Discussion of Atkinson and Burstein (2015), “Aggregate Implications of Innovation Policy.”

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Big picture

- Study of the core determinants of socially optimal innovation levels.
- Direct growth impact of increased R&D spending limited by calibrated growth rate.
  - In absence of social depreciation of innovation.
  - Assuming conditionally efficient innovation.
- Thus, given the limited direct impact of innovation spending, optimal innovation levels depend crucially on intertemporal knowledge spillovers and patience of consumers.
- Very useful for focusing empirical work on identifying key determinants of optimal policy.

Model

- Two goods: Consumption good and research good.
- Labor resource constraint, $1 = L_p + L_r$. Production and research labor.

Model - production side

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- Imperfect competition in intermediary goods market. $\mu(j)$ is j's markup.
- $L_p = \sum_j \tilde{N}(j)\ell(j)$, where $\ell(j)$ is j's labor demand per good.
- Assuming $\mu(j) = \mu$ along with competitive final goods market gives aggregate productivity,

$$Z = \left(\sum_j z(j)^{\rho-1} \tilde{N}(j) \right)^{1/(\rho-1)}.$$

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- $Y_r = \sum_j \tilde{N}(j) y_r(j) + E \bar{y}_r$.

Model - dynamics

- Transition function for $N_t(j)$:

$$\vec{\tilde{N}}_{t+1} = T\left(\vec{y}_r, E_t; \vec{\tilde{N}}_t\right).$$

- Growth rate in Z_t:

$$g_{zt} = \ln(Z_{t+1}) - \ln(Z_t) = G\left(\vec{y}_r, E_t; \vec{\tilde{N}}_t\right).$$

special cases

- The model includes as special cases:
  1. Grossman and Helpman (1991) and Aghion and Howitt (1992) quality ladder model. $\sum_j \tilde{N}(j) = 1$.
  2. Luttmer (2007) expanding varieties. $\sum_j \tilde{N}(j)$ endogenous.
  3. Klette and Kortum (2004) ladder model – Hopenhayn (1992) meets GH and AH.
  4. Lentz and Mortensen (2008, 2014) – Empirical KK with firm heterogeneity.

Results

- Define ε_{gt} as elasticity of g_{zt} with respect to $Y_r t$,

$$\tilde{g}_{zt} - \bar{g}_z = \varepsilon_{gt} \left(\tilde{Y}_{rt} - \bar{Y}_r \right),$$

  where $\bar{Y}_r$ is the baseline spending.

- Core result:

$$\varepsilon_{gt} \leq \bar{g} - G_t^0,$$

  where G_t^0 is the growth rate in productivity at zero research spending.

- Result subject to three assumptions:
  1. $(\vec{y}_r, E)$ are conditionally efficient (for given Y_r they maximize G).
  2. G is concave (decreasing return to additional spending... roughly speaking).
  3. $\vec{\tilde{N}}$ does not figure in G.

Results...

- $G(0) = 0$ and $G(\bar{Y}_r) = \bar{g}_z$. So, spending on the order of 10-15% of GDP gives us an increase in growth rate of $\bar{g}_z$ and given concavity of G, highest marginal returns to spending have already been reaped.

Results...

- Assumptions 1-3 satisfied in special cases 1-3, but LM violates A1 and A3.
- Quantitative results for the KK model:
  - Consider a permanent increase in innovation spending relative to GDP from 0.11 to 0.14.
  - In very long run, productivity very sensitive to degree of knowledge spillover, and in endogenous growth model response is large.
  - However, for the shorter span, productivity is only about 5% higher in year 20 after the change.
  - GDP net of innovation spending has only just recovered from the drop due to the increased Y_r.

Optimal policy

- Given A1-A3 and calibrated growth rate of roughly 0.015, cannot expect a large productivity growth rate response from increased R&D spending – at least in short and medium run.
- That is however not the only determinant of optimal innovation policy which AB demonstrate can vary from an R&D intensity between,
  - 1.21 for very patient individuals and large knowledge spillovers
  - 0.15 for impatient individuals and low knowledge spillovers.

Optimal policy – Lentz and Mortensen (2014)

- Take estimated model in Lentz and Mortensen (2008) and show that:
  - Planner can double productivity growth from 0.014 to 0.028.
  - Inefficiency equivalent to a 20% tax on planner consumption path.
  - Thus, substantial gains to optimally designed innovation policy.
  - Simple enough to implement through patent fees and general innovation subsidies.
- LM violates A1 and A3.
- AB make the rather wonderful observation that the associated increase in R&D spending implies a relative growth rate response of,

$$\frac{0.028 - 0.014}{\ln(4.85) - \ln(1.58)} = 0.0125 < \bar{g}_z = 0.014.$$

Optimal policy – Lentz and Mortensen (2014)

- However, if one constrains the planner to use only $Y_r = 1.58$ as in the decentralized solution, planner solution implies,
  - Increased growth rate of 0.022 from 0.014.
  - Decentralized solution equivalent to a 17% tax on planner consumption path.
- This solution represent a state where A1 is now satisfied.
  - Increased spending from 1.58 to 4.58 associated with a moderate growth rate response reflecting the substantial concavity of G in LM.

Inefficiency in Lentz and Mortensen (2014)

- G depends on $\vec{\tilde{N}}$.
- Innovation ability embodied in product leadership.
- Low ability innovation moves $\vec{\tilde{N}}$ in a direction that lowers G for given Y_r.
- Planner kills low ability innovation.