Productivity, Demand and Growth

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This Paper

Firms are heterogeneous in demand and production efficiency

$$C_t = \left[\int b_{jt}^{1/\eta} \cdot q_{jt}^{1-1/\eta} \cdot l_{jt}^{1-1/\eta} dj \right]^{\eta/(\eta-1)}$$

1. Demand evolves randomly (though not unpredictably)

2. Production efficiency evolves through R&D (innovation)

This Paper

Firms are heterogeneous in demand and production efficiency

$$c_{jt} = b_{jt} \cdot p_{jt}^{-\eta} C_t$$

- Demand evolves randomly (though **not** unpredictably)

- Incentive to innovate if demand is expected to grow

- Path of production efficiency is affected by demand

Analytical Model

Keep things simple:

- Firms die exogenously, rate δ

- Firms are born with some demand b_0, grows at rate θ

- Choose some convenient but not crazy parameters

- Result: some stationary distribution of firm age (overlaps with demand)

Analytical Results

Firm's innovation increases in demand growth rate θ

- Innovation raises productivity in the future at some cost today

- Higher $\theta \rightarrow$ greater demand for output in the future

Growth rate of total factor productivity rises in θ

- Productivity growth maps directly into firm's innovation rate

Subsidy for innovation has greater effect on growth rate at higher θ

- Effect of a subsidy is proportional to firm's returns to R&D.

Full model

Use moments from detailed micro data to estimate complicated demand profile

- 3 components: firm's natural output level, AR(1) demand shock, noise shock

- Add fixed operating costs, endogenous exit, endogenous entry

- Carefully evaluate model fit using micro data

- Show that demand fits excellently with existing empirical findings on firm growth, productivity and demand

- Policy experiments: operation subsidies, growth-enhancing policies $\rightarrow$ **demand matters**

Discussion

Intriguing paper, bridging the gap between literatures with two ways of thinking:

- Firm dynamics with exogenous productivity but rich dynamics

- Endogenous growth: endogenous productivity, but simplistic heterogeneity

Comments:

- What is the mechanism?

- What is demand? Should monetary policy maker care?

- Lesson: heterogeneity matters

Understanding the Results

Back to analytics: firm's innovation increases in demand growth rate θ

- Innovation raises productivity in the future at some cost today

- Higher $\theta \rightarrow$ greater demand for firm's output in the future

- Higher innovation rates cause higher productivity growth

- Counter-intuitive? Demand has a stationary distribution!

Understanding the Results

Back to analytics: firm's innovation increases in demand growth rate θ

- Answer: firm-level demand growth makes R&D relatively cheap

$$rd_{jt} = b_{jt}q_{jt}^{\eta-1}x_{jt}^{\psi}$$

- R&D costs are scaled by **current** demand

- Demand expected to grow: wedge between current and future demand

- That wedge determines incentive to innovate

- Young firms: demand profile is such that today's demand $<$ future demand

- Hence young firms are relatively innovative

Understanding the results

So if we take the mechanism seriously:

- A positive anticipated 'demand shock' across firms **raises** R&D today

- A positive temporary 'demand shock' across firms **lowers** R&D today

- Is that really true in reality?

Why do we think R&D costs scale with size?

- Usually: large firm produces sophisticated product

- Question is: what determines how complicated innovation is!

- Demand grows over firm life cycle: reflects financial constraints? Consumer capital? Returns to advertising? Product sophistication?

What is demand?

Demand in this paper is not really 'aggregate demand' in the AD-AS model

$$C_t = \left[\int y_{jt}^{1-1/\eta} dj \right]^{\frac{\eta}{\eta-1}}, \quad y_{jt} = b_{jt}^{\frac{1}{\eta-1}} \cdot q_{jt} \cdot l_{jt}$$

- Demand is **real**: positive demand shock raises utility

- Demand shock is **deflationary**: same utility for lower spending

- Demand reflects **broad factors** that determine firm life cycle

- **Monetary policy**: not clear if it should learn lessons from this paper

Heterogeneity Matters

Real contribution: serious attempt to think about firm heterogeneity in the context of innovation and productivity growth

- Data-driven model of dispersion in firm size for non-technological reasons

- Key for innovation decisions: demand has a *profile* (non-random)

- Time to reconsider homogeneous firm model of innovation?

- Rise of oligopolistic competition, winner takes all. Concave returns to R&D?

- Great avenues for future research: think about implications for the concentration and misallocation of research and development

Productivity Growth

Figure: Trends in Productivity Growth and Research & Development
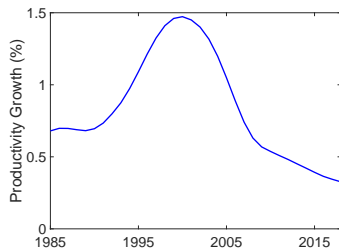
(a) Productivity Growth
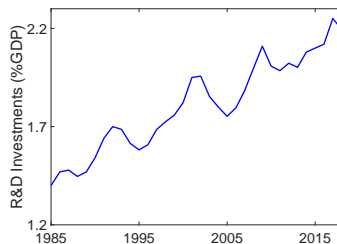
(b) R&D Investments

Conclusion

- Paper offers an intuitive model of heterogeneous demand and innovation

- Quantification shows that demand could be relevant for growth (policies)

- How confident are we about the mechanism?

- Heterogeneity matters!