- Trade, firm selection, and innovation: the competition channel
- Giammario Impullitti and Omar Licandro
- (working paper)

Impullitti & Licandro (2009)

- Want to introduce (cost-reducing) innovation and competitive effects of trade.
- Use an oligopolistic (as opposed to monopolistic competition) framework.
- Model is solved analytically
- Abandon use of fixed cost of entering the export market

Three Stylised Facts

- Impullitti & Licandro aim to create a model that captures the following three stylised facts from the empirical trade literature;
  - 1) Selection Effect
  - 2) Innovation
  - 3) Pro-competitive effects

- Selection Effect: Trade liberalisation induces the least productive firms to exit the market and the most productive non-exporters to become exporters
- Innovation: Role of firm heterogeneity in shaping the effects of trade liberalisation on innovation activities: Surviving firms tend to innovate more.
  - Note: This is to be differentiated from 'learning-by-exporting'.

- Pro-competitive effects: Trade liberalisation has pro-competitive effects that can potentially lead to more selection and innovation.
  - eg. Griffith, Harrison & Simpson (2008) have studied the effects of trade integration reforms carried out under the EU Single Market Program and found that these reforms have increased competition (measured as avg. Markups) & stimulated innovation (R&D expenditure).

The Model (Autarky)

- Two goods: Homogenous good, Y_t

  Differentiated good, X_t

- Consumers have endowments of unit flow of homogenous good Y
- Preferences of representative consumer

$$\int_0^{\infty} (\ln X_t + \beta \ln Y_t)\ \mathrm{e}^{-\rho t}\ \mathrm{d}t$$

Market Production

- The differentiated good X is produced by the mean of a continuum of varieties of engogenous mass M∈[0,1], by

- Each variety in X is produced by n identical firms by transforming the homog. good into this particular variety.

$$X_t = \left(\int_0^{M_t} x_{jt}^{\alpha} \, \mathrm{d}j \right)^{\frac{1}{\alpha}}$$

Firm production & innovation

- Firms face the same fixed cost $\lambda>0$, but may have different productivities z.
- Firms production tech.; $q_t=(\hat{z}_t+bz_t)(y_t-\lambda)$

  $\hat{z}_t$: avg. productivity of other (n-1) firms producing same variety

  b: spillovers (intraindustry)
- Innovation activites: $\dot{z}_t=A\,\hat{z}_t h$

  h: units of Y allocated to innovation

  A>0: innovation efficiency

Entry and Exit of Firms

- Much the same as in Melitz (2003)
  - Fixed cost of exit
  - Fraction $\delta>0$ of varieties exit every period, regardless of productivity z
  - We get entry that keeps mass of varieties constant
  - We will get a cutoff condition similar to Melitz (2003)

Solving the Model

- Households solve their utility maximization problem. Among other things this gives a price rule which the firms will then follow.
- Firms play a Cournot competition game. We then solve the firms maximization for an open-loop Nash equilibrium.

- Firms maximization problem is

$$V_s = \max_{(q_t,h_t)_{t=s}^{\infty}} \int_s^{\infty} \left[\left(p_t - \left(z_t + b\hat{z}_t \right)^{-1} \right) q_t - h_t - \lambda \right] e^{-(\rho+\delta)(t-s)} \, dt, \qquad \text{st.}$$

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

Markup (from firm FOCs)

- From the firms maximization problem we get that, as is standard in Cournot type equilibria, the markup, $1/\theta$, over marginal costs $(z_t+b\hat{z}_t)^{-1}$ depends on both the demand elasticity and the number of competitors;

$$1/\theta=n/(n-1+\alpha) \quad (=\sigma n/(\sigma n-1))$$

- Note: In equilibrium firms producing the same good operate with the same technology ($z_t=\hat{z}_t$) & face the same initial conditions. So they will also produce the same

R&D

- We also get that the profitability of R&D depends on production as the benefit of reducing production costs is larger, the higher production.
- Since more efficient firms produce more they also have more incentives to do R&D, meaning that firm's R&D activity depends positively on firm's state of technology.

- As a result, our equation for productivity growth depends positivel on output, which depends on productivity level;

$$g=A\theta e/(1+b)-\rho-\delta$$

where g=growth rate of the average productivity $\bar{z}_t$

- The term $A\theta e/(1+b)$ is the marginal return to R&D investment for firms with the average productivity

Stationary Equilibrium

- For a stationary distribution of firms we need

$$(1 - M)\,(1 - F(\tilde{z}^*)) = \delta M$$

$$M(\tilde{z}^*) = \frac{1 - F(\tilde{z}^*)}{1 + \delta - F(\tilde{z}^*)}$$

- The market clearing condition for the homogenous good can be written as

$$n \int_0^M (y_j + h_j)\ \mathrm{d}j + Y = n \int_0^M \left(\frac{q_j}{z_j (1 + b)} + h_j + \lambda \right)\ \mathrm{d}j + \beta E = 1$$

Equilibrium Equations

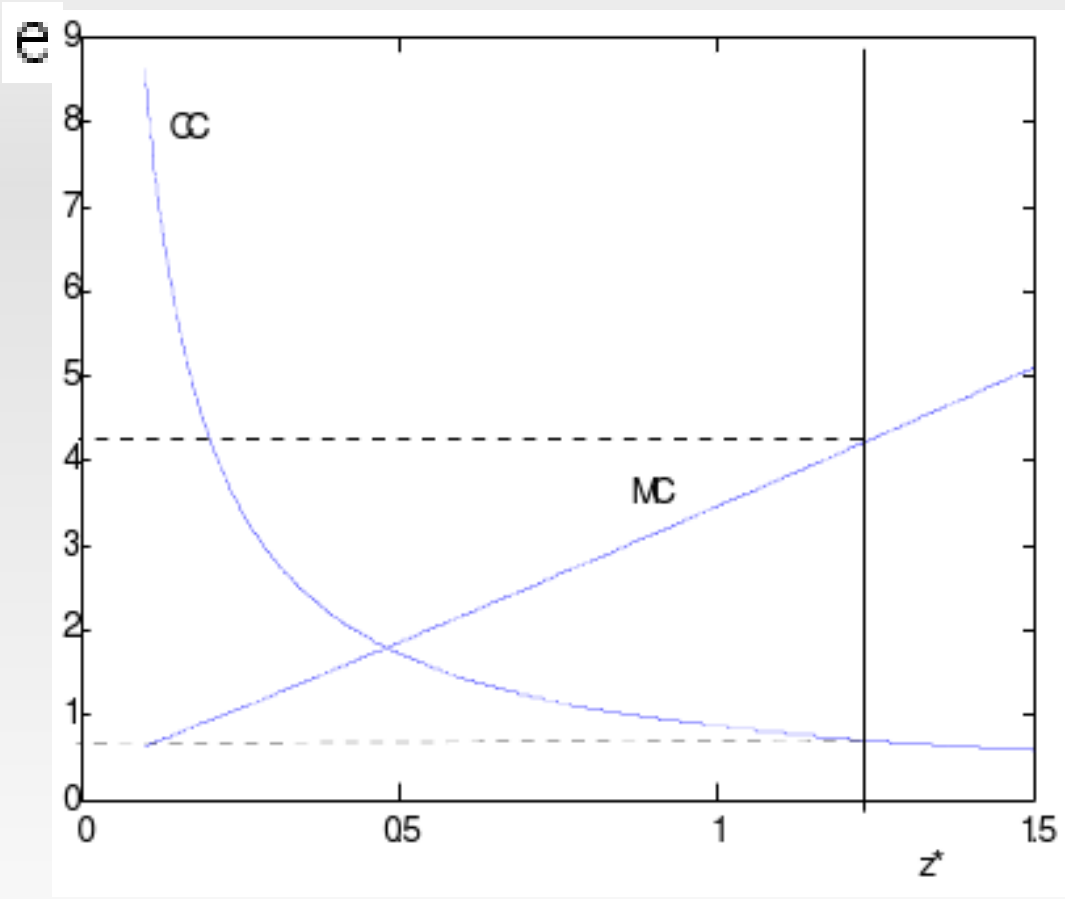
- From these equations we get

$$e = \frac{\frac{1}{n\,M(\tilde{z}^*)} + \frac{\delta+\rho}{A} - \lambda}{\beta + \frac{2+b}{1+b}\theta} \qquad \text{(MC)}$$

- From our market exit cutoff condition we get

$$e\tilde{z}^* = \frac{\lambda - \frac{\rho+\delta}{A}}{1 - \frac{2+b}{1+b}\theta} \qquad \text{(EC)}$$

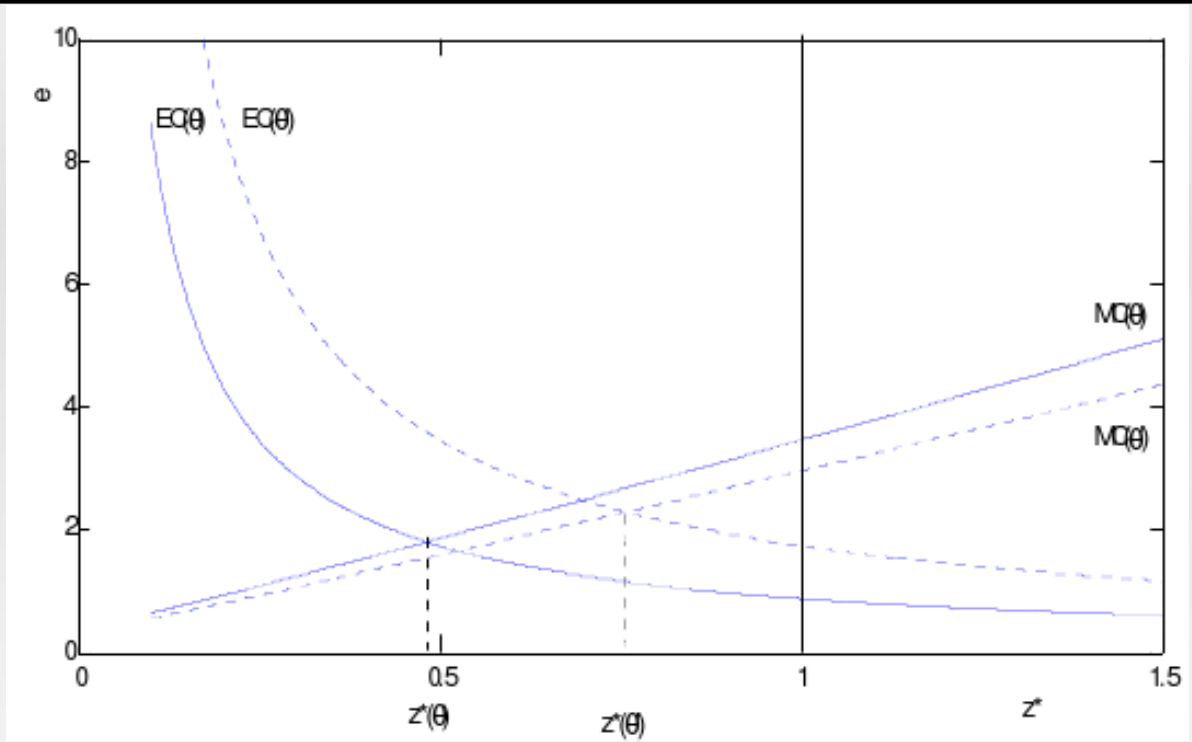
Equilibrium: MC & EC



- Make some assumptions about parameters to ensure interior solution

Proposition 2:

Proposition 2 *An increase in θ raises the productivity cutoff $(d\tilde{z}^*/d\theta > 0)$, reduces the number of operative varieties $(dM(\tilde{z}^*)/d\theta < 0)$, has an ambiguous effect on the labor resources allocated to the homogeneous sector $(d(\beta e)/d\theta < 0)$ and increases the growth rate $(dg/d\theta > 0)$*



- They call the change due to shift of MC the direct competition effect
- They call the change due to shift of EC the selection effect

Open Economy

- Two identical countries
- Iceberg type, $\tau>0$, trading costs
- No entry cost to export market

- Find,

$$\theta^T = \frac{2n-1+\alpha}{n(1+\tau)^2(1-\alpha)}\left[\tau^2(1-n-\alpha)+n(2\tau-1)+(1-\alpha)\right]$$

- This is a decreasing function of τ
  - When τ=1; $\theta^T_{\max} \equiv (2n-1+\alpha)/2n$
  - When τ=n/(n-1+α); $\theta = (n-1+\alpha)/n$
- Can also show that

$$\theta^T - \theta > 0$$

Proposition 4:

- The effect of trade liberalisation on selection & growth is decreasing in the number of firms.