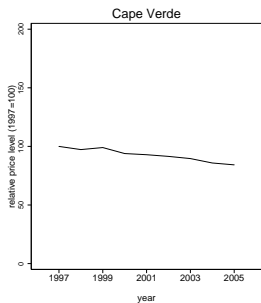
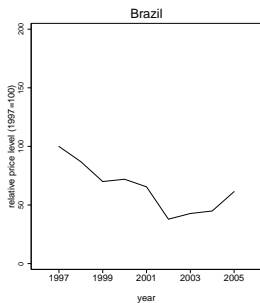
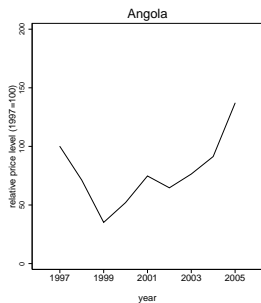
## Table 2 (cont.): Main import source countries, 1997

| Imports               | Full data<br>(aggreg.)<br>(4) | Est. sample<br>(aggreg.)<br>(5) | Est. sample<br>(firm-level)<br>(6) |
|-----------------------|-------------------------------|---------------------------------|------------------------------------|
| <b>Richer nations</b> | <b>0.907</b>                  | <b>0.888</b>                    | <b>0.891</b>                       |
| Spain                 | 0.252                         | 0.21                            | 0.28                               |
| Germany               | 0.16                          | 0.218                           | 0.112                              |
| France                | 0.115                         | 0.112                           | 0.106                              |
| Italy                 | 0.086                         | 0.061                           | 0.146                              |
| UK                    | 0.073                         | 0.071                           | 0.058                              |
| Netherlands           | 0.05                          | 0.036                           | 0.000                              |
| Belgium               | 0.034                         | 0.029                           | 0.033                              |
| US                    | 0.032                         | 0.030                           | 0.031                              |
| <b>Poorer nations</b> | <b>0.093</b>                  | <b>0.112</b>                    | <b>0.109</b>                       |
| Brazil                | 0.018                         | 0.024                           | 0.024                              |
| China                 | 0.007                         | 0.004                           | 0.021                              |
| Russia                | 0.005                         | 0.007                           | 0.004                              |
| India                 | 0.004                         | 0.006                           | 0.011                              |
| Thailand              | 0.004                         | 0.002                           | 0.002                              |
| South Africa          | 0.004                         | 0.004                           | 0.004                              |
| Turkey                | 0.003                         | 0.003                           | 0.004                              |
| Pakistan              | 0.003                         | 0.002                           | 0.009                              |

# Relative Price Levels, Top Richer Destinations



# Relative Price Levels, Top Poorer Destinations



# Table 3: Gravity and export prices, 1997

|                      | dep. var.: firm-product log export price |                   |                   |                   |
|----------------------|--|-------------------|-------------------|-------------------|
|                      | (1)                                      | (2)               | (3)               | (4)               |
| richer than Portugal | 0.09***<br>(0.03)                        | 0.08***<br>(0.02) |                   |                   |
| ln gdp per capita    |  |                   | 0.03***<br>(0.01) | 0.03***<br>(0.01) |
| ln gdp               | 0.01<br>(0.00)                           | 0.00<br>(0.01)    | 0.01<br>(0.00)    | 0.00<br>(0.01)    |
| European Union       | 0.07***<br>(0.02)                        | 0.03<br>(0.02)    | 0.07***<br>(0.02) | 0.04*<br>(0.02)   |
| landlocked           | 0.05**<br>(0.02)                         | 0.03*<br>(0.02)   | 0.03<br>(0.02)    | 0.02<br>(0.02)    |
| ln distance          | 0.09***<br>(0.01)                        | 0.07***<br>(0.01) | 0.08***<br>(0.01) | 0.07***<br>(0.01) |
| product effects      | Y  | N                 | Y                 | N                 |
| firm-product effects | N  | Y                 | N                 | Y                 |
| R2                   | 0.75                                     | 0.93              | 0.75              | 0.93              |
| N                    | 71687                                    | 71687             | 71687             | 71687             |

# Empirical Approach

- ▶ Estimate firm-level average prices:

$$\ln p_{ikt} = \theta_{it} + \psi_{kt} + u_{ikt}$$

- ▶ firm  $i$ , product  $k$ , time  $t$
- ▶ Recover coefficients on firm-year effects,  $\hat{\theta}_{it}$ . These represent firm-year-level average prices, deviating from product-year means.

# Empirical Approach

- ▶ Estimate firm-level average prices:

$$\ln p_{ikt} = \theta_{it} + \psi_{kt} + u_{ikt}$$

- ▶ firm  $i$ , product  $k$ , time  $t$
  - ▶ Recover coefficients on firm-year effects,  $\hat{\theta}_{it}$ . These represent firm-year-level average prices, deviating from product-year means.
- ▶ Regress average prices on exporting variables:

$$\hat{\theta}_{it} = inc_{it}\beta_1 + X_{it}\beta_2 + a_i + b_t + \varepsilon_{it}$$

- ▶  $inc_{it}$  is average destination income, including home market, using 1996 GDP/cap and current revenue shares.
- ▶  $X_{it}$  includes export share and log total sales.
- ▶  $a_i$  and  $b_t$  are firm and year effects.

## Empirical Approach (cont.)

- ▶ Instrument for destination income (and possibly export share and log sales):
  - ▶ For export destination  $j$ , define relative price level as:

$$e_{jt} = \log \left[ \left( \frac{CPI_{jt}}{CPI_{Ht}} \right) / (\text{nominal exch. rate}) \right]$$

- ▶ This is the log of the reciprocal of the real exchange rate as usually defined.
  - ▶ Interact relative price level with 1997 revenue share for each destination, including Portugal in denominator, for top 50 non-euro-zone destinations.



# First stage

|                   | avg. dest.<br>income<br>(1) | export<br>share<br>(2) | log<br>sales<br>(3) |
|-------------------|-----------------------------|------------------------|---------------------|
| UK                | 0.05***<br>(0.01)           | 0.03**<br>(0.01)       | 0.11**<br>(0.04)    |
| USA               | 0.15***<br>(0.02)           | 0.04***<br>(0.02)      | 0.13*<br>(0.07)     |
| Denmark           | 0.16***<br>(0.04)           | 0.09***<br>(0.03)      | 0.37*<br>(0.21)     |
| Angola            | -0.20***<br>(0.04)          | 0.03*<br>(0.02)        | -0.59***<br>(0.22)  |
| Brazil            | -0.16***<br>(0.04)          | 0.04<br>(0.04)         | 0.27**<br>(0.13)    |
| Turkey            | 0.05<br>(0.09)              | 0.19***<br>(0.04)      | 0.15<br>(0.10)      |
| (other countries) |                             |                        |                     |
| firm effects      | Y                           | Y                      | Y                   |
| year effects      | Y                           | Y                      | Y                   |
| N                 | 17988                       | 17988                  | 17988               |

Notes: Coefficient in first row is (1997 export revenues from UK/1997 total export + domestic revenues)\*(relative price level in UK, current year). Robust standard errors in parentheses. \*10% level, \*\*5% level, \*\*\*1% level.

# Avg destination income and output prices

|                              | dep. var.: firm average log real output price |                  |                |                  |                  |                 |
|------------------------------|---|------------------|----------------|------------------|------------------|-----------------|
|                              | OLS   |                  |                | IV               |                  |                 |
|                              | (1)   | (2)              | (3)            | (4)              | (5)              | (6)             |
| log avg. destination gdp/cap | 0.13***<br>(0.05)                             | 0.08<br>(0.05)   | 0.09<br>(0.05) | 0.40**<br>(0.18) | 0.35**<br>(0.17) | 0.34*<br>(0.20) |
| export share of sales        |   | 0.09**<br>(0.04) | 0.06<br>(0.04) |                  | -0.04<br>(0.07)  | 0.05<br>(0.58)  |
| log sales                    |   |                  | 0.06<br>(0.02) |                  | 0.06<br>(0.01)   | 0.07<br>(0.17)  |
| firm effects                 | Y   | Y                | Y              | Y                | Y                | Y               |
| year effects                 | Y   | Y                | Y              | Y                | Y                | Y               |
| N                            | 17988   | 17988            | 17988          | 17988            | 17988            | 17988           |

Notes: Export share, log sales treated as exogenous in Column 5, instrumented in Column 6. Robust standard errors in parentheses. \*10% level, \*\*5% level, \*\*\*1% level.

# Avg dest income and input prices, no euro-zone insts

dep. var.: firm average log real input price

OLS

IV

|                              | (1)               | (2)              | (3)              | (4)               | (5)               | (6)               |
|------------------------------|-------------------|------------------|------------------|-------------------|-------------------|-------------------|
| log avg. destination gdp/cap | 0.08***<br>(0.03) | 0.07**<br>(0.03) | 0.07**<br>(0.03) | 0.39***<br>(0.10) | 0.35***<br>(0.10) | 0.34***<br>(0.10) |
| export share of sales        |                   | 0.02<br>(0.03)   | -0.01<br>(0.03)  |                   | -0.11**<br>(0.04) | 0.31<br>(0.28)    |
| log sales                    |                   |                  | 0.05*<br>(0.01)  |                   | 0.06<br>(0.01)    | -0.00<br>(0.08)   |
| firm effects                 | Y                 | Y                | Y                | Y                 | Y                 | Y                 |
| year effects                 | Y                 | Y                | Y                | Y                 | Y                 | Y                 |
| N                            | 17988             | 17988            | 17988            | 17988             | 17988             | 17988             |

Notes: Export share, log sales treated as exogenous in Column 5, instrumented in Column 6. Robust standard errors in parentheses. \*10% level, \*\*5% level, \*\*\*1% level.

## Robustness: input prices, no euro-zone insts

|                              | dep. var.: firm average log real input price |                   |                   |                  |                   |                  |
|------------------------------|--|-------------------|-------------------|------------------|-------------------|------------------|
|                              | OLS  |                   |                   | IV               |                   |                  |
|                              | (1)  | (2)               | (3)               | (4)              | (5)               | (6)              |
| log avg. destination gdp/cap | 0.11***<br>(0.03)                            | 0.12***<br>(0.04) | 0.13***<br>(0.04) | 0.29**<br>(0.11) | 0.30***<br>(0.11) | 0.30**<br>(0.12) |
| export share of sales        |  | -0.02<br>(0.04)   | -0.05<br>(0.04)   |                  | -0.11**<br>(0.05) | -0.12<br>(0.23)  |
| log sales                    |  |                   | 0.04<br>(0.01)    |                  | 0.04<br>(0.01)    | 0.04<br>(0.10)   |
| (import share interactions)  |  |                   |                   |                  |                   |                  |
| firm effects                 | Y  | Y                 | Y                 | Y                | Y                 | Y                |
| year effects                 | Y  | Y                 | Y                 | Y                | Y                 | Y                |
| N                            | 13029  | 13029             | 13029             | 13029            | 13029             | 13029            |

Notes: Export share, log sales treated as exogenous in Column 5, instrumented in Column 6. Robust standard errors in parentheses. \*10% level, \*\*5% level, \*\*\*1% level.

# Conclusion

- ▶ Robust evidence that exogenous increases in average income of destination markets has positive effect on input prices paid by Portuguese firms.
- ▶ Work still to do to understand apparently anomalous results for 2nd income group.
- ▶ Paper is more evidence, admittedly still circumstantial, for quality story.
- ▶ N.B.: argument is that quality appears to be playing a role, not that scale effects are unimportant.

# References I

- Bastos, Paulo and Joana Silva, "The Quality of a Firm's Exports: Where You Export to Matters," Journal of International Economics, 2010, 82 (2), 99–111.
- Bernard, Andrew B. and J. Bradford Jensen, "Exceptional Exporter Performance: Cause, Effect, or Both?," Journal of International Economics, Feb. 1999, 47, 1–25.
- Brambilla, Irene, Daniel Lederman, and Guido Porto, "Exports, Export Destinations and Skills," forthcoming. Forthcoming, *American Economic Review*.
- Bustos, Paula, "Trade Liberalization, Exports and Technology Upgrading: Evidence on the Impact of MERCOSUR on Argentinean Firms," American Economic Review, 2011, 101 (1), 304–340.
- Clerides, Sofronis, Saul Lach, and James Tybout, "Is Learning by Exporting Important? Micro-Dynamic Evidence from Colombia, Mexico and Morocco," Quarterly Journal of Economics, Aug. 1998, 113, 903–947.
- De Loecker, Jan, "Do Exports Generate Higher Productivity? Evidence from Slovenia," Journal of International Economics, 2007, pp. 69–98.
- Görg, Holger, László Halpern, and Balázs Muraközy, "Why Do Within Firm-Product Export Prices Differ Across Markets?," Feb. 2010. Kiel Institute for the World Economy working paper no. 1596.
- Hallak, Juan Carlos, "Product Quality and the Direction of Trade," Journal of International Economics, 2006, 68, 238–265.
- and Peter Schott, "Estimating Cross-Country Differences in Product Quality," Quarterly Journal of Economics, 2011, 126 (1), 417–474.
- Hummels, David and Peter J. Klenow, "The Variety and Quality of a Nation's Exports," American Economic Review, 2005, 95 (3), 704–723.
- Khandelwal, Amit, "The Long and Short (of) Quality Ladders," Review of Economic Studies, 2010, 77 (4), 1450–1476.
- Kugler, Maurice and Eric Verhoogen, "Prices, Plant Size and Product Quality," Review of Economic Studies, January 2012, 79 (1), 307–339.

# References II

- Lileeva, Alla and Daniel Trefler, "Improved Access to Foreign Markets Raises Plant-Level Productivity ... For Some Plants," Quarterly Journal of Economics, August 2010, 125 (3), 1051–1099.
- Linder, Staffan Burenstam, An Essay on Trade and Transformation, New York NY: Wiley & Sons, 1961.
- Manova, Kalina and Zhiwei Zhang, "Export Prices Across Firms and Destinations," Quarterly Journal of Economics, February 2012, 127 (1), 379–436.
- Martin, Julien, "Mark-Ups, Quality and Transport Costs," 2010. Unpub. paper, CREST-INSEE.
- Melitz, Marc J., "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity," Econometrica, Nov. 2003, 71 (6), 1695–1725.
- Sutton, John, Technology and Market Structure: Theory and History, Cambridge Mass.: MIT Press, 1998.
- Van Biesebroeck, Johannes, "Exporting raises productivity in sub-Saharan African manufacturing firms," Journal of International Economics, December 2005, 67 (2), 373–391.
- Verhoogen, Eric, "Trade, Quality Upgrading and Wage Inequality in the Mexican Manufacturing Sector," Quarterly Journal of Economics, 2008, 123 (2), 489–530.
- Yeaple, Stephen Ross, "A Simple Model of Firm Heterogeneity, International Trade, and Wages," Journal of International Economics, January 2005, 65 (1), 1–20.

# Avg dest income and output prices, including euro zone

dep. var.: firm average log real output price

|                              | OLS               |                  |                | IV               |                 |                 |
|------------------------------|-------------------|------------------|----------------|------------------|-----------------|-----------------|
|                              | (1)               | (2)              | (3)            | (4)              | (5)             | (6)             |
| log avg. destination gdp/cap | 0.13***<br>(0.05) | 0.08<br>(0.05)   | 0.09<br>(0.05) | 0.31**<br>(0.15) | 0.29*<br>(0.16) | 0.34*<br>(0.19) |
| export share of sales        |                   | 0.09**<br>(0.04) | 0.06<br>(0.04) |                  | -0.02<br>(0.07) | -0.29<br>(0.45) |
| log sales                    |                   |                  | 0.06<br>(0.02) |                  | 0.06<br>(0.01)  | 0.07<br>(0.17)  |
| firm effects                 | Y                 | Y                | Y              | Y                | Y               | Y               |
| year effects                 | Y                 | Y                | Y              | Y                | Y               | Y               |
| N                            | 17988             | 17988            | 17988          | 17988            | 17988           | 17988           |

Notes: Export share, log sales treated as exogenous in Column 5, instrumented in Column 6. Robust standard errors in parentheses. \*10% level, \*\*5% level, \*\*\*1% level.



# Avg dest income and input prices, including euro zone

dep. var.: firm average log real input price

OLS

IV

|                              | (1)               | (2)              | (3)              | (4)               | (5)               | (6)               |
|------------------------------|-------------------|------------------|------------------|-------------------|-------------------|-------------------|
| log avg. destination gdp/cap | 0.08***<br>(0.03) | 0.07**<br>(0.03) | 0.07**<br>(0.03) | 0.30***<br>(0.09) | 0.27***<br>(0.10) | 0.27***<br>(0.10) |
| export share of sales        |                   | 0.02<br>(0.03)   | -0.01<br>(0.03)  |                   | -0.08*<br>(0.04)  | 0.07<br>(0.22)    |
| log sales                    |                   |                  | 0.05*<br>(0.01)  |                   | 0.06<br>(0.01)    | 0.00<br>(0.08)    |
| firm effects                 | Y                 | Y                | Y                | Y                 | Y                 | Y                 |
| year effects                 | Y                 | Y                | Y                | Y                 | Y                 | Y                 |
| N                            | 17988             | 17988            | 17988            | 17988             | 17988             | 17988             |

Notes: Export share, log sales treated as exogenous in Column 5, instrumented in Column 6. Robust standard errors in parentheses. \*10% level, \*\*5% level, \*\*\*1% level.

## Table 6: Exchange rates and export prices

| Full data<br>(1) | richest<br>(2) | 2nd<br>(3) | 3rd<br>(4) | poorest<br>(5) |
|------------------|----------------|------------|------------|----------------|
|------------------|----------------|------------|------------|----------------|

*A. Dependent variable: firm-destination average log real export price*

*B. Dependent variable: firm-destination log real export volume*

## Table 7: Destination income and firm average export prices

| dep. var.: firm average log real export price |     |           |           |      |      |      |      |
|---|-----|-----------|-----------|------|------|------|------|
| OLS   | OLS | Red. form | Red. form | 2SLS | 2SLS | 2SLS | 2SLS |
| (1)   | (2) | (3)       | (4)       | (5)  | (6)  | (7)  | (8)  |

## Table 4: First stage

*A. Dependent variable: avg. GDP/capita of export destinations*

## Table 4: First stage (cont.)

*B. Dependent variable: export share of sales*

## Table 5: Destination income and firm average input prices

| dep. var.: firm average log real input prices |     |           |           |      |      |      |      |
|---|-----|-----------|-----------|------|------|------|------|
| OLS   | OLS | Red. form | Red. form | 2SLS | 2SLS | 2SLS | 2SLS |
| (1)   | (2) | (3)       | (4)       | (5)  | (6)  | (7)  | (8)  |

## Table 9: Source-country income, first stage

(1) dep. var.: avg. source income (2) (3)

## Table 10: Source-country income and input prices

| dep. var.: firm average log real input price                              |           |           |      |      |
|---|-----------|-----------|------|------|
| OLS   | Red. form | Red. form | 2SLS | 2SLS |
| (1)   | (2)       | (3)       | (4)  | (5)  |
| <i>coefficients on dest. exch. rate not reported; see table in paper.</i> |           |           |      |      |



# Table 11: Destination income and input prices, one-step method

|     | dep. var.: firm-product log real input price |           |           |      |      |      |      |
|-----|--|-----------|-----------|------|------|------|------|
| OLS | OLS  | Red. form | Red. form | 2SLS | 2SLS | 2SLS | 2SLS |
| (1) | (2)  | (3)       | (4)       | (5)  | (6)  | (7)  | (8)  |

# Figure A1: Share of Exports by Destination, Top Richer Export Destinations

## Figure A2: Share of Exports by Destination, Top Poorer Export Destinations

# Table A1: Destination Income Groups

## *Richest income group*

United Kingdom

United States

Sweden

Denmark

Switzerland

Norway

Japan

Hong Kong

## *2nd income group*

Germany

Austria

## *3rd income group*

France

Netherlands

Belgium-Luxembourg

Canada

## *4th income group*

Spain

Italy

Finland

Ireland

Israel

Singapore

Australia

## *Poorest income group*

Angola

Brazil

Greece

Turkey

Cape Verde

Morocco

Russia

Hungary

South Africa