

# Trade and Productivity: The Family Connection Redux

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Competitiveness of industrialized countries. Standard reasoning:

- Population aging (Europe, Japan, United States)
- Labor force ↓ dependency ratio ↑
- Taxes and social security contributions ↑
- Competitiveness ↓
  
- “Europe’s rapid ageing will inflict economic pain” (Economist, 2004).
- “Can an ageing Europe stay competitive in a globalized world?” (European Commission 2011).

At least up to now, the data do not support such a dismal view.

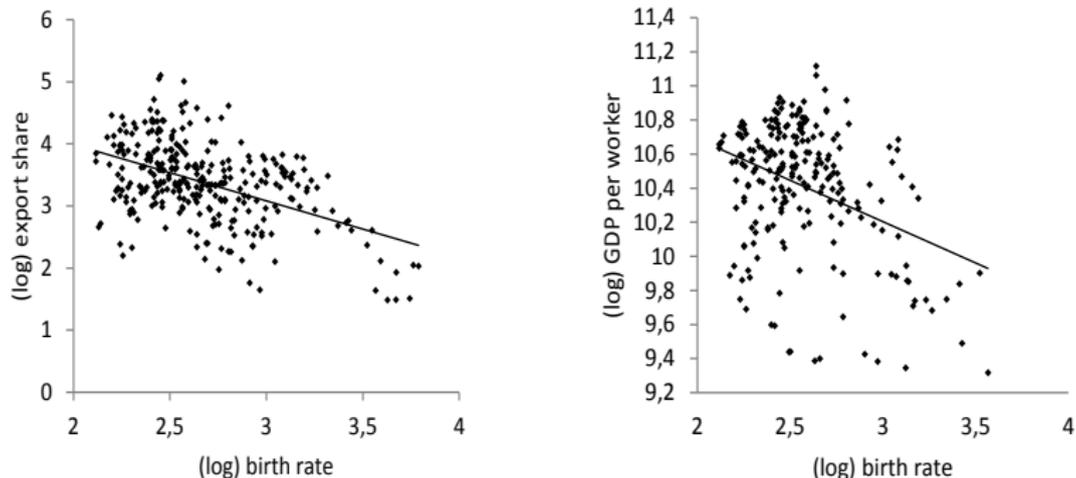


Figure: Birth rate, productivity, and competitiveness

## Our aims:

- 1 Propose a framework to **explain stylized facts**.
- 2 Test the suggested channels **empirically**.
- 3 Draw **policy conclusions** for aging open economies.

## Framework:

- Firm-specific heterogeneity a la Melitz (2003): random productivity of individual firms.

## New:

- Country-specific probability distributions are shaped **endogenously** by education:
  - Human capital externalities (Lucas, 1988),
  - Technological progress driven by scientists (Romer, 1990),
  - Education of managers (Gennaioli et al., 2013).
- Education and fertility decisions are themselves **endogenous**: child quantity-quality trade-off a la Becker (1993).

- 2 Overlapping Generations: **children & adults**.
- Adults care for consumption, number of children, and their children's education.
- Education determines **human capital** of the next generation.

Utility maximization:

$$\max_{c,n,e} u = \log(c) + \alpha \log(n) + \gamma \log(e).$$

Budget constraint:

$$hw(1 - \phi \cdot n - e \cdot n) = P \cdot c.$$

Solution:

$$c = \frac{hw}{(1+\alpha)P}, \quad n = \frac{\alpha - \gamma}{\phi(1+\alpha)}, \quad e = \frac{\gamma\phi}{\alpha - \gamma}.$$

Observe:

① Preferences imply:

$$\alpha \uparrow \quad \Rightarrow \quad n \uparrow \quad e \downarrow ,$$

$$\gamma \uparrow \quad \Rightarrow \quad n \downarrow \quad e \uparrow .$$

② There is a **negative relation** between education and fertility:

$$e = \frac{1+\alpha}{\gamma} \cdot \frac{1}{n}.$$

- Cobb-Douglas sub-utility function  $c = Z^\eta Q^{1-\eta}$ :
  - $Z$  is a homogeneous good,
  - $Q$  is a continuum of  $\omega$  differentiated manufactured goods defined by a CES sub-sub-utility function.
- $Z$  is produced in all countries with a unitary labor input coefficient and traded without cost  $\Rightarrow$  **FPE** such that  $w = 1$ .
- Solution for demand per variety (according to standard CES sub-sub-utility function):

$$q(\omega) = \left[ \frac{P}{p(\omega)} \right]^\sigma Q, \quad P = \left[ \int_{\omega \in \Omega} p(\omega)^{1-\sigma} d\omega \right]^{1/(1-\sigma)} .$$

- Labor input (in efficiency units)  $h$ .
- Fix cost of production  $f$ .
- Technology  $A(\omega)$  is random for each firm.

Solution of profit maximization problem:

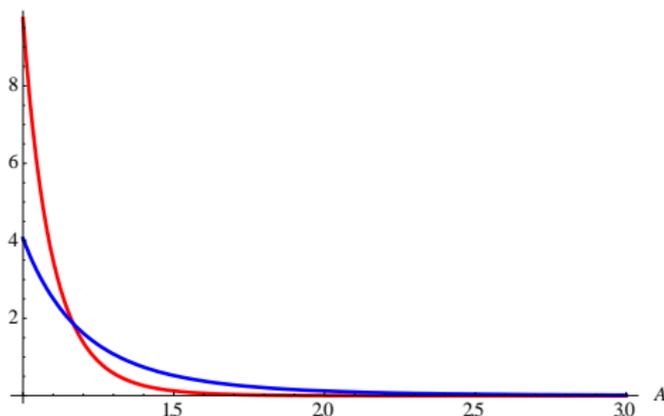
$$p(\omega) = \frac{\sigma}{\sigma - 1} \cdot \frac{1}{A(\omega)}.$$

This implies:

Firms with higher productivity charge lower prices, are bigger, and are more profitable.

# Aggregation

- Firms draw productivity from a Pareto distribution  
 $G(A) = 1 - A^{-a}$ .
- New: on the aggregate level, the moments of the distribution are endogenously determined.
- More likely to draw a high productivity when the level of education is high  $a = 1/h$ :



- Iceberg trade costs:  $\tau > 1$ . Fixed costs of exporting:  $f_x$ .
- Partitioning of firms:
  - $A < A^*$ : exit,
  - $A^* < A \leq A_x^*$ : produce for home market only,
  - $A > A_x^*$  produce for home market and export markets.
- Probability of exporting conditional on successful entry:

$$\Phi_x = \frac{1 - G(A_x^*)}{1 - G(A^*)} = \left[ \frac{A^*}{A_x^*} \right]^{\frac{\alpha - \gamma}{\gamma \phi}} .$$

## Central analytical results:

- 1 Country with stronger desire for education ( $\gamma$ ) faces
  - **higher** average productivity,
  - **higher** international competitiveness.
- 2 Country with stronger desire for fertility ( $\alpha$ ) faces
  - **lower** average productivity,
  - **lower** international competitiveness.

# This theory explains the observed patterns

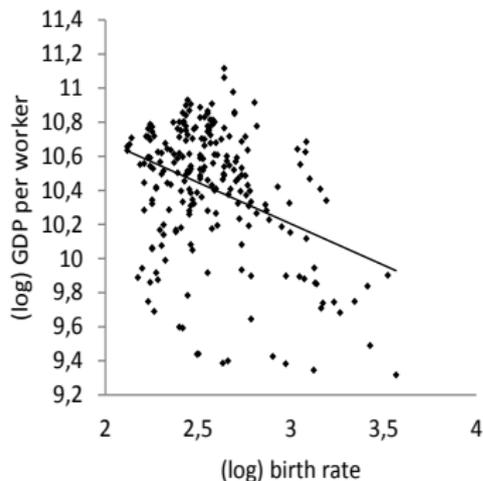
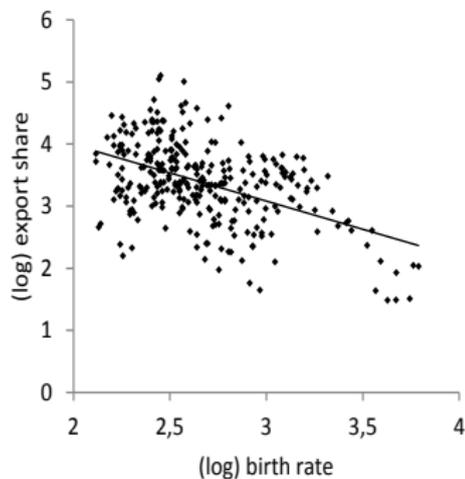


Figure: Birth rate, productivity, and competitiveness

Panel data:

- OECD countries 1960–2010.
  - Export share,
  - Mean years of tertiary education,
  - Birth rates,
  - GDP per firm, GDP per worker,
  - Other controls (pop size, investment rate).
  - Country fixed effects: cultural and geographical features,
  - Time fixed effects: trends in (transport) technology.

Canonical specification:

$$y_{i,t} = \beta_1 x_{i,t-1} + \sum_{k=2}^K \beta_k z_{i,t-1,k} + \epsilon_i + \psi_t + u_{i,t}.$$

- OLS and FE: consistent with the basic story  $\Rightarrow$  **endogeneity**.
- Theory suggests to use **birth rate as IV** for human capital.

# Results

	Exports (IV)	pwGDP (IV)	educ (1st-stage)
educ	0.587 (0.228)**	0.383 (0.174)**	
birth			-0.471 (0.133)***
pop	0.349 (0.157)**	-0.296 (0.160)*	0.236 (0.397)
pcGDP	-0.429 (0.172)**	0.390 (0.117)***	0.403 (0.173)**
invest	0.102 (0.113)	-0.016 (0.077)	-0.097 (0.139)
consump	-0.161 (0.085)*	-0.031 (0.062)	0.073 (0.136)
Widstat	14.90	17.16	
ldstat	13.38	13.74	
F			64.31
country fe	yes	yes	yes
time fe	yes	yes	yes
N	264	211	264

- Estimation technique (Difference- and system GMM, corrected FE).
- Exclusion of controls and fixed effects (time and country).
- Lagging variables further.
- Results of firm-level data are also consistent with our findings.

Theoretical point of view:

- As compared to Melitz (2003), firm productivity is **country-specific** and **endogenous**.

Empirical point of view:

- Explanation why **low birth rates** are associated with **high productivity** and **high international competitiveness**.
- The education channel is supported by **empirical evidence**.

Policy-maker's point of view:

- Future of aging economies is perhaps **less gloomy** than conventionally assumed.
- **Investing in education** should be a top priority.

Thank you for your attention!

# Dynamic evaluation

Argument: Do not tinker with the utility function!

Solution: Dynamic version of the model.

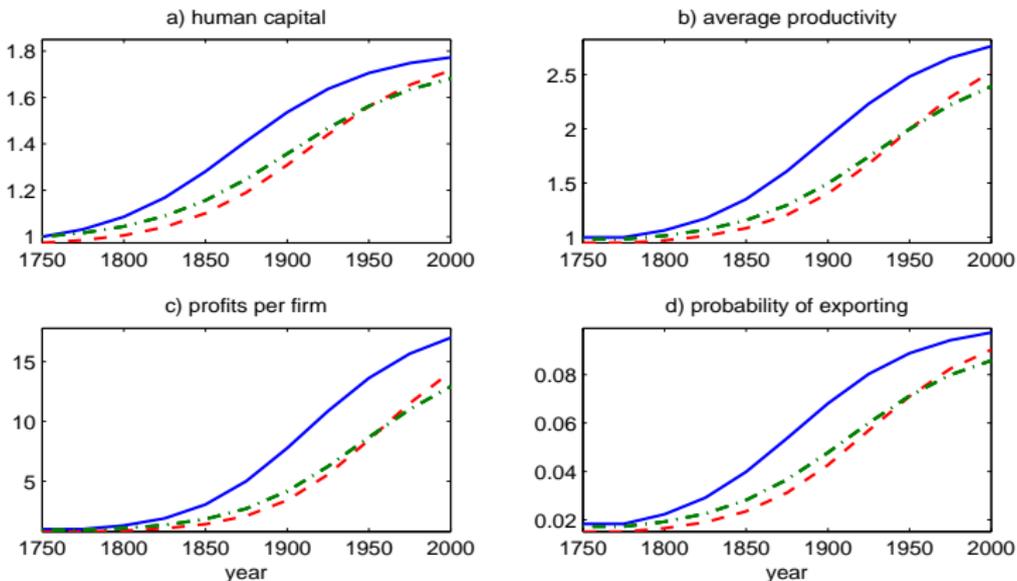
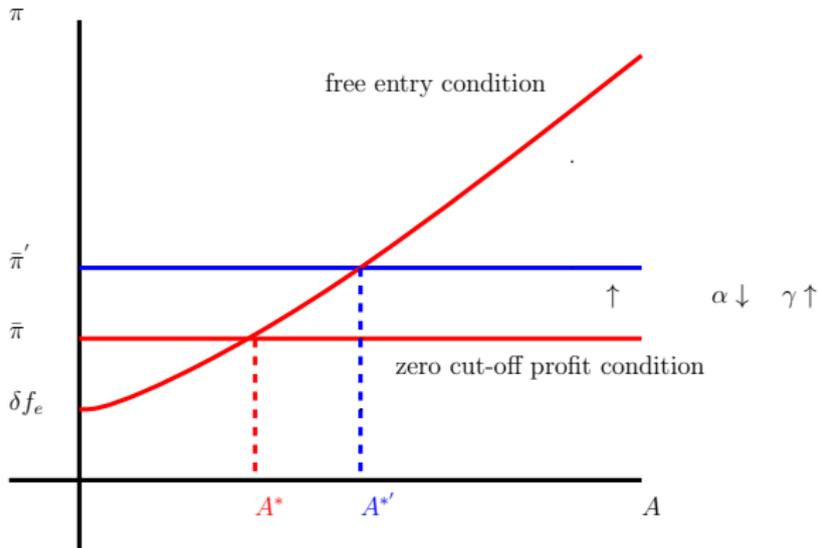


Figure: Evolution of Human Capital and International Competitiveness

# Equilibrium in the closed economy

- Firms that draw very low productivity exit.
- Zero profits at the cut-off  $\pi(A^*) = 0$ .
- Free entry condition  $[1 - G(A^*)]\bar{\pi}/\delta = f_e$  (expected discounted profit stream equals entry costs).



# Equilibrium in the open economy II

