Imperfect Competition, Compensating Differentials and Rent Sharing in the U.S. Labor Market

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The opinions expressed in this paper are those of the authors alone and do not reflect the views of the Internal Revenue Service or the U.S. Treasury Department. This work is a component of a larger project on income risk in the United States, conducted through the SOI Joint Statistical Research Program.

Introduction

- It is increasingly argued that labor markets are pervasively **imperfectly competitive** (Manning, 2011; CEA, 2016)
  - Textbook **competitive** model: Worker's wage depends only on her **own productivity**, no matter which employer she works for
  - **Imperfect competition:** employers, workers or both may derive additional value or **rents** from ongoing employment relationships

- Goal: Develop, identify and estimate a model to **quantify** the size of such **rents** earned by U.S. employers and workers, and
  - Show relevance of imperfect comp. for **inequality** and **tax policy**
  - Offer a unifying explanation for observed **wage structure**, pattern of **worker sorting**, and **pass-through** of firm and market shocks

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Introduction: What we do in 1st part of paper

Construct employer-employee panel data from U.S. **tax records** to **describe key features** of **U.S. labor market**:

1) Most variation in earnings explained by **heterogeneity in the quality of workers** as measured by their fixed effects

2) **Firm-specific wage premiums** explain only a few percent of the earnings variation (once one corrects for limited mobility bias)

3) Larger earnings gains for better workers from moving to higher paying firms, consistent with **production complementarities**

4) Strong **positive sorting** of better workers to higher paying firms, with a correlation between worker and firm effects of 0.4

5) Significant **pass-through** of firm and market level productivity shocks to earnings of incumbent workers

These findings motivate and guide our model of the labor market

Introduction: What we do in 2nd part of paper

Develop an eqm. **model of the labor market** with **two-sided heterogeneity** where workers view firms as imp. substitutes
⇒ Firms act as **local monopsonists** but cannot perfectly price discriminate according to workers' idiosyncratic tastes
⇒ In equilibrium, there will be **inframarginal workers**, capturing **rents** due to the information asymmetry

We prove **identification** of model and estimate it, allowing us to measure quantities of interest and perform counterfactuals

To recover **structural parameters**, worker effects, firm-wage premiums, interaction effects, and pass-through are key
⇒ Forges a link between the two parts of the paper
⇒ Possible to economically interpret these data moments

Introduction: Model based insights

1. **Significant imperfect competition** in the U.S. labor market
   - Worker rents at firm (market) level = 14 (18) % of earnings
   - Worker share of total rents at firm (market) level: 49 (48) %
2. **Structural interpretation** of the **AKM estimates** suggests:
   - **High TFP firms** tend to have **good amenities**
     - which keeps paid wages, and thus firm premiums, down
   - **Positive sorting** driven by **production complementarities**
     - Not heterogeneous tastes for workplace amenities
3. **Monopsonistic** labor market creates **misallocation** of workers
   - A tax reform could eliminate **labor and tax wedges,** increasing welfare by 5 percent and output by 3 percent

Introduction: Our study and some related literatures

- Study of two-sided heterogeneity
  AKM 1999, see reviews in Card et al. (2016), and subsequently, Song et al. (2018), Sorkin (2018), Bonhomme et al. (2019) and Kline et al. (2018)
- Earnings dynamics and firm-level shocks
  Guiso et al, 2005, Friedrich et al. (2016); Lamadon (2016)
  Kline et al (2018a) & Kogan et al (2018): effect of patents
  Abowd & Lemieux (1993), Garin & Silverio (2019): effect of export prices
- Compensating differentials and wage inequality
  extensive literature reviewed in **Taber and Vejlin** (2016) and Sorkin (2018)
- Monopsonistic Competition
  Manning (2003), Bashkar (2002), Card et al (2016)

Key features of the U.S. labor market

Data and descriptives

- We use **administrative data** from the U.S.
  - Population tax records for individuals (W-2)
  - Business/corporate income tax returns (1120; 1120-S; 1065)
  - Covering the years 2001-2015
- **Baseline sample**: Trying to conform with existing work:
  - **Prime-aged workers**, aged 25-60
  - Earnings $\succeq$ full-time employment minimum-wage equivalent
  - Linked to firms (i.e., C-corp, S-corp, Partnership) with V.A. >0
  - 89.6M unique workers 6.5M unique firms
- **Stayers sample**: extra restrictions:
  - **Workers stay in the firm** for several consecutive years
  - Firms have at least 10 stayers
  - Firms belong to industry-region with at least 10 firms
  - 10.3M unique workers, 1.5M unique firms

TOC

Sample Size

	Workers		Firms	
Panel A.	**Baseline Sample**			
	Unique	**Observation-Years**	**Unique**	**Observation-Years**
Full Sample:	89,570,480	447,519,609	6,478,231	39,163,975
Panel B.	**Movers Sample**			
	Unique	**Observation-Years**	**Unique**	**Observation-Years**
Movers Only:	32,070,390	207,990,422	3,559,678	23,321,807
Panel C.	**Stayers Sample**			
	Unique	**6 Year Spells**	**Unique**	**6 Year Spells**
Complete Stayer Spells:	10,311,339	35,123,330	1,549,190	6,533,912
10 Stayers per Firm:	6,297,042	20,354,024	144,412	597,912
10 Firms per Market:	5,217,960	16,506,865	117,698	476,878

Detailed sample characteristics | Sample comparison to literature

Statistical model of earnings and value added

- Firm log value added:

$$y_{jt} = \zeta_j + y^p_{jt} + \xi_{jt} + \delta_{y,1}\xi_{jt-1}$$
$$y^p_{jt} = y^p_{jt-1} + \underbrace{\tilde{u}_{jt}}_{\text{firm}} + \underbrace{\bar{u}_{r(j)t}}_{\text{market}}$$

- Log wages of workers

$$w_{it} = \phi_{ij(i,t)} + w^p_{it} + \nu_{it} + \delta_{w,1}\nu_{it-1}$$
$$w^p_{it} = w^p_{it-1} + \gamma\tilde{u}_{j(i)t} + \Upsilon\bar{u}_{r(i,t),t} + \mu_{it},$$

- γ,Υ tell us how firm and market performance relates to earnings
  - if markets are perfectly competitive, we should expect $\gamma \simeq 0$
- ϕ_{ij} tells us about firms pay policies:
  - how much does ϕ_{ij} depend on the employer?
  - are there complementarities in ϕ_{ij}?

Identifying assumptions

- Let $J = \{j(i,t)\}_{i,t}$ and $U = \{\tilde{u}_{jt}, \bar{u}_{r(j)t}\}_{j,t}$ and $Q = \{\xi_{jt}\}_{j,t}$
- Assumptions on **transitory shocks** to **value added**:

$$\mathbb{E}\left[\xi_{jt} | r(j){=}r, J, U\right] = \mathbb{E}\left[\xi_{jt'}\xi_{jt} | r(j){=}r, J, U\right] = 0$$

- Assumptions on **mobility** and **worker-specific innovations**:

$$\mathbb{E}\left[\mu_{it}, \nu_{it} | J, U, Q\right] = 0$$

- **Assumptions do not**:
  - restrict whether or how workers sort into firms according to ϕ_{ij}
  - restrict what type of workers move across firms in response to innovations to firm value added
  - specify why individuals choose the firm that they do
  - preclude that individuals choose firms to maximize earnings

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Pass-throughs: identification

- Under the previous assumptions, when $\gamma = \Upsilon$ we get that

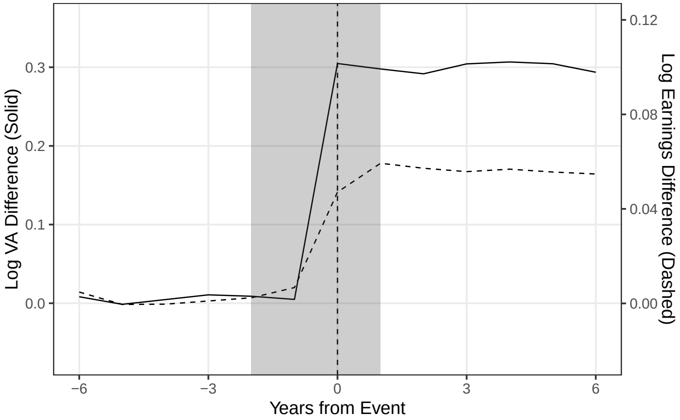
$$\mathbb{E}\left[\Delta y_{j(i)t}\left(w_{it+\tau} - w_{it-\tau'} - \gamma\left(y_{j(i),t+\tau} - y_{j(i),t-\tau'}\right)\right)|S_i{=}1\right] = 0$$

  - for $\tau \geq 2, \tau' \geq 3$
  - the moments are conditional on stayers, which controls for worker heterogeneity
  - same expression except for market averages gives Υ when $\gamma \neq \Upsilon$

- This moment condition has a DiD representation
  - As an event study for stayers, where γ is the ratio of two DiDs:

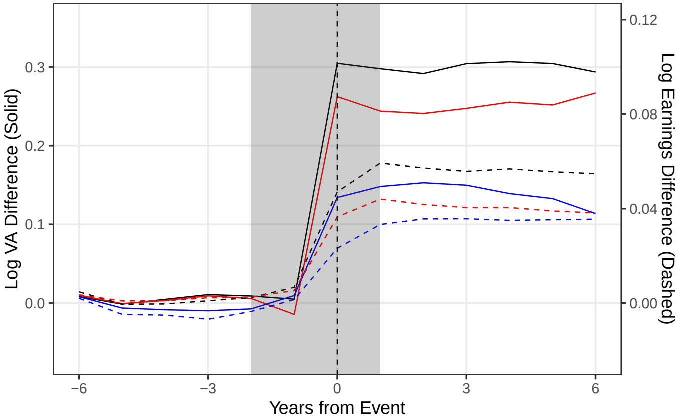
$$\frac{\mathbb{E}\left[w_{it+\tau}{-}w_{it-\tau'}|\Delta y_{j(i)t}{>}z_0\right] - \mathbb{E}\left[w_{it+\tau}{-}w_{it-\tau'}|\Delta y_{j(i)t}{\leq}z_0\right]}{\mathbb{E}\left[y_{j(i),t+\tau}{-}y_{j(i),t-\tau'}|\Delta y_{j(i)t}{>}z_0\right] - \mathbb{E}\left[y_{j(i),t+\tau}{-}y_{j(i),t-\tau'}|\Delta y_{j(i)t}{\leq}z_0\right]}$$

Pass-throughs: Difference-in-differences representation



- Split firms in 2 groups: Above/below median in log V.A. growth at time t
- Solid line: difference in log value added between the 2 groups over time
- Dotted line: Difference in log wages of stayers between the two groups

Pass-throughs: Market and firm shocks



- Red lines: remove market-year means to isolate own-firm passthrough
- Blue lines: market-year means to capture shocks common to the market
- Passthrough estimates: Market > Unconditional > Firm → role for markets

Detailed GMM Process Estimation

	Parameters and Growth Decomposition			
	Firm Only		Accounting for Markets	
	Parameter	Var. (%)	Parameter	Var. (%)
Permanent Worker Shock (Std. Dev.)	0.10	39.5%	0.10	38.1%
	(0.00)		(0.00)	
Transitory Worker Shock (Std. Dev.)	0.13	57.6%	0.13	57.4%
	(0.00)		(0.00)	
Permanent Firm Shock Passed-through (Std. Dev.)	0.03	2.8%	0.02	1.8%
	(0.00)		(0.00)	
— Permanent Firm Shock Passthrough Coefficient	0.14		0.13	
	(0.01)		(0.01)	
Transitory Firm Shock Passed-through (Std. Dev.)	0.00	0.0%	0.00	0.0%
	(0.00)		(0.00)	
— Transitory Firm Shock Passthrough Coefficient	-0.01		0.00	
	(0.01)		(0.00)	
Market Shock Passed-through (Std. Dev.)			0.02	1.1%
			(0.00)	
— Market Shock Passthrough Coefficient			0.18	
			(0.02)	

Worker heterogeneity | Firm heterogeneity and robustness

Identification and estimation issues

- First we assume $\gamma = \Upsilon = 0$ and $\phi_{ij} = x_i + \psi_j$ in which case the assumptions imply AKM

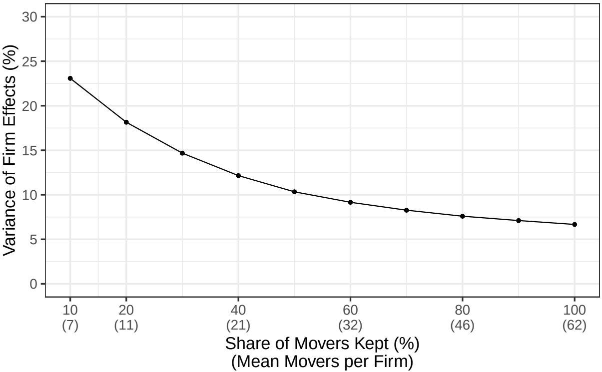
$$\mathbb{E}\left[w_{it}|J\right] = x_i + \psi_j$$

  - Specification concerns: non-additivity
  - Estimation concern: limited mobility bias
- Extension 1: Apply Bonhomme Lamadon Manresa (2019)
  - group firms first based on distribution
  - assume $\phi_{ij} = \underbrace{\theta_{j(i,t)} \cdot x_i}_{\text{interaction}} + \psi_{j(i,t)}$
- Extension 2: pass-through and time-varying firm types

$$\mathbb{E}[w_{it} - \gamma(y_{j(i,t),t} - y_{j(i,t),1})|j(i,1), ..., j(i,T)] = x_i + \psi_j.$$

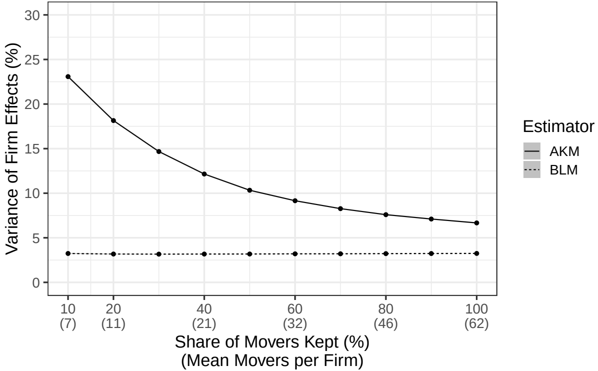
Firm effects: Is limited mobility bias likely to be a problem?

- Start with firms with many movers ($\geq$15)
- **Remove movers randomly** within each firm, re-estimate
- The set of firms is $\sim$ fixed



Small firm effects and strong sorting

- Possible to address limited mobility bias in several ways:
  - FE correction: Andrews et al. (2008) or Kline et al. (2018b)
  - **Group FE** using Bonhomme et al. (2019)



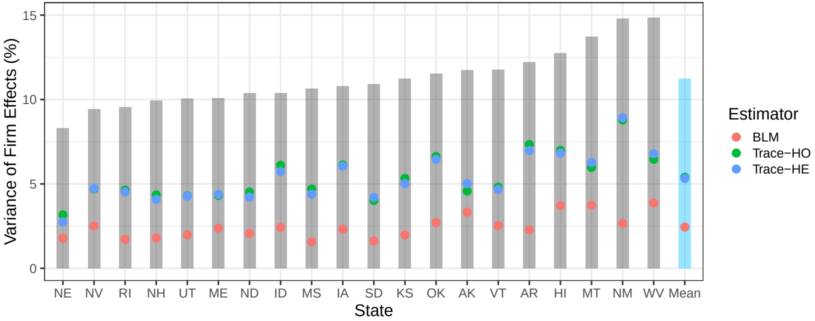
Connected set | Limited mobility bias

Worker heterogeneity, firm effects, and worker sorting

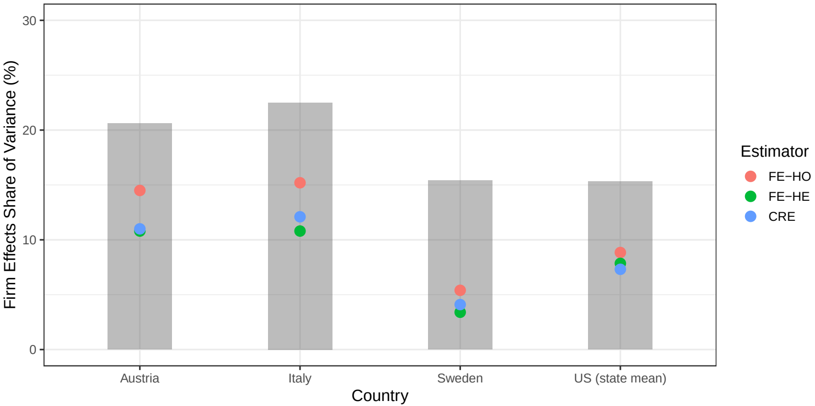
Years:		**2001-2008**	**2008-2015**	**Pooled**
Panel A.			**AKM Estimation**	
Share explained by:				
i) Worker Effects	$Var(x_i)$	75%	75%	75%
ii) Firm Effects	$Var(\psi_{j(i)})$	9%	9%	9%
iii) Sorting	$2Cov(x_i, \psi_{j(i)})$	5%	6%	5%
Sorting Correlation:	$Cor(x_i, \psi_{j(i)})$	0.09	0.11	0.10
Panel B.			**BLM Estimation**	
Share explained by:				
i) Worker Effects	$Var(x_i)$	72%	72%	72%
ii) Firm Effects	$Var(\psi_{j(i)})$	3%	3%	3%
iii) Sorting	$2Cov(x_i, \psi_{j(i)})$	13%	14%	14%
Sorting Correlation:	$Cor(x_i, \psi_{j(i)})$	0.43	0.46	0.44

Between Firm Decomposition | BLM by number of clusters

Detour: Different approaches to bias correction



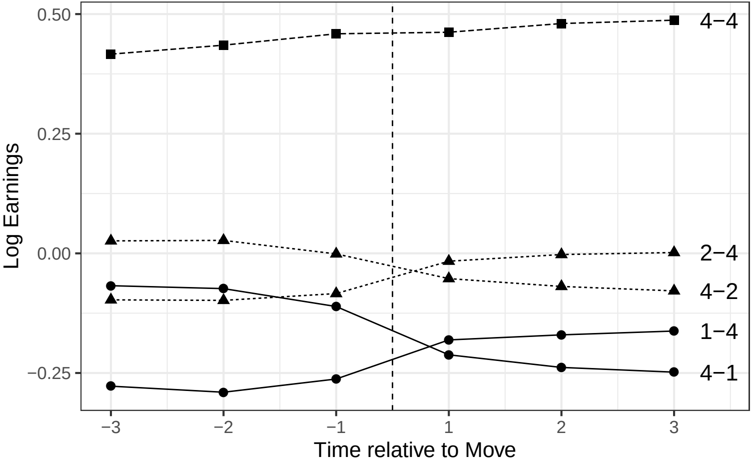
Detour 2: Firm effects in different countries



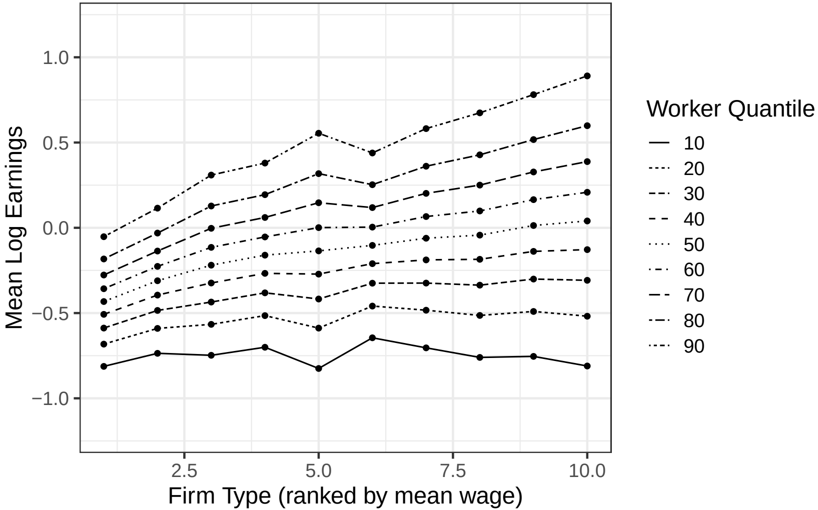
- FE (grey bar), FE-HO (red), FE-HE (green), CRE (blue)

Firm effects: Wage changes of upward vs downward moves

- The movers event study of Card Heining and Kline (2013)
  1. Group firms based on mean wage in quartiles
  2. Show wage gains and losses of movers



Estimates of interaction effects



Decomposition: Time-varying firm types and interactions with worker effects

		Model Specification			
		(1)	(2)	(3)	(4)
Share explained by:					
i) Worker Quality	$Var(x_i)$	72.4%	70.4%	73.5%	71.6%
ii) Firm Effects	$Var(\psi_{j(i)})$	3.2%	4.3%	3.0%	4.3%
iii) Sorting	$2Cov(x_i, \psi_{j(i)})$	12.9%	13.1%	12.8%	13.1%
iv) Interactions	$Var(\varrho_{ij})$		3.0%		3.3%
	$+2Cov(x_i + \psi_{j(i)}, \varrho_{ij})$		-1.8%		-2.5%
v) Time-varying Effects	$Var(\psi_{j(i),t} - \psi_{j(i)})$ $+2Cov(x_i, \psi_{j(i),t} - \psi_{j(i)})$			0.3%	0.3%
Sorting Correlation:	$Cor(x_i, \psi_{j(i)})$	0.43	0.38	0.43	0.37
Variance Explained:	R^2	0.89	0.89	0.90	0.90
Specification:					
Firm-Worker Interactions		✗	✓	✗	✓
Time-varying Firm Effects		✗	✗	✓	✓

Findings and model choices

How and why we depart from textbook model of labor market:

1. Existence of **firm premiums**: **Non-wage attributes**
   - Some employers have better amenities than others
   - Wage differentials compensate for bad amenities
2. Significant **firm pass-through**: **Heterogeneous taste**
   - This gives upward sloping local labor supply curve
   - Monopsonistic firms with some wage setting power
3. Significant **market pass-through**: **Correlated taste**
   - Imperfect competition both within and between markets
4. **Small firm effects** despite large **VA dispersion**:
   - **Correlation** between firm **amenities** and **productivity**
5. **Production complementarities** and **strong sorting**:
   - Firm-specific TFP and efficiency unit of labor
   - Allow for firm specific valuation of worker heterogeneity
   - **Correlation** between workers' **preferences** and **productivity**
   - Sorting on production complementarities

TOC

Model of the labor market

Environment: Workers and preferences

- The environment:
  - A large population of workers indexed by $i \in I$
  - Many markets r, each with many firms j
  - Time is indexed by t

- **Individual** i is described by:
  - **productivity** (X_i, V_{it})
    - X_i is a permanent heterogeneity, can be valued differently at different firms
    - V_{it} is time varying, exogenous, serially corr. (eg unit root + MA)

  - **preferences** over a set of firms $j \in J$:

$$u_{it}(j, W) = \log \tau W^{\lambda} + \log G_j(X_i) + \beta^{-1}\epsilon_{ijt}.$$

    - $G_j(X)$: preference for firm j common to all workers of type X
    - ϵ_{ijt}: idiosyncratic preference (or suitability) for firm j
    - ϵ_{ijt} at given t is Nested logit with correlation within market
    - Law of motion $(\epsilon_{i1t}, ..., \epsilon_{iJt}) \equiv \vec{\epsilon}_{it} \sim \Psi(\vec{\epsilon}|\vec{\epsilon}_{it-1}, X_i)$ is exogenous
    - (τ, λ) are tax parameters

  - Importantly, ϵ_{ijt} is **private information** to the worker

Environment: firms and technology

- Each **firm** j has a large work force:
  - employs $D_{jt}(X, V)$ workers of type (X, V) at wage $W_{jt}(X, V)$
- The **revenue technology** for firm j in market m is:

$$Y_{jt} \equiv A_{jt} \left(\int \int X^{\theta_j} V \cdot D_{jt}(X, V) \, \mathsf{d}X \, \mathsf{d}V \right)^{1-\alpha_r}$$

  - Y_{jt} : value added (revenue - intermediates) of firm j
  - $A_{jt} = \bar{A}_{rt} \tilde{A}_{jt} = \bar{P}_r \bar{Z}_{rt} \tilde{P}_j \tilde{Z}_{jt}$: total factor productivity of firm j
    - $\bar{P}_r$: fixed market TFP level
    - $\bar{Z}_{rt}$: time varying market level TFP shock (unit root + MA)
    - $\tilde{P}_j$: permanent firm TFP level
    - $\tilde{Z}_{jt}$: time varying firm specific TFP shock (unit root + MA)
  - $X^{\theta_j} V$ is the productivity of a worker (X, V)
    - firm specific return to X captured by θ_j

Local labor supply curves

- Given the set of wages $W_{jt}(X, V)$ chosen by firms
- Within t worker nested-logit preferences give

$$\underbrace{\Pr[j|r, X, V]}_{\substack{\text{choosing firm } j \\ \text{given market } r}} = \frac{\left(\tau^{\frac{1}{\lambda}} G_j(X)^{\frac{1}{\lambda}} W_{jt}(X, V)\right)^{\lambda\beta/\rho_r}}{\underbrace{\sum_{j' \in J_r} \left(\tau^{\frac{1}{\lambda}} G_{j'}(X)^{\frac{1}{\lambda}} W_{jt}(X, V)\right)^{\beta/\rho_r}}_{\equiv I_{rt}(X,V)^{\lambda\beta/\rho_r}}}$$

$$\underbrace{\Pr[r|X, V]}_{\text{choosing market } r} = M(X, V) \frac{I_{rt}(X, V)^{\lambda\beta}}{\sum_{r'} I_{r't}(X, V)^{\lambda\beta}}$$

- We assume firms take market quantity I_{rt} as given (many firms)
- The **firm local labor supply curve** as a function of W is:

$$S_{jt}(X, V; W) = K_{r(j),t}(X, V)\left(G_j(X)\, W\right)^{\lambda\beta/\rho_{r(j)}}$$

Firm's problem

- Given (K_{rt}), the monopsonistic **firm problem** is then given by:

$$\max_{W_t(X,V),D_t(X,V)} \iint X^{\theta_j} V D_t(X, V) \, \mathsf{d}X \, \mathsf{d}V - \iint W_t(X, V) D_t(X, V) \, \mathsf{d}X \, \mathsf{d}V$$

$$\text{s.t.} D_t(X, V) = K_{r(j),t}(X, V) \left(G_j(X) W_t(X, V)\right)^{\lambda\beta/\rho_{r(j)}}$$

- Firm chooses $W_t(X, V), D_t(X, V)$ taking the upward supply curve into account.

Environment: equilibrium definition

- **Primitives**: firm characteristics $(\alpha_r, \theta_j, A_{jt}, G_{jt}(\cdot))$, worker distribution $M(X, V)$ and preference parameter (β, ρ_r).

- **Equilibrium:** wages $W_{jt}(X, V)$, supply curves $S_{jt}(X, V, W)$ and labor demands $D_{jt}(X, V)$ such that:

  1. $S_{jt}(X, V, W)$ consistent with workers' choices, assuming large N, M:
  2. $D_{jt}(X)$, $W_{jt}(X)$ solve each firm's problem, taking the labor supply curve $S_{jt}(X, W)$ as given.

- This restricts our attention to **equilibria** where
  - firms can only write **spot wage contract**
  - **ignore** any **strategic interactions** with other firms

Equilibrium Wages

- Using lower cases for logs, we get the following struct. equations:

$$w_{jt}(x, v) = \underbrace{\theta_j x}_{\text{perm. worker}} + v + \underbrace{c_r - \alpha_r h_j}_{\text{firm differential due to } G_j(X)}$$
$$+ \underbrace{\frac{1}{1 + \alpha_r \lambda\beta/\rho_r} \tilde{a}_{jt}}_{\text{firm specific TFP}} + \underbrace{\frac{1}{1 + \alpha_r \lambda\beta} \bar{a}_{rt}}_{\text{market TFP}}$$

where

$$h_j \equiv \underbrace{\log\left(\mathbb{E}\left[X^{\theta_j} | j\right]\right)}_{\equiv \bar{x}_j \text{ (labor avg quality)}} + \underbrace{\log\left(\xi_r \int K_r(X') \left(X^{\lambda} G_j(X')\right)^{\beta/\rho_r} \mathrm{d}X'\right)}_{\equiv \bar{g}_j \text{ (common ammenity term)}}$$

$$c_r \equiv \log(1 - \alpha_r) + \log \frac{\lambda\beta/\rho_r}{1 + \lambda\beta/\rho_r}$$

Equilibrium Wages and Value added

- Wage equation (from previous slide):

$$w_{jt}(x,v) = \underbrace{\theta_j x}_{\text{perm. worker}} + v + \underbrace{c_r - \alpha_r h_j}_{\text{firm differential due to } G_j(X)} + \underbrace{\frac{1}{1+\alpha_r \lambda \beta / \rho_r} \tilde{a}_{jt}}_{\text{firm specific TFP}} + \underbrace{\frac{1}{1+\alpha_r \lambda \beta} \bar{a}_{rt}}_{\text{market TFP}}$$

- Value added equation:

$$y_{jt} = \underbrace{(1-\alpha_r) h_j}_{\text{firm differential due to } G_j(X)} + \underbrace{\frac{1+\lambda\beta/\rho_r}{1+\alpha_r \lambda \beta / \rho_r} \tilde{a}_{jt}}_{\text{firm specific TFP}} + \underbrace{\frac{1+\lambda\beta}{1+\alpha_r \lambda \beta} a_{rt}}_{\text{market TFP}}$$

Worker rents, firm level

Result 1:

Worker firm-level rent R_i^w: the surplus derived from being **infra-marginal** at his current job.

$$u_{it}(j(i,t), W_{j(i,t),t}(X_i, V_{it}) - R_{it}^w) = \max_{j' \neq j(i,t)} u_{it}(j', W_{j',t}(X_i, V_{it})).$$

Expected worker rents at the **firm-level** is given by:

$$\mathbb{E}\left[R_{it}^w | j(i,t){=}j\right] = \frac{1}{1 + \lambda\beta/\rho_r}\mathbb{E}\left[W_{jt}(X_i, V_{it}) | j(i,t){=}j\right].$$

Worker rents, market level

Result 2:

Worker market-level rent R_i^{wm}: the surplus derived from being **infra-marginal** in his current market.

$$u_{it}(j(i,t), W_{j(i,t),t}(X_i, V_{it}) - R_{it}^{wm}) = \max_{j' \mid r(j') \neq r(j(i,t))} u_{it}(j', W_{j',t}(X_i, V_{it})).$$

Expected worker rents at the **market-level** is given by:

$$\mathbb{E}\left[R_{it}^{wm} | j(i,t)=j\right] = \frac{1}{1+\lambda\beta} \mathbb{E}\left[W_{jt}(X_i, V_{it}) | j(i,t)=j\right]$$

Interpreting Worker Rents

- To interpret the measure of firm level rents and link it to compensating differentials, it is useful to express R^w_{it} in terms of the worker's **reservation wage**.
  - The worker's **reservation wage** for his current choice of firm is defined as the lowest wage at which he would be willing to continue working in this firm.
  - Substituting in preferences in the above definition of R^w_{it}, we get:

$$\underbrace{\log W_{j(i,t),t}(X_i, V_{it})}_{\text{current wage}} - \underbrace{\log\left(W_{j(i,t),t}(X_i, V_{it}) - R^w_{it}\right)}_{\text{reservation wage}} =$$

$$\underbrace{\log W_{j(i,t),t}(X_i, V_{it})}_{\text{current wage}} - \underbrace{\log W_{j^o(i,t),t}(X_i, V_{it})}_{\text{wage at best outside option}}$$

$$+ \underbrace{\log G^{1/\lambda}_{j(i,t)}(X_i) e^{\frac{1}{\lambda\beta}\epsilon_{ij(i,t)t}}}_{\text{current amenities}} - \underbrace{\log G^{1/\lambda}_{j^o(i,t)}(X_i) e^{\frac{1}{\lambda\beta}\epsilon_{ij^o(i,t)t}}}_{\text{amenities at best outside option}}$$

Compensating differentials

- Eq. allocation of workers to firms ensures no rents at the margin:
  - Utility gains (or losses) of **marginal workers** due to amenities are exactly offset by market wage differences

Result 3:

Market wage difference between firms j and j' for workers of type (X, V) define the equalizing or **comp. differential**

$$\begin{aligned} CD_{jj't}(X, V) &= u_i(j, W_{jt}(X, V)) - u_i(j', W_{jt}(X, V)) \text{ s.t. } R^w_{it} = 0 \\ &= \log W_{jt}(X, V) - \log W_{j't}(X, V) \\ &= (\theta_j - \theta_{j'})x + \psi_j - \psi_{j'} \end{aligned}$$

Firm rents

- **Firm rent** R_j^f: the excess profit firm j derives by acting as a **local monopsonist**:
$$R_j^f = \Pi_j - \Pi_j^{\text{pt}}$$
where pt denotes "price-taker". Only firm j acts as if labor is supplied perfectly elastically
- **Firm rent** R_j^{fm} at the **market-level** is when **all firms** in the market act as price takers

Result 4: Rents at the **firm-level** and **market-level** are given by

$$R_j^f = \left(1 - \left(\frac{\alpha_r\left(1+\lambda\beta/\rho_r\right)}{1+\alpha_r\lambda\beta/\rho_r}\right)\left(\frac{\lambda\beta/\rho_r}{1+\lambda\beta/\rho_r}\right)^{\frac{-(1-\alpha_r)\lambda\beta/\rho_r}{1+\alpha_r\lambda\beta/\rho_r}}\right)\cdot\Pi_j$$

$$R_j^{fm} = \left(1 - \left(\frac{\alpha_r\left(1+\lambda\beta/\rho_r\right)}{1+\alpha_r\lambda\beta/\rho_r}\right)\left(\frac{\lambda\beta/\rho_r}{1+\lambda\beta/\rho_r}\right)^{\frac{-(1-\alpha_r)\lambda\beta}{1+\alpha_r\lambda\beta}}\right)\cdot\Pi_j$$

Wedges and allocative inefficiencies

Natural question are **whether** and **why** the eq. **allocation** of workers to firms will be **inefficient**

Rewriting the wage equation and including taxes, we can express **labor wedges** as ratios of marginal products to wages:

$$\frac{X^{\theta_j} V(1-\alpha)\bar{A}\tilde{A}L_j(\bar{A},\tilde{A})^{-\alpha_r}}{W_j(x,v,\bar{a},\tilde{a})} = 1 + \frac{\rho_r}{\lambda\beta}$$

— $\rho_r = 0$: no wedges as workers view all firms within market as perfect substitutes

— $\rho_r \neq 0$: the more important amenities are, the larger the wedges

However, neither wedges nor rents imply **allocative inefficiencies**

- Labor wedges must vary across market, or taxes must be progressive $(\lambda < 1)$, or both

Taking the model to the data

Identification

To achieve identification, we first make restrictions on the primitives that deliver that statistical model of earnings

Once this link has been established, we show how estimates from statistical model can be used to recover structural parameters

- A few key **restrictions**
  - Firm productivity innovations are independent of endowment of firm amenities
  - Worker productivity innovations are indep. across co-workers and orthogonal to shocks to firm productivity and worker tastes
  - Worker productivity innovations do not induce mobility (because they are paid everywhere)

Note that we still allow:
— **arbitrary correlation** among time-invariant primitives
— rich **firm and worker heterogeneity** with systematic **sorting**
Details

Identification: Rents and Return to scale

Parameters:			
		Unique Parameters	Mean Estimate
Idiosyncratic Taste Parameter	β	1	4.99
Taste Correlation Parameter	ρ_r	8	0.70
Returns to Scale Parameter	α_r	8	0.21
Moments:			
		Observed in Data	
Market Passthrough		$\frac{\mathbb{E}\left[\Delta \tilde{y}_{jt}\left(\tilde{w}_{it+\tau}-\tilde{w}_{it-\tau'}\right)\mid S_i=1, r(j)=r\right]}{\mathbb{E}\left[\Delta \tilde{y}_{jt}\left(\tilde{y}_{jt+\tau}-\tilde{y}_{jt-\tau'}\right)\mid S_i=1, r(j)=r\right]}$	
Net Passthrough		$\frac{\mathbb{E}\left[\Delta \bar{y}_{rt}\left(\bar{w}_{rt+\tau}-\bar{w}_{rt-\tau'}\right)\mid S_i=1\right]}{\mathbb{E}\left[\Delta \bar{y}_{rt}\left(\bar{y}_{rt+\tau}-\bar{y}_{rt-\tau'}\right)\mid S_i=1\right]}$	
Labor Share		$\mathbb{E}[b_{j(i,t)} - y_{j(i,t)} \mid r(j) = r]$	

Details

Identification: AKM Interpretation

Parameters:			
		Unique Parameters	Mean Estimate
Time-varying Firm Premium	ψ_{jt}	10,669,602	0.02
Firm-specific Technology Parameter	θ_j	10	0.04
Worker Quality	x_i	61,670,459	0.31
Amenity Efficiency Units at Neutral TFP	h_j	1,953,915	0.14
Firm-specific TFP	$\tilde{p}_j$	1,953,915	0.04
Market-specific TFP	$\bar{p}_r$	114,773	0.12
Moments:			
		Observed in Data	
Structural Wage Equation		$\mathbb{E}[w_{it} - \frac{1}{1+\lambda\beta}\bar{y}_{r,t} - \frac{\rho_r}{\rho_r+\lambda\beta}\tilde{y}_{j,t} \mid r(j) = r]$	
Wage Changes around Moves		$\mathbb{E}[w_{it+1} \mid j \to j'] - \mathbb{E}[w_{it} \mid j' \to j]$ $\mathbb{E}[w_{it} \mid j' \to j] - \mathbb{E}[w_{it+1} \mid j \to j']$	
Total Labor Input & Time-varying Firm Premium		$l_{jt} = \log \sum X_i^{\theta_j}$ and ψ_{jt}	

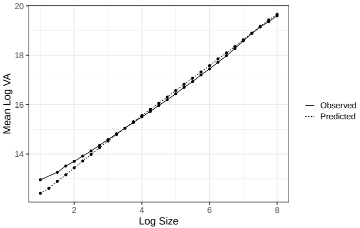
Details

Identification: Model Counterfactuals

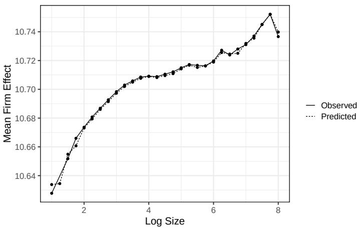
Parameters:			
		Unique Parameters	Mean Estimate
Preferences for amenities for: Firm j for workers of quality X Market r for workers of quality X	$g_j(X)$	37,236,342	0.20
Moments:			
		Observed in Data	
Firm Size & Firm Composition & Market Composition		$\Pr[j]$ $\Pr[x\|k(j) = k]$ $\Pr[x\|r(j) = r]$	

Details

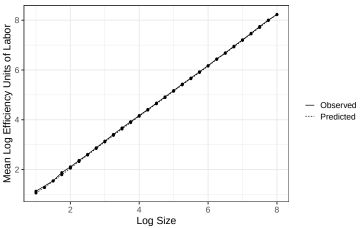
Fit of the Model for Untargeted Moments



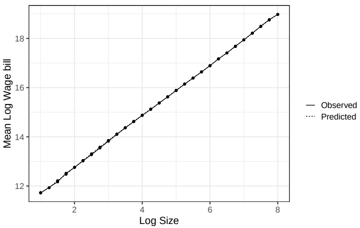
(a) Value Added



(b) Firm Effects

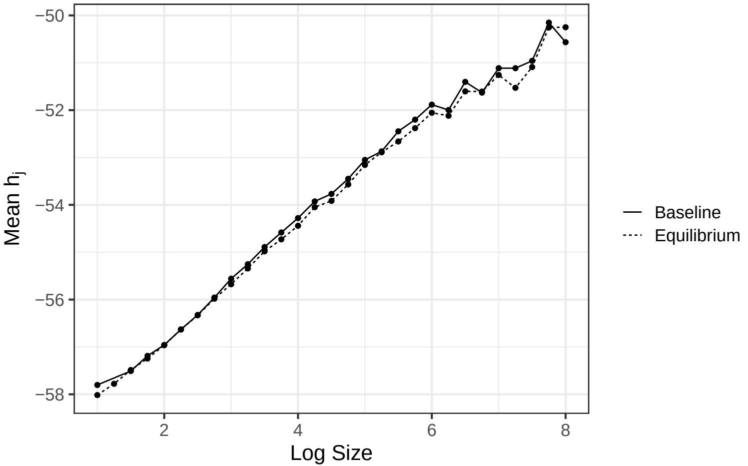


(c) Efficiency Units of Labor



(d) Wage Bill

Estimates of the Amenity Components h_j from the Wage Equation versus the Equilbrium Constraint



Model Based Estimates

What Does the Model Deliver?

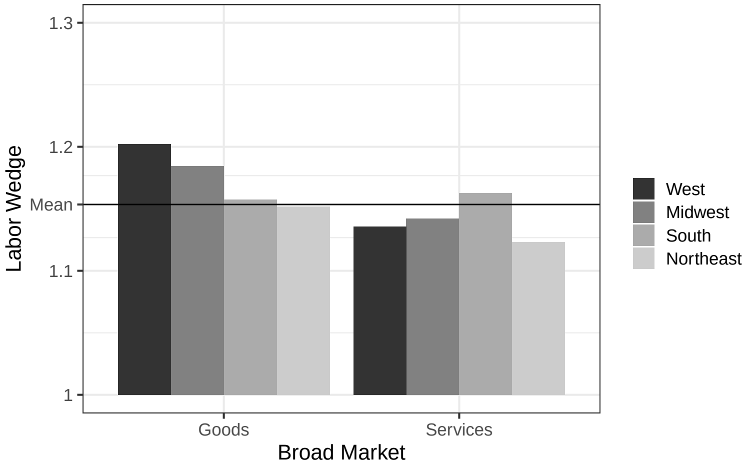
1. **Suff. stats** for **rents** and **labor wedges**: $(\boldsymbol{\alpha_r}, \beta, \boldsymbol{\rho_r})$
   - All you need are the pass-throughs and labor shares

Rent Sharing: National Averages

	Rents and Rent-shares		
	Firm Only	Accounting for Markets	
	Firm-level	Firm-level	Market-level
Workers' Rents:			
Per-worker Dollars	5,875	5,447	7,331
	(284)	(395)	(1,234)
Share of Earnings	14%	13%	18%
	(1%)	(1%)	(3%)
Firms' Rents:			
Per-worker Dollars	5,932	5,780	7,910
	(709)	(1,547)	(1,737)
Share of Profits	11%	11%	15%
	(1%)	(3%)	(3%)
Workers' Share of Rents	50%	49%	48%
	(2%)	(4%)	(3%)

Appendix: Heterogeneity across regions and sectors

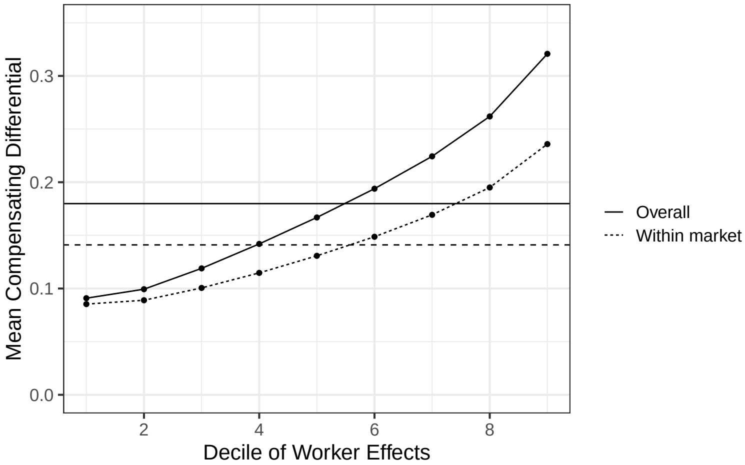
Labor Wedges



What Does the Model Deliver?

1. **Suff. stats** for **rents** and **labor wedges**: $(\boldsymbol{\alpha_r}, \beta, \boldsymbol{\rho_r})$
   - All you need are the pass-throughs and labor shares
2. **Economic interpretation** of **AKM**: $(\boldsymbol{A_j}, \boldsymbol{\alpha_r}, \beta, \boldsymbol{\rho_r}, \boldsymbol{h_j})$
   - Compensating differentials
   - Understanding firm effects

Compensating Differentials



Model interpretation of small firm effects

Decomposition of firm effects:

$$Var(\psi_{j(i,t),t}) = \underbrace{Var(c_r - \alpha_r h_{j(i,t)})}_{\text{Amenities}} + \underbrace{Var(\frac{1}{1+\alpha_r\lambda\beta}\bar{a}_{rt} + \frac{1}{1+\alpha_r\lambda\beta/\rho_r}\tilde{a}_{j(i,t),t})}_{\text{TFP}}$$

$$\underbrace{+ 2Cov(c_r - \alpha_r h_{j(i,t)}, \frac{1}{1+\alpha_r\lambda\beta}\bar{a}_{rt} + \frac{1}{1+\alpha_r\lambda\beta/\rho_r}\tilde{a}_{j(i,t),t})}_{\text{covariance between amenities and TFP}}$$

	Between Broad Markets	**Within Broad Markets**	
		Between Detailed Markets	**Within Detailed Markets**
Total	0.4%	2.0%	3.1%
Decomposition:			
Amenity Differences	15.9%	7.8%	7.1%
TFP Differences	15.5%	11.9%	8.6%
Amenity-TFP Covariance	-31.1%	-17.7%	-12.6%

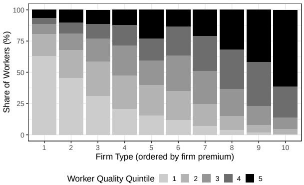
Note: percentages refer to shares of wage variance.

TOC

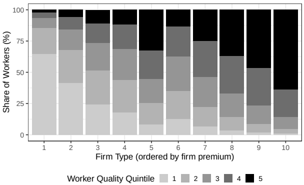
What Does the Model Deliver?

1. **Suff. stats** for **rents** and **labor wedges**: $(\boldsymbol{\alpha_r}, \beta, \boldsymbol{\rho_r})$
   - All you need for (1) and (2) are the pass-throughs and labor shares
2. **Economic interpretation** of **AKM**: $(\boldsymbol{A_j}, \boldsymbol{\alpha_r}, \beta, \boldsymbol{\rho_r}, \boldsymbol{h_j})$
   - Compensating differentials
   - Understanding firm effects
3. **Counterfactual analysis** $(\boldsymbol{A_j}, \boldsymbol{\alpha_r}, \beta, \boldsymbol{\rho_r}, \boldsymbol{G_j(X)})$
   - What is the key determinant of worker sorting?
   - How important are the allocative inefficiencies from imperfect competition in the labor market?

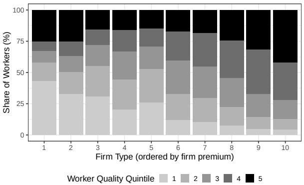
Sorting: Amenities vs Complementarities



(e) Baseline Equilibrium

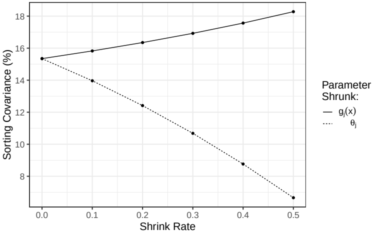


(f) Shrink $g_j(x)$

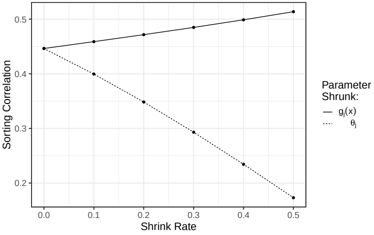


(g) Shrink θ_j

Worker sorting with counterfactual values of $g_j(x)$ and θ_j



(h) Sorting



(i) Sorting Correlation

Progressive taxation and imperfect competition

Workers' choices of firms are distorted for two reasons:

- Tax wedge due to $\tilde{W} = \tau W^{\lambda}$ with $\lambda < 0$
  - Makes workplace amenities more important
- Labor wedges $1 + \frac{\rho_r}{\lambda\beta}$ vary across markets
  - Creating differences in wage setting power of firms

		(1) Monopsonistic Labor Market	(2) No Labor or Tax Wedges	Difference between (1) and (2)
Log of Expected Output	$\log \mathbb{E}[Y_{jt}]$	11.38	11.41	0.03
Total Welfare (log dollars)		12.16	12.21	0.05
Sorting Correlation	$Cor(\psi_{jt}, x_i)$	0.44	0.47	0.03
Labor Wedges	$1 + \frac{\rho_r}{\beta\lambda}$	1.15	1.00	-0.15
Worker Rents (as share of earnings):				
Firm-level	$\frac{\rho_r}{\rho_r + \beta\lambda}$	13.3%	12.3%	-1.0%
Market-level	$\frac{1}{1+\beta\lambda}$	18.0%	16.7%	-1.3%

Conclusion

Conclusion: What we did

- Develop an eqm. **model of the labor market** with two-sided heterogeneity where workers view firms as imperfect substitutes
  - Show how the model can be **identified** and estimated from matched **employer-employee data**
  - **Measure rents** of workers and firms from ongoing employment relationships
  - Show relevance of imperfect comp. for **inequality** and **tax policy**
  - Offer a unifying explanation for evidence of **firm wage premiums**, **worker sorting**, and **pass-through** of firm and market shocks

Appendix: Sample Details

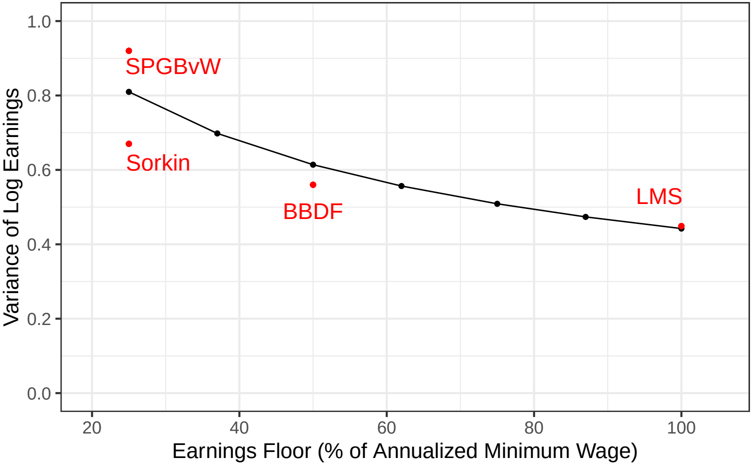
back.

Detailed Sample Characteristics

	Goods				Services				All
	Midwest	Northeast	South	West	Midwest	Northeast	South	West	All
Panel A.	**Full Sample**								
Observation Counts:									
Number of FTE Worker-Years	42,910,324	26,701,886	40,332,913	31,598,149	69,049,669	62,399,969	103,263,800	71,385,819	447,642,529
Number of Unique FTE Workers	9,319,084	6,088,816	10,218,947	7,714,829	17,315,144	15,168,284	26,530,182	17,953,911	89,579,704
Number of Unique Firms with FTE Workers	294,907	232,740	439,823	329,721	1,051,608	1,055,084	1,908,800	1,314,677	6,479,326
Number of Unique Markets with FTE Workers	1,514	270	1,780	916	4,108	761	4,926	2,509	16,164
Group Counts:									
Mean Number of FTE Workers per Firm	22.1	17.8	16.1	16.3	10.4	9.7	9.5	9.6	11.4
Mean Number of FTE Workers per Market	2,007.0	6,778.8	1,581.7	2,524.2	1,217.4	5,623.1	1,488.4	2,084.0	1,906.6
Mean Number of Firms per Market with FTE Workers	91.0	380.6	98.0	155.2	117.0	577.9	156.2	216.3	166.9
Outcome Variables in Log $:									
Mean Log Wage for FTE Workers	10.76	10.81	10.70	10.81	10.61	10.74	10.62	10.70	10.69
Mean Value Added for FTE Workers	17.36	16.80	16.67	16.64	16.18	16.04	15.94	16.07	16.31
Firm Aggregates in $1,000:									
Wage Bill per Worker	43.6	50.7	42.2	52.9	34.3	44.2	35.8	40.3	40.9
Value Added per Worker	91.2	107.5	85.1	91.6	90.5	111.1	94.2	92.3	95.2
Panel B.	**Movers Sample**								
Observation Counts:									
Number of FTE Mover-Years	17,458,234	11,545,098	18,078,675	15,521,491	31,647,628	28,398,961	50,074,776	35,344,937	208,069,800
Number of Unique FTE Movers	4,125,425	2,830,268	4,822,238	3,877,827	7,724,643	6,663,264	11,909,494	8,324,587	32,077,850
Number of Unique Firms with FTE Movers	188,405	144,294	265,504	215,212	571,413	549,162	1,019,393	700,921	3,560,534
Number of Unique Markets with FTE Movers	1,463	266	1,753	878	3,915	755	4,783	2,359	15,609
Group Counts:									
Mean Number of FTE Movers per Firm with FTE Movers	13.5	11.9	11.2	11.6	8.2	7.9	7.9	8.2	8.9
Mean Number of Movers per Market with FTE Movers	862.4	2,964.1	730.3	1,310.7	597.7	2,617.4	759.3	1,116.4	936.7
Mean Number of Firms per Market with FTE Movers	64.0	248.9	65.3	112.8	72.6	332.3	96.1	136.8	105.0
Outcome Variables in Log $:									
Mean Log Wage for FTE Movers	10.76	10.81	10.70	10.81	10.61	10.74	10.62	10.70	10.69
Mean Value Added for FTE Movers	17.36	16.80	16.67	16.64	16.18	16.04	15.94	16.07	16.31
Panel C.	**Stayers Sample**								
Sample Counts:									
Number of 8-year Worker-Firm Stayer Spells	2,588,628	1,777,928	1,237,821	1,150,115	2,315,238	2,527,212	2,609,997	2,207,552	16,506,865
Number of Unique FTE Stayers in Firms with 10 FTE Stayers	798,575	532,507	416,549	354,518	740,091	764,699	865,629	724,155	5,217,960
Number of Unique Firms with 10 FTE Stayers	13,884	10,896	9,409	9,767	18,083	19,475	19,626	16,185	117,698
Number of Unique Markets with 10 Firms with 10 FTE Stayers	197	111	216	104	335	213	438	219	1,826
Outcome Variables in Log $:									
Mean Log Wage for FTE Stayers	10.95	10.99	10.97	10.99	10.90	11.01	10.96	11.05	10.97
Mean Log Value Added for FTE Stayers	18.04	17.56	17.46	16.56	17.45	17.23	17.89	17.93	17.61

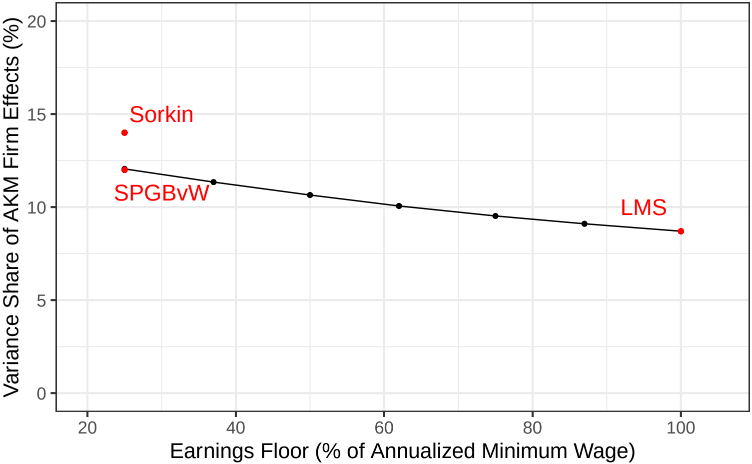
back.

Wage Floor vs Literature: Total Variance



back.

Wage Floor vs Literature: Firm Effect Share of Variance



back.

Appendix: AKM and BLM Details

back.

Limited mobility bias

- Key concern: **Limited mobility bias**, $\hat{\psi}_j$ essentially coming from movers,

$$\hat{\psi}_j - \hat{\psi}_{j'} = \frac{1}{N_m} \sum_i (w_{it+1} - w_{it})$$
$$= \psi_j - \psi_{j'} + \underbrace{\frac{1}{N_m} \sum_i (\epsilon_{it+1} - \epsilon_{it-1})}_{\text{meas. error.}}$$
$$\hat{\alpha}_i = \frac{1}{T} \sum_t (w_{it} - \hat{\psi}_{j(i,t)})$$

- meas. error. inflates variance, bias down covariance:

$$Var(\hat{\psi}_{j(i,t)}) \simeq Var(\psi_{j(i,t)} + \hat{e})$$
$$Cov(\hat{\alpha}_i, \hat{\psi}_{j(i,t)}) \simeq Cov(\alpha_i - \hat{e}, \psi_{j(i,t)} + \hat{e})$$

- Other issues: Short panel; selection on TFP shocks; endogenous mobility, non-additivity (Bonhomme Lamadon Manresa 2019)

back.

AKM Connected Set

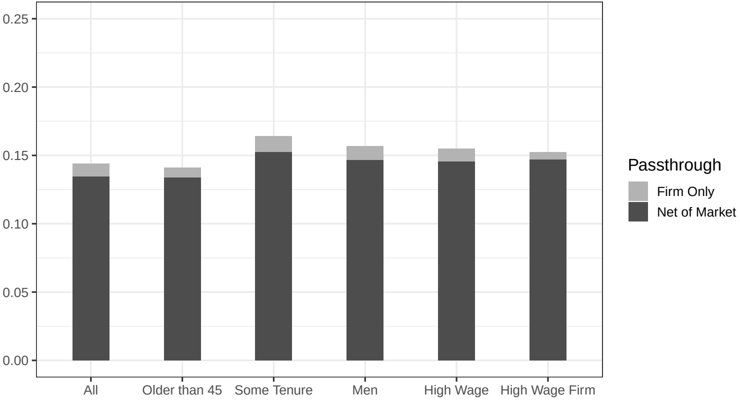
Sample:	Full Sample	≥ 2 Movers	Connected Set
Workers in 2001-2008:			
Worker-Years (Millions)	245.0	227.8	227.4
	(100.0%)	(93.0%)	(92.8%)
Unique Workers (Millions)	66.2	61.8	61.7
	(100.0%)	(93.3%)	(93.2%)
Workers in 2008-2015:			
Worker-Years (Millions)	232.9	212.4	211.9
	(100.0%)	(91.2%)	(91.0%)
Unique Workers (Millions)	64.0	58.8	58.6
	(100.0%)	(91.9%)	(91.7%)

back.

Appendix: Passthrough Details

back.

Pass-throughs: Worker heterogeneity



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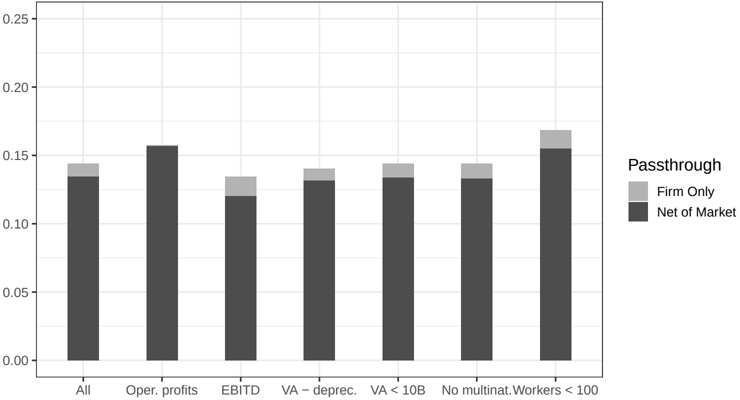
Pass-throughs: Firm heterogeneity and robustness



back.

Detailed GMM estimates

	GMM Estimates of Joint Process			
	Firm Only		Accounting for Markets	
	Log Value Added	Log Earnings	Log Value Added	Log Earnings
Panel A.	**Process: MA(1)**			
Total Growth (Std. Dev.)	0.31	0.17	0.29	0.16
	(0.01)	(0.00)	(0.01)	(0.00)
Permanent Shock (Std. Dev.)	0.20	0.10	0.17	0.10
	(0.01)	(0.00)	(0.01)	(0.00)
Transitory Shock (Std. Dev.)	0.18	0.10	0.17	0.10
	(0.01)	(0.00)	(0.01)	(0.00)
MA Coefficient, Lag 1	0.09	0.15	0.09	0.15
	(0.01)	(0.00)	(0.01)	(0.00)
MA Coefficient, Lag 2	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Permanent Passthrough Coefficient		0.14		0.13
		(0.01)		(0.01)
Transitory Passthrough Coefficient		-0.01		0.00
		(0.01)		(0.00)
Market Passthrough Coefficient				0.18
				(0.02)
Panel B.	**Process: MA(2)**			
Total Growth (Std. Dev.)	0.31	0.17	0.29	0.16
	(0.01)	(0.00)	(0.01)	(0.00)
Permanent Shock (Std. Dev.)	0.20	0.10	0.17	0.10
	(0.01)	(0.00)	(0.00)	(0.00)
Transitory Shock (Std. Dev.)	0.17	0.10	0.17	0.10
	(0.01)	(0.00)	(0.01)	(0.00)
MA Coefficient, Lag 1	0.05	0.21	0.07	0.21
	(0.05)	(0.01)	(0.04)	(0.01)
MA Coefficient, Lag 2	-0.03	0.04	-0.01	0.04
	(0.03)	(0.00)	(0.02)	(0.00)
Permanent Passthrough Coefficient		0.15		0.13
		(0.01)		(0.01)
Transitory Passthrough Coefficient		-0.02		0.00
		(0.01)		(0.00)
Market Passthrough Coefficient				0.18
				(0.03)

back.

Identifying complementarities

- Consider the following equation

$$w_{it} = \underbrace{\gamma_j \cdot x_i}_{\text{interaction}} + \psi_{j(i,t)} + \epsilon_{it}$$

- Then consider movers, and under usual AKM assumptions:

$$\mathbb{E}[w_{it+1}|j_2 \to j_1] - \mathbb{E}[w_{it}|j_1 \to j_2] = \gamma_{j_1} \left(\mathbb{E}\left[x_i|j_2 \to j_1\right] - \mathbb{E}\left[x_i|j_1 \to j_2\right]\right)$$
$$\mathbb{E}[w_{it}|j_2 \to j_1] - \mathbb{E}[w_{it+1}|j_1 \to j_2] = \gamma_{j_2} \left(\mathbb{E}\left[x_i|j_2 \to j_1\right] - \mathbb{E}\left[x_i|j_1 \to j_2\right]\right)$$

- Then as long as second expression is not 0, we get:

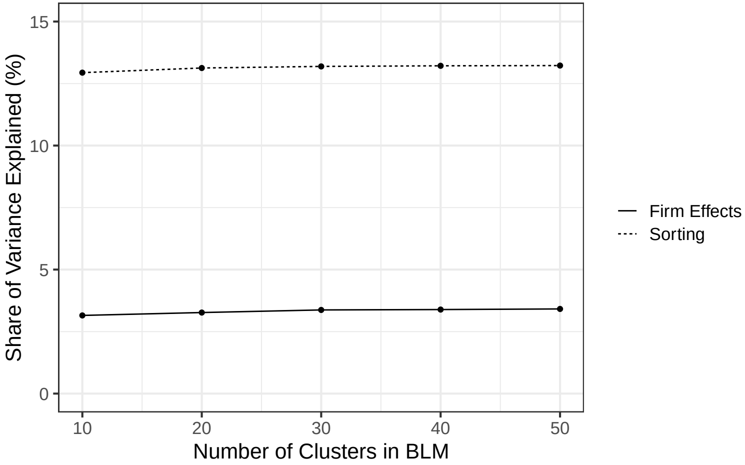
$$\frac{\mathbb{E}[w_{it+1}|j_2 \to j_1] - \mathbb{E}[w_{it}|j_1 \to j_2]}{\mathbb{E}[w_{it}|j_2 \to j_1] - \mathbb{E}[w_{it+1}|j_1 \to j_2]} = \frac{\gamma_{j1}}{\gamma_{j2}}$$

Fixed-effect: Between firm

Years:		**2001-2008**	**2008-2015**	**Pooled**
Panel A.		**Total Decomposition**		
Within Firm Share:	$Var(w_{it} - \mathbb{E}[w_{it}\|j])$	67%	64%	66%
Between Firm Share:	$Var(\mathbb{E}[w_{it}\|j])$	33%	36%	34%
Panel B.		**AKM Decomposition**		
Shares of Within Firm Variance:				
Worker Heterogeneity:	$Var(x_i + X'_{it}b - \mathbb{E}[x_i + X'_{it}b\|j])$	84%	85%	84%
Residual:	$Var(\epsilon_{it})$	16%	15%	16%
Shares of Between Firm Variance:				
Firm Effects:	$Var(\psi_j)$	27%	25%	26%
Segregation:	$Var(\mathbb{E}[x_i + X'_{it}b\|j])$	58%	59%	59%
Sorting:	$2Cov(x_i + X'_{it}b, \psi_j)$	15%	16%	15%
Panel C.		**BLM Decomposition**		
Shares of Within Firm Variance:				
Worker Heterogeneity:	$Var(x_i + X'_{it}b - \mathbb{E}[x_i + X'_{it}b\|j])$	83%	84%	84%
Residual:	$Var(\epsilon_{it})$	17%	16%	16%
Shares of Between Firm Variance:				
Firm Effects:	$Var(\psi_j)$	10%	10%	10%
Segregation:	$Var(\mathbb{E}[x_i + X'_{it}b\|j])$	50%	50%	50%
Sorting:	$2Cov(x_i + X'_{it}b, \psi_j)$	40%	40%	40%

back.

BLM by number of clusters



back.

Identifying assumption

- Identification of (β, ρ_r) relies on the panel structure
  - Assume unit-root + MA structure of the innovations to $\bar{z}_{rt}, \tilde{z}_{jt}, v_{it}$ (as well as VA measurement error)
  - Let Ω_t denote the history of innovations to $(\bar{z}_{rt}, \tilde{z}_{jt}, v_{it})$ and $\Gamma = (\bar{p}_r, \tilde{p}_j, g_j(x), x_i)$ denote time-invariant primitives
  - **Identifying assumption:** innovations in $\bar{z}_{rt}, \tilde{z}_{jt}, v_{it}$ are independent, given Ω_t and Γ.
    back.

Identification overview 1/3

- The structural equations and this identifying assumption deliver:

$$\gamma = \frac{1}{1 + \lambda\beta/\rho_r} \qquad \Upsilon = \frac{1}{1 + \lambda\beta}$$

  relating the pass-through parameters to the model parameters

- Identification of (β, ρ_r) is obtained from the moment condition:

$$\mathbb{E}\left[\Delta y_{j(i)t}\left(\tilde{w}_{it+\tau} - \tilde{w}_{it-\tau'} - \frac{1}{1 + \lambda\beta/\rho_r}\left(\tilde{y}_{j(i),t+\tau} - \tilde{y}_{j(i),t-\tau'}\right)\right)|S\right] = 0$$

  - A similar equation at the market level identifies $\frac{1}{1+\lambda\beta}$

- They also permit identifying α_r using the labor share:

$$\mathbb{E}\left[y_{jt} - b_{jt}|r\right] = -c_r = -\log(1 - \alpha_r) - \log\left(\frac{\lambda\beta/\rho_r}{1 + \lambda\beta/\rho_r}\right)$$

back.

Identification overview 2/3

- Identifying h_j and worker heterogeneity using movers and two-way decompositions
  - the structural wage and V.A. equation give:

$$\mathbb{E}\left[w_{it} - \frac{1}{1+\lambda\beta}\bar{y}_{rt} - \frac{\rho_r}{\rho_r+\lambda\beta}\left(y_{jt}-\bar{y}_{rt}\right) \middle| \begin{array}{c} j(i)=j \\ j \in J_r \end{array} \right] = \theta_j x_i + \psi_j$$

    where we define $\psi_j \equiv c_r - \alpha_r h_j - \frac{\lambda\beta(\rho_r-1)(1-\alpha_r)}{(1+\lambda\beta)(\rho_r+\beta)}\bar{h}_r$.
  - can be estimated using BLM procedure.

    back.

Identification overview 3/3

- Identifying $G_j(X)$ using within firm distribution

$$\text{Pr}\left[j|r,X\right] = \left(\frac{G_j(X)\, W_{jt}(X)}{I_{rt}(X)}\right)^{\beta/\rho_r}$$

  - where $I_{rt}(X)$ can be estimated from probability that X chooses market r
    back.

H fixed point expression

$$H_j = \bar{V} \int X^{\theta_j(1+\lambda\beta/\rho_r)} \left(\frac{I_{r0}(X)}{I_0(X)} \right)^{\lambda\beta} \left(\frac{1}{I_{r0}(X)} \right)^{\lambda\beta/\rho_r} G_j(X)^{\beta/\rho_r} \, \mathsf{d}X$$

$$I_{r0}(X) = \left(\xi_r \sum_{j'} \left(\tau^{1/\lambda} G_{j'}(X)^{1/\lambda} X^{\theta_{j'}} \right)^{\lambda\beta/\rho_r} \left(C_r \tilde{P}_{j'} H_j^{-\alpha} \right)^{\frac{\lambda\beta/\rho_r}{1+\alpha_r\lambda\beta/\rho_r}} \right)^{\rho_r/}$$

$$I_0(X) = \mathbb{E} \left(\bar{Z}_{rt} \bar{P}_r \right)^{\frac{1}{1+\alpha\lambda\beta}} \sum_r I_{r0}(X)$$

Full moment condition for firm pass-through

- define $\tilde{w}_{it} = w_{it} - \mathbb{E}\left[w_{it} | r(i){=}r, t\right]$ and $\tilde{y}_{jt} = y_{jt} - \mathbb{E}\left[y_{jt} | r(j){=}r, t\right]$
- then

$$\mathbb{E}\left[\Delta y_{j(i)t}\left(\tilde{w}_{it+\tau} - \tilde{w}_{it-\tau} - \gamma\left(\tilde{y}_{j(i),t+\tau} - \tilde{y}_{j(i),t-\tau}\right)\right) | S_i{=}1\right] = 0$$

for for $\tau \geq 2, \tau' \geq 3$.

Rents heterogeneity in regions and sectors

	Goods				Services			
	Midwest	Northeast	South	West	Midwest	Northeast	South	West
Panel A.	**Model Parameters**							
Idyosinctratic taste parameter (β^{-1})	0.200 (0.044)							
Taste correlation parameter (ρ)	0.844	0.694	0.719	0.924	0.649	0.563	0.744	0.619
	(0.179)	(0.153)	(0.160)	(0.182)	(0.141)	(0.109)	(0.246)	(0.117)
Returns to scale ($1-\alpha$)	0.746	0.764	0.863	0.949	0.753	0.740	0.814	0.752
	(0.016)	(0.013)	(0.017)	(0.019)	(0.013)	(0.015)	(0.036)	(0.015)
Panel B.	**Firm-level Rents and Rent Shares**							
Workers' Rents:								
Per-worker Dollars	6,802	6,681	5,737	8,906	4,234	4,847	5,009	4,805
	(770)	(723)	(720)	(867)	(502)	(803)	(1,295)	(684)
Share of Earnings	16%	13%	14%	17%	12%	11%	14%	12%
	(2%)	(1%)	(2%)	(2%)	(1%)	(2%)	(4%)	(2%)
Firms' Rents:								
Per-worker Dollars	4,041	4,198	7,465	20,069	3,531	3,097	6,915	3,018
	(1,243)	(1,130)	(2,681)	(6,323)	(1,004)	(1,305)	(5,650)	(1,060)
Share of Profits	8%	7%	17%	52%	6%	5%	12%	6%
	(3%)	(2%)	(6%)	(16%)	(2%)	(2%)	(10%)	(2%)
Workers' Share of Rents	63%	61%	43%	31%	55%	61%	42%	61%
	(4%)	(4%)	(5%)	(4%)	(4%)	(5%)	(9%)	(5%)
Panel C.	**Market-level Rents and Rent Shares**							
Workers' Rents:								
Per-worker Dollars	7,837	9,102	7,572	9,506	6,115	7,935	6,422	7,230
	(1,319)	(1,532)	(1,274)	(1,600)	(1,029)	(1,335)	(1,081)	(1,217)
Share of Earnings	18%	18%	18%	18%	18%	18%	18%	18%
	(3%)	(3%)	(3%)	(3%)	(3%)	(3%)	(3%)	(3%)
Firms' Rents:								
Per-worker Dollars	4,940	6,311	10,000	20,846	5,734	5,897	9,363	5,153
	(1,140)	(1,350)	(2,267)	(5,787)	(1,351)	(1,786)	(4,218)	(1,433)
Share of Profits	10%	11%	23%	54%	10%	9%	16%	10%
	(2%)	(2%)	(5%)	(15%)	(2%)	(3%)	(7%)	(3%)
Workers' Share of Rents	61%	59%	43%	31%	52%	57%	41%	58%
	(3%)	(3%)	(4%)	(5%)	(3%)	(4%)	(8%)	(4%)

back.

Estimated tax policy

- Estimating
$$\tilde{I}_{it} = \tau I_{it}^{\lambda}$$
- We find $\tau = 0.89$ and $\lambda = 0.92$, and the r-square is 0.98.