Worker Mobility, R&D Human Capital, and Firm Productivity

Erling Barth[1,3], James Davis[2], Holden Diethorn[3], Gerald Marschke[4,3], and Andrew Wang[3]

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1. Institute for Social Research; 2. US Department of Agriculture; 3. NBER; 4. University at Albany, SUNY.

Research question

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)
- **Concern about declining firm innovativeness and productivity growth**
  - Akcigit and Ates (2019), Bloom, Jones, Van Reenen, and Webb (2019), etc.
- **Declining worker mobility**
  - Davis, Faberman, Haltiwanger (2012), Lazear and Spletzer (2012), Hyatt and Spletzer 2013)

Data

- **Linked U.S. employer employee data** (LEHD)
  - 9 states (AZ CA CO IL IN KS MD PA WA)
  - Annualized earnings, gender, age, race
  - Linked to Census data to get education and occupation (15%-20%)
  - 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)

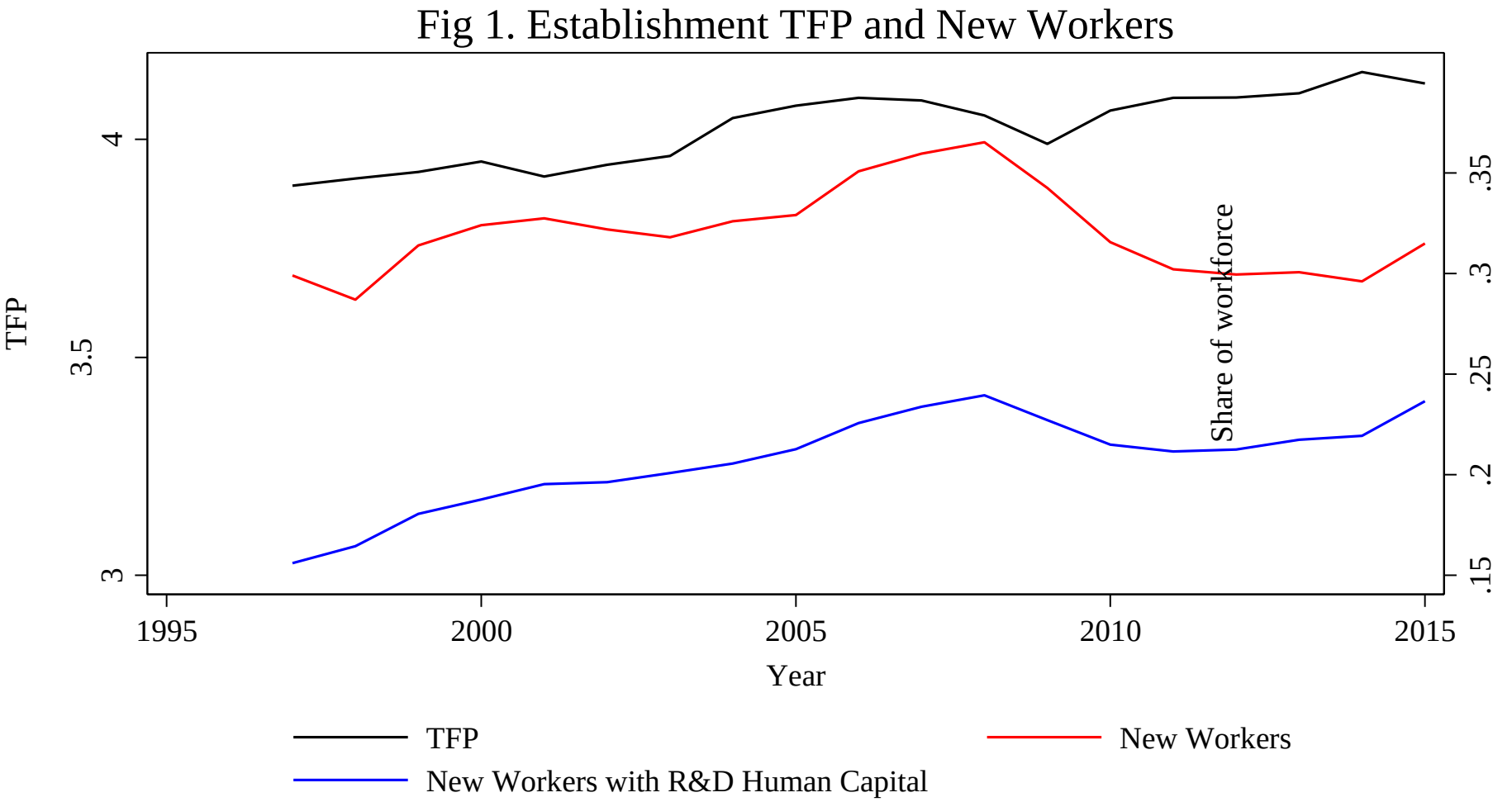
Measures of spillovers from worker flows

- **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

Establishment-level Production Function

- Cobb-Douglas; 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
  - Year and establishment fixed effects
- **Total factor productivity** at establishment level (TFP) computed as log output minus output contribution of "basic" inputs, calculated using estimated model

Establishment TFP and New Workers (1997-2015)



Regression Results

Productivity regressions with worker flows, ASM weights, plant FE		
	Model 1	Model 2
	b/se	b/se
Ln(K equip)	0.0358***	0.0362***
	(0.0033)	(0.0036)
Ln(K stock)	0.0377***	0.0363***
	(0.0042)	(0.0045)
Ln(Tot employ.)	0.4350***	0.4346***
	(0.0050)	(0.0055)
Ln(Materials)	0.2826***	0.2764***
	(0.0038)	(0.0040)
Ln(Energy)	0.1110***	0.1118***
	(0.0034)	(0.0037)
R&D indicator	0.0107	0.0033
	(0.0084)	(0.0094)
Ln(R&D stock)	0.0080***	0.0090***
	(0.0012)	(0.0012)
Frac new workers w/o R&D hum cap		0.0788**
		(0.0290)
(Frac new workers w/o R&D hum cap)^2		-0.0850*
		(0.0343)
Frac new workers w/ R&D hum cap		0.2205***
		(0.0246)
(Frac new workers w/ R&D hum cap)^2		-0.2276***
		(0.0251)
Constant	3.900***	3.929***
	(0.0318)	(0.0343)
Adjusted R squared	0.971	0.972
N	2.60e+05	2.31e+05

Year effects omitted.

Regression Results

- New workers associated with higher productivity, but productivity boost especially large for new workers with R&D human capital

Time-Varying Effect of New Workers with R&D Human Capital

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

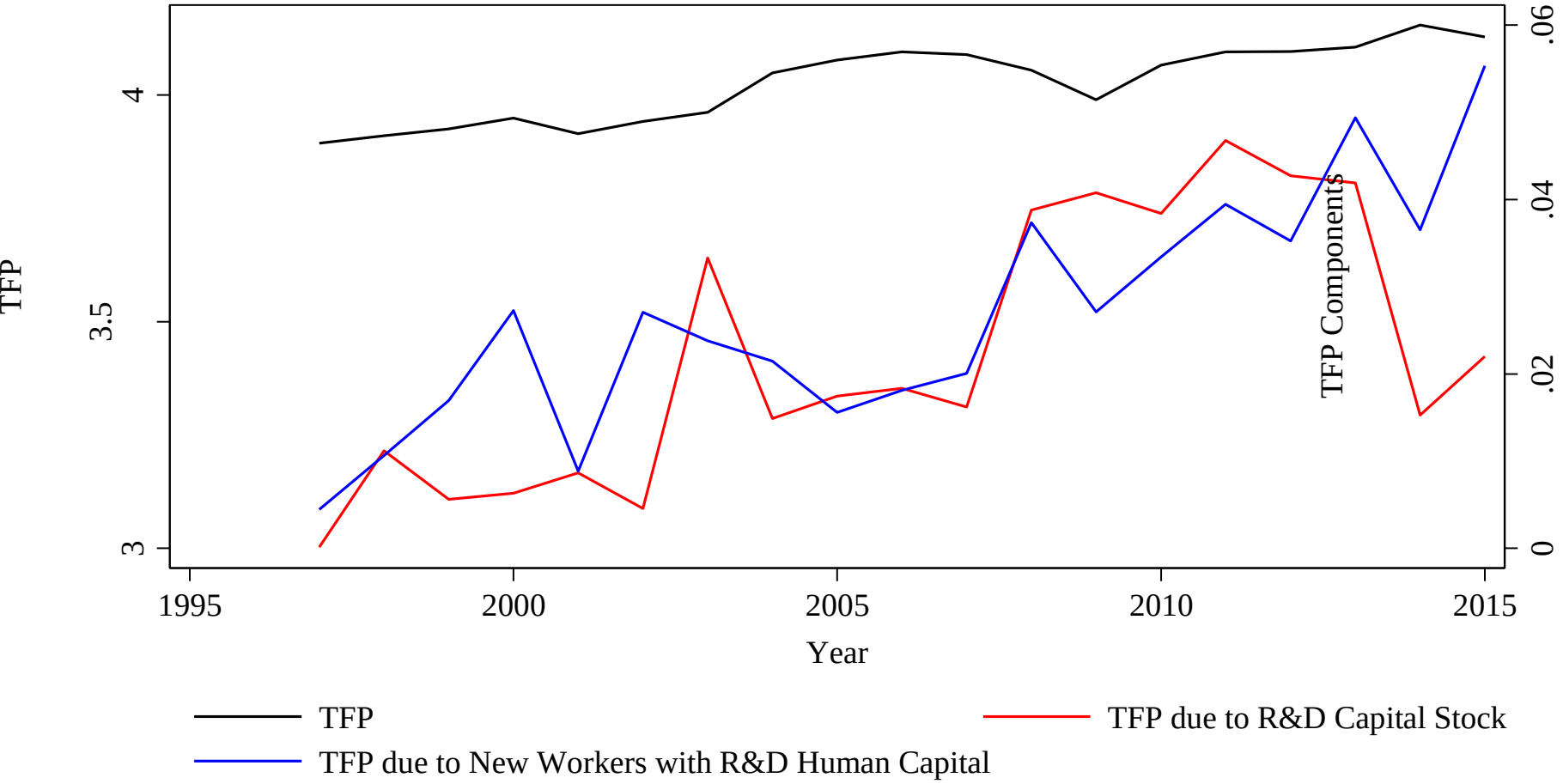
Using coefficients from regression model with time-varying effects and yearly mean fraction of workers with R&D human capital. In fixed fraction case, coefficient on fraction of workers who are new with R&D human capital varies but fraction is fixed at 1997 mean level.

Time-Varying Effect of New Workers with R&D Human Capital

- Productivity impact of new workers with R&D human capital and their representation in average establishment both increase over time

Decomposition of TFP

Fig 3. Decomposition of TFP



Conclusions and Remarks

- Over 1997-2015 period, manufacturing establishment TFP increased by 6% (.23 log points)
- At the establishment level, the share of new workers with R&D human capital also increased over this period
- Association between workers with R&D human capital and productivity is positive and increasing over time.
- R&D capital stock accounts for about .02 of the .23 log point increase in TFP
- Share of new workers with R&D human capital account for about .04 of the .23 log point increase in TFP
- Next step: Instrumenting for worker mobility and R&D using R&D tax subsidies, non-compete laws, local downsizings of employment