ORGANIZATIONS, SKILLS, AND WAGE INEQUALITY

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WHAT IS IT ABOUT?

$$\text{Var}\left(w_{it}\right) = \underbrace{\mathbb{E}\,\text{Var}\left(w_{it}|z_{it}\right)}_{\text{within}} + \underbrace{\text{Var}\,\mathbb{E}\left(w_{it}|z_{it}\right)}_{\text{between}}$$

- A model with worker and firm heterogeneity accounting for wage dispersion
- Within- and between-group components (+ $\triangle$ from mid-1980s to late 2000s) driven by:
  - TFP distribution
  - Value added per worker
  - Labor market frictions
  - Education

OUTLINE

1. Reviewing the properties of the model
2. A few comments on the estimation
3. Comments on the results and experiments
   - 3.1 how to disentangle labor market frictions and technology?
   - 3.2 what does ‘technological change’ actually measure/capture?

THE MODEL

- Burdett & Mortensen [IER '98] with two-sided heterogeneity

- Workers differ by skill-type, indexed by $i = 1, \ldots, N$
  - population measure $m(i)$
  - home production $b(i)$
  - friction parameters $\lambda(i)$ and $\delta(i)$

- Firms differ by TFP level x
  - x is drawn from distribution $\Gamma(\cdot)$
  - production function is $p(x, i)$

THE MODEL

Worker's problem:

$$rU(i) = b(i) + \lambda(i) f(i) \int_{R(i)} \left(W\left(w', i\right) - U(i)\right) dF_i\left(w'\right)$$

and

$$rW(w,i) = w + \lambda(i) f(i) \int_{w} \left(W\left(w', i\right) - W(w,i)\right) dF_i\left(w'\right) + \delta(i)\left(U(i) - W(w,i)\right)$$

- $f(i) = 1 - \Gamma(\underline{x}(i))$, where $\underline{x}(i)$ is the lowest x hiring type-i workers
- $F_i(w)$ is the distribution of posted wage offers
- On-the job search is as effective as off-the-job search, implying that

$$R(i) = b(i)$$

THE MODEL

- $\frac{\partial p}{\partial x}(x,i) \geq 0$; $\underline{x}(i)$ is pinned down by

$$p(\underline{x}(i),i) = b(i)$$

- $\frac{\partial p}{\partial i}(x,i) \geq 0$; the sign of $\frac{\partial \underline{x}}{\partial i}(i)$ is given by

$$b'(i) - \frac{\partial p}{\partial i}(\underline{x}(i),i)$$

Firm's problem:

$$\pi(x,i) = \max_{w} (p(x,i) - w)\,\ell(w;i)$$

Standard trade-off for wage posting

- higher $w \Rightarrow \downarrow$ profit per worker
- higher $w \Rightarrow \uparrow \ell(w;i)$ ($\uparrow$ hires and retention)

THE MODEL

Theorem 1: Firms with higher x are bigger and

1. hire more at all i's, and proportionally more at high i
2. hire i's who are hired by lower-x firms
3. hire i's that are beyond the reach of lower-x firms
4. pay higher w at all i's

Propositions 2 and 3: If $i > j$, then $F_i(w)$ (resp. $G_i(w)$) dominates $F_j(w)$ (resp. $G_j(w)$)

- corollary: average wages (posted and observed) increase with i

ESTIMATION/CALIBRATION

- Assumption: the economy is at a steady state in 1985 and 2009

Reminder:

$$f(i) = 1 - \Gamma(\underline{x}(i)) \text{ and } p(\underline{x}(i), i) = b(i)$$

- $m(i) = 5$ education levels
- $\delta(i)$ = EU transition rate
- $\lambda(i) f(i) (1 - \delta(i))$ = UE transition rate
- $b(i)$ = lowest wage by education

Note: no EE transition, no 'reallocation shock' (Jolivet, Postel-Vinay & Robin [EER '06])

ESTIMATION/CALIBRATION

1- Nonparametric approach

- follows Bontemps, Robin & van den Berg [IER '00]
- use wage distributions to recover the productivity distribution
- caveat: cannot separately estimate x and $p(x,i)$

2- Parametric approach

- suppose that $p(x,i) = x^{\alpha} A(i)^{\beta}$, with $\alpha + \beta = 1$ and $\beta \sim$ labor share
- fit the TFP distribution taken from an external source (İmrohoroğlu & Tuzel [MS '14])
- adjust $A(i)$ to match average wages by skill type

NONPARAMETRIC ESTIMATION

- Must impose some estimation restrictions:
  - single-peaked wage distribution for each type
    however, it seems that this condition is not fulfilled at the lower end of the wage distribution among low-skill workers
  - all firms hire all skill levels, i.e. $\Gamma\left(\underline{x}\left(i\right)\right) = 0$ for all i

- Under this approach, they are able to recover the distribution of $p\left(x, i\right)$
  - in other words, the results cannot be related to a given firm

PARAMETRIC ESTIMATION

- External distribution of firm-level TFP is possibly biased towards high TFP firms
- Conditional on this TFP distribution, part of the results become more heavily driven by the imposed theoretical structure
  - in the Burdett-Mortensen model, high TFP firms compete little with low TFP firms
  - ... so this TFP distribution boosts the competition among high TFP firms
  - ... and high TFP firms in the model hire proportionally more at the top skill level

PARAMETRIC ESTIMATION

Table 8: Variance Decomposition

Firm Decomposition

	Within-group	Between-group
1985	0.48	0.52
2009	0.60	0.40

Skill Decomposition

	Within-group	Between-group
1985 - Model	0.29	0.71
1985 - Data	0.81	0.19
2009 - Model	0.21	0.79
2009 - Data	0.77	0.23

- Size of the within-firm component of wage dispersion? Lentz, Piyapromdee & Robin ['18] find very small firm effects (much smaller than AKM firm effects)
- 2/3 of the rise in the variance of (log) earnings occurred between firms (Song, Price, Guvenen, Bloom & von Wachter [QJE '19])

OTHER COMMENTS ON THE ESTIMATION

- The estimation draws little on the results from Theorem 1
- Suppose that

$$p(x,i) = p_0 + p_1 x + p_2 x^2 + p_3 i + p_4 i^2 + p_5 x \cdot i$$

- To exploit this formula, you would need firm-level data moments, such as, e.g., moments on the joint distribution of firms' size and education composition of their workforce
- The new draft uses data from the Quarterly Workforce Indicators. Going in this direction?

RESULTS (NONPARAMETRIC APPROACH)

Table 5: St. Deviation Decomposition - within-group
(Values in $1000 2009 USD)

	HS Dropout	HS Grads	Some College	College Grads	Post Grads
1985 Benchmark	1.10	1.29	1.59	2.52	3.67
2009 Benchmark	.98	1.49	1.76	4.33	7.64
Difference	-0.12	0.19	0.17	1.81	3.98
Counterfactuals:					
Production	234.25%	38.81%	118.26%	110.30%	117.06%
Labor	-154.47%	49.90%	-15.56%	-4.65%	-6.83%
Education	0.00%	0.00%	0.00%	0.00%	0.00%
Production + Labor	100%	100%	100%	100%	100%

RESULTS (PARAMETRIC APPROACH)

Table 10: St. Deviation Decomposition - within-group
(Calculations using values in $1000 2009 USD)

	HS Dropout	HS Graduate	Some College	College	Post-Graduate
1985 - Benchmark	0.54	0.57	0.62	0.77	0.95
2009 - Benchmark	0.55	0.65	0.72	1.02	1.36
Difference	0.01	0.08	0.09	0.26	0.41
Counterfactuals:					
TFP	-75.76%	9.02%	28.62%	52.68%	69.13%
Labor	-42.73%	-5.53%	-2.42%	-0.02%	-0.09%
Education	0.00%	0.00%	0.00%	0.00%	0.00%
Labor Productivity	-387.74%	58.65%	55.99%	79.13%	86.92%
Production Fcn	-44.37%	0.16%	-0.00%	-0.85%	-2.34%

COUNTERFACTUAL EXERCISES

- 'Labor market frictions helped to attenuate the impact of SBTC'
  - separate out the effects of higher $\lambda(i)$ vs. lower $\delta(i)$
  - ... and their impact on earnings through the competition among firms
- Technological change (i.e. changes in the distribution of $p(x,i)$)
  - flesh out the interpretation of technological change
  - does technological change affect labor market frictions?
- Changes in permanent vs. transitory components of wage earnings

POSSIBLE EXPLANATIONS

1. Increased sorting of high-wage workers across high-wage firms
   Song, Price, Guvenen, Bloom & von Wachter [QJE '19]

2. Rising segregation of similar workers between firms

3. Changes in pay schemes (incidence of performance pay contracts)
   Card, Cardoso, Heining & Kline [JoLE '18]

OTHER POSSIBLY RELEVANT ISSUES

- Lower end of the wage distribution: role of changes in the minimum wage
  - during the 1980s, this explains 1/3 of the change in overall residual wage inequality
    DiNardo, Fortin & Lemieux [ECMA '96], Card & DiNardo [JoLE '02]
  - ideal theoretical framework to examine this issue

- Inequality at the top end of the wage distribution
  - a distinct model for large firms with 1000+ employees?
  - however, your data is not ideal to study this issue

CONCLUDING REMARKS

- This is really interesting and relevant work
  - a structural model showing the role of firms in explaining wage inequality
  - match key properties discussed in the empirical literature on organizations
- The authors take this structure to data over a long period
- Expect additional gains from using moments on firms' size, composition, and value added