

# *Asymmetric Trade Liberalization, Sector Heterogeneity and Innovation.*

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- A recent body of literature studies the effects of trade openness and trade policy on firms' decision to innovate (Licandro and Navas (2011), Atkeson and Burstein (2010), Long, Raff and Stähler (2011), Navas and Sala (2010), Impulliti and Licandro (2011)).

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- These models focus on the representative sector case so differences across sectors are not included in the analysis.

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- The degree of trade openness varies substantially across industries. In the US manufacturing industry, weighted tariffs went from 0 to 9%.
- Recent episodes of asymmetric trade liberalization (Eslava, Haltiwanger and Kugler (2009), Bustos (2011)).



- This paper introduces industrial heterogeneity in both PMC and the degree of trade openness into a multi-sector endogenous growth model with private R&D investments to:
  - Explore how the degree of PMC shapes firm's innovative activity response to trade liberalization.
  - Explore the impact of asymmetric trade liberalization on industry productivity growth.

# Results (brief)

- Both sources of heterogeneity imply heterogeneous firms' responses to trade liberalization.
- The inclusion of these sources of heterogeneity in general equilibrium reveals that there are important reallocation effects across sectors that emerge from the interaction of trade with these distortions.

# The autarkic model

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- Y is homogeneous, while X is differentiated. A discrete number of industries (goods)  $N$  that enters in the utility function following the Cobb-Douglas specification:

$$C_t^x = \prod_{j=1}^N (c_{jt})^{\phi_j}, \quad 0 < \phi_j < 1, \quad \text{and} \quad \sum_{j=1}^N \phi_j = 1.$$

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- Within each industry a continuum of varieties (products) aggregated as the std. CES form:

$$c_{jt}^x = \left( \int_0^1 c_{ijt}^{\alpha_j} di \right)^{\frac{1}{\alpha_j}}, \quad 0 \leq \alpha_j < 1$$

- The homogeneous good ( $Y$ ) is produced using the following linear technology  $q_t^Y = L_t^Y$ .
- Within each variety there are  $n_j$  firms producing the same good using the following linear technology:  $q_{lij t} = z_{lij t} l_{lij t}^x$ ,
- They engage in Cournot competition.

- Each firm invests in increasing its own stock of knowledge using the following technology:
- $\dot{z}_{ij,t} = T_{jt} \left( I_{ij,t}^z \right)^\gamma z_{ij,t}, \quad \gamma \in (0, 1),$
- We focus on Open-Loop Nash Equilibrium: Firms' decide at period  $t = 0$ , the production and innovation path taking as given the strategies of the rivals.

# Some useful previous results in the homogeneous case (Intuitions)

- I consider trade openness between identical countries.
- In this model there is a complementarity between firms' size and innovation.
- When the economy opens to trade,:
  - ① All firms have access to a larger market
  - ② All firms face tougher competition within each market.



# Some useful previous results in the homogeneous case (Intuitions)

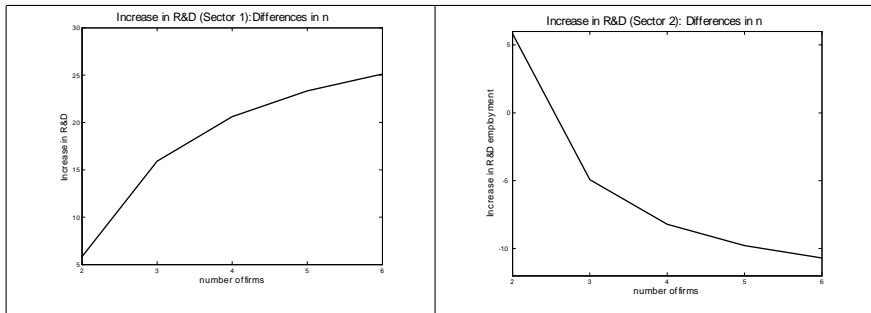
- The increase in competition has in principle two effects on firms' output:
  - ① Increases the perceived elasticity of demand. As firms face a more elastic demand they find optimal to increase output. (Competition effect).
  - ② As more firms are serving the same market, the residual demand for each firm decreases. (Size effect).
- When the economy opens to trade there is an additional positive size effect. This positive size effect perfectly compensates the negative size effect.
- Output for each firm in each market falls. However, the total output of each firm increases.
- As output for each firm increases, resources devoted to R&D increases too.

- We find that differences in the degree of PMC have important consequences on firms' innovation efforts.
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  - General equilibrium effects induce **competing sectors' R&D efforts to fall**. The larger increase in efficiency in the less competitive sectors, deviate productive resources from competing sectors.
  - Trade liberalization **increases R&D efforts in those sectors relatively less open to foreign trade**.

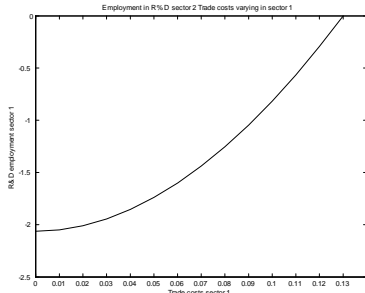
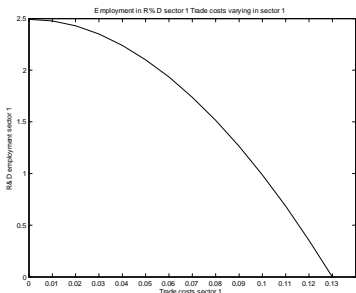
- To see the importance of this general equilibrium effects, the paper focuses on the special case of two industries.
- Both industries open to trade. Industry one has initially two firms in each market. We consider that the number of firms in industry 2 may vary from 2 to 4.



- When the two industries are symmetric, per firm R&D employment increases by 6%. However, when the number of firms in the industry 2 is larger, R&D employment increases disproportionately in industry 1 (the less competitive), but it falls in the initially more competitive sector.

- The paper also finds that asymmetries in trade liberalization generates substantially different firm responses to trade liberalization in terms of R&D.
- In a trade liberalization process when two identical industries face a different tariff cut, innovation increases in the industry facing a larger cut, while it falls in the rest.

- This can be seen in the next figure:



- In this case both industries start with the same initial tariff (13% (Anderson and Wincoop (2004))) and then we let the tariff in sector 1 to vary. As tariffs in industry 1 falls, innovation increases in industry 1 while it falls in industry 2.



- Evidence suggest that industries are heterogeneous in the degree of PMC and in the degree of trade openness. Recent trade liberalization episodes document substantial variation across sectors.
- In this paper we build a multi-sector endogenous growth model with private R&D to explore the impact of such asymmetries on firms' innovative activity response to trade.
- We find that these asymmetries generate very different responses on firms' innovation. The increase in competition has a larger positive impact on innovation when the sector is initially less competitive.
- Asymmetric trade liberalization generates substantial differences in R&D investments across industries. Everything else equal, firms innovate more in more open markets.