Technological Innovation and Labor Income Risk

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Broad Question

- Effect of Innovation on earning dynamics of employees?

- **Employer** innovation:
  - Higher mean and *variance*
    - Some *employees* **lose** ≠ ``**rent sharing**''

    ➔ **why?**

- **Competitor** innovation:
  - Lower earnings

Why It Is Very Cool

1. Innovation is not **just** good
   - First step to start thinking about aggregation
   - Estimate: Log(Wage_ijt) = β Log(Innovation_jt) + FEs

     - Get β = 1.38

     ➔ If you double innovation in the economy, wages will increase by 138%?

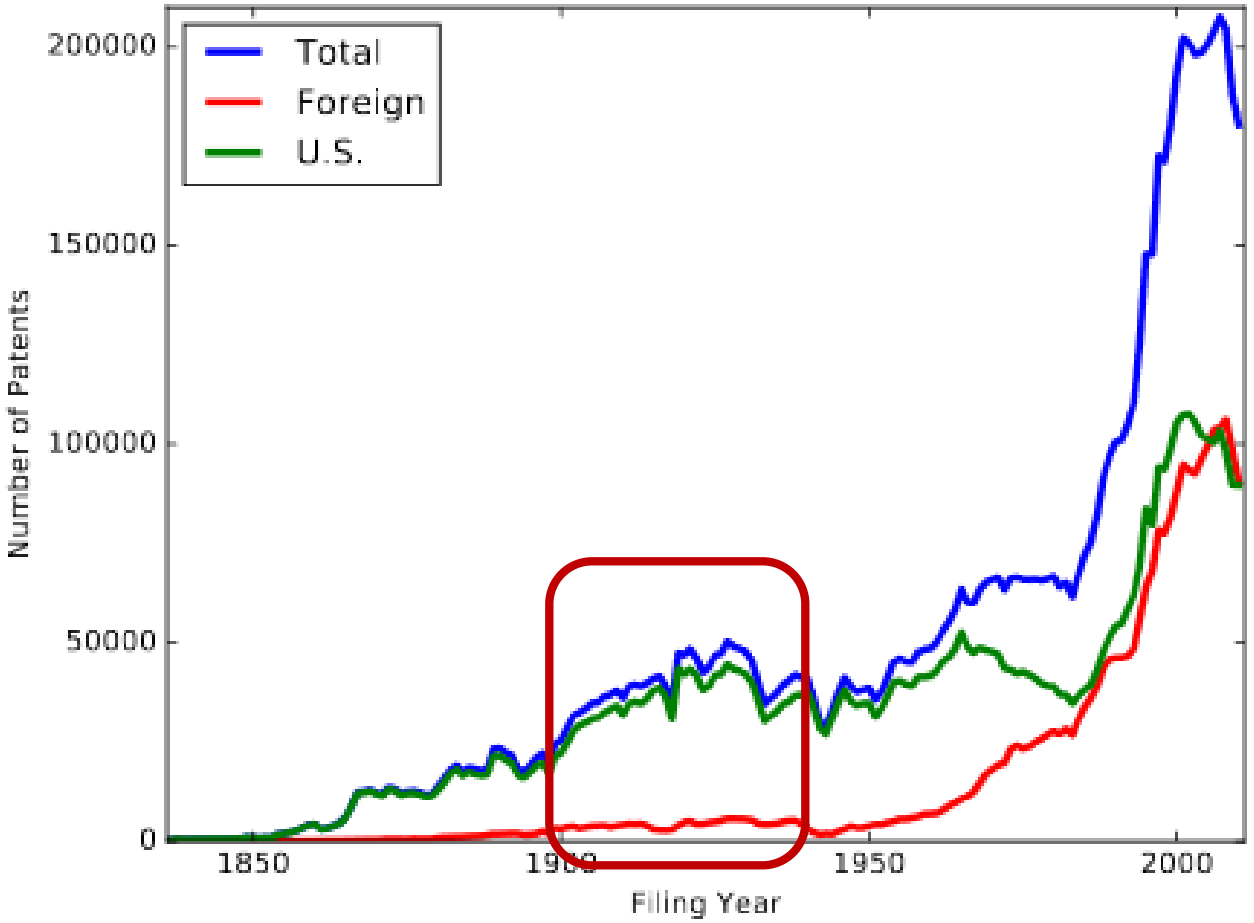
     - No: **negatively** affects employees' competitors
     - Similar to ``**business stealing**'' for product markets (Bloom et al. 2013)

2. **Dispersion** in innovation matters for inequality
   - ≠ **average** trend (step away from ``skill biased technological change'')

On This Note …

Patent data is available also for this period!

Low Mean but High Dispersion?



Berkes (2017)

Overall

- Wondeful paper, fantastic data, big question
- Completely buy the results
  - Made me rethink about some basics in innovation economics

The Plan

- The Puzzle: Where are the Spillovers?
- The Big Picture: Which Economic Mechanism?
- The Disgression: Implications for Endogenous Growth
- The Smaller Picture

Knowledge Spillovers

- Innovators don't fully capture returns to innovation
  - Usually: **social return ≈ 1.5 private return**

- Innovation by a given firm leads to
  - Higher **firm value** by firms in same **techno-space** (Bloom et al. 2013)
  - Higher **innovation** by firms in same **county** (Matray, 2017)
  - Higher innovation by **firms poaching** employees (Akcigit et al. 2018)
  - Higher rate of **employment** in **neighboring states** (Lucking, 2019)

➔ Seems in contradiction with the paper's result

Looking for Spillovers: Suggestions

- Distinguish between **product market space** vs **technological space**
  - Product markets:
    - sales correlation across SIC4 (BSV, 2013)
    - Hoberg-Phillips (2010) TNIC

  Negative effect on earnings

  - Technological space:
    - Jaffe-Covariance and Exposure measures (1986)

  Positive effect on earnings

- Distinguish between **geographical close** vs **far**
  - Jaffe et al. (1993), Matray (2017): spillovers quickly decline with distance

Why Does It Matter? Aggregation

- Employer innovation: +1.38
- Competitor innovation: -1.45

➔ Would suggest that the net effect of innovation on wages is zero. **BUT**

  - By definition, far more competitors

  ➔ Aggregate effect could be **negative**

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Who Loses? Why?

- Losers:
  1. Employees of competitors
     - More so for **leavers**
  2. Leavers of **innovator**

Concentrated on **high innovation periods**

- Principal explanation explored: **job displacement**
  + adverse selection for (2)

Alternative Explanations

- **Three** reasons for why innovation ➔ human capital loss (Hombert and Matray, 2019)
  - Job displacement
  - Skill obsolescence (``vintage human capital model'')
  - Labor reallocation and span of control

Alternative Explanations

- **Three** reasons for why innovation ➔ human capital loss (Hombert and Matray, 2019)
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Unlikely

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More likely
- \+ in line with Hombert and Matray ('19)

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Open question

➔ Not mutually exclusive!

Job Displacement

- Authors' stylized facts inconsistent with displacement:
  - Displacement **outside** high innovation periods = **muted** effect
  - Negative effect for **stayers** at competitors
  - < 0 effect for leavers of **innovators** ➔ need ``stigma'' effect + displacement (e.g. Gibbons and Katz, 1991)

Skill Obsolescence

- Intense periods of technological change ➔ increase in **skill obsolescence rate**

- Can rationalize:
  - Why **competitors** are affected
  - Why earning drop concentrated in periods of **high innovation**
  - Why some employees of the **innovative firms**
    - Leave
    - Have lower earnings when they leave

``Old'' employees with old skills ➔ no longer needed + outside value of their skills lower

Skill Obsolescence

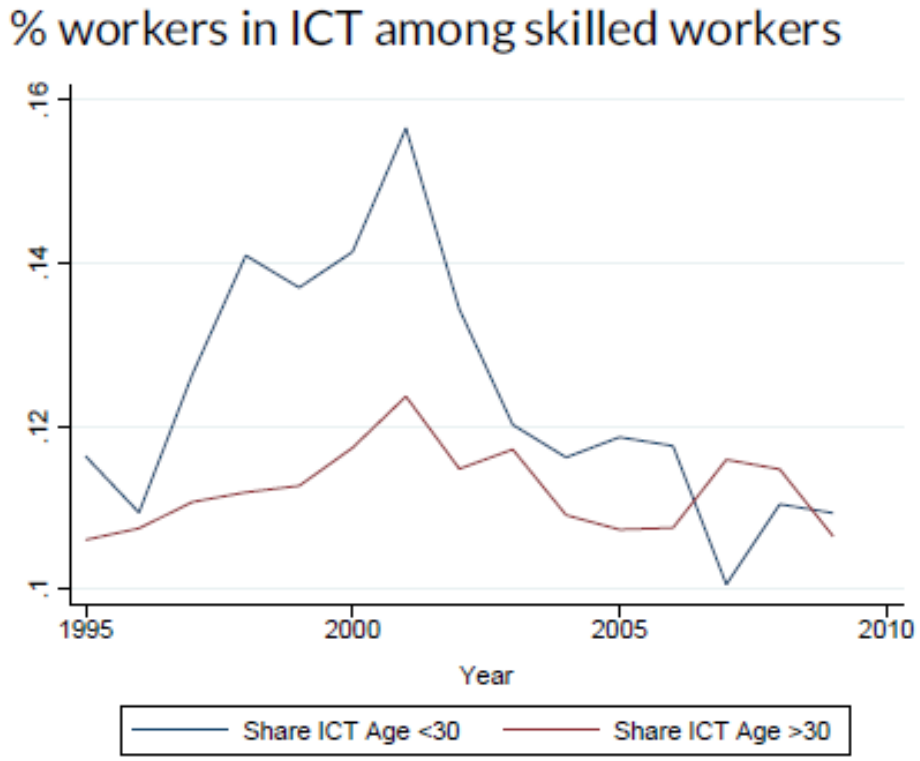
- Hombert Matray (2019): ``**ICT Boom-Cohort Discount**''
  - Workers exposed to the **tech bubble of the late 90s** in France have earnings growth **11% lower** by 2015
  - **Not** driven by job displacement, more likely skill obsolence
  - (see also references: Chari and Hopenhayn, 91, Deming and Noray 18)

Labor Reallocation and Span of Controls

- In organization, wage = productivity + **span of controls**
  - Garicano and Rossi-Hansberg, 2015
  - Caliendo, Monte and Rossi-Hansberg, 2015
- Span of controls can depend on # young workers managers can supervise

Labor Reallocation and Span of Controls

- Innovation leads to **labor reallocation**
  - e.g. Kogan, Papanikolaou, Seru, Stoffman, 2017
  - In particular among **young workers** (Hombert and Matray, 2019)



Labor Reallocation and Span of Controls

- Mechanism:
  - Firm i innovates

➔ Young workers of firm j go to firm i

➔ **Higher** hierarchy in firm i (**wages ↑**)

➔ **Lower** hierarchy in firm j (**wages ↓**)

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Innovation fosters income risk

- **Who** innovate and why?

- Right now innovation is **deterministic** (endogenous?) + assumption that outside option is **not proportional** to past wage
  - Not true in most countries: Unemployment Benefit = f(wage)

  - Why does it matter?

Effect of Income Risk on Incentive to Innovate?

- Higher risk ➔ workers adjust downward their risky behavior
  - Bad for innovation (e.g. Aghion et al., 2013) or entrepreneurship (Hombert et al. 2018)

➔ Which system better to **cushion income risk** and promote innovation? ``cut-throat'' or ``cuddly'' (Acemoglu, Robinson and Verdier, 2012)?

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Understanding Better Innovation

- Product vs process → check
- Incremental
- General Purpose Technology (GPT)
  - e.g. the Internet
- From patent texts:
  - Disruptive (Bowen, Fresard, Hoberg, 2018)
  - Significant (Kelly, Papanilolaou, Seru, and Taddy, 2018)

Understanding Better Innovation

- Different types in term of **potential spillovers** ≠ ``**economic value**'' of KPPS (2017)

- E.g.: disruptive vs GPT
  - **Disruptive**: large displacement ➔ **<0** for workers
  - **GPT**: higher productivity across the board ➔ **>0** for workers

➔ We can potentially learn a lot here

Minor comments

- Effect concentrated on high-wage ➔ driven by stock options? (cf ``human capitalists'', Eisfeldt, Falato, Xiaolan, 2018)

- Interesting to decompose (W2 should allow that)

Conclusion

- Great paper, offer a new way to think about consequences of innovation
- Empirics: spillovers
- Framing: economic mechanisms