

# Discussion of “Tapping into Talent: Coupling Education and Innovation Policies for Economic Growth”

by

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## The paper

- ▶ Explores complementarities btw education and innovation: taking seriously the research labor input in innovation production (“unpacking” the relationship btw human capital and innovation policies)
- ▶ Presents stylised facts about PhD education and innovation in Denmark, builds a model to capture those features, and analyzes alternative policies
- ▶ Why does it matter? Because the process of generating of human capital that creates innovation constitutes a constraint to the effectiveness of R&D subsidy policies: the model is able to explain the small effects found in the data.
- ▶ Key ingredients: talent heterogeneity, time to build HK, and financial constraints (→ talent misallocation)

## Model framework

- ▶ Career choice model where agents are born with different “IQs”, but also different preferences for research.
- ▶ Can work in the production or research sectors. Those who want to become researchers are constrained by: the number of places available, a financial constraint (have to pay upfront).
- ▶ As a consequence: high IQ agents may not be able to obtain a PhD, low IQ researchers with high parental income can become researchers. → inefficiency part. Some high IQ agents may just prefer to work for prod sector (→ efficient)
- ▶ Time to build: once a PhD it takes “time” (an arrival rate) to become a lab leader and produce ideas.
- ▶ R&D subsidies are thus less effective as number of PhDs is limited by universities and financial constraints. I really liked this result, as it's intuitive and takes seriously how researchers are actually trained in society

# Key results

- ▶ Theoretical results about policies:
  - ▶ **Expanding PhD slots:** increases number of researchers but attracts less talented agents, and reduces R&D profits making research careers less attractive. Growth result: ambiguous.
  - ▶ **R&D subsidy:** increases lab equipment and profitability, but doesn't lift financial constraint. Growth result: positive but less than standard models.
  - ▶ **Subsidize cost of education:** lifts financial constraint for talented agents. Growth result: positive (though may be expensive)
- ▶ Model calibrated to very rich micro-data from Denmark. Quantitative results:
  - ▶ R&D subsidy increases growth by much less than the 1:1 result of standard models (only 0.5% after one year!)
  - ▶ At low levels of budget, it's always better to spend more on subsidizing education. Reverts for high subsidy budget
  - ▶ Education subsidies work better in more "unequal" societies

## Comments: theory

- ▶ Borrowing and lending: agents are hand-to-mouth, there is no possibility of borrowing to finance the cost of education. Makes life easier as you don't need to track another state, but:
  - ▶ Student loans have increased dramatically in the past two decades for US and UK
  - ▶ For countries where it has not, it is mostly due to the fact that education is “free”. In essence, the government borrows on behalf of credit constrained individuals.
  - ▶ Even allowing for a small amount of borrowing (imposing a borrowing limit), given education costs, may un-do the effect of the financial constraint in the model
  - ▶ How are PhDs funded in Denmark? For home (and EU) students: no tuition, PhDs get a salary (i.e. covers living costs). If UG degrees are free and there are maintenance grants, what prevents talented individuals from getting a PhD? Parental income matters for educational attainment, but in which ways?
  - ▶ Links to two comments below about modelling PhD or HE funding structure, and evidence on financial constraints
- ▶ Smaller point: Education (PhD) cost is constant (I believe). But anecdotal evidence shows that PhDs are taking longer: maybe as ideas grow the shoulders of giants get higher to climb! May be another mechanism that reduces the effectiveness of R&D policies.

## Comments: quantitative analysis

- ▶ **General comment:** model used to match data for Denmark. However, PhD funding system in Denmark is very different from that in the model. PhDs do not pay for their own education in Denmark through scholarships (government financed). You are matching the data of an economy whose government has understood the credit constraint and has changed the HE funding system to lift it, but using a model in which the government has no PhD funding policy. This may bias the estimate of deep parameters of the model. Possible solution: match to data before the 2002 reform? Takeaway: need a model block of HE funding to really "unpack" the channels
- ▶ **Calibration of education cost:** Danish PhDs get a salary! Denmark cannot discriminate other EU students.
- ▶ **Question:** who is the cost of education paid to? No education production sector. Assume it is "imported" by the SOE?

## Comments: quantitative analysis

### ► The link btw parental income, IQ, and PhD prob:

- You show: proportion of PhDs by parental income (+), and IQ by parental income (+). But since  $\text{Corr}(IQ, \text{income}) < 1$ : conclude that this is evidence in favor of financial constraints. But I would like to see the proportion of PhDs by parental income *controlling for IQ*: residual probability of PhD by parental income bin. This would clearly show your point. I suspect this conditional correlation shows a flatter pattern.
- Links to borrowing/lending comment: if no clear evidence that high IQ individuals are constrained, it may be the case that agents can borrow or the government does it for them. Hence, this is key for your mechanisms to be convincing.
- Another plausible story: the true difficulty is in revealing the type  $z$  of the students (private information). You may get a semi-separating equilibrium where both types may end up getting PhDs (but more so for high  $z$  types). Consistent with no shirking condition whereby your salary as researcher increases with seniority. [I've had several experiences of low  $z$  pooling into a PhD!!]

## Conclusions

- ▶ Great read (certainly by the metric of “I learned a lot”)
- ▶ Innovative paper (coming from PhDs...)
- ▶ Clever but intuitive way of making R&D policies empirically more realistic
- ▶ Perhaps a more convincing structure of the actual HE funding structure and thus constraints for training PhDs would make the R&D policy results quantitatively more relevant