

Erling Barth<sup>1,3</sup>, James Davis<sup>2</sup>, Holden Diethorn<sup>3</sup>, Gerald Marschke<sup>4,3,5</sup>, Andrew Wang<sup>3</sup>

<sup>1</sup> Institute for Social Research

<sup>2</sup> US Department of Agriculture

<sup>3</sup> National Bureau of Economic Research

<sup>4</sup> University at Albany, SUNY

<sup>5</sup> Corresponding author email: [marschke@albany.edu](mailto:marschke@albany.edu)

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## Research Questions

Does variation in mobility rates of workers with R&D human capital explain variation in US establishment productivity in manufacturing?

Does changing mobility patterns across firms explain *declining* productivity growth in manufacturing?

## Related Literature

### Knowledge “in the air”

Growth: Romer, Aghion et al

Externalities: Justify public interventions

### Labor market spillovers

Jaffe, Trajtenberg, and Henderson (1993)—spillovers geographically limited

Møen (2005) technical workers accept lower wages early in career for higher wages later (Norway), [workers pay: spillovers internalized by labor market],

Maliranta, Mohnen and Rouvinen (2009) links productivity growth to worker mobility from R&D firms (Finland)

Stoyanov and Zubanov (2012) productivity gains from worker mobility across firms (Denmark)

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### Concern about declining firm productivity

Akcigit and Ates (2019), Bloom, Jones, Van Reenen, and Webb (2019)

### Declining worker mobility

Davis, Faberman, Haltiwanger (2012), Lazear and Spletzer (2012), Hyatt and Spletzer (2013)

## Data

### Linked U.S. employer-employee data

- Longitudinal Employer-Household Dynamics (LEHD)
- 9 states (AZ CA CO IL IN KS MD PA WA)
- Annualized earnings, gender, age, race
- Work history 1992-2014

### Firm, establishment data

- NSF annual firm R&D surveys (SIRD, BRDIS), 1976-2016
- Annual Survey of Manufactures (ASM), 1997-2015
- Sales, capital, materials, energy, employment

## Measuring Establishment-Level Inflows of Workers with R&D Human Capital

- Individuals’ work history across establishments (including R&D of previous employer)
- Calculate worker flows to an establishment from outside the firm (i.e., from other firms)
- Wage premium associated with R&D experience from other firms narrows over time, becomes small after 5-10 years (Barth et al 2017)
- **New workers with R&D human capital:** Share of workers at the establishment who are recent hires (< 5 years at the firm) and whose previous firm is an R&D performing firm.
- R&D human capital (exposure to previous firm’s R&D) impacts wages in current firm if the human capital (exposure) is recent, less than five years old

## Empirical Approach

- Estimating establishment-level Cobb-Douglas production functions:
  - Log output regressed on:
    - Log employment, capital equipment, capital structures, materials, energy (“basic” inputs)
    - Log R&D capital stock (and indicator for positive R&D capital stock)
    - Share of new workers from R&D firms, and from non-R&D firms (quadratic specification)
    - Year and establishment fixed effects
    - Year interactions with 1) R&D indicator, 2) log R&D capital stock, 3) Share of new workers from R&D firms, and from non-R&D firms (including quadratic terms)
- **Total factor productivity** at establishment level (TFP) computed as log output minus output contribution of “basic” inputs, calculated using estimated model

## Results

- 1997-2015: manufacturing establishment TFP increased by 6% (.23 log points) (Fig. 1)
- At the establishment level, the share of new workers with R&D human capital increased by over 50% to one quarter between 1997-2015 (Fig. 1)
- Productivity impact of new workers with R&D human capital and their representation in average establishment both increase over time (Fig. 2)
- R&D capital stock accounts for about .02 of the .23 log point increase in TFP (Fig. 3)
- Share of new workers with R&D human capital account for about .04 of the .23 log point increase in TFP (Fig. 3)

Fig 1. Establishment TFP and New Workers

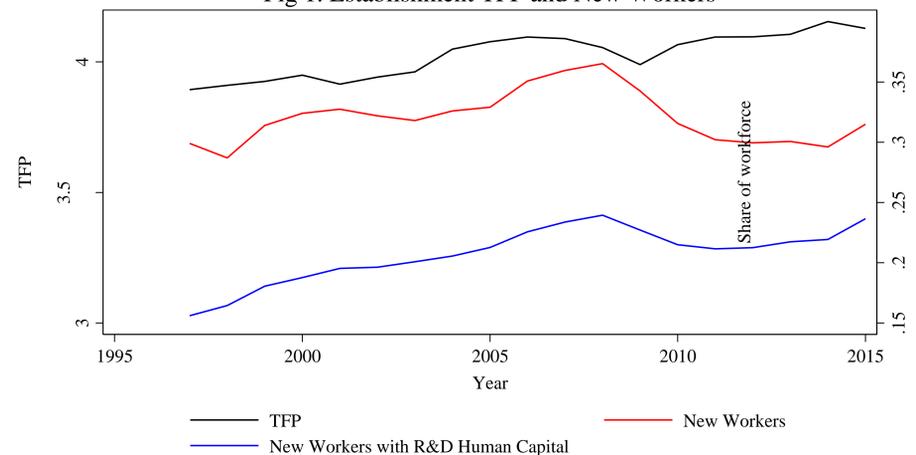
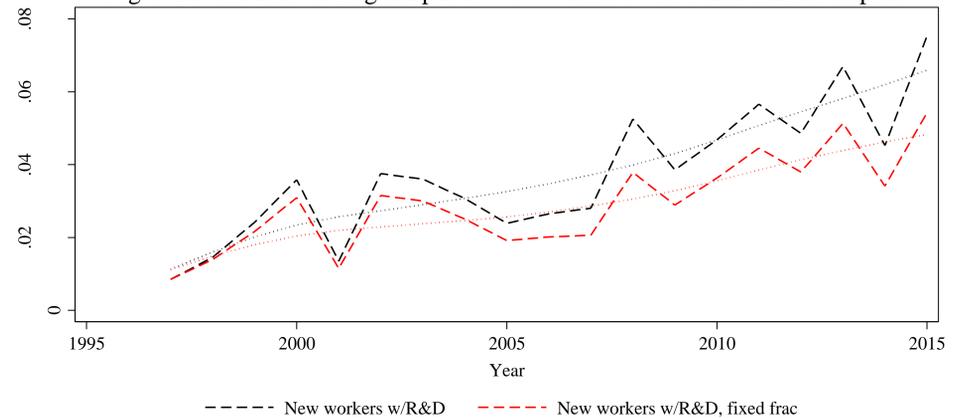
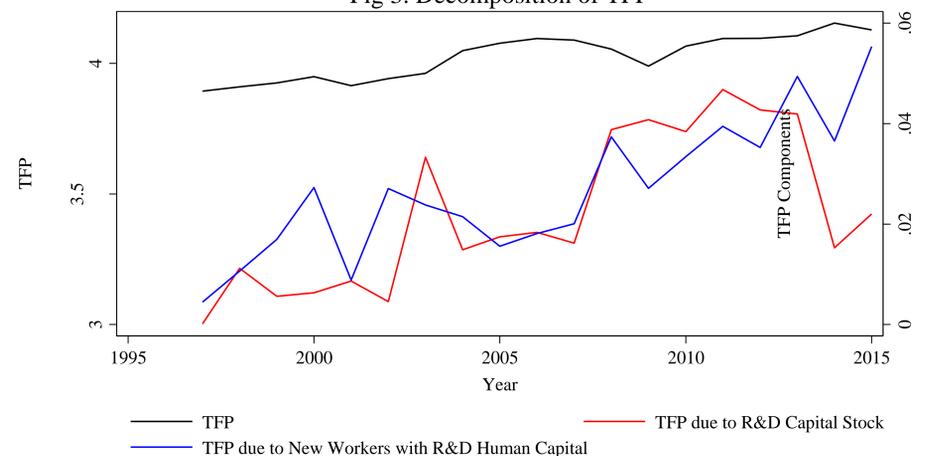


Fig 2. Contribution to Log Output of New Workers with R&D Human Capital



Using coefficients from regression model with time-varying effects and yearly mean fraction of workers with R&D human capital. In fixed fraction case, coefficient on fraction of workers who are new with R&D human capital varies but fraction is fixed at 1997 mean level.

Fig 3. Decomposition of TFP



## Conclusion

- New workers associated with higher productivity, but productivity boost especially large for new workers with R&D human capital
- Association between new workers with R&D human capital and productivity is positive and increasing over time.