Growth Through Heterogeneous Innovations

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Heterogeneous firms $\rightleftharpoons$ Heterogeneous innovations

Recall Klette & Kortum (2004):

- firm size = # product lines
  - **geometric dist.** of sizes
  - growth **independent** of size
- innovation size = **constant**
- Cost(R&D) $\Longrightarrow$ R&D intensity **constant** in firm size

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From the data:

- ☑ Size distribution of firms is highly skewed (A1)
- ☒ Small firms that survive grow **faster** (A3)
- ☒ Relative rate of major innovations **higher** for smaller firms (D4)
- ☒ R&D intensity **decreases** with firm size (B1)

Akcigit & Kerr (2010) $\approx$ Klette & Kortum (2004) + 2 new features

Feature 1: Two innovation types

- **exploitation**: incumbent improves own existing product j
  - motive: increase mark-ups, profit
  - cost $\propto$ quality of j
  - step size **constant** $\lambda > 0$
- **exploration**: incumbent/entrant "creatively destroys" a product line
  - motive: expand, more profit
  - cost $\propto$ avg. quality
  - step size **heterogeneous**

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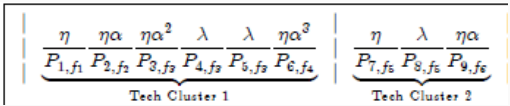
Feature 2: Heterogeneous step sizes

- **major** (θ)**:** size $\eta > \lambda$
  - starts new wave of follow-ups
- **follow-up** $(1-\theta)$**:** size $s_j = \eta\alpha^{k_j}$
  - $s_j \lessgtr \lambda$ depends on $\alpha \in (0,1)$, k_j steps since last major innovation



Main results

- **Prop. 5:** Small firms grow faster than large firms.
- **Prop. 6:** Small firms have greater R&D intensity than large firms.
- **Prop. 7:** Small firms / new entrants have comparative advantage in major innovations

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intuition: Exploitation scales linearly with firm size; exploration does not.

Intuition: Scaling of exploitation vs. exploration

- **Prop 1:** For any firm f, the optimal R&D decisions are given by

$$z_j^* = z^* = c_z'^{-1}(A\lambda), \quad \forall j \in \mathcal{J}_f$$
$$x^* = c_z'^{-1}(A[1+\Gamma])$$

  which implies

$$\text{Cost(Exploit)} = c_z(z^*) \sum_{q_j \in \boldsymbol{q}_f} q_j = c_z(z^*) \underbrace{Q_f}_{\text{firm size}}$$
$$\text{Cost(Explore)} = c_x(x^*)\bar{q}$$

- **note:** Klette & Kortum (2004) have exploration that scales linearly with firm size