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Economic Growth through Diversity in Beliefs

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Every period, a cohort of candidates of size ν works on their dissertations.

They absorb existing knowledge Y and have two options:

1. write a non-innovative dissertation that replicates existing knowledge Y
2. write an innovative but risky dissertation, which produces

$$\begin{array}{ll} A\delta Y & \text{with probability } p \text{ (success)} \\ \delta Y & \text{with probability } 1-p \text{ (failure)} \end{array} \qquad \text{assume } A\delta > 1 > \delta$$

These researchers replace a measure ν of retiring researchers and their knowledge νY.

Assume that a share α of candidates chooses the innovative option.

Then the increase in the stock of knowledge is

$$\nu\{\underbrace{\alpha \cdot [pA\delta + (1-p)\,\delta]}_{\text{innovative dissertations}} + \underbrace{(1-\alpha)\cdot 1}_{\text{non-innovative dissertations}}\}Y - \underbrace{\nu Y}_{\text{retired knowledge}} .$$

This implies the growth rate of the knowledge stock

$$\mu_Y = \nu\alpha\left\{p\left(A\delta - 1\right) - (1-p)\left(1-\delta\right)\right\}.$$

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This is not a model of the innovation frontier!

- bad research is not discarded and has an adverse impact on future innovation

Candidates may not have the correct belief p about success of innovative dissertations.

Assume that candidates are optimistic/overconfident:

- their subjective probability of success is $p^s \geq p$

Candidates have logarithmic preferences over the dissertation quality

- will choose an innovative dissertation iff

$$\underbrace{p^s \log(A\delta) + \left(1 - p^s\right) \log \delta}_{\substack{\text{expected utility} \\ \text{from innovative project}}} \geq \log 1$$

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$$\underbrace{p^s \log(A\delta) + (1 - p^s) \log \delta}_{\text{expected utility from innovative project}} \geq \log 1 \quad \Longrightarrow \quad \underbrace{p^s \geq -\frac{\log \delta}{\log(A)}}_{\text{sufficient optimism needed}} \doteq p^*$$

Share α of candidates who take innovative projects given by share of candidates with belief $p^s \geq p^*$.

For a high growth rate, the economy needs

- innovative projects to have high payoffs and high success rates
- sufficiently optimistic/overconfident candidates ($p^s \geq p$) so they implement these projects
- high rate of turnover ν (senior researchers have to retire quickly to allow for new ideas)

Paper advertises diversity of beliefs but key to high growth in the model is **optimism, not diversity**.

- the authors mechanically tie optimism to diversity by assuming $p^s \sim U[p, p + \mathcal{D}]$ and varying $\mathcal{D}$
- however the only thing that matters is how many candidates have $p^s \geq p^*$

We could have achieved the same by assuming $p^s \sim U\left[\underline{p}, \underline{p} + \mathcal{D}\right]$ and varying $\underline{p}$.

Candidates are long-lived, with perpetual youth as in Blanchard (1985)–Yaari (1965).

- effects are neutralized by logarithmic utility and life insurance contracts
- candidates enjoy a constant stream of benefits over their lifetime proportional to the realization of the dissertation project

No aggregate uncertainty, no other risky decisions.

- idiosyncratic project risk diversified at the aggregate level
- paper contains inconsequential narrative about H different project outcomes

No equilibrium interaction except when specific across-cohort redistribution moves interest rate.

$\Longrightarrow$ Dynamics summarized by chaining static choice problems.

A) Lack of diversification within the cohort

- this can be justified by moral hazard
- candidates may (!!!) prefer pooling projects and share outcomes

B) Indivisibility of projects (**not discussed in the paper**)

- candidates cannot devote part of their know-how Y to a risky project and part to a safe one
- this is hard to justify in the context of entrepreneurs who invest their resources

C) Intergenerational externality

- candidates do not take into account spillovers of their knowledge on future generations
- they cannot patent ideas in their dissertations to internalize it

(Optimal) policy

Paper considers alternative redistribution policies and their impact on the choice of risky projects.

- the purpose is not to design optimal policy but rather to understand comparative statics

Since the economy features subjective beliefs, we would have to choose the welfare criterion.

- utilitarian planner: respects subjective beliefs
- paternalistic planner: wants to correct agents' belief biases

In each case, we need to take a stand on

- what are technological constraints
- what is the set of policies the planner is allowed to engage in

Policy 1: Lump sum tax before choosing the project

Policy

- government taxes away a fraction τ of the investable endowment Y
- new entrepreneurs then choose type of project but at a smaller scale $(1-\tau)Y$
- government then rebates τY within cohort

Outcome

- entrepreneurs who found innovative projects too risky may now be willing to innovate because smaller scale means less risk $(+)$
- entrepreneurs who chose the innovative project before have to now scale it down $(+/-)$
  - signs depend on the optimal unconstrained size of project and utilitarian/paternalistic view
- net effect for the given parameteric examples is less innovation $\implies$ less growth $(-)$

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Problem: Why couldn't agents choose a smaller scale on their own? [indivisibility!]

- here, the policy is more than just redistribution, it is breaking a technological constraint

Policy

- new entrepreneurs choose type of project at full scale Y
- government taxes proceeds from the project at rate τ
- government redistributes tax revenue

Outcome

- positive effect on taking innovative projects (government provides insurance) $(+)$
- when costly effort of innovation is involved then taxing proceeds implies a distortion $\Longrightarrow$ negative impact on growth $(-)$
- when tax proceeds redistributed across cohorts, after-tax endowment paths are no longer constant $\Longrightarrow$ impact on the risk-free rate

Policy 4: Venture capital

Policy

- venture capital pools share θ the investable endowment Y and invests into innovative projects
- new entrepreneurs then choose type of project but at a smaller scale $(1-\theta)\,Y$
- venture capital redistributes the proceeds

Outcome

- strictly better than taxation policy 1 when innovative projects have positive NPV

Policy

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Problem: Forced participation

- the paper first states that entrepreneurs '*can invest*' in the fund, and later that they '*do invest*'
- that is not the same: if they are highly optimistic about their own project, they may prefer not to diversify

Inequality

The model has two types of inequality

- within-cohort: different realizations of the project quality: $A\delta$, δ, 1
- between-cohort: more recent projects have higher payouts

Authors are able to characterize inequality analytically (very nice!).

But the distribution has some pathological properties

- youngest entrepreneurs have highest levels of wealth
- the between-cohort distribution is left-skewed, oldest entrepreneurs are poorest

This is opposite to what perpetual youth models with savings sometimes generate.

- right tail populated by very old agents

Moskowitz and Vissing-Jørgensen (2002)) say that returns to entrepreneurial investments are low.

- 'entrepreneurial choice puzzle', based on data from 1990s
- Kartashova (2014) documents high private equity returns in later period

Very large quantitative macro literature on entrepreneurial choice and firm dynamics

- Hopenhayn (1992), Quadrini (1999), Cagetti and De Nardi (2006), Buera, Kaboski, and Shin (2011), Midrigan and Xu (2014)
- idiosyncratic risk, financial constraints, life-cycle, firm entry, policies reducing misallocation, implications for wealth inequality, ...

Optimism/overconfidence as an explanation

Optimism/overconfidence is plausible but there are competing explanations.

- Hurst and Pugsley (2011, 2017), Sterk, Sedláček, and Pugsley (2021), Bhandari et al. (2020), Bhandari and McGrattan (2021)
- entrepeneurs are highly heterogeneous, reasons for entrepeneurship differ
- innovation and enterpreneurship are not the same thing
- entrepreneurs who truly engage in innovation may actually earn high returns

Optimism/overconfidence can also have the adverse effects

- large area of study also in management and organizations literature: Amore, Garofalo, and Martin-Sanchez (2021), Puri and Robinson (2007, 2013)
- too little diversification, systematic overinvestment on socially inefficient projects

Conclusion

The paper tackles an important question: What are the fundamental reasons for entrepreneurship?

- many different possible factors: excessive optimism/overconfidence one of them

In the presence of externalities, individually suboptimal actions may improve welfare.

- paternalistic and utilitarian views will differ
- here, current generation exposes itself to risk and welfare of future generations improves

'*Our model is deliberately stylized yet highly tractable.*'

- analytical tractability and transparency are desirable
- but perhaps this model is 'too stylized'
- market interaction and dynamics are oversimplified $\implies$ many interesting aspects off the table

Policy experiments could/should be refined.

- what happens to welfare within generation / between generations?
- restrict attention to Pareto-improving policies (between-generation redistribution)?
- some of the policies are too crude, seemingly breaking technological constraints

Appendix

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