Strategic Innovation and Competition by Superstars

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- Superstars: focus on the formation of superstar firms

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Today: a theoretical framework incorporating all these features

Contribution

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  2. productivity: exclusive — own productivity, e.g., building towers

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  3. Does product differentiation always create market power? Endogenous market structure
     - Industries with low elasticity of substitution are favor of entrants
     - Might end up with lower market power due to intense competition

Model Setup

Overview

- Representative household: nested-CES consumption; labor only factor
- Firms make innovation and production decisions
  1. Innovating firms compete for quality ladder in each industry
     - Free entry specified by non-negative expected profits
     - At *most* one firm gets the new idea (henceforth, winner) and stay to the next stage
  2. Producing firms make investment on productivity
     - Winner (if any) moves first
     - Free entry: other firms enter simultaneously until entry becomes not profitable
  3. Producing firms compete on the product market a là Atkeson and Burstein (2008)
- Repeated static problem, but with interesting dynamics for the economy as a whole

Household Problem

- Representative households problem:

$$\max_{\{C_t, L_t\}} \mathcal{U}_0 = \sum_{t=0}^{\infty} \beta^t C_t, \quad \text{s.t. } C_t = W_t L_t + \Pi_t, \quad L_t = \overline{L} \tag{1}$$

with a nested-CES consumption aggregation:

$$C_t = \left[\int_0^1 \left(q_{jt} c_{jt} \right)^{\frac{\theta-1}{\theta}} dj \right]^{\frac{\theta}{\theta-1}} \quad \text{and} \quad c_{jt} = \left[\sum_i c_{ijt}^{\frac{\eta_j - 1}{\eta_j}} \right]^{\frac{\eta_j}{\eta_j - 1}}$$

- A standard problem that can be summarized by the following static solutions:
  - Labor supply: $L_t = \overline{L}$
  - Demand system: $c_{ijt} = q_{jt}^{\theta-1} \left(\frac{p_{ijt}}{p_{jt}} \right)^{-\eta_j} \left(\frac{p_{jt}}{P_t} \right)^{-\theta} C_t$

Firm Problem – 1. Innovation on Quality Ladder

- Quality dynamics: at time t, past quality $q_{j,t-1}$ is accessible to all innovating firms
  - With a quality ladder, quality improves to $q_{jt} = \lambda q_{j,t-1}$
  - Otherwise, it remains at the same level $q_{jt} = q_{j,t-1}$

- Innovation process on quality ladder of industry j at time t
  - N_j (determined by free entry) firms compete for quality ladder with research level l^q_{njt}
  - Probability of firm n and of industry j drawing the quality ladder:

$$h_{njt} = l^q_{njt} / \left[(q_{j,t-1}/\overline{q}_t)\overline{l}^q + \sum_{n'} l^q_{n'jt} \right], \quad H_{jt} = \sum_n h_{njt} \leq 1$$

- Innovating firms problem

$$\max_{l^q_{njt}} \left\{ h_{njt} \mathbb{E}\left[\pi^{\text{win}}_{jt} | q_{jt}, \eta_j, \psi\right] - W_t \left(\lambda q_{j,t-1}\right)^{\theta-1} \left(l^q_{njt} + \phi^q\right) \right\} \tag{2}$$

Firm Problem – 2. Investment on Productivity

- Productivity a is determined by firm type z and investment $l^a = \frac{1}{z}\frac{a^\gamma}{\gamma}$
  - All followers have the same type $\overline{z}$
  - Leader's (if any) type $z_{0j} \in [\underline{z}_0, +\infty)$ follows a Pareto distribution

- Leader's (if any) first mover problem

$$\pi_{jt}^{\text{win}} = \max_{a_0} \left\{ \pi_0 \left(a_0, I_j(a_0), a_f(a_0) | q_{jt}, \eta_j, \psi_t\right) - W_t q_{jt}^{\theta-1} \left(\frac{1}{z_{0jt}} \frac{a_0^\gamma}{\gamma} + \phi^a \right) \right\} \tag{3}$$

- Follower problem conditional on the number of followers $I_j \geq 1$

$$\pi_{jt}^{\text{fol}} = \max_{a_f} \left\{ \pi_f \left(a_0, a_f | I_j, a_0, q_{jt}, \eta_j, \psi_t\right) - W_t q_{jt}^{\theta-1} \left(\frac{1}{\overline{z}} \frac{a_f^\gamma}{\gamma} + \phi^a \right) \right\} \tag{4}$$

Firm Problem – 3. Production

- Firms compete in Cournot given the distribution of quality $\{q_{jt}\}$, productivity $\{a_{0jt}, a_{fjt}\}$ and market structure $\{I_{jt}\}$
- Firm problem:

$$\pi_{ijt} = \max_{y_{ijt}} \left\{ p_{ijt}(y_{ijt}, y_{-ijt}) y_{ijt} - \left(\frac{W_t}{a_{ijt}} \right) y_{ijt} \right\} \tag{5}$$

  - Strategic interaction occurs within each industry j through the demand system
  - Take aggregates as given: no strategic interaction across industries

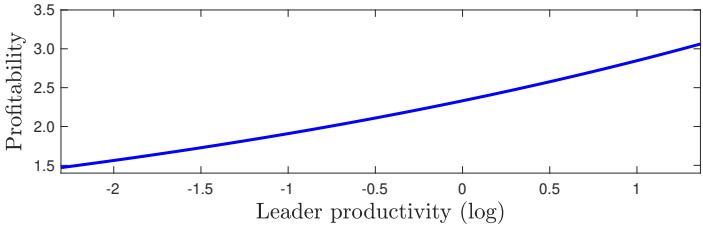
Stationary Equilibrium

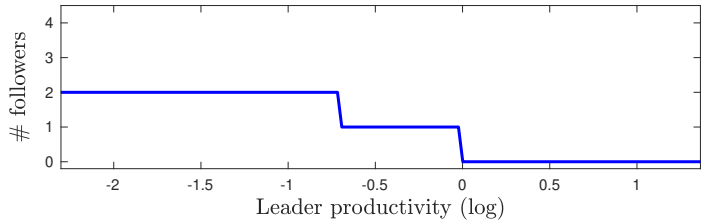
- Stationary distribution over the *relative* quality $x_{jt} = \log q_{jt} - \log \overline{q}_t$
- A stationary equilibrium along balanced growth path is a set of
  - household's consumption $\{c_{ijt}\}$ and labor supply L_t
  - innovating firm choices $l^q : X \times \Theta \to \mathbb{R}$ and market structure $N : X \times \Theta \to \mathbb{N}$
  - leader choices $a_0 : Z \times X \times \Theta \to \mathbb{R}$
  - followers choices $a_f : A \times X \times \Theta \to \mathbb{R}$ and market structure $I : A \times X \times \Theta \to \mathbb{N}$
  - producing firms choices $y : A \times A \times \mathbb{N} \to \mathbb{R}, (a_0, a_f, I) \mapsto y$
  - prices $\{p_{ijt}\}$ and $\{W_t\}$
  - stationary distribution of relative quality x

  such that all the agents optimize, goods and labor markets clear, and the relative quality distribution is invariant over time

Applications

1. Higher Profitability, More Entry ?





$\eta = \overline{\eta}$

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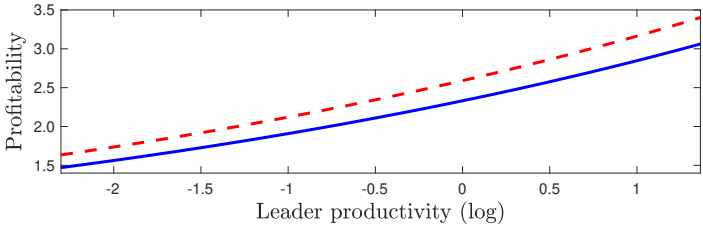

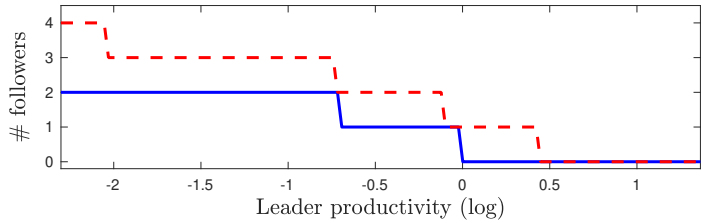

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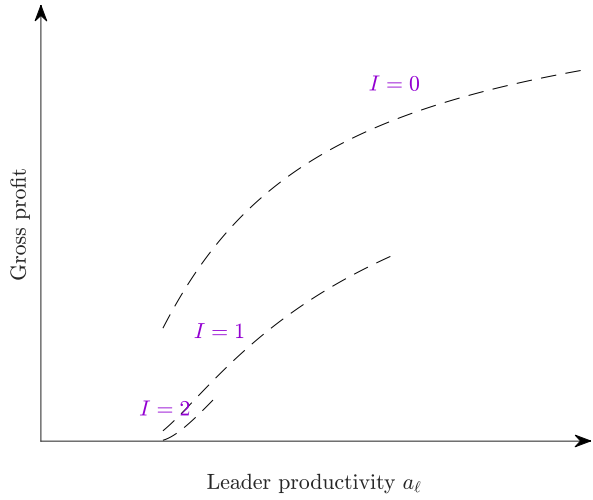
2. Where Do Superstar Firms Come From ?



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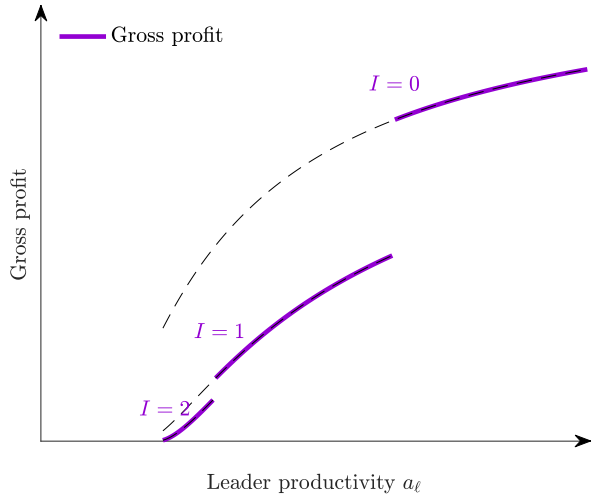

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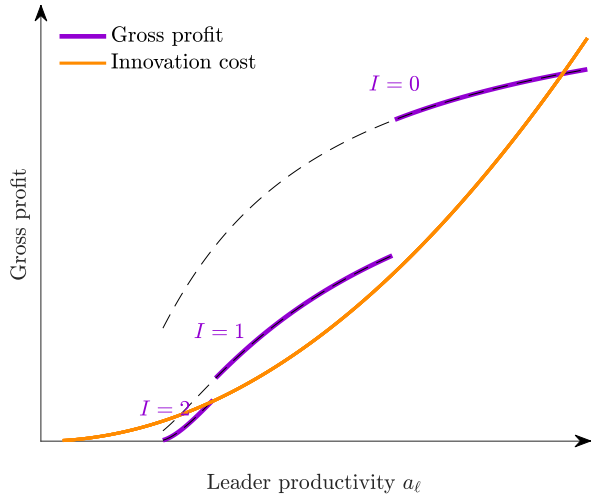

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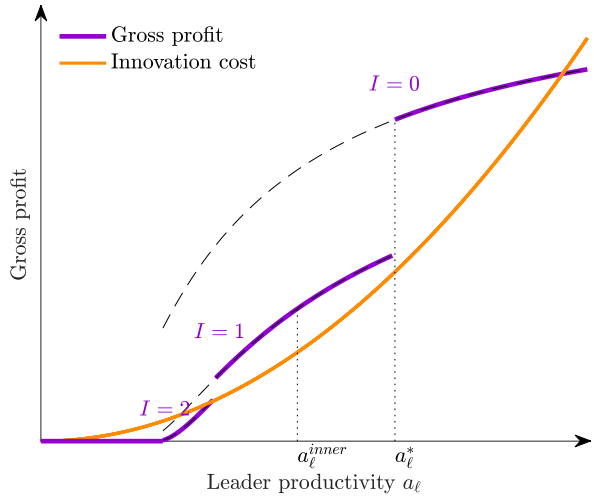

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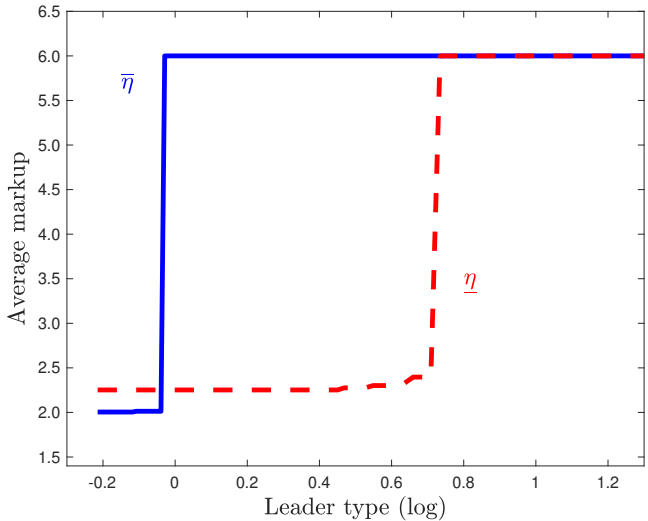

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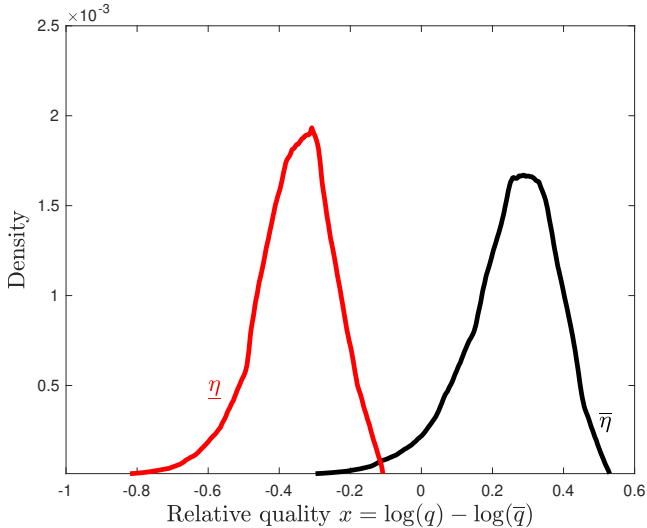

Conclusions

Next Steps

1. Long-run growth driven by innovation on quality ladders; market power matters for transition
2. Quantification and cross-sectional analysis
3. Counterfactual policies: taxes and subsidies

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