Exchange Rate Pass-through, Firm Heterogeneity, and Product Quality

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Introduction

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  - firm heterogeneity in productivity
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  - firm heterogeneity in productivity
  - product differentiation in quality
- Motivation
  - incompleteness of exchange rate pass-through
  - heterogeneous firm models of international trade

Literature

- Incomplete ERPT: Pricing-to-Market.
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  e: exchange rate (foreign currency/home currency).
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  - No study on firm-level determinants (firm heterogeneity).

Literature (ctd) and contributions

- Heterogeneous firm models:
  - spurred by empirical studies: Bernard & Jensen (1995,1999).
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  - firm-level ERPT is incomplete: markup adjustment and quality adjustment.
  - ERPT depends on both firm productivity and product quality.
- Empirics: use Chinese transaction-level export data and firm-level manuf. data to test model predictions.

The Model: Demand

- Two countries: Home (h) & Foreign (f), with consumers L^h & L^f.

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- Consumers' preferences: Antoniades (2008)

$$U = q_0^c + \alpha \int_{i \in \Omega} (q_i^c + z_i) di - \frac{1}{2}\gamma \int_{i \in \Omega} (q_i^c - z_i)^2 di - \frac{1}{2}\eta \left(\int_{i \in \Omega} (q_i^c - \frac{1}{2} z_i) di \right)^2 \quad (1)$$

where q_i: quantity of variety i; z_i: quality of variety i.

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where q_i: quantity of variety i; z_i: quality of variety i.

- Market demand: $l \in \{h, f\}$

$$q_i^l \equiv L^l q_i^c = \frac{\alpha L^l}{\eta N^l + \gamma} - \frac{L^l}{\gamma} p_i^l + \frac{\eta N^l L^l}{(\eta N^l + \gamma)\gamma} \bar{p^l} + L^l z_i^l - \frac{1}{2} \frac{\eta N^l L^l}{\eta N^l + \gamma} \bar{z^l} \quad (2)$$

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- Subsequent production of firm i incurs the total cost function:

$$TC_i = c_i q_i + b q_i z_i + \theta(z_i)^2 \tag{3}$$

  - $c_i q_i$: processing cost ($1/c_i$ indexes firm productivity)
  - $b q_i z_i$: component upgrading cost (not in Antoniades), z_i market-specific
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- A firm in the home country independently maximizes

$$\begin{aligned} \pi^{hh} &= p^{hh} q^{hh} - c q^{hh} - b q^{hh} z^{hh} - \theta(z^{hh})^2 \\ \pi^{hf} &= \frac{p^{hf}}{e} q^{hf} - c q^{hf} - b q^{hf} z^{hf} - \theta(z^{hf})^2 \end{aligned} \tag{4}$$

The Model: Equilibrium

- Equilibrium export price (in exporting currency)

$$p = \frac{p^{hf}}{e} = (1 - B)c^{hf} + Bc. \tag{5}$$

where $B = \frac{2\gamma\theta e - \gamma(\gamma - eb)L^f}{4\gamma\theta e - (\gamma - eb)^2 L^f}$, and $1 - B = \frac{2\gamma\theta e + eb(\gamma - eb)L^f}{4\gamma\theta e - (\gamma - eb)^2 L^f} > 0$.

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- Price-productivity schedule:

$$\frac{\partial p}{\partial(\frac{1}{c})} < 0 \quad \text{if} \quad B > 0, i.e., \left(\frac{2\theta}{L^f} + b\right) e > \gamma - \text{quality homogeneous goods} \tag{6}$$

$$\frac{\partial p}{\partial(\frac{1}{c})} > 0 \quad \text{if} \quad B < 0, i.e., \left(\frac{2\theta}{L^f} + b\right) e < \gamma - \text{quality differentiated goods} \tag{7}$$

The Model: Exchange Rate Absorption

- Existence of exchange rate absorption (incomplete ERPT):

$$\frac{\partial p}{\partial e} < 0, \quad \Theta \equiv \frac{\partial p}{\partial e}\frac{e}{p} < 0 \quad \text{(exchange rate absorption elasticity)} \qquad (8)$$

$\rightarrow$ due to: $\partial\mu/\partial e < 0$ (μ: markup), $\partial z/\partial e < 0$

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$$\frac{\partial|\partial p/\partial e|}{\partial(\frac{1}{c})} > 0. \tag{9}$$

The Model: Exchange Rate Absorption (ctd)

- Relative exchange rate absorption and productivity

$$\frac{\partial|\Theta|}{\partial(\frac{1}{c})} > 0 \qquad \text{if} \qquad B > 0, i.e., \left(\frac{2\theta}{L^f} + b\right) e > \gamma - \text{homogeneous} \quad (10)$$

$$\frac{\partial|\Theta|}{\partial(\frac{1}{c})} \sim 0 \qquad \text{if} \qquad B < 0, i.e., \left(\frac{2\theta}{L^f} + b\right) e < \gamma - \text{differentiated} \quad (11)$$

$$\frac{\partial|\Theta|}{\partial(\frac{1}{c})} < 0 \qquad \text{if} \qquad B \ll 0, i.e., \left(\frac{2\theta}{L^f} + b\right) e \ll \gamma - \text{differentiated} \quad (12)$$

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- Trade data: Chinese transaction-level trade data collected by Chinese customs for 2000-2006.

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- Firm productivity: computed using Chinese firms input-output information from Chinese production data collected by China's National Bureau of Statistics for 1998-2007; use the info. for the base year 2004.

Empiric: Data (ctd)

- Product quality scope:
  - Rauch classification
    – commodities: products traded on organized markets or with reference prices $\rightarrow$ quality homogeneous goods.
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    – commodities: products traded on organized markets or with reference prices $\rightarrow$ quality homogeneous goods.
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  - R&D/Sales ratio for diff. industries
    – with low R&D/Sales ratios $\rightarrow$ quality homogeneous goods.
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    – with high R&D/Sales ratios → highly differentiated goods.
  - Khandelwal (2008) "quality ladders"
    – with short quality ladders → quality homogeneous goods.
    – with mid quality ladders → modestly differentiated goods.
    – with long quality ladders → highly differentiated goods.

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- Pooling all products in the sample:
  - Step 1. check whether the products, on average, are quality homogeneous or differentiated goods:

$$lnP_{if(t-1)} = \beta lnTFP_{f(t-1)} + \delta_{i(t-1)} + \mu_{if(t-1)}. \quad (13)$$

$(-$: homogeneous)

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$$(- : \text{homogeneous})$$

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  - step 2. check how the absolute exchange rate absorption depends on firm productivity:

$$\Delta P_{ift} = \underset{(-)}{\beta_1 \Delta e_t} + \beta_2 TFPH_{f(t-1)} + \underset{(-)}{\beta_{12}[\Delta e_t \times TFPH_{f(t-1)}]} + \delta_{it} + \mu_{ift}, \quad (14)$$

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Empiric: Strategies (ctd)

- Pooling all products in the sample (ctd)
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- Dividing all products into different groups in terms of their product quality scope (3 criteria); run regressions (13)-(16) separately for each group to test model predictions.

Conclusions

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  - When exporting firms face an exchange rate change, they will absorb part of the exchange rate change by adjusting both their markups and their product quality, which leads to an incomplete exchange rate pass-through.

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  - Moreover, exchange rate absorption elasticity (in terms of its absolute value) and firm productivity are negatively correlated for products with high scope for quality differentiation, but positively correlated for quality homogeneous goods.

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- On the empirical side, I will use the Chinese transaction-level export data and firm-level manufacturing data to test the model predictions.

Thanks

Thank you !