Monopsonistic Competition: Diagnosis and Remedies

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February 24, 2020
Introduction

- Monopsonistic labor markets
  - Explosion of research
  - No disemployment after minimum wage

- Heterogeneity matters
  - Exit of firms on the margin
  - Price increases

- Recent theoretical advances
  - Thisse & Ushchev (2016)
  - Dhingra & Morrow (2019)
  - Baqaee & Farhi (2020)

Cengiz et. al (2019)
Luca & Luca (2019)
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**Key Questions**

1. Does monopsony \(\Rightarrow\) inefficient competitive equilibrium?
2. Which sufficient statistics matter?
3. When can a minimum wage improve welfare?
This Paper

- Foundation of monopsonistic competition:
  1. Micro to Macro
  2. Yields general Kimball aggregator
  3. Links shape of aggregator to individual elasticities

- Welfare analysis of monopsonistic competition:
  1. Heterogeneous Firms $\implies$ Rich allocation patterns
  2. General functional forms $\implies$ Variables markups and markdowns
  3. Entry $\implies$ Non-trivial efficiency

- Minimum wage:
  1. Interacts will entry, misallocation, and selection
  2. Identifies elasticities needed for assessment
Literature


Outline

1. Micro to Macro

2. Macroeconomic Framework

3. Welfare

4. Minimum Wage
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Monopsonistic Competition

- **Goal:** aggregation to a canonical macro model

- Monopsonistic power of firms comes from preferences of RA:

  \[ U(C, L) = \frac{c^{1-\gamma}}{1-\gamma} - L \]

  With a Kimball aggregator for labor:

  \[ \int \mathcal{K}\left(\frac{l_i}{L}\right) \, di = 1 \]

  So elasticity of labor supply is finite:

  \[ w_i = W \mathcal{K}'\left(\frac{l_i}{L}\right) \]

  So what matters for welfare will be first-order and second-order elasticities of the aggregator \( \mathcal{K} \)

- Key is how to estimate them?
Micro to Macro: Setup

- Thiffe & Ushchev (2016)

- Discrete choice model

- Idiosyncratic preferences for working at some firm $i$

- Given posted wages workers can work at any firm they wish

- Idiosyncratic tastes drawn from Gumbel distribution

- Probability to choose a given firm $\Rightarrow$ logit choice probabilities
A CES system arises when the indirect utility at the micro level is logarithmic.

Specifically, an individual $i$ has a disutility of supplying $h_j$ to firm $j$ equal to:

$$V_{ij}(h_j) = \ln(h_j) + \mu \epsilon_{ij}$$

where the term $\epsilon_{ij}$ is worker-firm specific, and is i.i.d. under a Gumbel density.

If a worker wants to earn an income $y$, then given the wage $w_j$ offered by the firm his disutility would become:

$$V_{ij}(h_j) = \ln(w_j) - \ln(y) + \mu \epsilon_{ij}$$

which is the expression the worker solves to find the optimal firm to work at.
The probability that worker $i$ chooses firm $j$ is then:

$$P_j = \frac{e^{ln(\frac{w_j}{y})/\mu}}{\int_k e^{ln(\frac{w_k}{y})/\mu}} = \frac{w_j^{1/\mu}}{\int_k w_k^{1/\mu}}$$

the familiar CES formulation.

CES hence directly comes from logarithmic disutility of labor.
The Kimball case (1)

- The supply curve for labor is of the form:

\[
  w_i = \frac{\mathcal{K}'\left(\frac{l_i}{L}\right)}{\int \frac{l_j}{L} \mathcal{K}'\left(\frac{l_j}{L}\right) dj}
\]

- Which has a flavor of probability like in the CES case

- Rewrite to have the amount of labor supply to firm \( i \):

\[
  l_i = \int_j l_j w_j \frac{w_i}{W} \mathcal{K}'^{-1}(\frac{w_i}{W}) \frac{w_i}{w_i} \int_j \frac{w_j}{W} \mathcal{K}'^{-1}(\frac{w_j}{W})
\]

- The first term \( \int_j l_j w_j \) is income

- Change the micro utility to get \( l_i \) as a probability to work at firm \( i \)
The Kimball case (2)

▶ Set the individual utility as:

\[ \ln \left( \psi \left( \frac{w_i}{W} \right) \right) + \epsilon_i \]

▶ Assume further that given the wage offered, each worker needs to make in total \( y \sim F(y) \), hence to work \( y/w_i \) hours

▶ Then hours supplied to firm \( i \) will be equal to:

\[
l_i = \frac{\bar{y}}{w_i} \frac{w_i \psi(w_i/W)}{\int_j w_j \psi(w_j/W)}
\]

▶ Which is our Kimball expression when \( \bar{y} \) is income and \( \psi = (\mathcal{K}')^{-1} \)

▶ Individual utility is:

\[
\ln \left( (\mathcal{K}')^{-1} \left( \frac{w_i}{W} \right) \right) + \epsilon_i
\]
Estimation

- For a set of wages \( \{w_i\} \), once we construct the wage index \( W \), the theory implies that the probability of a worker to work at firm \( i \) is:

\[
P_i = \frac{\frac{w_i}{W} \psi\left(\frac{w_i}{W}\right)}{\int \frac{w_j}{W} \psi\left(\frac{w_j}{W}\right)}
\]

- Because the fraction is a normalizing coefficient, it is the same for every firm and we can write it:

\[
\ln P_i = \ln \left(\frac{w_i}{W} \psi\left(\frac{w_i}{W}\right)\right) - C
\]

- AKM flavor: what explains that similar workers are choosing different firms offering different wages?

- Estimating this relationship allows for recovering the shape of \( x \cdot \psi \), and so indirectly the shape of \( (\mathcal{K}')^{-1} \)
Relation with Literature and CES

\[ \ln P_i = \ln \left( \frac{w_i}{\bar{W}} \psi \left( \frac{w_i}{\bar{W}} \right) \right) - C \]  

- The usual estimation equation for labor supply elasticity is:

\[ \ln h_i = \beta_i \ln w_i + \text{controls} + \epsilon_i \]

- The two equations are similar when:

\[ \phi(w) = w^{\beta - 1} \]

- This is equivalent to the CES model:

\[ K(x) = x^{\frac{\beta}{\beta - 1}} \]

because the linear regression is implicitly saying that the elasticity of labor supply is constant.
Estimation: \( W \)

- Issue: the construction of \( W \) (for it to be model-consistent) depends on the aggregator \( \mathcal{K} \) that we are trying to recover
- The wage index is:

\[
W = \int \frac{l_j}{L} \mathcal{K}' \left( \frac{l_j}{L} \right) \, dj = \int \frac{l_j}{L} \psi^{-1} \left( \frac{l_j}{L} \right) \, dj
\]

where \( l_i \) is measurable in the data, and \( L \) too once you have \( \mathcal{K} \) by:

\[
\int \mathcal{K} \left( \frac{l_j}{L} \right) \, dj = 1
\]

- Proposal: fixed-point algorithm:
  1. Construct \( W \) just by taking the average wage
  2. Estimate the relationship with \( w/W \)
  3. Recover the shape of \( \mathcal{K} \)
  4. Construct a new \( W \) with the recovered aggregator
  5. Repeat until convergence of the wage index
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Representative Consumer

- The representative consumer consumes a final good and supplies differentiated labor:

\[ U(C, L) = \frac{c^{1-\gamma}}{1-\gamma} - L \]

- With a Kimball aggregator for labor:

\[ \int \mathcal{K} \left( \frac{l_i}{L} \right) di = 1 \]

- Labor/leisure condition job-by-job:

\[ w_i = c^\gamma \frac{\mathcal{K}' \left( \frac{l_i}{L} \right)}{\int \frac{l_j}{L} \mathcal{K}' \left( \frac{l_j}{L} \right) dj} = W \mathcal{K}' \left( \frac{l_i}{L} \right) \]

- \( \mathcal{K} \) convex

- CES: \( \mathcal{K}(x) = x^{\frac{n+1}{n}} \)
Final good

- Final good produced competitively using an aggregate of differentiated goods:

\[ \int \Upsilon \left( \frac{y_i}{Y} \right) \, di = 1 \]

- Pricing condition good-by-good:

\[ p_i = \frac{\Upsilon' \left( \frac{y_i}{Y} \right)}{\int \frac{y_j}{Y} \Upsilon' \left( \frac{y_j}{Y} \right) \, dj} = P \Upsilon' \left( \frac{y_i}{Y} \right) \]

- \( \Upsilon \) concave

- CES: \( \Upsilon(x) = x^{\frac{\sigma}{\sigma + 1}} \)
Intermediate producers

- Profit maximization with productivity A:
  \[
  \max_y y p - \frac{y}{A} w
  \]

- Take effect on price and wage into account:
  \[
  \max_y y P \Upsilon' \left(\frac{y}{Y}\right) - \frac{y}{A} W \mathcal{K}' \left(\frac{y}{AL}\right)
  \]

- Price and wage elasticities:
  \[
  \sigma_{y,i} = -\frac{\Upsilon' \left(\frac{y_i}{Y}\right)}{y_i \Upsilon'' \left(\frac{y_i}{Y}\right)} \quad ; \quad \sigma_{w,i} = \frac{\mathcal{K}' \left(\frac{l_i}{L}\right)}{l_i \mathcal{K}'' \left(\frac{l_i}{L}\right)}
  \]

- Constant with CES. Can take any shape with Kimball
Markups, Markdowns

▶ Profit maximization:

\[
p_i \left(1 - \frac{1}{\sigma_{y,i}}\right) = \frac{w_i}{A_i} \left(1 + \frac{1}{\sigma_{w,i}}\right)
\]

▶ Total markup (multiplicative effect):

\[
p_i = \frac{w_i}{A_i} \cdot \frac{\mu_{y,i}}{\mu_{w,i}}
\]

▶ With CES, total markup is:

\[
\frac{\mu_{y,i}}{\mu_{w,i}} = \frac{\sigma}{\sigma - 1} \cdot \frac{\eta + 1}{\eta}
\]

▶ Hard to distinguish markups from markdowns
Entry and Selection

- Firms draw a productivity $\varphi$ from distribution $g(\varphi)$

- Produce only if:

$$p_\varphi y_\varphi \left(1 - \frac{\mu_{w,i}}{\mu_{y,i}}\right) \geq f_o$$

- Free entry:

$$\int_{\varphi^*}^{+\infty} \left[ p_\varphi y_\varphi \left(1 - \frac{\mu_{w,i}}{\mu_{y,i}}\right) - f_o \right] g(\varphi) d\varphi = f_e$$

- In equilibrium mass of firm $M$

$$M \int_{\varphi^*}^{\infty} Y \left(\frac{y_\varphi}{Y}\right) g(\varphi) d\varphi = 1 ; \quad M \int_{\varphi^*}^{\infty} K \left(\frac{l_\varphi}{L}\right) g(\varphi) d\varphi = 1$$
Estimation: Markups

- With the full shape of $(\mathcal{K}')^{-1}$, one can recover the labor supply elasticity:

$$\sigma_{w,i} = \frac{\mathcal{K}' \left( \frac{l_i}{L} \right)}{\frac{l_i}{L} \mathcal{K}'' \left( \frac{l_i}{L} \right)}$$

- However we need a boundary condition to recover the first-order elasticity:

$$\delta_{w,i} = \frac{\mathcal{K} \left( \frac{l_i}{L} \right)}{\frac{l_i}{L} \mathcal{K}' \left( \frac{l_i}{L} \right)}$$
If we can estimate markups separately, then we get:

$$\mu_i = \frac{1 - \frac{1}{\sigma_{y,i}}}{1 - \frac{1}{\sigma_{w,i}}}$$

And because we already know $\sigma_{w,i}$ we recover $\sigma_{y,i}$

Similarly we need a boundary condition to infer from this the infra-marginal surplus for consuming a new variety.
Production Function Estimation: Markdowns

- Hershbein, Macaluso and Yeh (2020): Separate markups from markdowns
- Assume you have flexible material inputs and labor chosen statically
- Use the material inputs $m$ to estimate total markups:

$$\frac{\mu_{i,y}}{\mu_{i,l}} = \frac{\theta_i^m}{\alpha_i^m}$$

with output elasticity and revenue share of the material inputs $m$
- Now do the same think with labor and you only get:

$$\mu_{i,y} = \frac{\theta_i^l}{\alpha_i^l}$$

using output elasticity and revenue share of the labor inputs
- You can isolate markdowns by:

$$\mu_{i,l} = \frac{\theta_i^l \alpha_i^m}{\alpha_i^l \theta_i^m}$$
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Welfare

- Follow Baqee & Farhi (2020):
  - Potentially distorted margins:
    1. Entry $M$
    2. Relative allocation $l_{\varphi_1}/l_{\varphi_2}$
    3. Selection $\varphi^*$
  - Welfare:
    \[
    \mathcal{W} = \frac{c^{1-\gamma}}{1-\gamma} - L
    \]
  - Infinitesimal reallocation and resulting effect on welfare
    \[
    d \log L = \mathbb{E}[s_w \delta_{w,\varphi}] d \log M + \mathbb{E}[s_w d \log l_{\varphi}] - \frac{g(\varphi^*)}{1 - G(\varphi^*)} s_{w,\varphi^*} \delta_{w,\varphi^*} d\varphi^*
    \]
Utility Elasticities

\[
d \log L = \mathbb{E}[s_w \delta_{w,\varphi}] d \log M + \mathbb{E}[s_w d \log l_{\varphi}] - \frac{g(\varphi^*)}{1 - G(\varphi^*)} s_{w,\varphi^*} \delta_{w,\varphi^*} d\varphi^*
\]

1. Cost share \( s_w \)

2. Utility and disutility inverse elasticities (Baqae & Farhi, 2020):

\[
\delta_{y,i} = \frac{\Upsilon (\frac{y_i}{Y})}{\frac{y_i}{Y} \Upsilon'(\frac{y_i}{Y})} \quad ; \quad \delta_{w,i} = \frac{K (\frac{l_i}{L})}{\frac{l_i}{L} K'(\frac{l_i}{L})}
\]

3. \( \delta \Rightarrow \) surplus from marginal variety

4. CES \( \Rightarrow \delta = \mu \)
Elasticities patterns

\( \delta_y \)

\( \delta_l \)

Markups

\( \mu_y \)

\( \mu_l \)
Welfare: Entry inefficiency

- Perturb the equilibrium while keeping the selection cutoff and the disutility of labor constant, job-by-job:
  \[ d \log y_\varphi = -\delta_{l,\varphi} d \log M \]

- Can we increase welfare?
  \[ dW \propto d \log M \int_{\varphi^*}^{+\infty} s_{y,\varphi} \left[ \delta_{y,\varphi} - \delta_{l,\varphi} - \left( 1 - \frac{\mu_{w,i}}{\mu_{y,i}} \right) \right] g(\varphi) d\varphi \]

- The inefficiency depends now on the weighted average of the comparison between marginal surpluses and markups/markdowns

- With CES, the weighting effect disappears because all the quantities are constant
The planner values new varieties for consumers as $\delta_{y,\varphi} - \delta_{l,\varphi}$.

But the incentives for firms to enter are proportional to average markups $\mu_{y,\varphi}/\mu_{w,\varphi}$.

This difference is weighted by sales $s_{y,\varphi}$ along the whole distribution.

Not enough entry for CES.
Welfare: Misallocation (1)

- Decrease labor supplied to varieties \([\varphi_2, \varphi_2 + d\varphi]\), add it to production of varieties \([\varphi_1, \varphi_1 + d\varphi]\):
  \[
d \log l_{\varphi_2} = -\frac{l_{\varphi_1}}{l_{\varphi_2} g(\varphi_2)} g(\varphi_1) d \log l_{\varphi_1}
  \]

- This changes consumption, but also disutility of labor \(L\)

- Can we increase welfare?
  \[
dW \propto d \log l_{\varphi_1} \left[ (A_{\varphi_1} p_{\varphi_1} - w_{\varphi_1}) - (A_{\varphi_2} p_{\varphi_2} - w_{\varphi_2}) \right]
  \]

- Difference in **unit profits**

- Different from earlier results in literature: only markups matter
Welfare: Misallocation (2)

\[ dW \propto d \log l_{\varphi_1} \left[ w_{\varphi_1} \left( \frac{\mu_{y,\varphi_1}}{\mu_{w,\varphi_1}} - 1 \right) - w_{\varphi_2} \left( \frac{\mu_{y,\varphi_2}}{\mu_{w,\varphi_2}} - 1 \right) \right] \]

- Without monopsony power, this boils down to \( \mu_{y,\varphi_1} - \mu_{y,\varphi_2} \), hence just a markup comparison

- With monopsony one needs also to control for wages.

- Typically \( w \) increasing in total markups

- **Non-zero** for CES: \( \propto w_{\varphi_1} - w_{\varphi_2} \)
Welfare: Selection

- Increase the selection cutoff by $d\varphi^*$, to increase the mass of firms and keep $dL = 0$:

$$d \log M = d\varphi^* \frac{g(\varphi^*)}{1 - G(\varphi^*)} \frac{s_{w,\varphi^*}\delta_{w,\varphi^*}}{\int s_{w,\varphi}\delta_{w,\varphi}}$$

- Change in production of final good:

$$dY \propto d\varphi^* \left( \frac{s_{w,\varphi^*}\delta_{w,\varphi^*}}{\mathbb{E}[s_w\delta_w]} - \frac{s_{y,\varphi^*}\delta_{y,\varphi^*}}{\mathbb{E}[s_y\delta_y]} \right)$$

- Change in share going to fixed costs:

$$d(Y - c) \propto d\varphi^* \left( \frac{s_{w,\varphi^*}\delta_{w,\varphi^*}}{\mathbb{E}[s_w\delta_w]} - \frac{s_{w,\varphi^*}\left( \frac{\mu_y\varphi^*}{\mu_w}\right)}{\mathbb{E}[s_w\left( \frac{\mu_y}{\mu_w} - 1 \right)]} \right)$$
Welfare: Selection (2)

\[ dY \propto d\varphi^* \left( \frac{s_{w,\varphi^*} \delta_{w,\varphi^*}}{\mathbb{E}[s_w \delta_w]} - \frac{s_{y,\varphi^*} \delta_{y,\varphi^*}}{\mathbb{E}[s_y \delta_y]} \right) \]

\[ d(Y - c) \propto d\varphi^* \left( \frac{s_{w,\varphi^*} \tilde{\delta}_{w,\varphi^*}}{\mathbb{E}[s_w \tilde{\delta}_w]} - \frac{s_{w,\varphi^*} \left( \frac{\mu_y \varphi^*}{\mu_w \varphi^*} - 1 \right)}{\mathbb{E}[s_w \left( \frac{\mu_y}{\mu_w} - 1 \right)]} \right) \]

- Increasing selection suppresses the firm at the bottom of the distribution (\( \varphi^* \)) to replace it with a firm on the average of the distribution

- Always efficient for CES
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Minimum Wage

- Minimum wage changes entry incentives
  \[\Rightarrow\] interacts with entry inefficiency

- Minimum wage changes the production level of all firms
  \[\Rightarrow\] interacts with misallocation

- Minimum wage forces least productive firms to exit
  \[\Rightarrow\] interacts with selection inefficiency

- With CES, entry is too weak while selection is always efficient
  \[\Rightarrow\] unlikely to improve welfare
Minimum Wage: PE Effects

- Introduce a marginal minimum wage $w$, infinitesimally higher than $w_{\varphi^*}$
- Firms making negative profits with the minimum wage exit
- New selection cutoff $\varphi_1^*$:

$$y_{\varphi_1^*}p_{\varphi_1^*} - \frac{y_{\varphi_1^*}}{A_{\varphi_1^*}}w = f_o$$

with:

$$p_{\varphi_1^*} = \frac{w}{A_{\varphi_1^*}}\mu_{y,\varphi_1^*}$$

- PE effect:

$$dW = d\varphi^* \left( W_{\varphi^*} - s_{y,\varphi^*} \frac{g(\varphi^*)}{1 - G(\varphi^*)} W_M \right)$$
Minimum Wage: GE Effects

- PE change in the selection cutoff causes a change in the aggregate indexes
- All firms in the distribution adapt production and markups/markdowns in response to the aggregate shock (reallocation)
- New production structure modifies entry incentives, changing the mass of firm the selection cutoff again
- GE total effect: fixed point of the process

\[ dM, d\phi^*, dW, dP, dy_\phi, d\mu_\phi \]
GE effects of Minimum Wage (1)

In GE, sales shares, costs shares, and markups are also changing with the aggregate indexes

\[
d\log s_{y,\varphi} = d\log M - \frac{g(\varphi^*)}{1 - G(\varphi^*)} d\varphi^* + d\log P + \mu_{y,\varphi} d\log \left(\frac{y\varphi}{Y}\right)
\]

\[
d\log s_{w,\varphi} = d\log M - \frac{g(\varphi^*)}{1 - G(\varphi^*)} d\varphi^* + d\log W + \mu_{w,\varphi} d\log \left(\frac{y\varphi}{A\varphi L}\right)
\]

\[
\int s_\pi \left[ d\log s_{y,\varphi} + d\log \left(1 - \frac{\mu_w}{\mu_y}\right) \right] = d\log M - \frac{g(\varphi^*)}{1 - G(\varphi^*)} d\varphi^* + d\log Y
\]
GE effects of Minimum Wage (2)

\[ d \log P = -d \log M + \frac{g(\varphi^*)}{1 - G(\varphi^*)} d\varphi^* - s_{y,\varphi^*} d\varphi^* + \int \mu_y d \log \left( \frac{y}{Y} \right) \]

\[ d \log W = -d \log M + \frac{g(\varphi^*)}{1 - G(\varphi^*)} d\varphi^* - s_{w,\varphi^*} d\varphi^* + \int \mu_w d \log \left( \frac{y}{AL} \right) \]
How Large is Labor Market Power?

- Empirical literature estimates extremely low level of labor supply elasticities:
  - Dube, Jacobs, Naidu and Suri (2019) find an elasticity of 0.1
  - Azar, Berry and Marinescu (2019): between 0.6 and 6
  - Berger, Herkenhoff and Mongey (2019): between 1 and 2

- Suggests very high degree of labor market power

- Sufficient for minimum wage?

⇒ Welfare theory shows we need the full distribution of elasticities at all levels, and the marginal surpluses:

\[ \sigma_{y,\varphi} ; \ \sigma_{w,\varphi} ; \ \delta_{y,\varphi} ; \ \delta_{w,\varphi} \ \forall \varphi \]
Conclusion

- Monopsonistic competition with entry is generically inefficient:
  1. Inefficient entry
  2. Inefficient allocation
  3. Inefficient selection

- A minimum wage policy interacts with these three margins

- Key statistics for its welfare implications:
  1. Markups and Markdowns on the whole distribution
  2. Utility and disutility elasticities on the whole distribution
  3. Sales and Costs shares on the whole distribution