

# Globalization, product differentiation and wage inequality

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# 1 Introduction

- Classic research questions of trade theory:
  - How does freer trade affect
    - \* the distribution of national income (e.g., the wage skill premium)?
    - \* the intersectoral allocation of resources?
    - \* aggregate welfare?

- We reexamine these questions in a two-country GE model with
  - oligopolistic competition and intra-industry trade,
  - two types of labor (skilled and unskilled),
  - endogenous product differentiation.
- Our model is consistent with several important stylized facts:
  - increased prevalence of intraindustry trade,
  - increased wage skill premium in both developed and developing countries,
  - slow aggregate productivity growth following trade liberalization.

- Our key partial equilibrium result:
  - stronger import competition increases innovation incentives, and thereby the relative demand for skill.
- In general equilibrium:
  - globalization will increase the skill premium if the share of sectors that are shielded from international competition remains sufficiently high

- Our key partial equilibrium result is consistent with Chilean panel data for the period 1996-2006:
  - manufacturing plants respond to stronger import competition in their own industry by increasing the share of skilled (non-manual) workers.
  - this effect cannot be fully explained by a number of competing mechanisms (process innovation, exporting, FDI, outsourcing)

## 2 A sketch of the theoretical model

- Two identical countries: "domestic" and "foreign".
- A continuum of imperfectly competitive industries defined on the unit interval.
- Firms have market power in their own industry but treat all economy-wide variable parametrically.
- In each industry, two horizontally differentiated products are produced by a domestic and a foreign firm.

- Some industries are shielded from international competition while others are not:
  - in all industries  $z \in [0, \hat{z}]$ , firms engage in intra-industry trade
    - \* Cournot competition in segmented markets
    - \* per-unit tariff  $t$
  - in all remaining industries there is a domestic (resp. foreign) monopolist
  
- In each industry, firms play a two-stage game:
  1. Product innovation
  2. Production

- Production requires unskilled labor
- Product innovation requires skilled labor
- Labor markets are perfectly competitive.
- Two measures of globalization:
  1. Product market integration (lower  $t$ )
  2. Increased trade openness (higher  $\hat{z}$ )



### 3 Preferences

- The utility function of a representative consumer in the domestic country is given by

$$U [q_i(z), q_j(z)] = \int_0^1 u [q_i(z), q_j(z)] dz,$$

where  $q_i$  and  $q_j$  are quantities consumed of the domestic and foreign varieties.

- The sub-utility function is given by

$$u = q_i(z) + q_j(z) - \frac{1}{2} [q_i(z)^2 + q_j(z)^2 + 2b(z) q_i(z) q_j(z)].$$

- From individual utility maximization, the indirect demand functions are

$$p_i(z) = \begin{cases} \frac{1}{\lambda} (1 - q_i(z) - b(z) q_j(z)) & \text{if } z \in [0, \hat{z}] \\ \frac{1}{\lambda} (1 - q_i(z)) & \text{if } z \in (\hat{z}, 1] \end{cases},$$

where  $\lambda$  is the marginal utility of income.

- The indirect utility function of the representative consumer is

$$V = \frac{1}{1+b} \left( \hat{z} - \frac{\lambda^2 (\mu_2^p - b v^p)}{2(1-b)} \right) + \frac{1}{2} \left( (1 - \hat{z}) - \lambda^2 \hat{\mu}_2^p \right),$$

where

$$\begin{aligned} \mu_2^p &= \int_0^{\hat{z}} (p_i^2 + p_j^2) dz, & \hat{\mu}_2^p &= \int_{\hat{z}}^1 p_i^2 dz, \\ v^p &= 2 \int_0^{\hat{z}} (p_i p_j) dz. \end{aligned}$$

## 4 Product innovation

- The inverse degree of product differentiation is given by

$$b = b(s_i + s_j),$$

with  $b'(\cdot) < 0$  and  $b''(\cdot) > 0$ .

- Product innovation is a pure public good for the competing firms.
- The equilibrium level of product innovation (in each industry) is given by

$$s_i^* = s_j^* = s^*(w_u, w_s, t).$$

- Product market integration (lower  $t$ ) increases the optimal level of product innovation.
- It can be shown that the relationship between  $s_i^*$  and  $t$  is primarily driven by an import competition effect.
- Higher wages (skilled or unskilled) reduces the optimal level of product innovation.

## 5 General Oligopolistic Equilibrium

- Supply of skilled and unskilled labor is inelastically given by  $L_s$  and  $L_u$ .
- The market for skilled labor is cleared when

$$\hat{z}s^*(w_u, w_s, t) - L_s = 0.$$

- The market for unskilled labor is cleared when

$$\hat{z} \left( \frac{2(1 - w_u) - t}{2 + b(s^*(w_u, w_s, t))} \right) + (1 - \hat{z}) \frac{1}{2} (1 - w_u) - L_u = 0.$$

## 5.1 Wage effects of globalization

- Product market integration (lower  $t$ ) increases both skilled and unskilled wages.
  - The skill premium will increase if the number of shielded industries is sufficiently high.
- Increased trade openness (higher  $\hat{z}$ ) increases the unskilled wage while the skilled wage response is ambiguous.
  - The skill premium will increase if the initial degree of trade openness is low

## 5.2 Costless skill upgrading

- Assume that total resources in the economy are fixed, but can be costlessly shifted between innovation and production.
- Globalization implies a welfare trade-off between product variety and total output.
- Globalization will lead to more variety but less output if the number of shielded industries is sufficiently high.

## 6 Empirical analysis

- We want to test our key partial equilibrium result, that increased import competition leads to an increase in the relative demand for skilled labor.

### 6.1 Data

- Panel data for Chilean manufacturing plants for the period 1996-2006.
- Information on employment according to different occupational categories allows us to define a measure of skilled versus unskilled labor demand



- The plant-level data is supplemented by information on *industry-specific import-weighted tariffs* and *real exchange rates*
- Industry-specific tariffs are weighted by static import weights (from 1996-1997), to avoid endogeneity
- The final panel used contains information on 9656 plants yielding a total of 54591 observations

## 6.2 Empirical strategy

- We estimate the following fixed-effects model:

$$\text{Share}_{ijt} = \mathbf{X}'_{ijt}\alpha + \beta\text{Tariff}_{jt} + \nu_i + \tau_t + \mu_{ijt},$$

- $\text{Share}_{ijt}$  is the *share of skilled (non-manual) workers* among the plant's workforce in plant  $i$  in industry  $j$  in year  $t$
- $\mathbf{X}_{ijt}$  is a vector of other plant attributes
- $\text{Tariff}_{jt}$  is the industry-specific import tariff in industry  $j$  in period  $t$
- $\nu_i$  is a plant fixed-effect
- $\tau_t$  is a year fixed-effect

- We also use industry-specific import-weighted real exchange rates as an alternative measure to capture changes in import competition

## **6.3 Main results**

- Results are strong and significant (at 1% level), and in line with our predictions.

Dependent variable:	Share of skilled (non-manual) workers among workforce related to the production process								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Tariff	-0.924*** (0.350)	-0.942*** (0.347)	-0.941*** (0.347)				-0.849** (0.336)	-0.865*** (0.333)	-0.864*** (0.333)
Real exchange rate				1.876*** (0.565)	1.904*** (0.566)	1.903*** (0.566)	1.709*** (0.549)	1.733*** (0.551)	1.733*** (0.551)
Total employment		-0.024*** (0.003)	-0.024*** (0.003)		-0.023*** (0.003)	-0.024*** (0.003)		-0.024*** (0.003)	-0.024*** (0.003)
Production			0.003 (0.006)			0.004 (0.006)			0.003 (0.006)
N	54591	54591	54591	54591	54591	54591	54591	54591	54591
R <sup>2</sup> (within)	0.033	0.035	0.035	0.033	0.035	0.035	0.034	0.036	0.036
F-statistic	49.17	52.76	49.35	44.42	47.51	44.7	47.64	51.14	48.07

Baseline estimates

## 6.4 Alternative hypotheses

- Trade-induced process innovation
  - Controlling for changes in labor productivity does not change our results
- Export-market entry
  - Controlling for plant-level exports or excluding exporting firms do not change our results
- FDI/Outsourcing
  - Controlling for share of foreign capital does not change our results

## 6.5 Further robustness checks

- A possible concern is that the dependent variable is bounded on the interval  $[0, 100]$ 
  - we estimate a Tobit random-effects model and the results are qualitatively the same and of larger magnitude than previously
- There might be some lag in the adjustments of the labor force to increased import competition
  - re-estimating the model using lagged import tariffs and real exchange rates yield qualitatively similar results

## 7 Summary

- In imperfectly competitive markets, we show that stronger import competition increases firms' incentives to spend more resources on product innovation in order to horizontally differentiate their products
- Incorporating this partial equilibrium effect into a two-country model of general oligopolistic equilibrium, we offer a novel explanation for why globalization might lead to higher wage inequality between skilled and unskilled workers
  - globalization will always cause the skill premium to increase if the number of sectors shielded from international competition remains sufficiently high

- If skill upgrading is possible, there is a potential welfare trade-off between output and variety
- Our key partial equilibrium result is consistent with Chilean panel data on manufacturing plants for the years 1996 to 2006