Labor Economics, Week 4
Wage inequality, labor demand, Competitive model, and monopsony

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Takeaways for week 3 - Labor demand

1. Estimating labor demand
   - Regressions of relative wages on relative labor supply (possibly with instrument).
   - To assess the impact of migration or technical change on inequality.
   - Motivated by the competitive model of wage setting.

2. Minimum wages
   - The competitive model predicts that increasing minimum wages lowers employment.
   - Studies use difference-in-differences design across US states to estimate this effect.
   - Most find no effect on employment.

3. Monopsony
   - This has renewed interest in monopsony models of labor demand.
   - An employer has monopsony power if their labor supply is not infinitely responsive.
   - Monopsony power implies a non-monotonic relationship between minimum wages and employment.
Roadmap

Estimating labor demand

Minimum wages

Monopsony
Earned income is the largest source of household incomes (ca. 60%).

⇒ Wage inequality matters for income inequality.

Many factors might affect the wage distribution:

1. Labor supply of different “types” of workers
   1.1 Education
   1.2 Demographic change
   1.3 Migration

2. Labor demand
   2.1 Technology
   2.2 Trade

3. Institutions and policy
   3.1 Collective bargaining
   3.2 Social norms
   3.3 Minimum wages
   3.4 Tax system
What is the impact of labor supply on wages?

Large, controversial literatures on:

- What is the impact of immigration on native wage inequality?
- What is the impact of expanding / stagnating access to higher education on wage inequality?

- Detrended Wage Differential
- Detrended Relative Supply
Setup

- Types of workers $j = 1, \ldots, J$
  by level of education, country of birth, ...
- Cross-section of labor markets $i = 1, \ldots, n$
  e.g., metropolitan areas
  (some papers: time series $t = 1, \ldots, T$, or panel $i, t$)
- Wages $w_{ij}$
- Labor supply $N_{ij}$
A typical regression

Many papers estimate regressions such as:

$$\log \left( \frac{w_j}{w_{j'}} \right) = controls + \beta \cdot \log \left( \frac{N_j}{N_{j'}} \right) + \epsilon_{j,j'},$$

- possibly instrumenting for labor supply.
- We will discuss economic models justifying this regression.
- But don’t need to believe models for general interpretation!

Questions for you

Interpret this regression.
What is the meaning of $\beta$?
Assumption 1

- Output $Y_i$ in region $i$ is described by an aggregate production function:

$$Y_i = f_i(N_{i1}, \ldots, N_{iJ}).$$

- Marginal productivity theory of wages:

$$w_{ij} = \frac{\partial f_i(N_{i1}, \ldots, N_{iJ})}{\partial N_{ij}}$$

- Justified by competitive, profit maximizing firms
Reasons marginal productivity theory might not hold

- If effort / the qualification of applicants depend on wages, employers will not set wage = marginal productivity.
- If employers face upward sloping labor supply (search frictions!) they depress wages below marginal productivity, acting as a “monopsony.”
- With search frictions, there is match specific surplus, leaving room for bargaining.
- Who knows what the marginal productivity is, especially in large, complex firms?
- Social norms for remuneration.
- Collective bargaining.
- Labor markets do not clear.
- ...

...
Assumption 2

- Constant elasticity of substitution (CES) production function:

\[ f_i(N_{i1}, \ldots, N_{iJ}) = \left( \sum_{j=1}^{J} \gamma_j N_{ij}^\rho \right)^{1/\rho} \]

- Restricts the way different types of labor interact
- \( \rho - 1 \): “inverse elasticity of substitution”
  (we will see why)
- \( \gamma \): type-specific productivity
Questions for you

▶ Combine assumptions 1 and 2 to derive $w_{ij}$.
▶ Take the ratio of $w_{ij}$ and $w_{ij'}$.
▶ Take logarithms on both sides of the equation.
Answer: The wage equation

- Combining assumptions 1 and 2:

\[ w_{ij} = \frac{\partial f_i(N_{i1}, \ldots, N_{iJ})}{\partial N_{ij}} = \left( \sum_{j' = 1}^{J} \gamma_{j'} N_{ij'}^{\rho} \right)^{1/\rho - 1} \cdot \gamma_j \cdot N_{ij}^{\rho - 1} \]

- Taking ratios:

\[ \frac{w_{ij}}{w_{ij'}} = \frac{\gamma_j}{\gamma_{j'}} \cdot \left( \frac{N_{ij}}{N_{ij'}} \right)^{\rho - 1} \]

- Taking logs:

\[ \log \left( \frac{w_j}{w_{j'}} \right) = \log \left( \frac{\gamma_j}{\gamma_{j'}} \right) + \beta_0 \cdot \log \left( \frac{N_j}{N_{j'}} \right), \]

where \( \beta_0 = \rho - 1 \).
Aside: Capital, labor, and the long run evolution of capitalism

- Aggregate production functions show up in many debates
- More general form with capital goods $K$, technology $A$:
  \[ Y = f(N_1, \ldots, N_J, K_1, \ldots, K_M, A) \]

- Wages and rates of return:
  \[ w_j = \frac{\partial f}{\partial N_j} \]
  \[ r_m = \frac{\partial f}{\partial K_m} \]

- Wealth (market value of capital), given interest rate $r$:
  \[ \sum_m \frac{r_m}{r} \cdot K_m \]
Long standing debates

- Does technical change lead to increased inequality?
- What’s the distributional impact of international trade / globalization?
- Does the production function determine wages and profits, or leave room for power / collective action?
- What is the relationship between capital and wealth (capital times market prices)?
- Does an increase in $K$ lead to a fall in profit rates?
  cf. Marxist discussions about capitalist crises, imperialism.
  Answer depends on elasticities of substitution, technical change.
References

- Impact of migration:

- Domestic migration of African Americans:

- Technical change:
The competitive model predicts that raising minimum wages decreases employment.

What does the evidence say?

Many studies use a difference-in-differences design: Minimum wage raised in one state of the US but not other, similar states. Compare the changes in employment and earnings in similar states. Majority of recent studies finds no effect on employment. Cengiz et al. (2019) combine the evidence from lots of state minimum wage changes. Look at the effect on employment numbers across fine-grained wage cells.
Cengiz et al. (2019)

- 138 state-level minimum wage changes between 1979 and 2016 in the United States.
- Estimate the effect of the minimum wage increase on employment changes by wage bins, relative to the new minimum wage.
- Compare the number of excess jobs paying at or slightly above the new minimum wage to the missing jobs paying below it to infer the employment effect.
- The overall number of low-wage jobs remained essentially unchanged over the five years following the increase.
Inequality

Minimum wages

\[ \Delta a = 0.021 (0.003) \]
\[ \Delta b = -0.018 (0.004) \]
\[ \% \Delta \text{ affected employment} = 0.028 (0.029) \]
\[ \% \Delta \text{ affected wage} = 0.068 (0.010) \]
Monopsony

- This seems to contradict the competitive model: Raising wages yet not changing employment?
- This consistent empirical finding has renewed interest in monopsony models of the labor market.
- An employer has monopsony power if their labor supply is not infinitely elastic to the wage.
- Many reasons (static and dynamic) can lead to upward sloping labor supply for the employer.
The static monopsony model

- A firm chooses the number $L$ of workers it hires.
- Revenues equal $R(L)$ when hiring $L$ workers.
- In order to hire $L$ workers, it needs to pay a wage of $w(L)$.
- Competitive case: $w(L)$ is flat in $L$.
  Monopsony power: $w(L)$ is upward sloping.
- Firm profits:
  \[ \pi(L) = R(L) - w(L) \cdot L. \]
Questions for you

Solve for the profit maximizing wage and employment level in this model.
Solution

► First order condition:

\[ 0 = \pi'(L) = R'(L) - (w(L) + w'(L)L). \]

► Denote the inverse elasticity of labor supply by

\[ \eta = \frac{w'(L)L}{w}. \]

► Rearranging the FOC gives

\[ \frac{R'(L) - w(L)}{w} = \eta. \]

► The marginal revenue product \( R'(L) \) exceeds the wage by a factor of \( \eta \).

► Competitive benchmark: \( R'(L) = w(L) \).
Inequality

Monopsony

\[ MRP = R'(L) \]
(marginal revenue product)

\[ w(L) \]
Labor Supply

\[
(w(L) \cdot L)' = (w(L) + w'(L)L)
\]
Marginal Labor Cost

**Figure 1. Wage and Employment Determination under Monopsony**
Minimum wage in the monopsony model

- Now suppose that the firm is not allowed to pay a wage below $w_m$.
- How will it choose $L$ to maximize profits?

$$\arg\max_L \left( R(L) - \max(w(L), w_m) \cdot L \right)$$

Questions for you

Solve for the profit maximizing wage and employment level in the monopsony model when there is a minimum wage.

Hint: Distinguish between 3 different ranges for the minimum wage.
Solution

3 cases:

1. \( w_m \) is less than the solution of the monopsony FOC:
   \[
   L^* = \arg\max_L \left( R(L) - w(L) \cdot L \right).
   \]

2. \( w_m \) is greater than the solution of the competitive FOC:
   \[
   L^* = \arg\max_L \left( R(L) - w_m \cdot L \right).
   \]

3. \( w_m \) is between these two values:
   Corner solution \( w(L) = w_m \).

Comparative statics:

- For low \( w_m \), employment is constant in \( w_m \).
- For intermediate \( w_m \), employment is increasing in \( w_m \).
- For high \( w_m \), employment is decreasing in \( w_m \).
Sources of monopsony power

- Market Concentration
- Employer Collusion
- Employer Use of Non-Compete Agreements
- Search Costs and Labor Market Frictions
- Regulatory Barriers to Worker Mobility
- ...

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References

