Schumpeterian Growth Theory

Jonathan Colmer

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Is exit good or bad for growth?

Why Creative Destruction?

Product-Variety Lens:

- All varieties remain valuable forever
- Exit only reduces variety $\Rightarrow$ lower productivity
- More is always better

But Evidence Shows:

- Firm exit often raises aggregate productivity
- Industry leaders routinely get replaced
- Innovation makes old technologies obsolete

Schumpeter's Insight:

- Innovation is vertical—quality, not just variety

One-Sector Schumpeterian Model

Basic Setup

Environment:

- Discrete time $t = 0, 1, \ldots$; L workers live one period and supply labor inelastically
- Workers are risk neutral and care only about expected consumption

Final Good Production:

$$Y_t = (A_t L)^{1-\alpha} x_t^{\alpha}$$

- One intermediate good x_t combines with labor to produce the final good
- A_t measures the quality of the best available intermediate input

Intermediate Production:

- Monopoly supplier transforms the final good one-for-one into the intermediate
- GDP equals $Y_t - x_t$, i.e., final output net of the intermediate input used
- Innovation multiplies quality: $A_t = \gamma A_{t-1}$ with $\gamma > 1$

Production and Profits

Demand Side: Price equals the marginal product of the intermediate good,

$$p_t = \alpha(A_t L)^{1-\alpha} x_t^{\alpha-1}.$$

Monopolist's Problem:

$$\max_{x_t} \ \pi_t = p_t x_t - x_t = \alpha(A_t L)^{1-\alpha} x_t^{\alpha} - x_t.$$

Equilibrium Implications:

- Optimal quantity $x_t = \alpha^{\frac{2}{1-\alpha}} A_t L$
- Monopoly profit $\pi_t = \pi A_t L$ where $\pi = (1-\alpha)\alpha^{\frac{1+\alpha}{1-\alpha}}$
- GDP $\text{GDP}_t = \alpha^{\frac{2\alpha}{1-\alpha}}(1-\alpha^2) A_t L$

All key aggregates scale with the technology level $A_t L$.

Innovation

Research Technology:

$$\mu_t = \phi(n_t) = \lambda n_t^{\sigma}, \qquad 0 < \sigma < 1.$$

- μ_t is the probability of an innovation in period t
- $n_t = R_t / A_t^*$ is productivity-adjusted expenditure with $A_t^* = \gamma A_{t-1}$
- Captures increasing difficulty of improving higher-quality technologies

Expected Payoff:

- Success yields $\pi^* = \pi \gamma A_{t-1} L$
- Expected profit: $\phi(n_t)\pi^* - R_t$

Research Arbitrage

First-Order Condition:

$$\phi'(n_t)\frac{\pi^*}{A_t^*} = 1 \quad \Rightarrow \quad \phi'(n_t)\pi L = 1.$$

Implications:

- Productivity-adjusted level of research n_t is constant in steady state
- Innovation probability μ_t is also constant, $\mu = \phi(n)$.
- Solving:

$$n = (\sigma\lambda\pi L)^{\frac{1}{1-\sigma}}$$

$$\mu = \lambda^{\frac{1}{1-\sigma}}(\sigma\lambda\pi L)^{\frac{\sigma}{1-\sigma}}.$$

Higher rewards increase both the marginal benefit and marginal cost of research, leaving optimal intensity constant.

Growth

- The rate of economic growth is the proportional growth rate of A_t, $g_t = \frac{A_t - A_{t-1}}{A_{t-1}}$.
- Two possible outcomes each period:
  - No innovation: $g_t = 0$
  - Innovation: $g_t = \gamma - 1$

$$\begin{aligned} g = E(g_t) &= \mu \cdot (\gamma - 1) \\ &= \lambda^{\frac{1}{1-\sigma}} (\sigma \pi L)^{\frac{\sigma}{1-\sigma}} (\gamma - 1) \end{aligned}$$

Key Takeaway: The long-run average growth equals the frequency of innovation times the step size of the innovations.

Nondrastic Innovations

- Until now intermediate monopolist could charge any price without fear of entry (the drastic innovation case, Tirole, 1988).
- What if a competitive fringe can imitate the final good at cost $c > 1$?
- Results in limit pricing constraint: $p_t \leq c$

Nondrastic Innovation ($c < 1/\alpha$):

- Constraint binds; leader charges $p_t = c$ and scales quantity to meet limit pricing
- Profits remain proportional: $\pi_t = \pi(c) A_t L$ with $\pi(c)$ increasing in c

Implication: Everything holds, but now profits—and thus innovation incentives—depend on property-rights protection through c.

Comparative Statics

Growth Rises With:

- **Research productivity** (λ): e.g., higher education, better R&D institutions
- **Innovation size** (γ): larger quality jumps, advantage of backwardness
- **Property-rights protection** (c): stronger patents raise post-innovation rents
- **Market size** (L): more researchers $\Rightarrow$ higher innovation probability (scale effect)
  - Can be eliminated with both horizontal and vertical innovations.

Growth decreases with competition:

- Lower c (more competition) reduces growth by eroding rents
  - At odds with empirical evidence on competition and innovation.

Competition and Growth

Why Competition Matters for Growth

Traditional Schumpeterian View:

- Innovation rents finance R&D; tougher competition squeezes those rents
- Policy implication: protect incumbents to preserve innovation incentives

Empirical Puzzle:

- Deregulation and antitrust episodes often coincide with productivity accelerations
- Lower markups in IO data frequently accompany surges in patenting and entry

Key Question:

- How can stronger product-market competition both stifle and stimulate innovation?

Escape vs. Schumpeterian Effects

Escape-Competition Effect:

- Neck-and-neck firms innovate to escape intense rivalry
- Stronger product-market competition boosts frontier innovation

Schumpeterian Effect:

- Tougher competition reduces profits for laggards
- Lowers incentives when firms are far apart technologically

Predictions (Aghion–Bloom–Blundell–Griffith–Howitt, 2005):

- Inverted-U between competition and innovation
- Frontier firms respond positively to competition; followers may not
- Competition widens average technological gaps as sectors transition between states

Convergence

Club Convergence Patterns

Puzzle: Can we reconcile convergence within OECD countires with persistent divergence elsewhere?

Schumpeterian Resolution:

- Tacit know-how makes adoption of ideas resemble R&D, requiring effort
- Sustaining $\mu > 0$ keeps countries inside the club sharing the frontier growth rate g
- When institutions drive $\mu \to 0$, stagnation follows despite available ideas

Intuition:

- Innovation incentives determine whether distance to the frontier narrows or diverges.

Key Lessons

Schumpeterian Growth Theory: Key Lessons

- Growth is powered by vertical (quality) innovations and creative destruction
  - Winner-takes-all races displace incumbents and reallocate resources
- Competition has nuanced effects: escape-competition boosts frontier innovation, but laggards need rents
  - Need to account for distance to frontier and institutional context
- Firm dynamics and reallocation are central to aggregate productivity growth
- Welfare trade-offs hinge on balancing static losses from monopoly power with dynamic gains from innovation
- Convergence is conditional: sustaining innovation effort keeps countries in the growth club, weak institutions cause divergence