Imperfect Competition, Compensating Differentials, and Rent Sharing in the US Labor Market

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I. Model of the Labor Market

A. Agents, Preferences, and Technology

- *Worker Productivity and Preferences.*—Workers are heterogeneous both in preferences and productivity.

- Workers are characterized by a permanent skill level X_i.

- In period t, worker i with skill X_i has the following preferences over alternative firms j and earnings W:

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

- where $G_j(X)$ denotes the value that workers of quality X are expected to get from the amenities that firm j offers, $Z = Z(X)$ and ϵ_{ijt} denotes worker i's idiosyncratic taste for the amenities of firm j.

- The parameters (τ, λ) describe the tax function that maps wages to income available for consumption.

- Section IVC shows that this parsimonious tax function well approximates the US tax system.

- We assume that $(\epsilon_{i1t}, \ldots, \epsilon_{iJt}) \equiv \rightarrow \vec{\epsilon}_{it} \sim \Xi(\vec{\epsilon} \mid \rightarrow \vec{\epsilon}_{it-1}, Xi)$ follows a Markov process with independent innovations across individuals.

- This assumption does not imply strong restrictions on the copula of workers' skills and preferences over time (and, by extension, the patterns of mobility across firms by worker quality).

- We assume, however, that the (cross-sectional) distribution of $\vec{\epsilon}_{it}$ has a nested logit structure in each period:

$$F(\vec{\epsilon}_{it}) = \exp\left[-\sum_r \left(\sum_{j \in J_r} e^{-\frac{\epsilon_{ijt}}{\rho_r}}\right)^{\rho_r}\right].$$

- r denotes market

- J_r is set of firms in the market.

- *Firm Productivity and Technology.*—We let firms differ not only in workplace amenities but also in terms of productivity and technology.

- We start by introducing the total efficiency units of labor at the firm:

$$L_{jt} = \int X^{\theta_j} \cdot D_{jt}(X)\, dX,$$

- where X^{θ_j} tells us the efficiency of a worker of quality X in firm j.

- Assumes a common scales across firms.

- The component $D_{jt}(X)$ is the mass of workers with productivity X demanded by the firm.

- The value added (revenues minus expenditure on intermediate inputs) Y_{jt} generated by firm j in period t is determined by the production function

$$Y_{jt} = A_{jt} L_{jt}^{1-\alpha_{r(j)}},$$

- where A_{jt} is the firm's total factor productivity (TFP) and $1 - \alpha_{r(j)}$ is the firm's returns to scale.

- It is useful to express the productivity component A_{jt} as

$$A_{jt} = \bar{A}_{r(j)t}\tilde{A}_{jt} = \bar{P}_{r(j)}\bar{Z}_{r(j)t}\tilde{P}_j\tilde{Z}_{jt},$$

- where $\bar{A}_{r(j)t}$, $\bar{P}_{r(j)}$, and $\bar{Z}_{r(j)t}$ represent the overall, the permanent, and the time-varying components of productivity that are shared by all firms in market r; while $\tilde{A}_{jt}$, $\tilde{P}_j$, and $\tilde{Z}_{jt}$ denote the overall, the permanent, and the time-varying components that are specific to firm j.

- Let $W_{jt}(X)$ denote the wage that firm j offers to workers of quality X in period t and $B_{jt} = \int W_{jt}(X)D_{jt}(X)dX$ denote the wage bill of the firm, i.e., the total sum of wages paid to its workers.

- The profit of the firm is then given by $\Pi_{jt} = Y_{jt} - B_{jt}$.

B. Information, Wages, and Equilibrium

- We consider an environment where all labor is hired in a spot market and ϵ_{ijt} is private information to the worker.

- Hence, the wage may depend on the worker's attributes X, but not her value of ϵ_{ijt}. Given the set of offered wages $W_t = \{W_{jt}(X)\}_{j=1,\ldots,J}$ by all firms, worker i chooses a firm j to maximize her utility u it in each period:

$$(1) \qquad j(i,t) \equiv \underset{j}{\operatorname{argmax}}\, u_{it} \left(j, W_{jt}(X_i)\right).$$

- We introduce a wage index at the level of the market r defined by

$$(2) \qquad I_{rt}(X) \equiv \left(\sum_{j' \in J_r} \left(\tau^{1/\lambda} G_{j'}(X)^{1/\lambda} W_{j't}(X) \right)^{\frac{\lambda\beta}{\rho_r}} \right)^{\frac{\rho_r}{\lambda\beta}},$$

- from which we can derive the probability that an individual of type X chooses to work at firm j given all offered wages in the economy:

$$S_{jt}(X,W) \equiv NM(X) \frac{I_{r(j)t}(X)^{\lambda\beta}}{\sum_{r'} I_{r't}(X)^{\lambda\beta}} \left(\tau^{1/\lambda} G_j(X)^{1/\lambda} \frac{W}{I_{r(j)t}(X)} \right)^{\frac{\lambda\beta}{\rho_{r(j)}}}.$$

- This means the firm ignores the negligible effect of changing its own wages on the market-level wage index $I_{rt}(X)$.

- Then each firm chooses labor demand $D_{jt}(X)$ by setting wages $W_{jt}(X)$ for each type of worker X to maximize profits subject to labor supply $S_{jt}(X, W)$:

$$\text{(3)} \qquad \Pi_{jt} = \max_{\{W_{jt}(X)\}_X} A_{jt}\left(\int X^{\theta_j} D_{jt}(X)\, dX\right)^{1-\alpha_{r(j)}} - \int W_{jt}(X)\, D_{jt}(X)\, dX,$$

- subject to

$$D_{jt}(X) = S_{jt}\big(X, W_{jt}(X)\big) \quad \text{for all } t, j, X.$$

- From this environment, the definition of equilibrium naturally follows.

DEFINITION 1: *Given firm characteristics* $\{\alpha_{r(j)}, A_{jt}, \theta_j\}_{j,t}$, *worker distributions* $N, M(\cdot)$, *preference parameters* $(\beta, \rho_r, G_j(\cdot))$, *and tax parameters* (λ, τ); *we define the equilibrium as the worker decisions* $j(i,t)$, *market-level wage indices* $I_{rt}(X)$, *firm-specific labor supply curves* $S_{jt}(X, W)$, *wages* $W_{jt}(X)$, *and labor demand* $D_{jt}(X)$ *such that:*

(i) *Workers choose firms that maximize their utility, as defined in equation (1).*

(ii) *Firms choose labor demand* $D_{jt}(X)$ *by setting wages* $W_{jt}(X)$ *for each worker quality* X *to maximize profits subject to the labor supply constraint* $S_{jt}(X, W)$, *as described in equation (3).*

(iii) *The market-level wage indices* $I_{rt}(X)$ *are generated from the workers' optimal decisions* $j(i,t)$, *as described in equation (2).*

C. Sorting in Equilibrium

- Multiple sources of sorting: preferences, productivity

D. Structural Equations

- As shown in Proposition 1 in online Appendix A.1, our model delivers the following structural equations for (log of) wages, value added, and wage bill of firm $j \in J_r$:

$$(4) \qquad w_j(x, \bar{a}, \tilde{a}) = \theta_j x + c_r - \alpha_r h_j + \frac{1}{1 + \alpha_r \lambda \beta} \bar{a} + \frac{1}{1 + \alpha_r \lambda \beta / \rho_r} \tilde{a},$$

$$(5) \qquad y_j(\bar{a}, \tilde{a}) = (1 - \alpha_r) h_j + \frac{1 + \lambda \beta}{1 + \alpha_r \lambda \beta} \bar{a} + \frac{1 + \lambda \beta / \rho_r}{1 + \alpha_r \lambda \beta / \rho_r} \tilde{a},$$

$$(6) \qquad b_j(\bar{a}, \tilde{a}) = c_r + (1 - \alpha_r) h_j + \frac{1 + \lambda \beta}{1 + \alpha_r \lambda \beta} \bar{a} + \frac{1 + \lambda \beta / \rho_r}{1 + \alpha_r \lambda \beta / \rho_r} \tilde{a};$$

- where we use lower case letters to denote logs (e.g., $x \equiv \log(X)$), c_r is a market-specific constant that is equal to $\log((1 - \alpha_r)\lambda\beta/\rho_r)/(1 + \lambda\beta/\rho_r)$, and h_j is the solution to a fixed-point equation.

- Combining equations (4)–(6), we obtain a structural equation for the log efficiency units of labor of firm $j \in J_r$:

$$(7) \qquad \ell_j(\bar{a}, \tilde{a}) = h_j + \frac{\lambda\beta}{1 + \alpha_r \lambda\beta}\bar{a} + \frac{\lambda\beta/\rho_r}{1 + \alpha_r \lambda\beta/\rho_r}\tilde{a},$$

- where h_j (see definition in Lemma 3 in online Appendix A.1) can be interpreted as the efficiency units of labor the firm would have if ã and a– were exogenously set to zero.

- The key component of h_j is the vertical differentiation of firms due to the amenities.

- All else equal, better amenities raise the size of the firm, thus increasing its wage bill and value added.

- Furthermore, h_j also reflects worker composition, which depends both on the horizontal amenity differentiation of firms, as captured by $G_j(X)$; and on the complementarity in production, as captured by θ_j.

E. Rents, Compensating Differentials, and Allocative Inefficiencies

- Worker Rents.—In our model, rents are due to the idiosyncratic taste component ϵ_{ijt} that gives rise to horizontal differentiation of firms, upward sloping labor supply curves, and employer wage-setting power.
- We assume that employers do not observe the idiosyncratic taste for amenities of any given worker.
- This information asymmetry implies that firms cannot price discriminate with respect to workers' reservation wages.
- As a result, the equilibrium allocation of workers to firms creates surpluses or rents for inframarginal workers, defined as the excess return over that required to change a decision, as in Rosen (1986) and Alfred Marshall (1890).
- In our model, worker rents may exist at both the firm and the market level.

- RESULT 1: *We define the* **firm-level rents** *of worker* i, R_{it}^{w}, *as the surplus she derives from being inframarginal at her current choice of firm. Given her equilibrium choice* $j(i,t), R_{it}^{w}$ *is implicitly defined by*

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

- *As shown in Lemma 4 in online Appendix A.2, expected worker rents at the firm level are*

$$E\big[R_{it}^{w} \,|\, j(i,t) = j\big] = \frac{1}{1 + \lambda\beta/\rho_{r(j)}} E\big[W_{jt}(X_i) \,|\, j(i,t) = j\big].$$

- *RESULT 2: We define the* **market-level rents** *of worker* i, R_{it}^{wm}, *as the surplus derived from being inframarginal at her current choice of market.*

- *Given her equilibrium choice of market* $r(j(i,t),)$ R_{it}^{wm} *wit m is implicitly defined by*

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

- *As shown in Lemma 4 in online Appendix A.2, expected worker rents at the market level are*

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

- To interpret the measure of firm-level rents and link it to compensating differentials, it is useful to express R_{it}^{w} in terms of reservation wages.

- The worker's reservation wage for her current choice of firm is defined as the lowest wage at which she would be willing to continue working in this firm.

- Substituting preferences into the above definition of R_{it}^{w} for a worker whose current firm is j and next best option is j', it follows that

$$\underbrace{\log W_{j(i,t),t}(X_i)}_{\text{current wage}} - \underbrace{\log\left(W_{j(i,t),t}(X_i) - R_{it}^{w}\right)}_{\text{reservation wage}} = \underbrace{\log W_{j(i,t),t}(X_i)}_{\text{current wage}} - \underbrace{\log W_{j'(i,t),t}(X_i)}_{\text{wage at best outside option}}$$
$$+ \underbrace{\log G_{j(i,t)}^{1/\lambda}(X_i)\, e^{\frac{1}{\lambda\beta}\epsilon_{ij(i,t)t}}}_{\text{current amenities}}$$
$$- \underbrace{\log G_{j'(i,t)}^{1/\lambda}(X_i)\, e^{\frac{1}{\lambda\beta}\epsilon_{ij'(i,t)t}}}_{\text{amenities at best outside option}}.$$

- RESULT 3*: Consider $worker\ i$ of $type\ X$ whose current firm is j and best outside option is j' and who is marginal at the current firm (that is, $R_{it}^{w} = 0$).

- *The between j and j' for a worker of $type\ X$ is then defined as* **compensating differential**

$$CD_{jj't}(X) = u_{it}\big(j', W_{jt}(X)\big) - u_{it}\big(j, W_{jt}(X)\big) = \log W_{j't}(X) - \log W_{jt}(X)$$

$$= \big(\theta_{j'} - \theta_j\big)x + \psi_{j't} - \psi_{jt},$$

- *where the second equality becomes the fact that worker i is marginal, and the last equality follows from equation (4) and defining the firm effect ψ_{jt} as*

$$(8) \qquad \psi_{jt} \equiv c_r - \alpha_r h_j + \frac{1}{1 + \alpha_r \lambda \beta} \bar{a}_{r(j),t} + \frac{1}{1 + \alpha_r \lambda \beta / \rho_r} \tilde{a}_{jt}.$$

- ***Employer Rents***.—The equilibrium allocation of workers to firms may also create surpluses or rents for employers.

- The employer rents arise because of the additional profit the firm can extract by taking advantage of its wage-setting power.

- To measure employer rents, we therefore compare the profit Π_{jt} the firm actually earns to what it would have earned if the employer solved the firm's problem under the assumption that the labor supply it faced was perfectly elastic.

- In other words, wages, profits, and employment are such that $D_{jt}^{pt}(X)$ solves the firm's profit maximization given $W_{it}^{pt}(X)$:

$$\Pi_{jt}^{pt} = \max_{\{D_{jt}^{pt}(X)\}_X} A_{jt} \left(\int X^{\theta_j} \cdot D_{jt}^{pt}(X)\, dX \right)^{1-\alpha_{r(j)}} - \int D_{jt}^{pt}(X) \cdot W_{jt}^{pt}(X)\, dX.$$

- RESULT 4: *We define the* **employer rents** *at the firm level* R_{jt}^{f} *and at the market level* R_{jt}^{fm} *as the additional profit that firm* j *in market* r *derives by taking advantage of its wage-setting power:*

$$R_{jt}^{f} = \Pi_{jt} - \Pi_{jt}^{pt} = \left(1 - \frac{\alpha_r(\rho_r + \lambda\beta)}{\rho_r + \alpha_r\lambda\beta}\left(\frac{\lambda\beta}{\rho_r + \lambda\beta}\right)^{-\frac{(1-\alpha_r)\lambda\beta}{\rho_r+\alpha_r\lambda\beta}}\right)\Pi_{jt},$$

$$R_{jt}^{fm} = \Pi_{jt} - \Pi_{jt}^{ptm} = \left(1 - \frac{\alpha_r(\rho_r + \lambda\beta)}{\rho_r + \alpha_r\lambda\beta}\left(\frac{\lambda\beta}{\rho_r + \lambda\beta}\right)^{-\frac{(1-\alpha_r)\lambda\beta}{1+\alpha_r\lambda\beta}}\right)\Pi_{jt};$$

- *where the latter equality in each equation is shown in Lemmas 5 and 6 in online Appendix A.3.*

II. Data Sources and Sample Selection

A. Data Sources

B. Sample Selection

III. Identification

- We now describe how to take our model to the data, providing a formal identification argument while summarizing, in Table 1, the parameters needed to recover a given quantity of interest and the moments used to identify these parameters.

- Our results reveal that many of these quantities do not require knowledge of all the structural parameters.

- Thus, some of our findings may be considered more reliable than others.

Table 1—Quantities of Interest, Model Parameters, and Targeted Moments

Name		Unique parameters	Mean estimate	Moments of the data	
Panel A. Rents and scale					
Idiosyncratic taste parameter	β	1	4.99	Market pass-through	$\frac{E[\Delta \bar{y}_{rt}(\bar{w}_{rt+e} - \bar{w}_{rt-e'}) \| S_i = 1]}{E[\Delta \bar{y}_{rt}(\bar{y}_{rt+e} - \bar{y}_{rt-e'}) \| S_i = 1]}$
Taste correlation parameter	ρ_r	8	0.70	Net pass-through	$\frac{E[\Delta \tilde{y}_{jt}(\tilde{w}_{it+e} - \tilde{w}_{it-e'}) \| S_i = 1, r(j) = r]}{E[\Delta \tilde{y}_{jt}(\tilde{y}_{jt+e} - \tilde{y}_{jt-e'}) \| S_i = 1, r(j) = r]}$
Returns to scale parameter	α_r	8	0.21	Labor share	$E[b_{j(i,t)} - y_{j(i,t)} \| r(j) = r]$
Name		**Unique parameters**	**Var. estimate**	**Moments of the data**	
Panel B. Firm and worker heterogeneity					
Time-varying firm premium	ψ_{jt}	10,669,602	0.02	Structural wage equation	$E[w_{it} - \frac{1}{1+\lambda\beta}\bar{y}_{r,t} - \frac{\rho_r}{\rho_r + \lambda\beta}\tilde{y}_{j,t} \| r(j) = r]$
Firm-specific technology parameter	θ_j	10	0.04		
Worker quality	x_i	61,670,459	0.31	Wage changes around moves	$E[w_{it+1} \| j \to j'] - E[w_{it} \| j' \to j]$ $E[w_{it} \| j' \to j] - E[w_{it+1} \| j \to j']$
Amenity efficiency units at neutral TFP	h_j	1,953,915	0.14		
Time-varying firm-specific TFP	$\tilde{a}_{jt}$	10,669,602	0.14	Total labor input and time-varying firm premium	$\ell_{jt} = \log \sum X_i^{\theta_j}$ and ψ_{jt}
Time-varying market-specific TFP	$\bar{a}_{rt}$	111,829	0.12		
Name		**Unique parameters**	**Var. estimate**	**Moments of the data**	
Panel C. Model counterfactuals					
Preferences for amenities for:	$g_j(X)$	6,974,519	0.20	Firm size	$\Pr[j]$
Firm j for workers of quality X				Firm composition	$\Pr[x \| k(j) = k]$
Market r for workers of quality X				Market composition	$\Pr[x \| r(j) = r]$

Note: This table displays the model parameters and the moments targeted in their estimation.

A. Rents of Workers and Employers

- *Ideal Experiment*.—To see how one may recover $(\beta, \rho_r, \alpha_r)$, consider the structural equations (4) and (5) that express wages $w_j(x, \bar{a}, \tilde{a})$ and value added $y_j(\bar{a}, \tilde{a})$ as functions of model primitives $\Gamma = (\bar{p}_r, \tilde{p}_j, g_j(x), x_i)$ and potential firm and market-level productivity outcomes $(\bar{a}, \tilde{a})$.

- Suppose we were able to independently and exogenously change $\tilde{a}$, the component of productivity that is specific to a firm, and $\bar{a}$, the component of productivity that is common to all firms in a market.

- As evident from equations (4) and (5), exogenous changes in $\tilde{a}$ and $\bar{a}$ affect both the wages a firm offers to its workers of a given quality, $w_j(x, \bar{a}, \tilde{a})$, and the firm's value added, $y_j(\bar{a}, \tilde{a})$.

- We can express the ratio of these effects as

$$\frac{\partial w_j(x,\bar{a},\tilde{a})}{\partial \tilde{a}} \left(\frac{\partial y_j(\bar{a},\tilde{a})}{\partial \tilde{a}} \right)^{-1} = \frac{1}{1+\lambda\beta/\rho_r} \equiv \gamma_r,$$

$$\frac{\partial w_j(x,\bar{a},\tilde{a})}{\partial \bar{a}} \left(\frac{\partial y_j(\bar{a},\tilde{a})}{\partial \bar{a}} \right)^{-1} = \frac{1}{1+\lambda\beta} \equiv \Upsilon;$$

- where we refer to γ_r and Υ as the firm-level and market-level pass-through rates.

- Next, equations (5) and (6) imply

$$(9) \qquad E[y_{jt} - b_{jt} | j \in J_r] = -c_r = -\log(1 - \alpha_r) - \log\left(\frac{\lambda\beta/\rho_r}{1 + \lambda\beta/\rho_r}\right).$$

- Since $E[y_{jt} - b_{jt}|j \in J_r]$ can be estimated directly from the data, and λ is known, it follows that α r is identified given (β, ρ_r) , which are in turn identified from (γ_r , Υ).

- Thus, the key challenge for identifying $(\beta, \rho_r, \alpha_r)$ is to identify (γ_r , Υ).

- Consider first how to recover the market-level pass-through rate, Υ.
- Let $\bar{y}_{rt}$ denote market-level average log value added and $\bar{w}_{rt}$ denote market-level average log earnings for the sample of stayers in market r.
- Suppose for simplicity that workers can be assigned to two groups of firms in year t : one half has $\Delta\bar{y}_{r(i)t} = +\delta$ (treatment group) and the other half has $\Delta\bar{y}_{r(i)t} = -\delta$ (control group).
- Implicitly conditioning on stayers ($S_i = 1$) at firms in region $r(j(i,t) = j \in J_r)$, we construct the following estimand:

$$\frac{E\left[\bar{w}_{rt+e} - \bar{w}_{rt-e'} \middle| +\delta\right] - E\left[\bar{w}_{rt+e} - \bar{w}_{rt-e'} \middle| -\delta\right]}{E\left[\bar{y}_{rt+e} - \bar{y}_{rt-e'} \middle| +\delta\right] - E\left[\bar{y}_{rt+e} - \bar{y}_{rt-e'} \middle| -\delta\right]},$$

- where $e + t$ is a postperiod e years after t and $t - e'$ is a preperiod e' years before t.

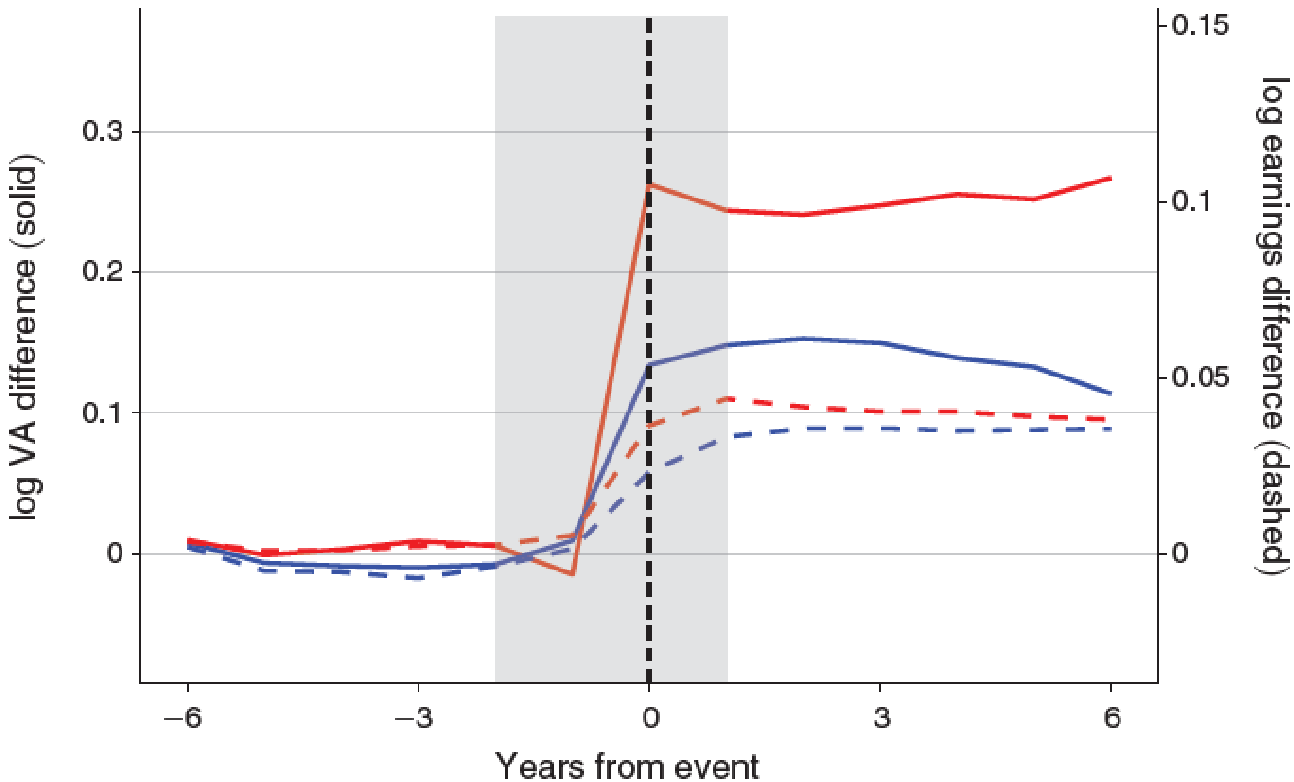
- In Figure 1, we visualize and assess this DiD strategy at the market level.

- The blue line in this figure is constructed as follows: in any given calendar year t , we (i) order markets according to the increase $\Delta\bar{y}_{rt}$; (ii) separate the firms at the median in the worker-weighted distribution of $\Delta\bar{y}_{rt}$, letting the upper half constitute the treatment markets and the lower half the control markets; and (iii) plot the differences in $\bar{y}_{rt+e}$ between these two groups in period $e = 0$ as well as in the years before ($e < 0$) and after ($e > 0$) .

- We perform these steps separately for various calendar years, weighting each market by the number of workers.

- The solid (dashed) blue line represents the difference in log value added (earnings) for the treatment and control markets.

Figure 1. DiD
Representation of the Estimation Procedure



Notes: This figure displays the mean differences in log value added (VA; solid lines) and log earnings (dashed lines) between firms that receive an above-median versus below-median log value-added change at event time zero. Results are presented for the measures of log value added and log earnings net of market interacted with year effects (red lines) and for the averages of log value added and log earnings by market and year (blue lines). The shaded area denotes the time periods during which the orthogonality condition need not hold in the identification of the permanent pass-through rate.

- Formal Identification Using Internal Instruments.—We now turn to the formal identification argument for the internal instruments to identify (γ_r, Υ).

- To this end, we specify a process for the productivity shocks to firms.

- Suppose that firm productivity evolves as a unit root process at both the firm level and market level:

$$\tilde{a}_{jt} = \tilde{p}_j + \tilde{z}_{jt}, \quad \text{where} \quad \tilde{z}_{jt} = \tilde{z}_{jt-1} + \tilde{u}_{jt}; \tag{10}$$

$$\bar{a}_{rt} = \bar{p}_r + \bar{z}_{rt}, \quad \text{where} \quad \bar{z}_{rt} = \bar{z}_{rt-1} + \bar{u}_{rt}. \tag{11}$$

- To ensure relevance of the internal instrument, we first assume that productivity shocks exist.

- Denoting the variance of $\tilde{u}$ by $\sigma^2_{\tilde{u}}$ and the variance of $\bar{u}$ by $\sigma^2_{\bar{u}}$, we require the following.

ASSUMPTION 1: *The variances of productivity shocks at the firm and market levels are strictly positive; i.e.,* $\sigma^2_{\tilde{u}} > 0$ *and* $\sigma^2_{\bar{u}} > 0$.

We also allow for measurement error ν_{jt} in the observed value added in the form of a transitory component with finite time dependence; i.e., $y_{jt} = y_j(\bar{a}_{r(j)t}, \tilde{a}_{jt}) + \nu_{jt}$. It is necessary to invoke some restrictions on the relationships between the primitives. Denoting the history of time-varying unobservables at time t by $\Omega_t \equiv \{\tilde{u}_{jt'}, \bar{u}_{rt'}, \epsilon_{ijt'}\}_{i,j,r,t' \leq t}$, we assume the following.

ASSUMPTION 2: *The value-added measurement error* ν_{jt} *is (i) mean independent of* Ω_T, *i.e,* $E[\nu_{jt} | \Omega_T] = 0$; *and (ii) has finite time dependence, i.e.,* $E[\nu_{jt}\nu_{jt'} | \Omega_T] = 0$ *if* $|t - t'| \geq 2$.

We also allow for measurement errors v_{it} in earnings; i.e., $w_{it} = w_{j(i,t)}\left(x_i, \bar{a}_{r(j(i,t))t}, \tilde{a}_{j(i,t)t}\right) + v_{it}$. We then make the following assumption.

ASSUMPTION 3: *The wage measurement error v_{it} is mean independent of value-added measurement error and Ω_T; i.e.,* $E\left[v_{it} | \nu_{j1}, \ldots, \nu_{jT}, \Omega_T\right] = 0$.

- Under Assumptions 2 and 3, we derive in online Appendix C.1 the following moment conditions that identify (γ_r, Υ):

$$(12) \quad E\left[\Delta \tilde{y}_{jt}\left(\tilde{w}_{it+e} - \tilde{w}_{it-e'} - \gamma_r\left(\tilde{y}_{jt+e} - \tilde{y}_{jt-e'}\right)\right) | S_i = 1, j(i) = j \in J_r\right] = 0,$$

$$(13) \quad E\left[\Delta \bar{y}_{rt}\left(\bar{w}_{rt+e} - \bar{w}_{rt-e'} - \Upsilon\left(\bar{y}_{rt+e} - \bar{y}_{rt-e'}\right)\right) | S_i = 1, j(i) = j \in J_r\right] = 0;$$

- for $e \geq 2, e' \geq 3$, where $\bar{y}_{rt} \equiv E[y_{jt} | S_i = 1, j(i,t) = j \in J_r]$ and $\bar{w}_{rt} \equiv E[w_{it} | S_i = 1, j(i) = j \in J_r]$ are market-level means, $\widetilde{w}_{it} = w_{it} - \overline{w}_{rt}$ and $\tilde{y}_{jt} = y_{jt} - \bar{y}_{rt}$ are deviations from market-level means, and $S_i = 1$ denotes a worker who does not change firms between $t - e'$ and $t + e$.

- To see why external instruments can achieve identification under weaker assumptions, we derive the wage equation in the presence of time-varying firm ($\tilde{g}_{jt}$) and market ($\bar{g}_{rt}$) level amenities.

- As shown in Lemma 8 in online Appendix A.5, the structural wage equation is the same as in (6) except for the amenity term h j which is now time-varying and given by

$$h_{jt} = \check{h}_{j(i,t)} + \frac{\alpha_{r(i,t)}\beta}{1+\alpha_{r(i,t)}\lambda\beta}\bar{g}_{r(i,t)t} + \frac{\alpha_{(i,t)}\beta/\rho_{(i,t)}}{1+\alpha_{r(i,t)}\lambda\beta/\rho_r}\tilde{g}_{j(i,t)t},$$

- and can be aggregated at the market level to $\bar{h}_{rt} \equiv E[h_{jt}|j \in J_r]$.

- Suppose we observe an instrument for firm-level TFP $\tilde{a}$, denoted $\widetilde{\Lambda}_{jt}$, satisfying the following firm-level condition.

ASSUMPTION 4: *The firm-level instrument $\tilde{\Lambda}_{jt}$ is relevant for firm-level productivity changes,* $E\left[\tilde{\Lambda}_{jt}\left(\tilde{a}_{j(i),\,t+e} - \tilde{a}_{j(i),\,t-e}\right)|S_i = 1, j(i) = j \in J_r\right] \neq 0$; *and exogenous of changes in firm-level amenities h_{jt},* $E\left[\tilde{\Lambda}_{jt}\left(h_{j(i),\,t+e} - h_{j(i),\,t-e'}\right)|S_i = 1, j(i) = j \in J_r\right] = 0.$

- Furthermore, suppose we observe a market-level instrument for market-level TFP $\bar{a}$, denoted $\bar{\Lambda}_{rt}$, satisfying the following market-level condition.

ASSUMPTION 5: *The market-level instrument* $\bar{\Lambda}_{rt}$ *is relevant for market-level productivity changes,* $E\left[\bar{\Lambda}_{rt}(\bar{a}_{rt+e} - \bar{a}_{rt-e}) | S_i = 1, j(i) = j \in J_r\right] \neq 0,$ *and exogenous of changes in market-level amenities* $\bar{h}_{rt}$, $E\left[\bar{\Lambda}_{rt}(\bar{h}_{rt+e} - \bar{h}_{rt-e}) | S_i = 1, j(i) = j \in J_r\right] = 0.$

- Impose Assumptions 4 and 5 and invoke the restrictions on the measurement errors from Assumptions 2 and 3.

B. Quality of Workers and Technology and Amenities of Firms

- Consider first how to recover the time-invariant firm-specific earnings premium ψ_j as well as the firm-worker interaction parameter θ_j using the earnings of movers.

- To do so, we remove time-varying firm- and market-level components of earnings, which allows us to express the expected earnings of worker i in firm j in terms of only x_i, ψ_j, and θ_j:

$$(14) \quad E\left[\underbrace{w_{it} - \left(\frac{1}{1+\lambda\beta}(\bar{y}_{rt} - \bar{y}_{ri}) + \frac{\rho_r}{\rho_r + \lambda\beta}(\tilde{y}_{jt} - \tilde{y}_{j1})\right)}_{w_{it}^a} \middle| j(i,t) = j \in J_r\right]$$

$$= \theta_j x_i + \psi_j;$$

- where we refer to w_{it}^a as adjusted log earnings, and for $j \in J_r$ we define the firm fixed effect as

$$(15) \quad \psi_j \equiv c_r - \alpha_r h_j + \frac{1}{1+\lambda\beta}\tilde{p}_r + \frac{\rho_r}{\rho_r + \lambda\beta}\bar{p}_j.$$

- The fixed effect ψ_j is the common wage intercept in the firm that can be attributed to permanent productivity and amenities.

- The structure of the adjusted log earnings equation (14) matches the model of earnings of Bonhomme, Lamadon, and Manresa (2019) and implies the following set of moments:

$$E\left[\left(\frac{w^a_{it+1}}{\theta_{j'}} - \frac{\psi_{j'}}{\theta_{j'}}\right) - \left(\frac{w^a_{it}}{\theta_j} - \frac{\psi_j}{\theta_j}\right) \middle| j(i,t) = j, j(i,t+1) = j'\right] = 0.$$

- Bonhomme, Lamadon, and Manresa (2019) show that this set of moments uniquely identifies (ψ_j, θ_j) if a rank condition holds that workers moving to a firm are not of the exact same quality as workers moving from that firm; i.e.,

$$E\left[x_i \mid j(i,t) = j, j(i,t+1) = j'\right] \neq E\left[x_i \mid j(i,t) = j', j(i,t+1) = j\right].$$

C. Amenities and Worker Preferences

- We formalize this intuition in Lemma 9 in online Appendix C.5, showing that $G_j(X)$ can be identified from data on the allocation of workers to firms and markets.

- Using the probability that workers choose to work for firm j conditional on selecting market r, $P_r[j(i,t) = j|X, r(j) = r]$, we consider two firms $j \text{ and } j'$ in the same market r.

- The differences in size and composition of these firms depend on the gaps in wages and amenities:

$$\underbrace{\lambda\big((\theta_j - \theta_{j'})x_i + \psi_j - \psi_{j'}\big)}_{\text{wage gap}} + \underbrace{\log G_j(X) - \log G_{j'}(X)}_{\text{amenity gap}}$$
$$= \frac{\rho_r}{\beta} \log \underbrace{\frac{\Pr\big[j(i,t) = j|X, r(j) = r\big]}{\Pr\big[j(i,t) = j'|X, r(j') = r\big]}}_{\text{relative size by worker type}},$$

- where ρ_r/β is the inverse (pretax) firm-specific labor supply elasticity.

IV. Estimation Procedure, Parameter Estimates, and Fit

A. Empirical Specification

- Lastly, we also make the following discreteness assumption for the systematic components of firm amenities:

$$G_j(X) = \bar{G}_{r(j)} \tilde{G}_j G_{k(j)}(X),$$

- where we define the firm class $k(j)$ within market r using the classification discussed above interacted with the market.

- This multiplicative structure reduces the number of parameters we need to estimate while allowing for systematic differences in amenities across firms and markets $(\tilde{G}_j, \bar{G}_{r(j)})$ and heterogeneous tastes according to the quality of the worker $G_{k(j)}(X)$.

- As a result, amenities may still generate sorting of better workers to more productive firms, and compensating differentials may still vary across firms, markets, and workers.

B. Estimates of the Pass-Through Rates

- Estimates Using Internal Instruments.—In Table 2, we use the internal instruments to estimate the pass-through rates and the implied labor supply elasticities at both the firm and market levels.

- We directly implement the sample counterpart to equation (12) at the firm level under the assumption that measurement errors follow an MA(1) process $(e = 2, e' = 3)$.

- We allow γ_r, and thus ρ_r, to vary by broad market, where a broad market is a set of markets.

- In practice, we consider eight broad markets defined by a census region and goods versus services sectors (see Section II).

- Similarly, we directly implement the sample counterpart to equation (13) to estimate Υ.

Table 2—Estimates of Pass-through Rates and Labor Supply Elasticities

Panel A	Firm-level estimation	
Instrumental variable	Pass-through ($E[\gamma_r]$)	Implied elasticity
Internal instrument:	0.13	6.52
Lagged firm-level value-added shock under MA(1) errors	(0.01)	(0.56)
External instrument:	0.14	6.02
Procurement auction shock at firm level	(0.07)	(3.37)
Panel B	Market-level estimation	
Instrumental variable	Pass-through (Υ)	Implied elasticity
Internal instrument:	0.18	4.57
Lagged market-level value-added shock under MA(1) errors	(0.03)	(0.80)
External instrument:	0.19	4.28
Shift-share industry value-added shock	(0.04)	(1.13)

Notes: This table summarizes estimates of the pass-through rates and implied pretax labor supply elasticities when using internal or external instrumental variables. Panel A provides these estimates at the firm level, while panel B provides these estimates at the market level.

- In the first row of panel A, we estimate that the average firm-level pass-through rate γ_r is about 0.13 with a standard error of about 0.01.
- This suggests that the earnings of an incumbent worker increases by 1.3 percent if her firm experiences a 10 percent permanent increase in value added, controlling for common shocks in the market.
- The firm-level pass-through rate implies a firm-level (pretax) labor supply elasticity of about 6.5.
- This estimate implies that, holding all other firms' wage offers fixed, a 1 percent increase in a firm's wage offer increases that firm's employment by 6.5 percent.

- In the first row of panel B, we estimate that the market-level pass-through rate Υ is about 0.18 with a standard error of about 0.03.

- This suggests that the earnings of incumbent workers increases by 1.8 percent if all firms in their market experience a 10 percent permanent increase in value added.

- This finding highlights the importance of distinguishing between shocks that are specific to workers in a given firm versus those that are common to workers in a market.

- The market-level pass-through rate implies a market-level (pretax) labor supply elasticity of about 4.6.

- This estimate implies that, if all firms in a market increase their wage offers by 1 percent, each firm's employment in the market increases by 4.6 percent.

- In particular, we examine how firms in the construction sector respond to a plausibly exogenous shift in product demand through a DiD design that compares first-time procurement auction winners to the firms that lose, both before and after the auction.

- Formally, consider the cohort of firms that received a procurement contract in year t ($\mathcal{D}_{jt} = 1$) and the set of comparison firms that bid for a procurement in year t but lost ($\mathcal{D}_{jt} = 0$).

- Let e denote an event time relative to t and $\bar{e}$ denote the omitted event time.

- For each event time $e = -4, \ldots, 4$, the DiD regression is implemented as

$$w_{jt+e} = \underbrace{\sum_{e' \neq \bar{e}} \mathbf{1}\{e' = e\}\, \mu_{te'}}_{\text{event time fixed effect}} + \underbrace{\sum_{j'} \mathbf{1}\{j' = j\}\, \psi_{j't}}_{\text{firm fixed effect}} + \underbrace{\sum_{e' \neq \bar{e}} \mathbf{1}\{e' = e\}\, \mathcal{D}_{jt} \vartheta_{te'}}_{\text{treatment status by event time}} + \underbrace{\nu_{jte}}_{\text{residual}} .$$

C. Estimates of the Parameters Needed to Recover Rents

D. Worker Heterogeneity, Firm Wage Premiums, and Worker Sorting

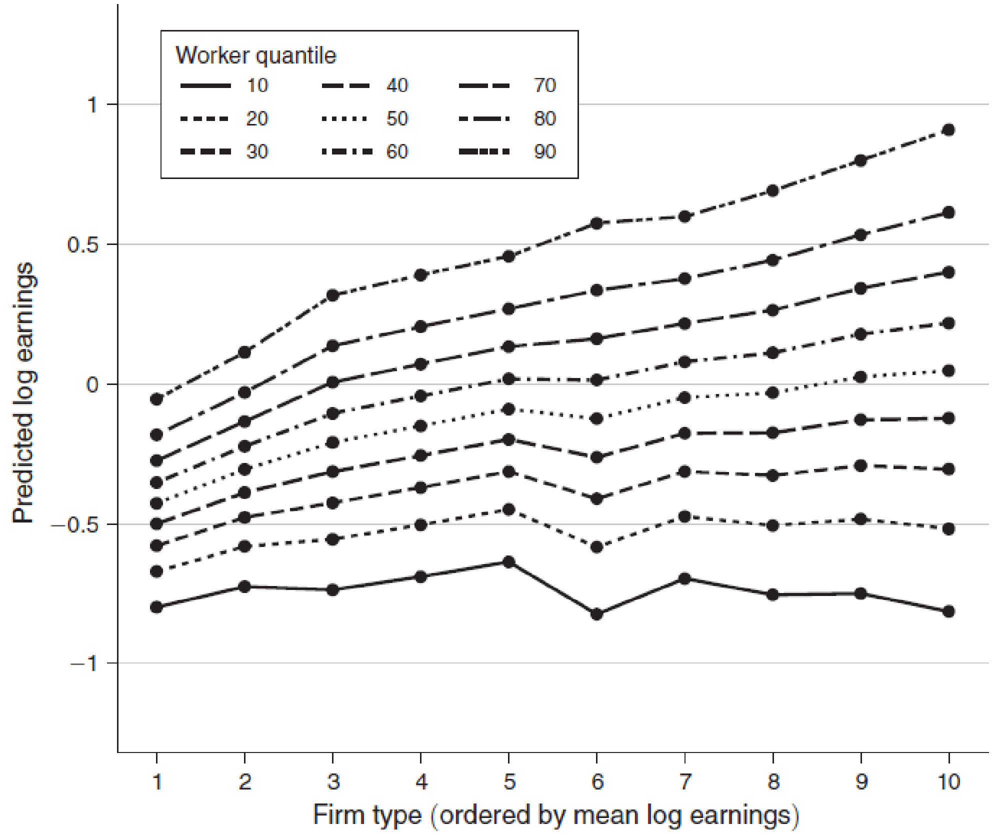
- Figure 2 summarizes the estimates (see our online Appendix for further details).

- On the y-axis, we plot the predicted log earnings for each firm type using the equation $\psi_k + \theta_k x_q$, where each quantile in the distribution of worker types x_q is presented as a separate line.

- On the x-axis, firm types are ordered in ascending order of mean log earnings.

- If $\psi_{k(j)}$ did not vary across firm types k, the typical worker would not experience an upward slope when moving from lower to higher firm types.

Figure 2. Predicted Log Earnings from the Estimated Model



Notes: In this figure, we summarize the estimates of worker ability x_i, time-invariant firm premiums $\psi_{k(j)}$, and firm-worker interactions $\theta_{k(j)}$ for ten firm groups k. On the y-axis, we plot the predicted log earnings for each firm type using the estimated equation $\psi_k + \theta_k x_q$, where each quantile in the distribution of worker types x_q is presented as a separate line. On the x-axis, firm types are ordered in ascending order, where "lower" and "higher" types refer to low and high mean log earnings.

- To compare and interpret the estimates of x_i, ψ_{jt}, and θ_j, we rearrange Equation (14) so that we can decompose log earnings as

$$w_{it} = \underbrace{\bar{\theta}(x_i - \bar{x})}_{\tilde{x}_i} + \underbrace{\psi_{j(i,t),t} - \psi_{j(i,t)}}_{\tilde{\psi}_{j(i,t),t}} + \underbrace{\left(\psi_{j(i,t)} + \theta_{j(i,t)}\bar{x}\right)}_{\tilde{\psi}_{j(i,t)}} + \underbrace{\left(\theta_{j(i,t)} - \bar{\theta}\right)(x_i - \bar{x})}_{\varrho_{ij(i,t)}} + v_{it},$$

- where $\bar{\theta} \equiv E[\theta_{j(i,t)}]$ and $\bar{x} \equiv E[x_i]$.

- This equation decomposes the earnings of worker i in period t into four distinct components: $\tilde{x}_i$ gives the direct effect of the quality of worker i (evaluated at the average firm), $\tilde{\psi}_{j(i,t)t}$ is the time variation in the firm premium due to the pass-through of value-added shocks, $\tilde{\psi}_{j(i,t)}$ represents the average effect of firm j (evaluated at the average worker), $\varrho_{ij(i,t)}$ captures the interaction effect between the productivity of firm j and the quality of worker i, and v it is the measurement error.

- Using this representation, we obtain a variance decomposition of log earnings:

$$\begin{aligned}
\operatorname{var}[w_{it}] = & \underbrace{\operatorname{var}[\tilde{x}_i]}_{\text{i) Worker Quality: 71.6\%}} + \underbrace{\operatorname{var}\left[\tilde{\psi}_{j(i,t)}\right]}_{\text{ii) Firm Effects: 4.3\%}} + \underbrace{2\operatorname{cov}\left[\tilde{x}_i, \tilde{\psi}_{j(i,t)}\right]}_{\text{iii) Sorting: 13.0\%}} \\
& + \underbrace{\operatorname{var}[v_{it}]}_{\text{iv) Meas. Error: 10.0\%}} + \underbrace{\operatorname{var}\left[\varrho_{ij(i,t)}\right] + 2\operatorname{cov}\left[\tilde{x}_i + \tilde{\psi}_{j(i,t)}, \varrho_{ij(i,t)}\right]}_{\text{v) Interactions: 0.9\%}} \\
& + \underbrace{\operatorname{var}\left[\tilde{\psi}_{j(i,t),t}\right] + 2\operatorname{cov}\left[\tilde{x}_i, \tilde{\psi}_{j(i,t),t}\right]}_{\text{vi) Time-varying Effects: 0.3\%}}.
\end{aligned}$$

E. Estimates of Remaining Parameters and Overidentification Checks

V. Empirical Insights from the Model

A. Rents and Labor Wedges

- Our first set of insights from the estimated model is about the rents and labor wedges that arise due to imperfect competition in the labor market.
- Table 3 presents estimates of the size of rents earned by American firms and workers from ongoing employment relationships.
- We find evidence of a significant amount of rents and imperfect competition in the US labor market due to horizontal employer differentiation.
- At the firm level, we estimate that workers are, on average, willing to pay 13 percent of their annual earnings to stay in their current jobs.
- This corresponds to about $5,400 per worker.
- By comparison, firms earn, on average, 11 percent of profits from rents (with profits being measured as value added minus the wage bill).

Table 3—Estimates of Rents and Rent Sharing (National Averages)

	Rents and rent shares			
	Firm level		Market level	
Workers' rents				
Per-worker dollars	5,447	(395)	7,331	(1,234)
Share of earnings	13%	(1%)	18%	(3%)
Firms' rents				
Per-worker dollars	5,780	(1,547)	7,910	(1,737)
Share of profits	11%	(3%)	15%	(3%)
Workers' share of rents	49%	(4%)	48%	(3%)

Notes: This table displays our main results on rents and rent sharing. Standard errors are in parentheses and are estimated using 40 block bootstrap draws in which the block is taken to be the market.

- This amounts to about $5,800 per worker in the firm.
- Thus, we conclude that firm-level rents from imperfect competition in the labor market are split equally between employers and their workers.
- At the market level, we estimate that rents are considerably larger than firm-level rents.
- Workers are, on average, willing to pay about $7,300 (18 percent of their annual earnings) to avoid having to work for a firm in a different market, which is almost $1,900 more than they would pay to avoid having to work for a different firm in the same market.
- The relatively large market-level rents reflect that firms within the same market are more likely to be close substitutes than firms in different markets.
- At the market-level, rents are again split almost evenly between firms and their workers.

B. Compensating Differentials

C. Understanding Firm Effects and Their Implications for Inequality

- As evident from equation (8), variation in the firm effects ψ_{jt} depends not only on the heterogeneity in firm amenities, but also on the differences in productivity across firms as well as the covariance between productivity and amenities within firms.

- The reason is that firms have wage-setting power, which generates a positive relationship between the firm's productivity and the wages it pays.

- To quantify the importance of these sources, consider the decomposition

$$\begin{aligned} \operatorname{var}\left(\psi_{j(i,t),t}\right) &= \underbrace{\operatorname{var}\left(c_r - \alpha_r h_{j(i,t)}\right)}_{\text{Amenities}} + \underbrace{\operatorname{var}\left(\frac{1}{1+\alpha_r \lambda \beta}\bar{a}_{rt} + \frac{1}{1+\alpha_r \lambda \beta / \rho_r}\tilde{a}_{j(i,t),t}\right)}_{\text{TFP}} \\ &\quad + \underbrace{2\operatorname{cov}\left(c_r - \alpha_r h_{j(i,t)}, \frac{1}{1+\alpha_r \lambda \beta}\bar{a}_{rt} + \frac{1}{1+\alpha_r \lambda \beta / \rho_r}\tilde{a}_{j(i,t),t}\right)}_{\text{Covariance between amenities and TFP}}. \end{aligned}$$

- These components can be broken down between and within broad markets and, within broad markets, further decomposed within and between markets.

- The results from these decompositions are reported in Table 4.
- The first panel reports results from our preferred approach described in Section IIIB.
- The second panel reports results from the standard approach of Abowd, Kramarz, and Margolis (1999), which may suffer from bias due limited worker mobility across firms and rules out firm-worker interactions.
- We find that the shares of the variance in firm effects explained by each component are fairly insensitive across these alternative estimation procedures.
- Either way, the results suggest substantial variation in amenities and productivity across firms.

Table 4—Decomposition of the Variation in Firm Premiums

	Between broad markets	Within broad markets: Between detailed markets	Within broad markets: Within detailed markets
Panel A. Preferred specification			
Total	0.4%	2.0%	3.1%
Decomposition			
Amenity differences	16.0%	7.8%	7.1%
TFP differences	15.5%	11.9%	8.6%
Amenity-TFP covariance	−31.1%	−17.7%	−12.6%
Panel B. Log-additive fixed effects specification			
Total	0.6%	2.8%	6.6%
Decomposition			
Amenity differences	15.7%	6.5%	7.2%
TFP differences	14.6%	13.2%	10.0%
Amenity-TFP covariance	−29.8%	−16.9%	−10.5%

Notes: This table displays our estimates of the decomposition of time-varying firm premium variation in three levels: variation between broad markets, between detailed markets (within broad markets), and between firms (within detailed markets). Broad markets are defined as the combination of census regions and broad sectors, and detailed markets are defined as the combination of industries and commuting zones. We decompose the variation in time-varying firm premiums into the contributions from amenity differences, TFP differences, and the covariance between amenity and TFP differences. All components are expressed as shares of log earnings variation. The first panel reports results from our preferred approach described in Section IIIB. The second panel reports results from the standard approach to estimate firm effects, as in Abowd, Kramarz, and Margolis (1999), which may suffer from bias due to limited worker mobility across firms and does not permit firm- worker interactions.

- If one were to ignore the covariance between amenities and productivity, the considerable heterogeneity in amenities and productivity across firms would imply that firm effects should have a large contribution to inequality.

- However, productive firms tend to have good amenities, which act as compensating differentials and push wages down in productive firms.

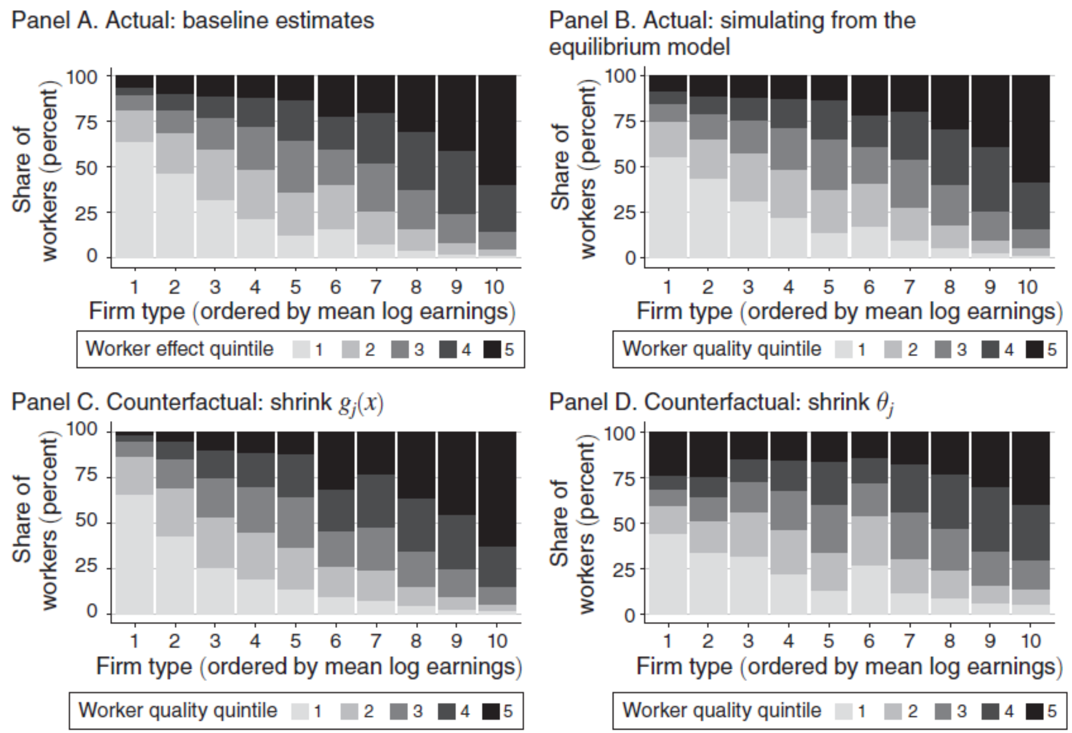
- As a result, firm effects explain only a few percent of the overall variation in log earnings.

- For example, firm effects within detailed markets explain 3.1 percent of the variation in log earnings, which is much less than predicted by the variances of firm productivity (8.6 percent) and amenities (7.1 percent).

D. Understanding Why Different Workers Sort into Different Firms, and the Implications of This Sorting for Inequality

- In Figure 3 panel A, we present the sorting of workers to firms in our data.
- In this figure, firm types are ordered along the x-axis in ascending order of mean log earnings.
- On the y-axis, we rank workers by their worker effects x i and divide them into five equally sized quintile groups.
- The bars present the share of workers within each firm type belonging to each quintile group.
- Figure 3 panel A reveals that the highest quality workers are vastly overrepresented at the highest paying firms.
- For example, in the lowest firm type, less than 10 percent of workers belong to the top quality quintile group.
- By contrast, in the highest firm type, about 60 percent of workers belong to the top group.

Figure 3. Actual and Counterfactual Composition of the Workforce by Firm Types



Notes: In this figure, we first compare the baseline estimates of the worker quality composition by firm type from the equation for firm wage premiums (15) in panel A versus those estimated using the equilibrium constraint by solving the fixed-point definition of h j as a function of $(\tilde{P}_j, \bar{P}_r, G_j(X)$, as shown in Lemma 3 in online Appendix A.1, then simulating the sorting of workers to firms (panel B). Then, we reduce the heterogeneity across firms in amenities or production complementarities by replacing either $g_j(x)$ with $(1-s)g_j(x) + s\bar{g}_j$, where $\bar{g}_j = E_x[g_j(x)], \bar{\theta} = E[\theta_j]$, then resimulate the equilibrium. Here, $s \in [0,1]$ is the shrink rate with s = 0 corresponding to the baseline model. We report the quality of the workforce by firm type for the counterfactual economies with s = 1/2 for either amenities (panel C) or production complementarities (panel D).

E. Implications of Imperfect Competition for Progressive Taxation and Allocative Efficiency

- For a set of wages $\{W_{jt}(X)\}_{j,t}$ and a tax policy (λ, τ), we define the welfare as

$$\mathcal{W}_t = E\left[\max_j u_{it}\left(j, (1+\phi_t)\tau W_{jt}(X_i)^{\lambda}\right)\right],$$

- where ϕ_t is the government spending rule set so that the government budget clears and profits and tax revenues are distributed among all the workers in proportion to their earnings:

$$\underbrace{\phi_t \cdot E\left[\tau W_{jt}(X_i)^{\lambda}\right]}_{\text{redistribution}} = \underbrace{\frac{1}{N}\sum \Pi_{jt}}_{\text{profits}} + \underbrace{E\left[W_j(X_i) - \tau W_j(X_i)^{\lambda}\right]}_{\text{government revenue}}.$$

- In other words, we redistribute aggregate profits and government tax revenues to workers in a nondistortionary way.

- The results are presented in Table 5. They suggest the monopsonistic labor market creates significant misallocation of workers to firms.

- Eliminating labor and tax wedges increases total welfare by 5 percent and total output by 3 percent.

- When we decompose this change by performing the counterfactuals one at a time, we find that 4 percentage points of the welfare gains are due to eliminating the labor wedge while the remaining 1 percentage point is due to eliminating the tax wedge.

- We also find that removing these wedges would increase the sorting of better workers to higher paying firms and lower the rents that workers earn from ongoing employment relationships.

- When we decompose this change by performing the counterfactual one at a time, we find that nearly all of the change in sorting is due to eliminating the tax wedge, with the labor wedge having a small impact on sorting.

Table 5—Consequences of Eliminating Tax and Labor Wedges

		Monopsonistic labor market (1)	No labor or tax wedges (2)	Difference between (1) and (2)
Log of expected output	$\log E[Y_{jt}]$	11.38	11.41	0.03
Total welfare (log dollars)		12.16	12.21	0.05
Sorting correlation	$\text{corr}(\psi_{jt}, x_i)$	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%	12.4%	–0.9%
Market level	$\frac{1}{1 + \beta\lambda}$	18.0%	16.7%	–1.3%

Notes: This table compares the monopsonistic labor market to a counterfactual economy which differs in two ways. First, we eliminate the tax wedge in the first order condition by setting the tax progressivity $(1 - \lambda)$ equal to zero. Second, we remove the labor wedges in the first order conditions of the firms by setting τ r equal to the labor wedge $1 + \rho_r/(\lambda\beta)$ in each market r. After changing these parameters of the model, we solve for the new equilibrium allocation and outcomes, including wages, output, and welfare. Results are displayed for output, welfare, the sorting correlation, the mean labor wedge, and worker rents.

VI. Conclusion