Lone Stars or Constellations? The Impact of Performance-Related Pay on Matching Assortativeness in Academia

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ASEA/ASSA Annual Meeting, 7-9 January 2022

Motivation

- Performance pay is widespread and increasingly more prevalent (Leinweber '09)
- Effects of performance pay on effort and sorting studied extensively (e.g., Cohrs and Flick '11, Bandiera et al. '16, Luzar '17)
  - BLT effects on workforce composition and matching assortativeness much less understood
- Performance pay is expected to affect matching assortativeness if there are complementarities in worker skill
  - Complementarities in worker skill cause matching to be positive assortative => large effects on output and growth (Kerr '02)
  - Positive assortativeness by worker productivity increases total output if production function is supermodular (Legros and Vanmarcke '02)
- Complementarities may be particularly pronounced in knowledge creation/academia (Bojorquez and Debono '12, Agrawal et al. '14, Oettl '12, Wielinger '10, Acs et al. '16)
  - Performance pay may thus have particularly strong effect on matching assortativeness in academia and academic output

Overview of Paper

- Study of the effect of performance pay on matching assortativeness in academia (clustering of similarly productive academics)
- Use introduction of performance pay in German academia as natural experiment + data of universe of academics in Germany
- Hypothesis
  - Performance pay should increase positive assortative matching if there are complementarities in worker skill
  - Increase in positive assortativeness should be larger if complementarities are stronger
- Two-step analysis:
  - Estimate strength of complementarities using plausibly exogenous variation in hiring budget to instrument for productivity of new hires
  - Test hypothesis in cief-in-diff framework, analyzing strength of complementarities as continuous treatment variable
  - Focus on 2 channels that affect departmental composition: hiring and "fringe" (leaves)

Main findings:
- There are sizable positive complementarities in research productivity among co-located faculty
- But only in fields with ample collaboration
- Performance pay increases positive assortative matching
- Higher quality departments in high complementarity fields hire more productive academics
- Biggest change in matching assortativeness of newly tenured academics ("junior" hires)
- Evidence of submodularity of production function
- Suggesting increase in assortativeness decreases total research output

Institutional Details - Pay Reform

- Before reform: age-related pay (C-Pay)
- Reform introduced performance-related pay scheme (W-Pay)
- Performance pay scheme raises basic wage plus bonuses
- Bonuses awarded for performance in research, education, training & promotion of young scientists
- Research, teaching, number and quality of papers, funding awards, prizes, etc.
- Bonuses nearly twice the monthly pay
- Only tenured professors can earn bonuses
- Reform implemented in 2005
- As of 2005, any new contracts follow under performance pay scheme

Spillover Effects

- Positive assortative matching - triple interactions

Estimation of Spillover Effects

- Instrument for productivity of new hires with hiring budget $B_{j,t-1}$; number of professors that retire (turnover) $t$ from university to which department $j$ belongs
- Plausibly exogenous variation in stock in hiring budget, because:
  - Administrative age comparator historically determined
  - Mandatory retirement age
  - Constant annual budget and number of chairs $p_{j,t-1}^h = x_i + p_{j,t-1}^h + y + c + \epsilon_t$, after stage
  - $p_{j,t-1}^h$: average productivity of new hires in faculty $j$ in field $i$ in year $t$
  - $p_{j,t}^e$: average productivity of existng affiliates of faculty $j$ in field $f$ in pre-sample years 1999-2000 (departmental quality)
  - $p_{j,t}^f$: average future productivity of affiliates in faculty $j$ in field $f$ in year $t$
  - $p_{j,t}^{FIV}$: instrumented average productivity of new hires of faculty $j$ in field $f$ in year $t$

Study change in departmental composition:
- Hiring: "junior" hires (first time tenure professors) and "senior" hires (professors moving)
- Fringe: tenured professors leaving department
- If matching assortativeness increases in response to performance pay, higher quality departments
  - can attract more productive new hires
  - less productive academics leave
- Response should be stronger if complementarities are larger

Increase in Positive Assortativeness?

- High/Low complementarity: academic fields with above/below median average number of authors on a paper
  - Rational: larger coauthor teams > more collaboration > greater opportunity for spillovers

Positive assortative matching - triple interactions

\[ p_{j,t-1}^h = \beta_0 + \beta_1 p_{j,t}^h + \beta_2 p_{j,t}^e + \beta_3 p_{j,t}^{FIV} + \epsilon_t \] (1)