Trade, Firm Selection, and Innovation: the Competition Channel

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  - Teshima (2009), Mexican data

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  - Griffith, Harrison, and Simpson (2008), EU Single Market Program: increase in product market competition (reduction in avg. markups) and higher innovation (R&D)

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  - No consensus evidence on trade and growth with aggregate data (Frenkel and Romer 1999, Rodriguez and Rodirk, 2000, Alcalà and Ciccone 2004)
  - Micro-level studies cited focus **specific channels** of productivity improvements: evidence I-III $\Rightarrow$ needed a theory of the competition channel

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- Oligopolistic market structure: M goods, each produced by n firms competing Cournot
- **Endogenous market structure**: trade liberalization $\Rightarrow$ increase number of firms per variety $\longrightarrow$ reduces markups $\longrightarrow$ study it's effects on selection and innovation

Related literature

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  - monopolistic competitive models (exogenous market structure) $\Longrightarrow$ no competition effect

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- Trade, selection and **pro-competitive** effects
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  - General Equilibrium Oligopolistic Models (Neary, 2003, Eckel and Neary, 2010): no firm heterogeneity and no innovation

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    - Overall growth effect sizable
    - More than 90% attributable to dynamic selection (**heterogeneity matters big time!!**)

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- $\hat{z}$ is an externality defined later (needed to get sustained growth)

Production and Innovation: solving the game

- Firms compete Cournot, solving

$$V_s = \max_{(q_t, h_t)_s^\infty} \int_s^\infty \left[\underbrace{(p_t - c(z_t))q_t - h_t - \lambda}_{\pi_t} \right] e^{-(\rho+\delta)(t-s)} \, dt, \qquad \text{st.}$$

$$\begin{aligned} p_t &= \frac{E_t}{X_t^\alpha} \, x_t^{\alpha-1} \\ x_t &= \hat{x}_t + q_t \\ \dot{\tilde{z}}_t &= A \, \hat{z}_t \, h_t \\ \tilde{z}_s &> 0, \end{aligned}$$

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- taking as given production and average productivity of competitors $(\hat{x}_t, \hat{z}_t)$ and the aggregates E_t and X_t, δ exogenous exit rate

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  - Notice: the markup is determined by CES parameter α and number of firms n

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- Innovation investment

$$\begin{aligned} h_t &= \eta c(\tilde{z}_t) q_t - \frac{(\rho + \delta)}{A}, \\ c(\tilde{z}_t) q_t &= \theta e\, z / \bar{z} \end{aligned}$$

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  - On competition: negatively on the markup $(1/\theta)$, positively on e

Stationary productivity growth

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- This yields stationary symmetric growth rate

$$g = \frac{\dot{\tilde{z}}}{\tilde{z}} = \eta\theta e \, - \rho - \delta$$

which allows a stationary distribution on productivity (in line with evidence)

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$$\pi(z/\bar{z}) = (1-\theta)\, ez/\bar{z} - \underbrace{\left(\eta\theta e - \frac{\rho+\delta}{A}\right) z/\bar{z}}_{h} - \lambda.$$

with

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- The zero-profit condition defines the cutoff

$$e = \frac{\frac{\lambda}{z^*/\bar{z}(z^*)} - \frac{\rho+\delta}{A}}{1-(1+\eta)\theta} \qquad \text{(EC)}$$

[downward sloping function in (e, z^*)] $\rightarrow$ intuition

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- The equilibrium distribution is

$$\mu(z) = f(z)/(1 - F(z^*))$$

for $z \geq z^*$

Stationary equilibrium: market clearing

- Using $\mu(z)$ the mkt. clearing can be written as

$$\underbrace{\int_{z^*}^{\infty}\left((1+\eta)\,\theta e\,z/\bar{z}-\frac{\delta+\rho}{A}z/\bar{z}+\lambda\right)\mu(z)\,dz}_{\texttt{differentiated}}+\underbrace{\beta e}_{\texttt{homogeneous}}=\frac{1}{nM}$$

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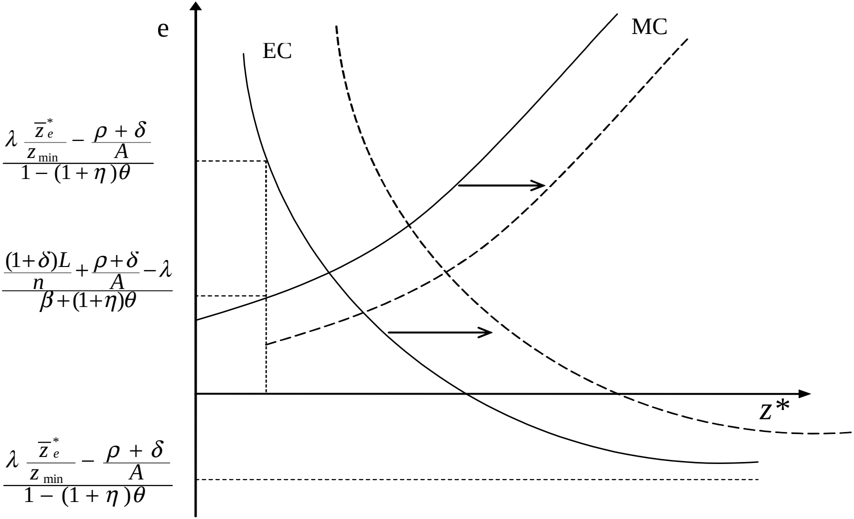
- **Proposition 1**. *Under some parameter restrictions* there exists a unique interior solution (e,z^*) of (MC) and (EC)

Stationary equilibrium



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- The two innovation effects:
    - **Direct effect**: higher $\theta \Rightarrow$ lower markup leads to higher efficiency $\longrightarrow$ higher quantity produced (no role for heterogeneity)
    - **Selection effect**: higher $\theta \Rightarrow$ higher $\tilde{z}^* \Longrightarrow$ resources reallocated from exiting to surviving firms (**heterogeneity matters!!**)

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  - **Direct competition effect**: $\uparrow \theta \Longrightarrow$ surviving firms produce higher quantity

Quantitative analysis: calibration external

- Calibrate the model to match US aggregate and firm-level statistics: assume $z \sim P(z_{\min}, \kappa)$

SUMMARY OF CALIBRATION

parameter	value	moment	Source
α	0.309	Elasticity of sub/markup	Ruhl (2008)
τ	1.13	Trade cost	Anderson-Wicoop(2004)
δ	0.09	Enterprise death rate	US Census (2004)
β	0.34	Share non differentiated	Rauch (1999)
n	6	Elasticity of sub/markup	Basu (1994)
ρ	0.05	interest rate	Mehra-Prescott (2005)
A	12.47	R&D/GDP+Growth	CHS(2006)
η	0.0119	R&D/GDP+Growth	CHS (2006)
λ	1.507	avg. firm size	Axtell (2001)
κ	2.621	std. firm productivity	BJEK (2003)

Trade liberalization

- Reduce trade cost τ by 10 percent:

Trade liberalization

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- Growth decomposition (direct and selection effect):

$$g_\tau = \frac{dg}{d\tau} = \underbrace{g_\tau^d}_{\texttt{Direct effect}} + \underbrace{g_\tau^*}_{\texttt{Selection effect}}$$

where

$$g_\tau^d = \frac{\partial g}{\partial \tau}\Big|_{z^* = \bar{z}^*} = \frac{\beta(1-\beta)\eta Ae}{\beta + (1+\eta)\theta_\tau}\frac{d\theta_\tau}{d\tau}. \tag{1}$$

and

$$g_\tau^* = g_\tau - g_\tau^d$$

Simulation results: 10% drop in trade costs

SENSITIVITY ANALYSIS: DOUBLE THE BENCHMARK

	bench	$n = 12$	$\kappa = 5.24$	$\beta = 0.68$	$\delta = 0.18$
$1/\theta_\tau$	-0.0115	-0.0252	-0.0115	-0.0115	-0.0115
z^*	0.0421	0.0702	0.0206	0.0418	0.0421
$1 - F(z^*)$	-0.1026	-0.1630	-0.1013	-0.1019	-0.1026
$\bar{y}$	0.1148	0.1965	0.1124	0.1148	0.1147
$\lvert g_\tau \rvert$	0.1298	0.2334	0.1320	0.1298	0.1345
$\lvert g_\tau^d \rvert$	4.2%	5.1	4.1	3.1	4
$\lvert g_\tau^* \rvert$	95.8%	94.9	95.9	96.9	96

Benchmark: $n = 6$, $\kappa = 2.62$, $\lambda = 1.5017$, $\beta = 0.34$, $\delta = 0.09$,

Comparison with existing empirical works

Table 3

Comparison with empirical evidence

Moments	model	CIS	CDMO*	BDV	ARX*	BUS
$1/\theta_\tau$	-0.0115	-0.01	-0.019			
$1-F(z^*)$	-0.1026			-0.12		
$\lvert g_\tau \rvert$	0.1298			0.24	0.053	0.24
$\lvert g_\tau^d \rvert$	4.2%			50%		
$\lvert g_\tau^* \rvert$	95.8%			50%		

Sources: Chen,et al.(2008), Corcos, et al (2007), Bloom,et al. (2009)

Aw, Roberts, Xu (2010), Bustos (2010), * means 5% drop in τ

Comparison ctd.

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  - Elasticity of the markup to a reduction in τ is the interval between 0.1 and 0.4
  - Elasticity of innovation to a reduction in τ roughly falls in the interval between 1 and 2.4.
- Existing works study only parts of our predictions $\Rightarrow$ we provide a complete picture (all effects) and a specific economic mechanism (source of selection) $\longrightarrow$ guideline for future empirical work

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- To simplify matters we remove innovation and look at effect of trade on markups and cutoffs
- Reintroducing innovation in progress

Extension: fixed entry and export costs

- Fixed export cost $\lambda_x \longrightarrow$ new cutoff z_x^*

$$(1-\theta_\tau)e = \frac{\lambda + \lambda_x}{z_x^*}\left(\frac{1}{\bar{p}\,\theta_\tau}\right)^{\frac{\alpha}{1-\alpha}}, \qquad \text{(XC)}$$

where the $\bar{p}$ is a weighted average of productivities

$$\bar{p} = \left(\theta^{\frac{\alpha}{1-\alpha}} \int_{z^*}^{z_x^*} z\mu(z)dz + \theta_\tau{}^{\frac{\alpha}{1-\alpha}} \int_{z_x^*}^{\infty} z\mu(z)dz\right)^{\frac{\alpha-1}{\alpha}},$$

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- Domestic cutoff z^*

$$(1-\theta)e = \frac{\lambda}{z^*}\left(\frac{1}{\bar{p}\,\theta}\right)^{\frac{\alpha}{1-\alpha}}, \qquad \text{(EC2)}$$

Extension: fixed entry and export costs

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- $d(z_x^*/z^*)/d\theta_\tau > 0$

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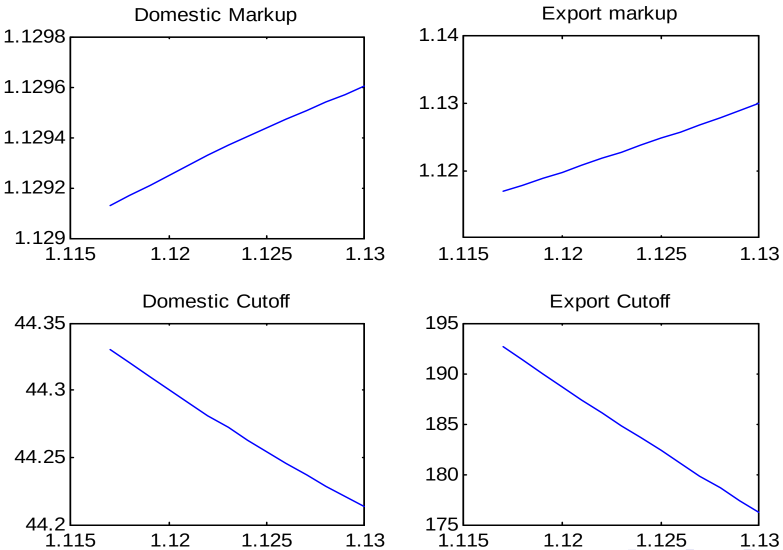
- Calibrate and solve it numerically

Trade liberalization



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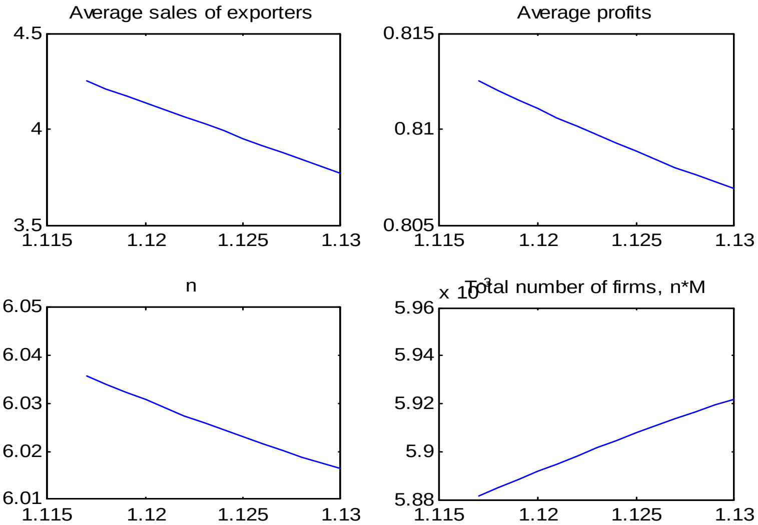

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  - entry depends on avg. profits $\bar{\pi}$ and trade liberalization increases $\bar{\pi} \Longrightarrow \uparrow n \Rightarrow$ reduces domestic markup a increases domestic cutoff z^*

Extension: policy implications

- **Policy implication**: in rigid economies ϕ is high $\Rightarrow$ trade liberalization can be a substitute to competition policy in generating more competition (higher n)

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- Many extensions: asymmetric countries and asymmetric liberalizations

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  - If a Dixit-Stiglitz aggregate of varieties is an industrial sector $\longrightarrow$ both models are models of industry and the economy would be represented by many of these industries

$$\prod_{h=1}^{H} X_t = \prod_{h=1}^{H} \left(\int_0^{M_t} x_{jht}^{\alpha} dj \right)^{\frac{1}{\alpha}}$$

H industries, M varieties in each industries, n firms in each varieties

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