Knowledge Spillovers and Inequality

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Motivation

- Spillovers of knowledge, tech flowing from leaders to followers
- Common wisdom: Spillovers promote equality
- Challenge: Spillovers can promote inequality
  - Free-riding incentive decreases investment in catch-up
  - Requires imperfect copying of leaders

Model Overview

- "Standard" deterministic endogenous growth model
  - Constant growth rate x_k
- Firms:
  - Heterogenous over physical/human capital k
- Representative Consumer: $\sum_{t=0}^{\infty} \rho^t \frac{c_t^{1-\gamma}}{1-\gamma}$, $\rho < 1, \gamma > 0$
  - Pins down interest rate r with Euler equation and x_k

Firm Problem

$$v_t(k) = \max_{\tilde{k}} \left\{ \left[1 - C\left(\frac{\tilde{k}}{k}\right) \right] A_t(k)k + \frac{1}{1+r} v_{t+1}(\tilde{k}) \right\}$$

- Technology: $A_t(k)$
- Convex adjustment cost: $C(\cdot)$

Distribution k

- Frontier: $K_t =$ maximum k at time t
- Normalization: $z = \frac{k}{K}$
- Distribution: $H_t(\cdot)$ cdf of z
- Support: $\mathrm{support}\,\{H_t\} = [z_{m,t}, 1]$

Production Technology

$$A_t(k) = \left[K_t \left(1 + \int_{k/K_t}^{1} \alpha(z) dH_t(z) \right) \right]^{\beta}$$

- Intensity of Externality: $\beta > 0$
- Copying Advantage: $\alpha(z) \geq 0$
- Copy Leaders: $\alpha'(z) > 0$

Equilibrium

v_t, x_m, H, and r such that:

i) $\tilde{k} = x_m k$ and v_t solve firm problem

ii) x_m and r solve consumer problem

iii) $H_t = H$

Inequality in $H(\cdot)$

Comparing inequality with z_m:

- $|\mathrm{support}\,\{H\}\,| = 1 - z_m$
- $z_m \to 1 \implies$ perfect equality

Nesting Simple A_t

$$A_t(k) = \left[K_t \left(1 + \int_{k/K_t}^{1} \alpha(z) dH_t(z) \right) \right]^{\beta}$$

AK model:

- $\beta = 0$ i.e. output $y = k$

Type Independent Externality:

- $\beta > 0$. e.g. $A_t = K_t^{\beta}$

Example: Undirected Copying

$$A_t(k) = \left[K_t \left(1 + \int_{k/K_t}^{1} \alpha(z) dH_t(z) \right) \right]^{\beta}$$

- Free-riding incentive: α
- Copy all above: $\alpha(z) = \alpha z$
- $\uparrow \alpha \implies \uparrow$ inequality

Example: Directed Copying

$$A_t(k) = \left[K_t \left(1 + \int_{k/K_t}^{1} \alpha(z) dH_t(z) \right) \right]^{\beta}$$

- Draw n values s_i from $H(\cdot)$ above z
- $\mathbb{E}\left[\max_i\{s_i\}\right] = n \int_z^1 s \left[H(s)\right]^{n-1} h(s) ds$
- $\alpha(z) = nz \left[H(z)\right]^{n-1}$
- $\uparrow n \implies \uparrow$ inequality